REPORT
2019012439

MERAMEC ENERGY CENTER
CCR SURFACE IMPOUNDMENT
REQUEST FOR A SITE-SPECIFIC ALTERNATIVE CLOSURE DATE

Prepared for

Ameren
MISSOURI

Prepared by

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November 27, 2020

The Professional whose signature and personal seal appear hereon assumes responsibility only for what appears in the attached report and disclaims (pursuant to Section 327.411 RSMo) any responsibility for all other plans, estimates, specifications, reports, or other documents or instruments not sealed by the undersigned Professional relating to or intended to be used for any part or parts of the project to which this report refers.

Index and Certification

Ameren Missouri
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Certification

I hereby certify, as a Professional Engineer in the state of Missouri, that the information in this document as noted in the above Index was assembled under my direct personal charge. This document is not intended or represented to be suitable for reuse by Ameren Missouri or others without specific verification or adaptation by the Engineer.

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NUMBER
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(Missouri License Number E-22353)

Date: November 27, 2020

Ameren Missouri
Meramec Energy Center
CCR Surface Impoundment
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1. INTRODUCTION

Ameren Missouri (Ameren) submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure of three interconnected CCR Surface Impoundments located at its Meramec Energy Center (Meramec or MEC): Pond 492 (MCPA), Pond 493 (MCPB), and Pond 496 (MCPC). Historically, and at various times, the MEC has utilized nine (9) surface impoundments to manage its CCR and non-CCR waste streams. Ameren Missouri has closed and/or will cease managing CCRs in six (6) of these impoundments by April 11, 2021. The MEC facility is scheduled to retire in 2022, but must continue to use these three interconnected cells (MCPC, MCPA, and MCPB comprise one 18.9-acre CCR impoundment) until retirement occurs. This 18.9-acre CCR impoundment will complete closure no later than October 17, 2023, following the plant's retirement. Therefore, pursuant to 40 C.F.R. § 257.103(f)(2), "Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain", Ameren Missouri is requesting an extension to continue operating MCPC, MCPA, and MCPB so as to manage CCR and non-CCR waste streams after April 11, 2021.

The MEC is located at the confluence of the Meramec and Mississippi Rivers in St. Louis County, Missouri. Under normal river conditions, the bottom elevation of the impoundment basins is **higher** than the groundwater table, as further discussed in the May 2019 Corrective Measures Assessment Report[1], and shown in the Figure 1 – Geologic Cross-Section.[2] As a result, and as described more fully herein, groundwater impacts are generally limited and are predicted to respond well to treatment technologies.

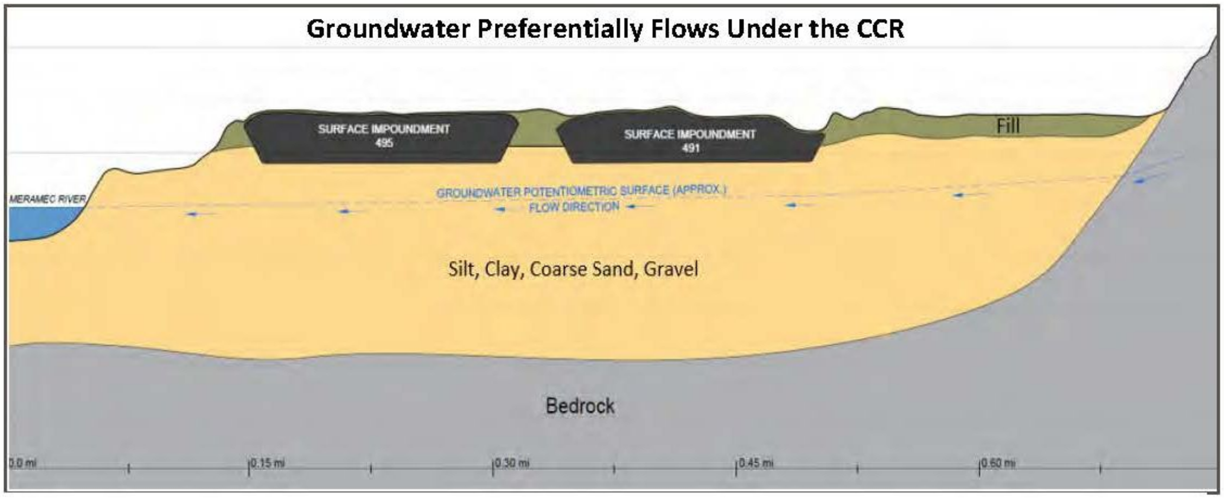

Image from Figure 2-2, MEC Groundwater Model Report (Burns & McDonnell 2019)

FIGURE 1 – MEC GEOLOGIC CROSS-SECTION

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[1] https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion/ccr-compliance-reports/meramec-energy-center

[2] Ponds 491 and 495, depicted in Figure 2-2, have been closed and are located closest to the rivers' confluence. MCPC, MCPA and MCPB are located upgradient on the plant property.

While the Meramec Energy Center operates as a peaking facility, it provides critical voltage support to the transmission system and must be able to continue to perform this critical reliability function through the end of 2022 while transmission upgrades occur elsewhere in the system. Ameren is systematically closing the MEC's inactive ash ponds as reflected on Figure 2 (also included in Appendix A).

FIGURE 2 – MEC SURFACE IMPOUNDMENTS

Ameren uses MCPA, MCPB and MCPC to manage the following waste streams: sluiced bottom and economizer ash (CCRs) from coal fired boiler #3 (Unit #3); wastewaters (non-CCR) from the plant's Combined Drain Sump (CDS) including water treatment plant waste, the demineralizer sump, the dirty waste sump, roof and yard drains; monitoring well purge water; coal pile runoff; and stormwater runoff. Flyash, bottom ash, and economizer ash from coal fired boiler #4 (Unit #4) is managed in dry form and is not wet sluiced to MCPA, MCPB and MCPC. The plant’s water balance diagram is included in Appendix B. Effluent is discharged pursuant to an NPDES permit issued by the Missouri Department of Natural Resources (MDNR).

On August 28, 2020, the EPA issued revisions to the CCR Rule that require all unlined surface impoundments to initiate closure by April 11, 2021, unless an alternative deadline is requested and approved. 40 C.F.R. § 257.101(a)(1) (85 Fed. Reg. 53,516 (Aug. 28, 2020)). Specifically, the CCR Rule authorizes the continued use of CCR Surface Impoundments if the facility will cease operation of the coal-fired boiler(s) and complete closure of the impoundments within certain specified timeframes. 40 C.F.R. § 257.103(f)(2). To qualify for an alternative closure deadline under § 257.103(f)(2), a facility must meet the following four criteria:

1. **§ 257.103(f)(2)(i) –** No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification.
2. **§ 257.103(f)(2)(ii) –** Potential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated;
3. **§ 257.103(f)(2)(iii) –** The facility is in compliance with the CCR rule, including the requirement to conduct any necessary corrective action; and
4. **§ 257.103(f)(2)(iv) –** The coal-fired boilers must cease operation and closure of the impoundment must be completed within the following timeframes:
    a. For a CCR Surface Impoundment that is 40 acres or smaller, the coal-fired boiler(s) must cease operation and the CCR Surface Impoundment must complete closure no later than October 17, 2023.
    b. For a CCR Surface Impoundment that is larger than 40 acres, the coal-fired boiler(s) must cease operation, and the CCR Surface Impoundment must complete closure no later than October 17, 2028.

Section 257.103(f)(2)(v) describes the documentation that must be provided to EPA to demonstrate that the four criteria described above have been met. This demonstration is organized based on the documentation requirements of §§ 257.103(f)(2)(v)(A) – (D).

2. DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

No alternative disposal capacity is currently available for the waste streams that are presently managed in MCPA, MCPB, and MCPC and therefore Ameren seeks EPA's approval to continue use of such interconnected impoundment past the April 11, 2021 deadline and until the plant retires at the end of 2022. Consistent with the regulations, neither an increase in costs nor the inconvenience of existing capacity can support qualification under this criterion. Instead, as EPA explained in the preamble to the proposed Part A revisions, “it would be illogical to require facilities (ceasing power generation) to construct new capacity to manage CCR and non-CCR waste streams." 84 Fed. Reg. 65,941, 65,956 (Dec. 2, 2019). EPA reiterated in the preamble to the final revisions that "in contrast to the provision under § 257.103(f)(1), the owner or operator does not need to develop alternative capacity because of the impending closure of the coal fired boiler. Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR waste streams." 85 Fed. Reg. at 53,547. Thus, new construction or the development of new alternative disposal capacity before the MEC's closure at the end of 2022 is not a viable option for any waste stream discussed below.

2.1 Site-Layout and Wastewater Processes

Currently, CCRs and the non-CCR wastewater flows from the MEC are managed in two surface impoundments: 1) the interconnected impoundment (MCPA, MCPB, MCPC) and 2) MCPD (Pond 498). MCPD receives only fly ash and will stop receipt of such material before April 11, 2021. With respect to the interconnected impoundment (MCPA, MCPB, and MCPC), CCRs are wet sluiced from the plant to the southern end of MCPC and then flow by gravity through the three cells allowing the solids to settle out before flowing to an on-site Combined Retention Pond. Effluent water is then discharged from the Combined Retention Pond to surface waters through NPDES permit MO-0000361 Outfall #003. The Combined Retention Pond receives only decanted effluent and is not a CCR Unit.

Post April 2021, fly ash produced at the MEC will be beneficially used onsite for closing MCPD and/or MCPA, MCPB, and MCPC or transported off-site for disposal. However, Meramec will continue to produce wet waste streams that can only be managed in the existing surface impoundment system. The conversion of Unit #3 from a "wet" process to "dry" would require the reconfiguration of equipment within the powerhouse building and/or the installation of a stacking and drying equipment on the plant site. Such an approach is simply not feasible in the remaining twenty-five (25) months before plant retirement.

2.2 CCR Waste Streams

Ameren evaluated each CCR waste stream discharged into Surface Impoundment MCPA, MCPB, and MCPC. For the reasons discussed below, each of the following CCR waste streams must continue to be placed in these impoundments due to lack of alternative capacity.

TABLE 1 – MERAMEC ENERGY CENTER CCR WASTE STREAMS

CCR Waste streams	Average Flow (MGD)	Alternative Capacity Currently Available? YES/NO	Details
Unit #3 Bottom and Economizer Ash Sluice	1.8	NO	Bottom and economizer ash slurry produced at the boiler is wet sluiced to Surface Impoundment MCPC, MCPA, and MCPB for management. All other impoundments onsite are closed or undergoing closure and no other CCR Unit on-site can accept and manage wet material. Design, permitting, and/or construction of dry ash handling systems to manage Unit #3 bottom and economizer ash cannot occur prior to MEC's 2022 retirement. Based upon Ameren's experience at other Missouri Energy Centers, such projects take at least 3 years to design, permit, and construct.
Unit #4 Bottom and Economizer Ash	NA (Dry)	N/A	The Unit #4 bottom and economizer ash is managed dry with an existing submerged flight conveyor system at the boiler and is not routed to MCPA, MCPB, and MCPC.
Unit #3 and #4 Fly Ash	NA (Dry)	NO	The fly ash is collected dry and is conditioned and disposed in Surface Impoundment MCPD. After April 11, 2021, the dry fly ash will be beneficially used for closing MCPD and/or MCPA, MCPB, and MCPC or transported off-site. Beneficial use during closure of the on-site CCR Surface Impoundments has less environmental and public safety impact than transporting them to an off-site landfill for disposal.

2.2.1 Onsite Disposal Alternatives: Dry Ash Handling and Tankage Facilities

For the 1.8 MGD Unit #3 ash sluice flow, there is no currently available onsite infrastructure to support dry handling of the ash or elimination of this waste stream prior to closure of the plant and its CCR Units. Managing bottom ash in dry form would require the installation of dry handling equipment at Unit #3, a process that based on recent experience by Ameren would take at least 36 months to design, permit and construct. The plant will be retired (12/2022) before such equipment could be placed into service.

In addition, the construction and permitting of large tanks to temporarily store the ash sluice onsite until it could be trucked off site for disposal at either a commercial landfill or incinerator would also require at least 24 months to complete, longer than the remaining lifespan of the plant. Offsite disposal would require substantial daily truck traffic. Since its construction, the metropolitan area around the MEC has become heavily populated with residential communities and any proposed increase in daily truck traffic could trigger considerable public opposition.

2.2.2 Offsite Disposal: Commercial Facilities

Disposal options for wet sluice material are extremely limited. Commercial landfills prefer to handle only dry material to minimize leachate and therefore require disposal material to pass a paint filter test. While the MEC is currently connected to a public sanitary sewer system owned and operated by the Metropolitan St. Louis Sewer District (MSD), the volume of sluiced ash flow would require upgrading more than 4,000 feet of existing underground pipe from the MEC to the nearest wastewater treatment plant. Design, permitting, and installation of these upgrades would also require at least 24 months to complete.

Closed and capped surface impoundments cover almost all of the MEC property thereby limiting the surface area available to build disposal capacity in the form of a new lined CCR unit, or other temporary tank storage facilities to manage the flows. Furthermore, the MEC does not currently have the required systems and equipment in place to dry the wet CCR material or direct load the wet CCR material for transport off site.

Ameren has performed reviews of all known waste landfills in the regional area and none (within 150 miles) have the required permits or the infrastructure to handle the quantity of wet ash the MEC produces. Two landfills are authorized to accept only limited quantities of liquid wastes, and solidify those liquids with drying agents prior to disposal in a dry landfill cell. However, those facilities do not have the required permitting or infrastructure to accept the quantity or volume of wet ash materials from the MEC. Such infrastructure (e.g. dewatering basins, conveyors, water treatment basins & clarifiers, power distribution, etc.) would need to be designed, permitted, and constructed and those activities would take longer than 24 months. At the MEC, the installation of equipment and systems would also be required to direct load the wet ash materials for transport, and would require longer than 24 months to design, permit, and place in-service. Further and as noted previously, transportation of wet ash is not feasible nor desirable from community and traveling public safety perspective including risks of waste spillage and leakage. As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. See 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) “While it is possible to transport dry ash off-site to (an) alternate disposal facility that is simply not feasible for wet-generated CCR. Nor can facilities immediately convert to dry handling systems.” As a result, the conditions at the MEC satisfy the demonstration requirement in § 257.103(f)(2)(i).

2.3 Non-CCR Waste streams

Ameren evaluated each non-CCR waste stream placed in Surface Impoundments MCPA, MCPB, and MCPC at the MEC. For the reasons discussed below in Table 2, each of the following non-CCR waste streams must continue to be placed in Surface Impoundments MCPA, MCPB, and MCPC due to lack of alternative capacity both on and off-site.

TABLE 2 – MERAMEC ENERGY CENTER NON-CCR WASTESTREAMS

Non-CCR Wastestreams	Average Flow (MGD)	Alternative Capacity Currently Available? YES/NO	Details
Combined Drain Sump (CDS) discharge including water treatment plant waste, demineralizer sump, dirty waste sump, roof and yard drains	1.8	NO	The CDS discharges require retention time for treatment to meet the permitted effluent limitations before being discharged from the Combined Retention Pond through NPDES permit MO-0000361 Outfall #003. A new treatment/storage system and NPDES permit modifications would be required to reroute the discharges to a new or existing permitted outfall. These discharges could also be rerouted to MSD's wastewater treatment plant but would require upgrading more than 4,000 feet of existing underground pipe. There are no other on-site alternatives for managing this waste stream.
Monitoring well purge water; coal pile runoff; and stormwater runoff from the ash ponds	Intermittent	NO	The monitoring well purge water could be managed so that it is no longer discharged through NPDES permit MO-0000361 Outfall #003. However, the stormwater runoff requires retention time for treatment to meet the permitted effluent limitations of Outfall #003. NPDES permit modifications, new stormwater only piping, and possibly a new treatment system would be required to reroute the discharges to a new or existing permitted outfall at the MEC. There are no other on- site alternatives for managing this waste stream.

Certain non-CCR flows are currently routed through Surface Impoundments MCPA, MCPB, and MCPC to the Combined Retention Pond for discharge through the NDPES Outfall #003. To redirect such flows to alternate locations would require permit modifications and installation of new piping, and potentially new treatment and/or storage systems including non-CCR surface impoundments, clarifiers, and/or storage tank(s). As stated previously, since Ameren will permanently cease the use of the coal fired boilers at the MEC by the end of 2022, development of alternative disposal capacity would be counterproductive to the work required for retirement of the boilers and closure of the CCR Impoundments. There is currently no existing installed infrastructure at the plant to support the rerouting of these flows. For the reasons discussed above, each of the remaining non-CCR waste streams, except potentially monitoring well purge water, must continue to be placed in CCR Surface Impoundments MCPA, MCPB, and MCPC due to lack of alternative capacity both on and off-site. Consequently, in order to continue to operate and generate electricity until December 31, 2022, the MEC must continue to use Surface Impoundments MCPA, MCPB, and MCPC to manage the non-CCR waste streams discussed above.

3. RISK MITIGATION PLAN

To demonstrate that the criteria in § 257.103(f)(2)(ii) has been met, Ameren has attached the MEC's Corrective Measures Assessment Report as Attachment 7. Of the 23 CCR parameters evaluated by Ameren, only three constituents (arsenic, lithium and molybdenum), exceeded the Groundwater Protection Standards (GWPS) established for the MEC in a very limited number of wells and to a limited extent. Groundwater modeling indicates that post-closure with in-situ treatment, concentration levels will attenuate and **attain** GWPS within five (lithium and molybdenum) and eleven (arsenic) years, respectively. (see Report Figures 4-2, 4-3 and 4-4). A Human Health and Ecological Assessment of the MEC, included as Attachment 8, confirms that the CCR units present no unacceptable risk to human health or the environment. In fact, concentration levels of arsenic, lithium and molybdenum would need to be more than 600, more than 24,000 and more than 13,000 times higher than currently found in groundwater before an adverse impact in the Mississippi River could occur. Sampling completed in the Meramec and Mississippi Rivers have shown no impacts from the MEC CCR ponds. Plume modeling and groundwater flow models, included as Attachment 9, show attainment of GWPS as noted previously.

As part of its corrective measures assessment, Ameren Missouri evaluated in situ treatment options to address groundwater impacts at its power plant sites. Laboratory testing has proven promising and Ameren is in the process of demonstrating the effectiveness of the treatment technology via a pilot test at its Rush Island Energy Center. Once effectiveness is demonstrated, such technology would be implemented at Ameren's other energy centers pursuant to permits issued by MDNR. The draft permit issued by MDNR, included as Attachment 10, along with Ameren's Remedy Selection Report describes test results for several plants including the MEC. MDNR is in the process of finalizing the permit and Ameren intends to initiate pilot tests at Rush Island in January 2021. As indicated in the Remedy Selection Report, groundwater conditions at the MEC are projected to respond favorably to treatment.

4. DOCUMENTATION AND CERTIFICATION COMPLIANCE

In the Part A rule preamble, the EPA reiterates that compliance with the CCR rule is a prerequisite to qualifying for an alternative closure extension, as it “provides some guarantee that the risks at the facility are properly managed and adequately mitigated." 85 Fed. Reg. at 53,543. The EPA further stated that it "must be able to affirmatively conclude that facility meets this criterion prior to any continued operation." 85 Fed. Reg. at 53,543. Accordingly, the EPA "will review a facility's current compliance with the requirements governing groundwater monitoring systems." 85 Fed. Reg. at 53,543. In addition, the EPA will also "require and examine a facility's corrective action documentation, structural stability documents and other pertinent compliance information." 85 Fed. Reg. at 53,543. Therefore, the EPA is requiring a certification of compliance and specific compliance documentation be submitted as part of the demonstration. 40 C.F.R. § 257.103(f)(2)(v)(C).

To demonstrate that the criteria in § 257.103(f)(2)(iii) have been met, Ameren is submitting the following information as required by § 257.103(f)(2)(v)(C):

4.1 Owner's Certification of Compliance - § 257.103(f)(2)(v)C(1)

I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations at the Meramec Energy Center, the facility is in compliance with all of the requirements contained in 40 C.F.R. Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The Ameren MEC CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

AMEREN MISSOURI

Steven C. Whitworth
Senior Director – Environmental Policy & Analysis
November 27, 2020

4.2 Visual representation of hydrogeologic information - § 257.103(f)(2)(v)(C)(2)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(2)(i) – (iii), Ameren has attached the following items to this demonstration:

- Map(s) of groundwater monitoring well locations in relation to the CCR unit (Attachment 2)
- Well construction diagrams for all groundwater monitoring wells (Attachment 3)
- Maps characterizing the direction of groundwater flow with seasonal variations (Attachment 4)

4.3 Groundwater monitoring results - § 257.103(f)(2)(v)(C)(3)

Baseline groundwater sampling at the MEC began in 2016 and has continued semi-annually. Consistent with the requirements of § 257.103(f)(2)(v)(C)(3), tables summarizing constituent concentrations at each groundwater monitoring well through December 2019 are included as Attachment 5.

4.4 Description of site hydrogeology including stratigraphic cross-sections - § 257.103(f)(2)(v)(C)(4)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(4), a copy of the 2019 Annual Groundwater Monitoring and Corrective Action Report with a description of the site hydrogeology and stratigraphic cross-sections of the site are included as Attachment 6.

4.5 Corrective measures assessment - § 257.103(f)(2)(v)(C)(5)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(5), a copy of the 2019 Corrective Measures Assessment Report is included as Attachment 7.

4.6 Remedy selection progress report - § 257.103(f)(2)(v)(C)(6)

In August 2019, Ameren selected a final remedy of source control through installation of low permeability cover systems on the CCR Units and use of Monitored Natural Attenuation (MNA) at the MEC. This is further discussed in the 2019 Remedy Selection Report, and 2019 Annual Groundwater Monitoring and Corrective Action Report included as Attachment 1 and 6 respectively. This is consistent with the requirements of § 257.103(f)(2)(v)(C)(6).

4.7 Structural stability assessment - § 257.103(f)(2)(v)(C)(7)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(7), a copy of the 2016 Structural Integrity Criteria and Hydrologic/Hydraulic Capacity Assessment for MCPA, MCPB, and MCPC pursuant to § 257.73(d), was completed in October 2016 and is included as Attachment 12. As required for compliance, additional stability assessments for these CCR Surface Impoundments will be completed in October 2021.

4.8 Safety factor assessment - § 257.103(f)(2)(v)(C)(8)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(8), a copy of the initial Structural Integrity Criteria and Hydrologic/Hydraulic Capacity Assessment for MCPA, MCPB, and MCPC, that includes the Safety factor assessment pursuant to § 257.73(e) was completed in October 2016 and is included as Attachment 12. As required for compliance, additional stability assessments for these CCR Surface Impoundments will be completed in October 2021.

5. DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

To demonstrate that the criteria in § 257.103(f)(2)(iv) has been met, “the owner or operator must submit the closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which they intend to cease receipt of waste into the unit in order to meet the closure deadlines.” Copies of the Closure Plans for CCR Surface Impoundments MCPA, MCPB, and MCPC at the MEC is included as Attachment 11.

In order for a CCR surface impoundment under 40 acres to continue to receive CCR and non-CCR waste streams after the April 11, 2021 deadline, the coal-fired boiler(s) at the facility must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2023. Ameren has committed in its Integrated Resource Plan[3] to retire the coal fired boilers (Units 3 and 4) at the Meramec Energy Center and cease operation at the end of 2022. (Units 1 and 2 are currently natural gas fired and will be retired at the same time). Until that time, CCR and non-CCR waste streams will be produced by the MEC and must be sluiced into Surface Impoundments MCPA, MCPB, and MCPC. Closure construction activities cannot begin until these waste streams are no longer sluiced into these CCR Surface Impoundments.

Table 6-1 summarizes the major tasks and estimated durations needed to complete the design, permitting, and construction required to complete closure of CCR Surface Impoundments MCPA, MCPB, and MCPC in place. To meet the required closure date of October 17, 2023, many of these actions will need overlap or be completed concurrently to assure that the schedule is maintained and provide some schedule float. The most critical aspect in meeting this schedule will be the 10-1/2 months between the ceasing of sluicing CCRs into the impoundments and completing their closure.

These durations shown in table 6-1 are consistent with the durations experienced in the closure of other similar sized CCR impoundments that have been completed by Ameren. As an example, Ameren completed installation of 39 acres of CCR Rule compliant cap on excluded ponds MOPI and MOPH at the MEC in 2020. Construction of these caps began in mid-February and was substantially complete by mid-October 2020, a period of 8 months. Closure of cells MCPC, MCPA, and MCPB will require similar construction activities as MOPI and MOPH. At less than half the size of MOPI and MOPH, closure of cells MCPC, MCPA, and MCPB should take less than 10-1/2 months to complete including unwatering and contouring work during winter and spring months.

To expedite closure, the construction activities will occur in two primary phases. The first phase will include construction of the necessary piping and treatment systems required to remove the non-CCR waste streams from MCPA, MCPB, and MCPC post-closure of the MEC. Design and construction of these improvements will occur before the MEC ceases operations at the end of 2022. The second phase will include unwatering and contouring the CCR materials in MCPA, MCPB, and MCPC so that these CCR Surface Impoundments can be closed in place by capping. While design, permitting, and award of the contract for construction of the closure can occur before the MEC ceases operations, unwatering the deposited ash and construction cannot begin until after the CCR and non-CCR waste streams no longer discharge into these CCR Surface Impoundments.

To unwater the ash deposited in the impoundments as part of closure, Ameren will likely release impounded water through the existing NPDES Outfall #003, and employ pumps, and potentially an engineered system to stabilize the CCR in the impoundments. Ameren's experience on other CCR projects is that that the bottom ash and economizer ash in MCPA, MCPB, and MCPC will unwater and stabilize much more quickly than flyash. As the water level is lowered and the material is stabilized, the contractor will contour the existing CCRs to achieve positive drainage. As contouring is completed, the contractor will place the final cover system in accordance with the CCR Unit Closure Plans.

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[3] https://www.ameren.com/missouri/company/environment-and-sustainability/integrated-resource-plan

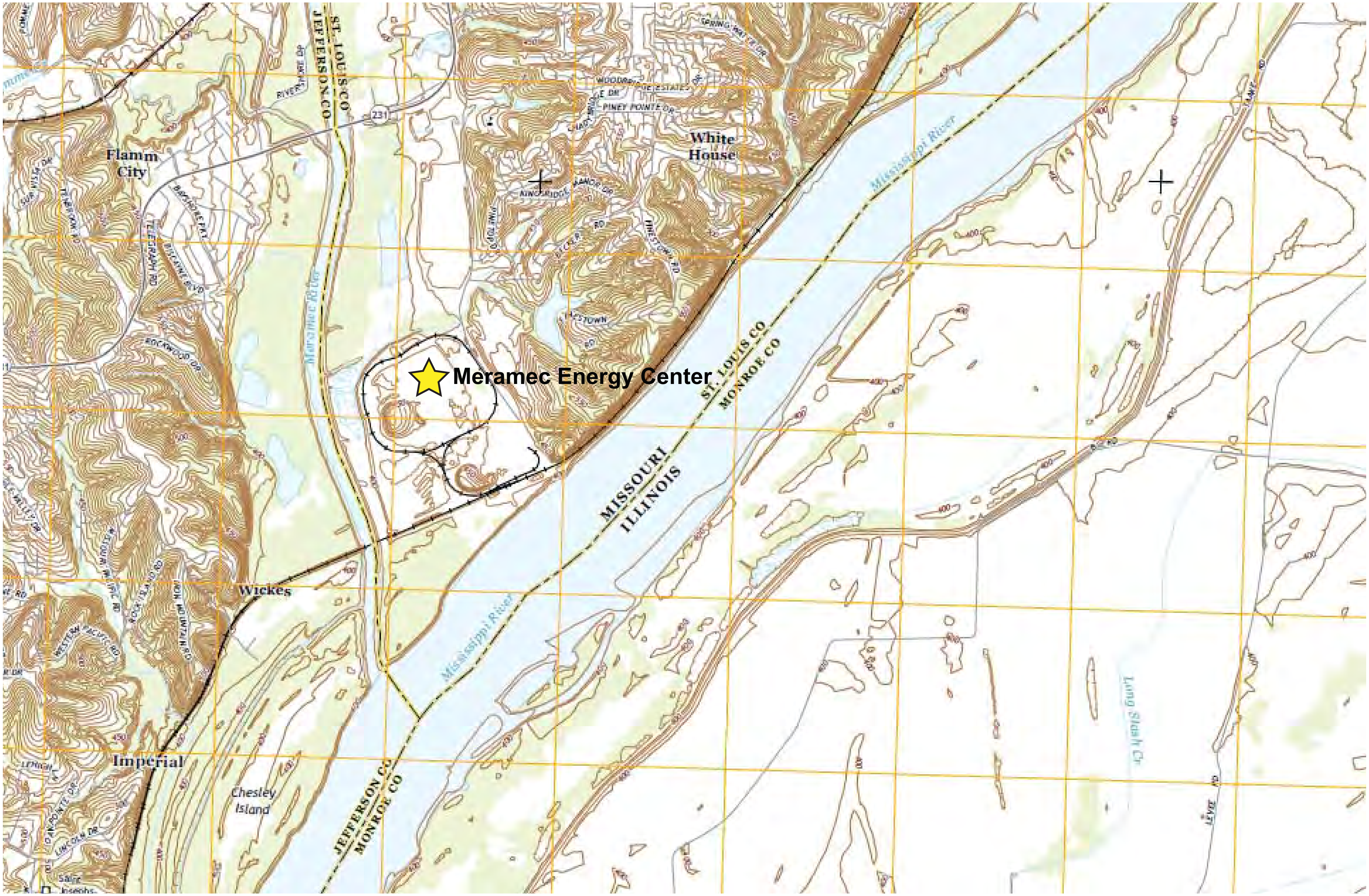
TABLE 3 – MEC IMPOUNDMENT MCPA, MCPB, AND MCPC CLOSURE SCHEDULE

Action	Estimated Time (Months)
Before December 31, 2022	
Design and develop Plans &Specifications for rerouting non-CCR waste streams from MCPA, MCPB, and MCPC	6
Obtain regulatory permits and approvals for rerouting non-CCR waste streams	6
Advertise, bid, and award construction services for rerouting non-CCR waste streams	4
Construct improvements required to reroute non-CCR waste streams from MCPA, MCPB, and MCPC	6
Date by which CCR waste streams must be rerouted from MCPA, MCPB, and MCPC	December 31, 2022
Design and develop Plans &Specifications for Closure of impoundments MCPA, MCPB, and MCPC	3
Obtain regulatory permits and approvals for Closure activities	2
Advertise, bid, and award construction services for Closure of impoundments	4
After December 31, 2022	
Unwater impoundments MCPA, MCPB, and MCPC to allow regrading of surface	3
Regrade impoundments to allow installation of cover system	3
Install cover system	3
Establish vegetation, restore site, complete closure, and initiate post-closure care	1
Date by Which Closure Must be Complete	October 17, 2023

6. CONCLUSION

The information included in this demonstration proves that Surface Impoundments MCPC, MCPA, and MCPB at the Meramec Energy Center meet all the requirements for the site-specific alternative deadline for the initiation of closure authorized by 40 C.F.R. § 257.103(f)(2), and should be able to continue receiving CCR and non-CCR waste streams after April 11, 2021, provided these CCR Units are closed no later than October 17, 2023. These Surface Impoundments are needed to continue to manage the CCR and non-CCR waste streams identified in Section 2.2 and 2.3 above, are collectively less than 40 acres, and the boilers at the MEC will cease coal-fired operation by December 31, 2022.

Ameren Missouri requests that the EPA approve this demonstration and authorize CCR Surface Impoundments MCPC, MCPA, and MCPB at the Meramec Energy Center to continue to receive CCR and non-CCR waste streams notwithstanding the deadline in § 257.101(a)(1), and grant the alternative deadline of October 17, 2023 to complete closure of these impoundments.

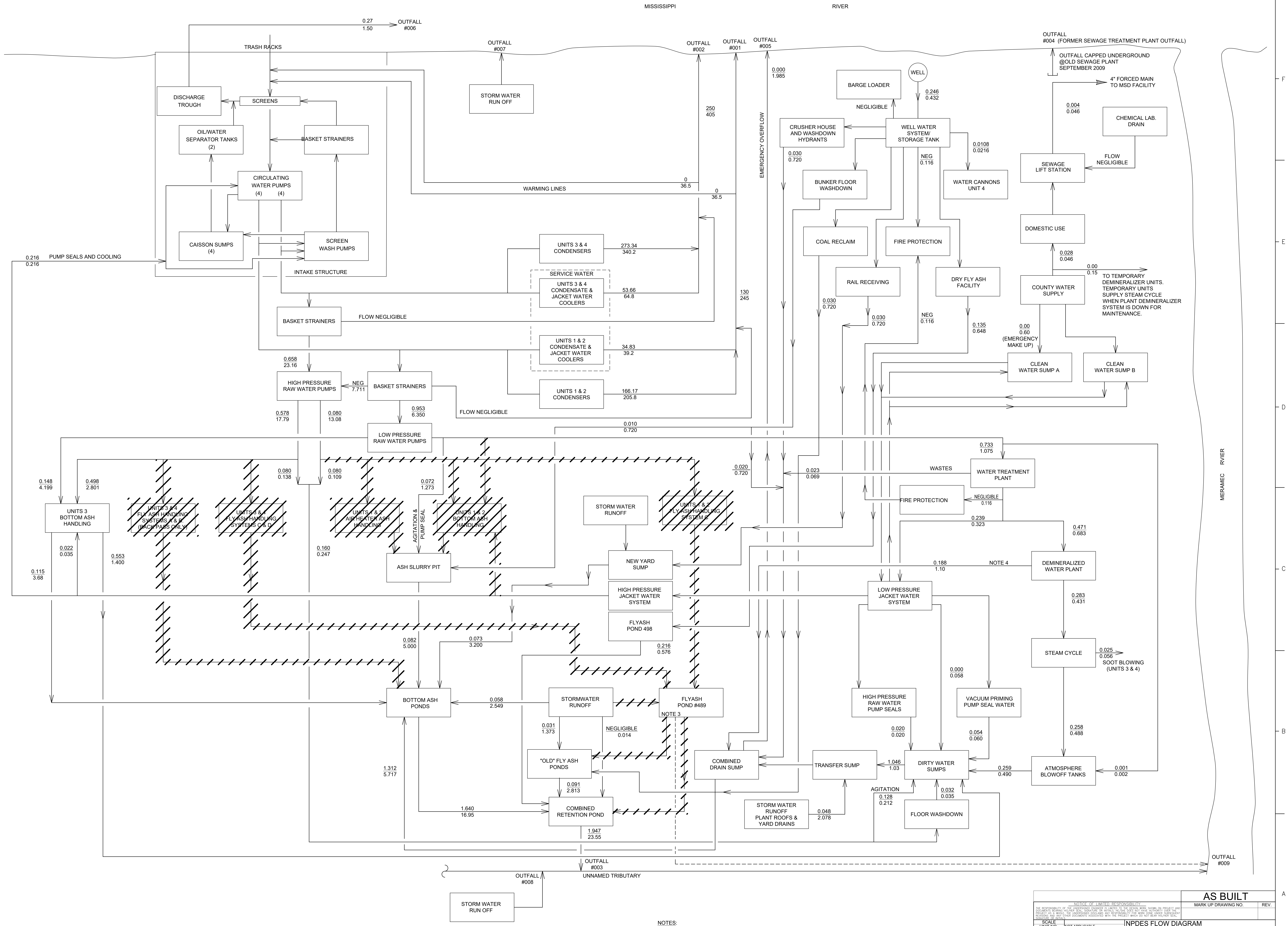


Ameren Missouri
Meramec Energy Center
CCR Unit Evaluation
USGS 7.5 minute quadrangle map

REITZ & JENS, INC.

Figure 1

Z:\CLIENTS\ENR\AMERENMO\90683_MERAMECCLOSURE\DESIGN\ENVIRO\REMEDIATION\GIS\90683 - FIG1 - SURFACE IMPOUNDMENT.DWG 9/9/2016 4:20 PM DNYBERG



NOTES:
1. EVAPORATION LOSSES ASSUMED NEGLIGIBLE.
2. FLOWS ARE PRESENTED AS $\frac{\text{AVERAGE DAY}}{\text{MAXIMUM DAY}}$ IN MGD.
3. FLY ASH POND #489 - CAPPED AND CLOSED.
4. REVERSE OSMOSIS REJECT.
5. ///// SIGNIFIES RETIRED IN PLACE.

DRAWING RECORD							
REV.	DATE	PROJECT NO.	DRAFTING DRFTR	CHK'D	SUPV	ENGR	DESCRIPTION
013	08/15/17	---	JAK	GPG	KAJ	GPG	AS BUILT

NOTICE OF LIMITED RESPONSIBILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

AS BUILT
MARK UP DRAWING NO. | REV.

SCALE
UNIT NO. NOT APPLICABLE
DWG. SIZE 34x44
SUB CLASS 05050

NPDES FLOW DIAGRAM
ASH POND RENOVATION
WATER BALANCE

SITE: MERAMEC ENERGY CENTER

Ameren MISSOURI

DRAWING NO.
MR-8000-X-053973-001
REVISION NO. 013

Attachment 1

Remedy Selection Report

August 30, 2019

REMEDY SELECTION REPORT - 40 CFR § 257.97
RUSH ISLAND, LABADIE, SIOUX AND MERAMEC CCR BASINS

In May 2019, Ameren Missouri completed Corrective Measures Assessment (CMA) Reports for certain coal ash (CCR) basins located at the Rush Island, Labadie, Meramec, and Sioux energy centers. For each site, the CMAs considered a series of alternatives, all of which are protective of human health and the environment, control source material, minimize the potential for further releases and, over time, will attain site-specific groundwater protection standards. After sharing the CMAs publicly, Ameren Missouri solicited public input. In addition to the CMAs, Ameren Missouri and its consultants performed numerous technical evaluations, all of which help to inform the Company's remedy selection. Those evaluations include groundwater modeling; human health and ecological risk assessments; groundwater treatment assessments; onsite and offsite monitoring data; rail, barge and truck transportation studies; and a deep excavation study report.[1] The technical assessments, data and public input inform the evaluation of selection factors that has led to this final remedy selection.

Set forth below is a summary of Ameren Missouri's remedial plan that, when fully implemented and completed, will achieve CCR Rule requirements. As previously announced, Ameren Missouri intends to expeditiously close CCR basins at its energy centers by completing necessary steps to remove the basins from service and then installing an engineered cap system that exceeds, by more than two orders of magnitude, the federal regulatory requirements and, as modeling indicates, will minimize the limited and localized impact to groundwater observed at the CCR basins. In time, the sites will attain site-specific groundwater protection standards. As conditions stabilize after cover system installation, groundwater evaluations and monitoring will continue, and, as necessary, be modified. Ameren Missouri intends to implement the following corrective action measures in conjunction with the closure of CCR basins.

CORRECTIVE MEASURES REMEDIAL PLAN

CMA Reports Alternative 1: Source Control Through Installation of Low Permeable Cover System & Monitored Natural Attenuation

1. Source control, stabilization and containment of CCR by installation of a low-permeability geomembrane cap (a minimum 1 x 10 -7 centimeters per second (cm/sec) versus 1 x 10 -5 cm/sec required by the CCR Rule).

2. Once source control is achieved, monitor the natural attenuation (MNA) of groundwater concentrations to address limited and localized CCR-related impacts. Ongoing monitoring and modeling evaluations will document that concentrations are

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[1] Technical assessments are appended to the CMA reports and/or to Ameren Missouri's Response to Public Concerns and all have been posted to Ameren's CCR website.

decreasing as modeled. MNA occurs due to naturally occurring processes within the aquifer.

3. Annual Groundwater *Monitoring and Corrective Action Reports* for each site will address the following:

    - Demonstrate that groundwater plume(s) are stable or decreasing and not expanding;

    - Contain an ongoing summary of baseline and periodic geochemical analysis including groundwater chemistry, subsurface soils chemical composition and mineralogy;

    - Determine site-specific attenuation factors and rate of attenuation process; and

    - Design a long-term performance monitoring program based on the specific attenuation mechanism to confirm concentration reductions and document trends.

The installation of a low-permeability, geomembrane cap system satisfies both the CCR Rule's basin closure requirements and can constitute an appropriate remedial corrective measure for groundwater impacts, as recently confirmed by the Missouri Department of Natural Resources (MDNR). A properly engineered and installed cap will practically eliminate the infiltration of water into the stored ash material. As summarized in the CMA reports, concentrations will reduce once the cap system stops recharge into the ash and groundwater conditions, such as pH levels, stabilize. Ameren Missouri will establish a long-term performance monitoring plan in accordance with the CCR Rule to document and confirm such reductions. MNA encompasses a variety of physical and chemical processes (biodegradation, sorption, dilution, chemical reactions and evaporation), which, under the right conditions, can immobilize metals in aquifer sediments. In addition to capping as a remedial corrective measure, both EPA and MDNR recognize MNA as a corrective action component for addressing inorganics (metals) in groundwater. *EPA Directive 9283.1-36 (2015); Section 644.143 RSMo (1999).* As MDNR notes, <u>MNA is not a "no action" alternative and is complementary to source control measures</u>. *(<u>See</u> Fact Sheet: MNA of Groundwater at Brownfields/Voluntary Cleanup Program Sites.)*

IMPLEMENTATION OF REMEDY

Under its current schedule, Ameren Missouri will close more than 67% (428 acres) of its CCR units by the end of 2020, with the remaining 33% by December 2023. Installation of a geomembrane cap at the energy centers will practically eliminate infiltration. Site preparation activities are underway at Rush Island and Labadie, with construction of the cap/cover systems occurring over the next 12 -18 months. Closure of additional basins at Meramec will occur in 2020 and 2021, with closure of remaining basins following the retirement of the energy center in 2023. At Sioux, use of the ash basins will terminate once wastewater and dry ash handling facilities are completed in 2020. Set forth below are key milestones in the implementation of Ameren's remedial plans. Such schedule is subject to revision based upon each energy center's construction schedule, ongoing field investigations and, if needed, regulatory approvals.

Facility	Ash Basin Removed from Service	Ash Basin Cap System Completed	Performance Review: Groundwater & Cap System
Rush Island	04/2019	12/2020	Annual - Commencing 2021
Labadie	09/2019	12/2020	Annual - Commencing 2021
Sioux	12/2020	2021	Annual - Commencing 2023
Meramec	12/2022	2023	Annual - Commencing 2024

SUPPLEMENTAL CORRECTIVE MEASURES

In its laboratories, XDD, Ameren Missouri's environmental consultant, reproduced existing (i.e. pre-closure) groundwater and soil conditions so as to evaluate potential treatment methods to accelerate existing natural attenuation processes. Under appropriate conditions, metals can attenuate through precipitation, co-precipitation and/or sorption processes with subsurface soil minerals. XDD is evaluating potential treatment methods such as the use of pH adjustment, zero valent iron (ZVI), and bio-augmentation.[2] Laboratory results for arsenic and molybdenum, the primary contaminants of concern (COC) at some of Ameren's energy centers, indicate that through the adjustment of pH levels in subsurface soils and groundwater, groundwater protection standards (GWPS) can be met for each site[3] and that the use of chemical reduction (ZVI) and bioremediation may be helpful in the reduction process for these and other compounds.

Set forth below is a summary chart reflecting results from ongoing treatment studies. Boron is included for evaluation purposes even though under the Federal CCR Rule it is not currently an Appendix IV parameter.

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[2] Ameren Missouri and XDD have experience with the use of ZVI and bio-augmentation at its Huster Substation property, a groundwater remediation project supervised by USEPA and MDNR, (CERCLA-07-2017-0129). Using a drill rig, XDD injected a slurry comprised of water and ZVI into subsurface soils and groundwater forming a reactive barrier that successfully contained groundwater contaminants that had migrated from the substation. In addition, ongoing degradation of source contaminants continues to occur through a bio-augmentation process consisting of the injection of feedstock into the sands of the aquifer.

[3] The slow groundwater flow rate at the Sioux energy center has allowed for the concentration of molybdenum at levels higher than those observed at the other energy centers. Such conditions however may be particularly conducive to the use of ZVI or bioremediation.

SUMMARY OF LABORATORY TREATMENT STUDIES

	Arsenic	Molybdenum	Boron	Lithium	Attenuation Mechanism
	mg/L				
pH 10	▨	R/M5/M6	▨	M6	P,C
pH 9	R	▨	▨	▨	P,C
pH 8	R	M6	▨	▨	P,C
pH 7	R	▨	▨	▨	P,C
pH 6	R/M5*/M6*	R/M5/M6/L/S	▨	▨	P,C
CaSx	R	R/M5/M6/L	M6	M5	P,C
Dissolved Iron (Anaerobic)	R	L	▨	▨	P,C
Dissolved Iron (Aerobic)	R	L	▨	▨	P,C
ZVI Injectable	R	R/M5/M6/L/S	L/S R/M5/M6	M5/M6	P,C
ZVI PRB	R	R/M5/M6/L	R/M5/M6	M5/M6	P,C
ZVI Injectable + Bio	R	R/M5/M6/L/S	R/M5/M6	M5/M6	P,C
ZVI Injectable pH 8 + Bio	R	R/L	R	⬜	P,C
ZVI PRB + Bio	R	M5/M6/L/S	S	M5/M6 L/S	P,C
ZVI PRB pH 8 + Bio	R	R/L	R	M6 L/S	P,C

Notes:

▨ No Effect

🟦 Reduce

🟧 Increase

🟩 Attains Standard

⬜ Non-Detect

L = Labadie

S = Sioux

R = Rush Island

M5/M6 =Meramec monitoring wells

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

CaSx = calcium polysulfide

P = Precipitation

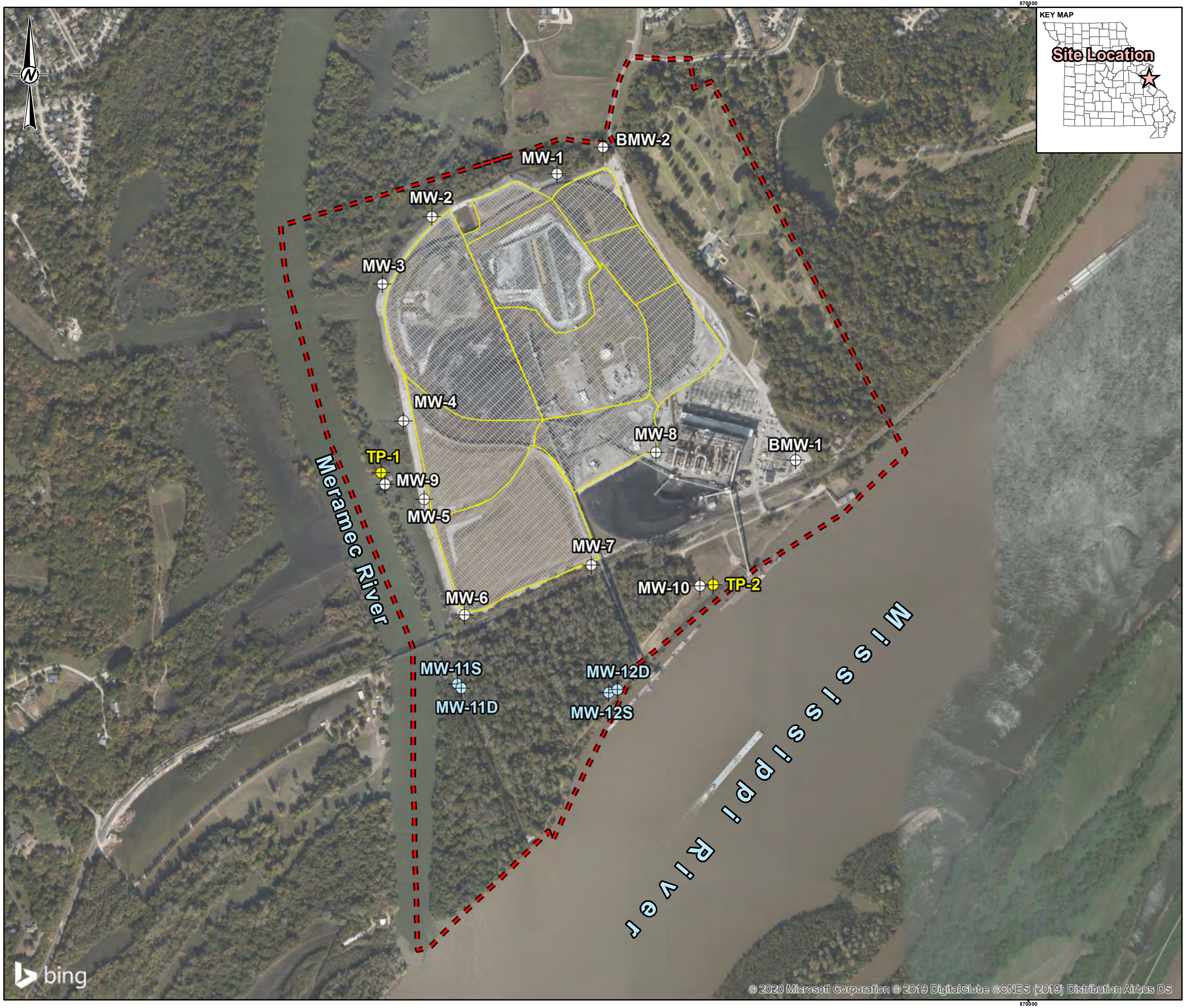
C = Co-precipitation

* = arsenic was not detected in M5/M6 baseline despite being detected during quarterly sampling at M5. Results indicate arsenic would likely be removed under pH 6 conditions.

Additional pilot studies are needed to confirm that laboratory results can be replicated and appropriately scaled under field conditions. Assuming such confirmation, corrective action Measures may also include groundwater treatment to facilitate reductions. Field demonstrations and groundwater treatment applications could require a state-issued permit pursuant to *10 CSR 20-6.010*. Remedial actions are iterative in nature and Ameren Missouri (as part of the long-term performance monitoring program) will periodically evaluate then-existing groundwater conditions relative to GWPS and determine whether additional treatment measures are warranted.

Attachment 2

Groundwater Monitoring Well Locations



LEGEND

▬ ▬	Meramec Energy Center Property Boundary
▨	Meramec Surface Impoundments

Groundwater Monitoring Wells Used for CCR Rule Monitoring

⊕	Detection/Assessment Monitoring Well Network
⊕	Corrective Action Monitoring Well Network
⊕	Proposed Corrective Action Monitoring Wells

0 500 1,000 1,500 2,000 2,500

Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
2.) LOCATIONS FOR MW-11 AND MW-12 ARE PROPOSED, THESE WELLS HAVE NOT YET BEEN INSTALLED.
3.) SOME MONITORING WELLS OFFSET FOR CLARIFICATION.

REFERENCE(S)

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION AERIAL MAP AND MONITORING WELL LOCATIONS

CONSULTANT

YYYY-MM-DD	2020-01-22
DESIGNED	JSI
PREPARED	EMS
REVIEWED	TJG
APPROVED	CMR

PROJECT NO.	REV.	FIGURE
153140601	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in

0

PATH: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 Annual Report\Figure 1 - Monitoring Well Location Map.mxd PRINTED ON: 2020-01-29 AT: 5:06:05 PM

Attachment 3

Monitoring Well Construction Diagrams

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-1

PROJECT NAME: AMEREN CCR GW MONITORING

PROJECT NUMBER: 153-1406.0004A

SITE NAME: MERAMEC ENERGY CENTER

LOCATION: MW-1

CLIENT: AMEREN MISSOURI

SURFACE ELEVATION: 404.1 FT MSL

GEOLOGIST: J. SUOZZI

NORTHING: 937676.9

EASTING: 865954.1

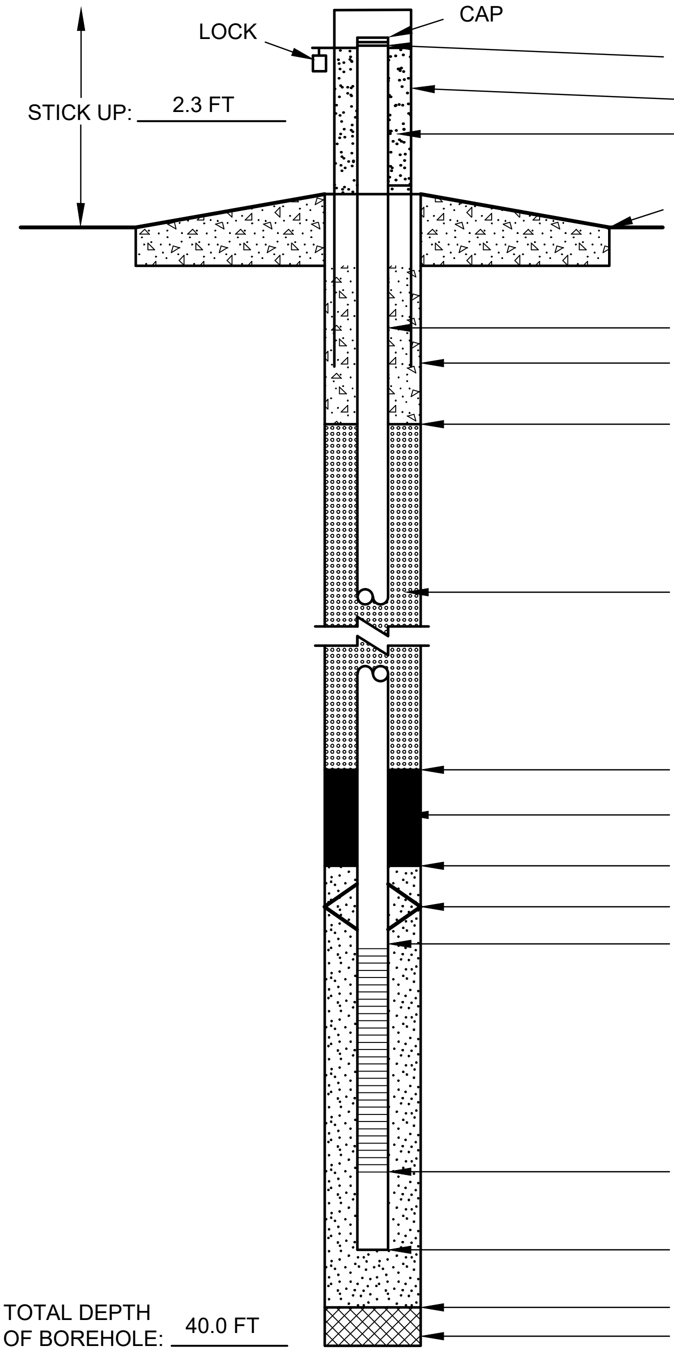
DRILLER: J. DRABEK

STATIC WATER LEVEL: 4.56 FT BTOC

COMPLETION DATE: 1/23/2016

DRILLING COMPANY: CASCADE

DRILLING METHODS: SONIC



STICK UP: 2.3 FT

TOP OF CASING ELEVATION: 406.43 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 404.1 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 5 $\frac{1}{2}$ BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 31.5 FINE: 30.0

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 33.9

TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 38.7

BOTTOM OF WELL DEPTH (ft. bgs): 39.1

BOTTOM OF FILTER PACK (ft. bgs): 39.1

TYPE AND AMOUNT OF BACKFILL: 0.9 FT - NATURAL CAVE IN

TOTAL DEPTH OF BOREHOLE: 40.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 125 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

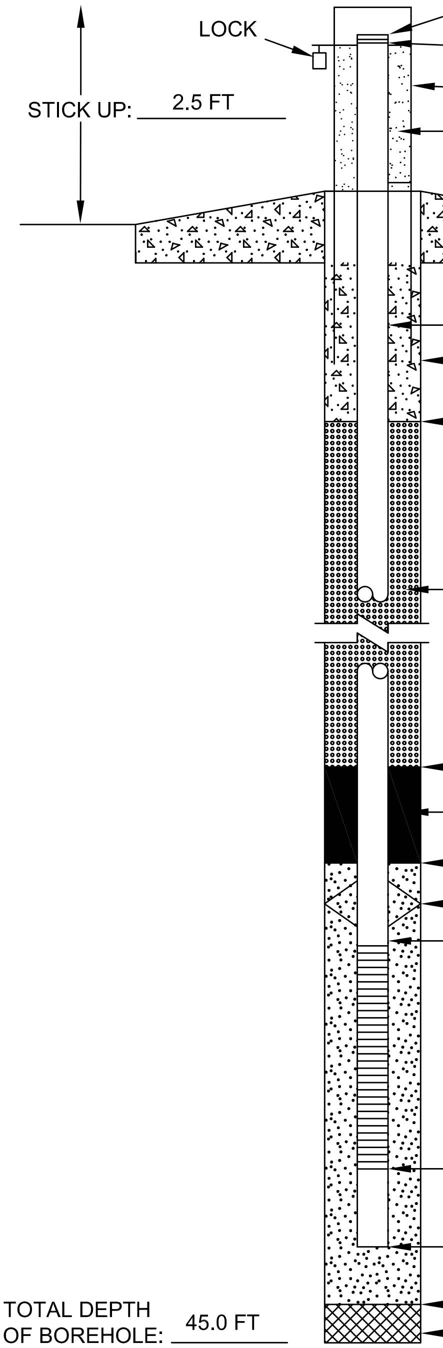
DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-2

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-2
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 396.1 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 937325.1
EASTING: 864864.5
DRILLER: J. DRABEK
STATIC WATER LEVEL: 15.06 FT BTOC
COMPLETION DATE: 1/23/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



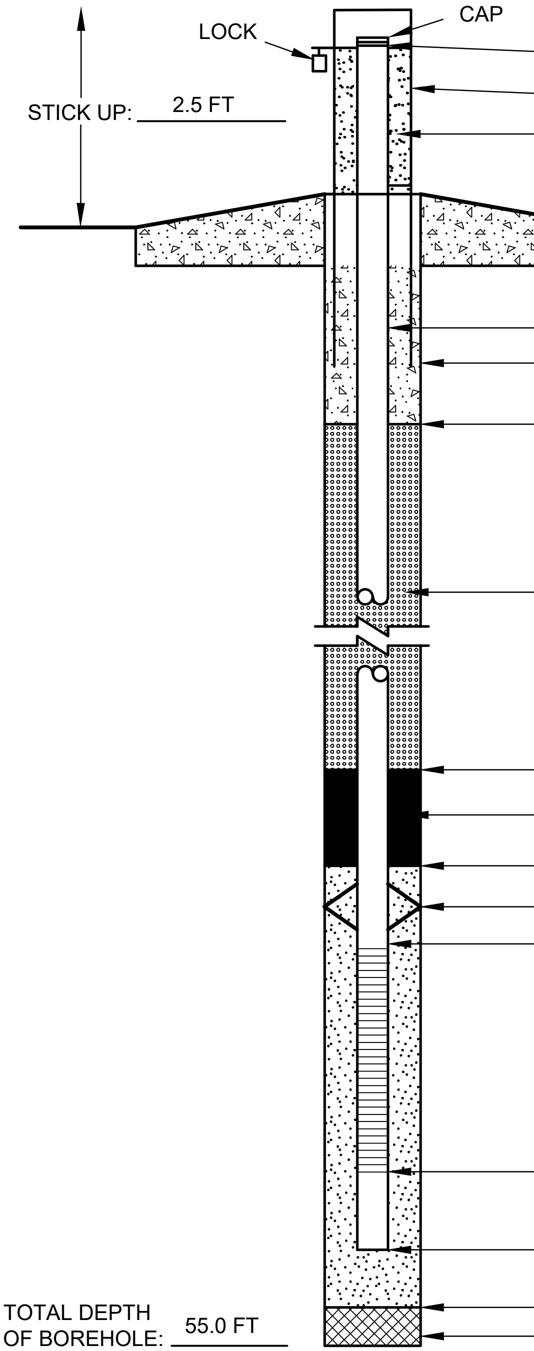
STICK UP: 2.5 FT
TOP OF CASING ELEVATION: 398.62 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 396.1 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 4 $\frac{1}{2}$ BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 27.0 FINE: 26.0
CENTRALIZER (yes [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (ft. bgs): 29.1
TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 33.9
BOTTOM OF WELL DEPTH (ft. bgs): 34.3
BOTTOM OF FILTER PACK (ft. bgs): 35.0
TOTAL DEPTH OF BOREHOLE: 45.0 FT
TYPE AND AMOUNT OF BACKFILL: 10.0 FT - 1.5 BAGS BENTONITE CHIPS

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
150 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-3

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-3
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 394.6 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 936750.8
EASTING: 864447.2
DRILLER: J. DRABEK
STATIC WATER LEVEL: 13.56 FT BTOC
COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.5 FT
TOP OF CASING ELEVATION: 397.12 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 394.6 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 5 BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 23.0 FINE: 22.0
CENTRALIZER (yes / [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (ft. bgs): 25.4
TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 30.2
BOTTOM OF WELL DEPTH (ft. bgs): 30.6
TOTAL DEPTH OF BOREHOLE: 55.0 FT
BOTTOM OF FILTER PACK (ft. bgs): 31.5
TYPE AND AMOUNT OF BACKFILL: 23.5 FEET - 3 BAGS BENTONITE CHIPS

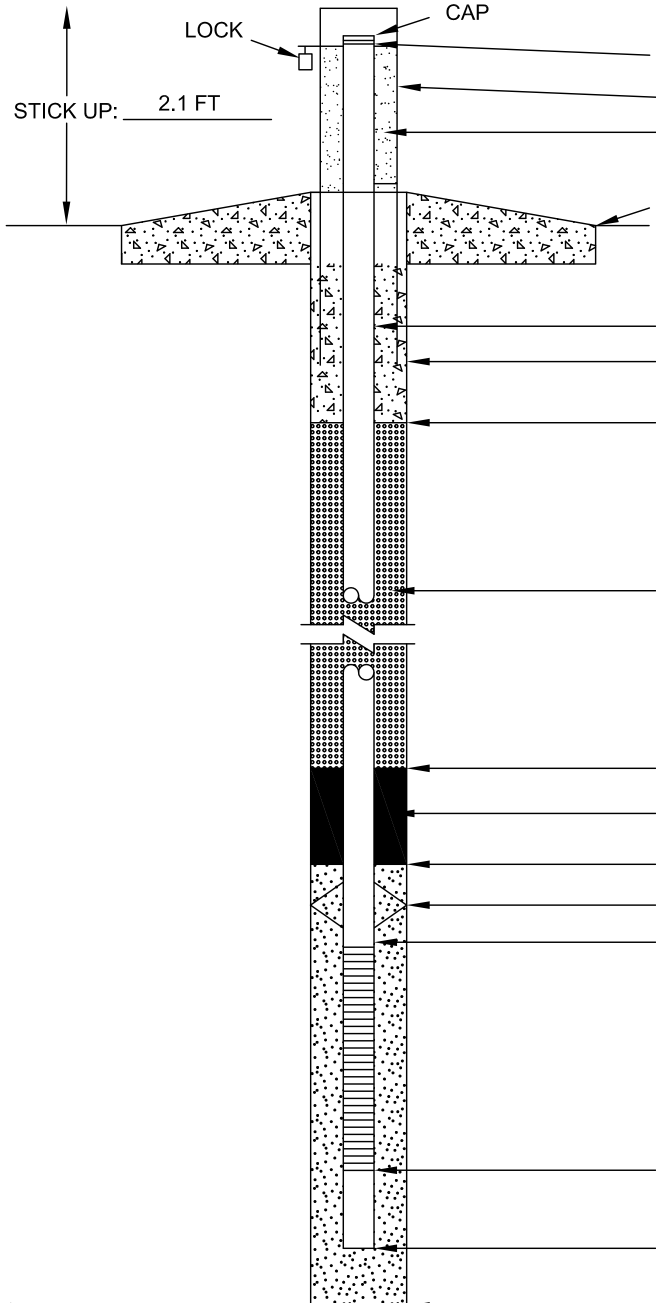
ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 150 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-4

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-4
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 402.0 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 935618.0
EASTING: 864629.8
DRILLER: J. DRABEK
STATIC WATER LEVEL: 20.25 FT BTOC
COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.1 FT

TOP OF CASING ELEVATION: 404.10 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 402.0 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 6 $\frac{1}{2}$ BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 35.7 FINE: 34.0
CENTRALIZER (yes [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (ft. bgs): 37.9
TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 42.7
BOTTOM OF WELL DEPTH (ft. bgs): 43.1
BOTTOM OF FILTER PACK (ft. bgs): 45.0
TYPE AND AMOUNT OF BACKFILL: 20.0 FT - 3 $\frac{1}{3}$ BAGS BENTONITE CHIPS

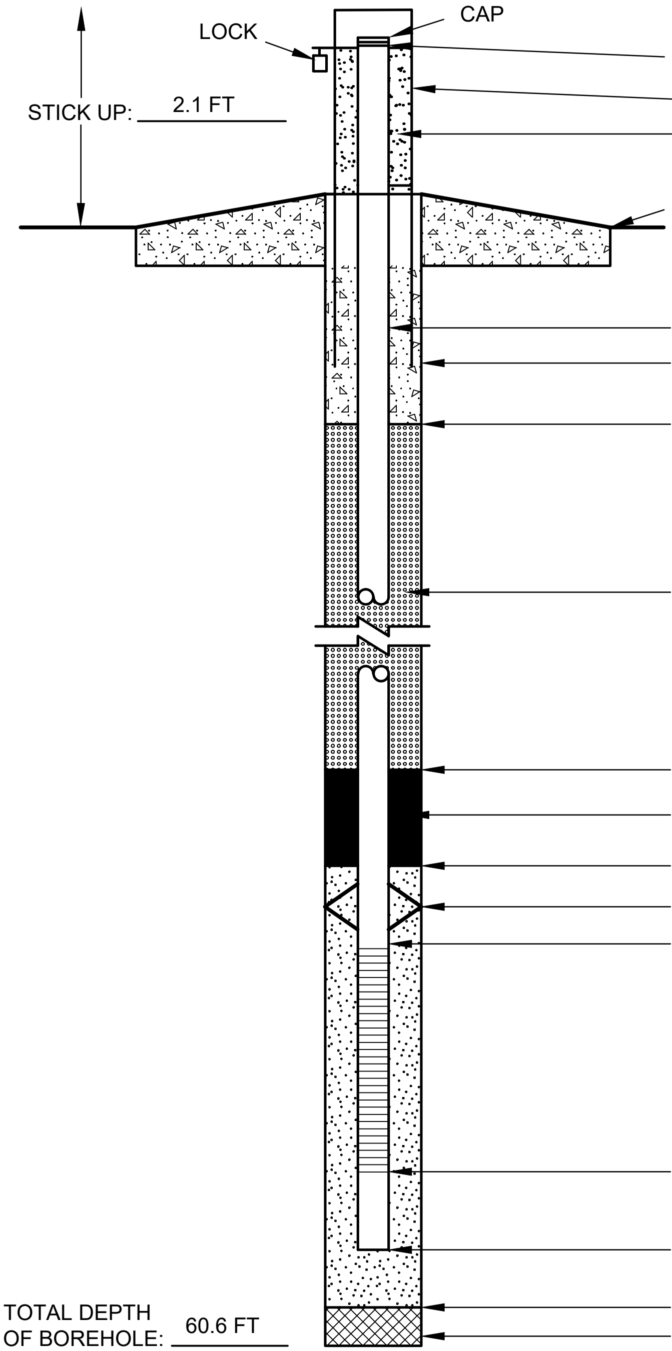
TOTAL DEPTH OF BOREHOLE: 65.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-5

PROJECT NAME: AMEREN CCR GW MONITORING		PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER		LOCATION: MW-5
CLIENT: AMEREN MISSOURI		SURFACE ELEVATION: 400.8 FT MSL
GEOLOGIST: J. SUOZZI	NORTHING: 934874.4	EASTING: 864781.0
DRILLER: J. DRABEK	STATIC WATER LEVEL: 18.89 FT BTOC	COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE		DRILLING METHODS: SONIC



STICK UP: 2.1 FT

TOP OF CASING ELEVATION: 402.93 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 400.8 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 8 BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 47.5 FINE: 46.0

CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)

TOP OF SCREEN DEPTH (ft. bgs): 50.4

TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 3 $\frac{1}{4}$ BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 60.2

BOTTOM OF WELL DEPTH (ft. bgs): 60.6

TOTAL DEPTH OF BOREHOLE: 60.6 FT

BOTTOM OF FILTER PACK (ft. bgs): 60.6

TYPE AND AMOUNT OF BACKFILL: NONE

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
250 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

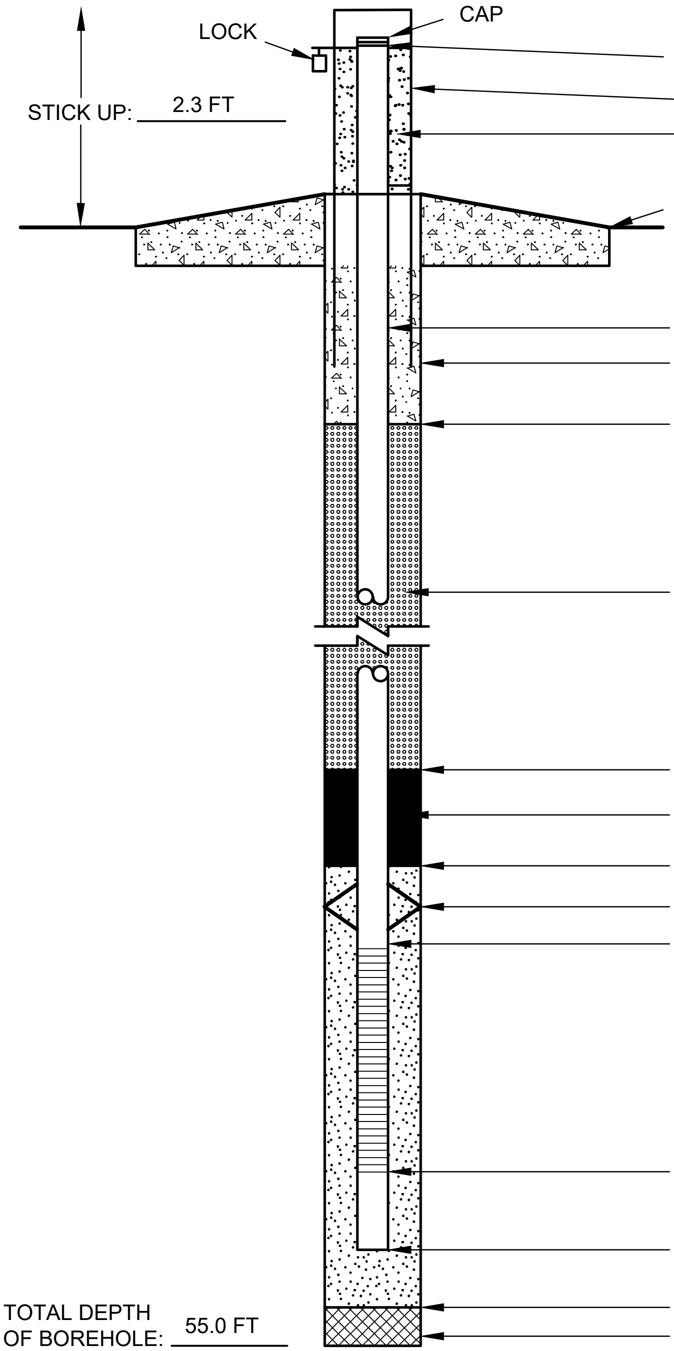
DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-6

Golder Associates

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-6
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 415.8 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 933905.2
EASTING: 865153.5
DRILLER: J. DRABEK
STATIC WATER LEVEL: 33.60 FT BTOC
COMPLETION DATE: 1/21/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.3 FT

TOP OF CASING ELEVATION: 418.12 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 415.8 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 7 BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 39.7 FINE: 39.0
CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 42.5
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 3.5 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 52.3
BOTTOM OF WELL DEPTH (ft. bgs): 52.7
BOTTOM OF FILTER PACK (ft. bgs): 52.7
TYPE AND AMOUNT OF BACKFILL: 2.3 FEET -NATURAL BACKFILL

TOTAL DEPTH OF BOREHOLE: 55.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 300 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

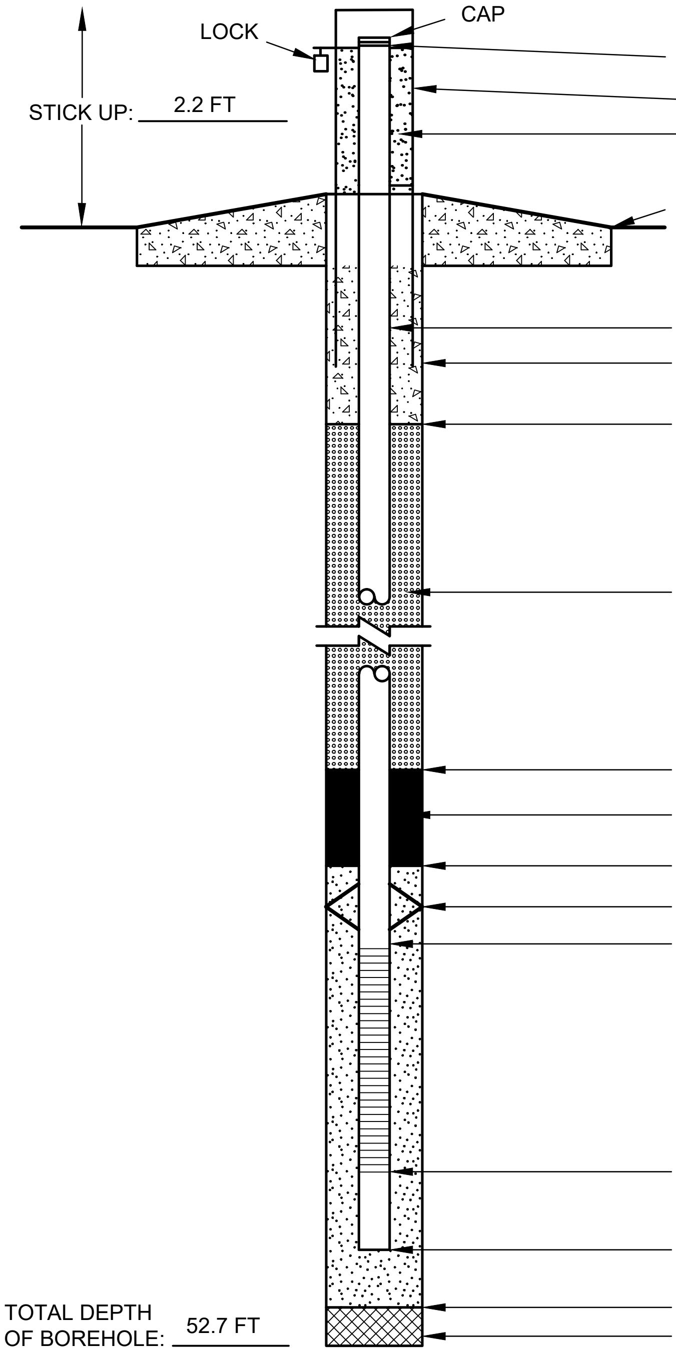
CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-7

PROJECT NAME: AMEREN CCR GW MONITORING	PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER	LOCATION: MW-7
CLIENT: AMEREN MISSOURI	SURFACE ELEVATION: 415.7 FT MSL

GEOLOGIST: J. SUOZZI	NORTHING: 934334.4	EASTING: 866242.5
DRILLER: J. DRABEK	STATIC WATER LEVEL: 33.26 FT BTOC	COMPLETION DATE: 1/24/2016

DRILLING COMPANY: CASCADE	DRILLING METHODS: SONIC



STICK UP: 2.2 FT

TOP OF CASING ELEVATION: 417.94 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 415.7 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 8 BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 38.5 FINE: 37.0

CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)

TOP OF SCREEN DEPTH (ft. bgs): 42.5

TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2.5 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 52.3

BOTTOM OF WELL DEPTH (ft. bgs): 52.7

TOTAL DEPTH OF BOREHOLE: 52.7 FT

BOTTOM OF FILTER PACK (ft. bgs): 52.7

TYPE AND AMOUNT OF BACKFILL: NONE

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

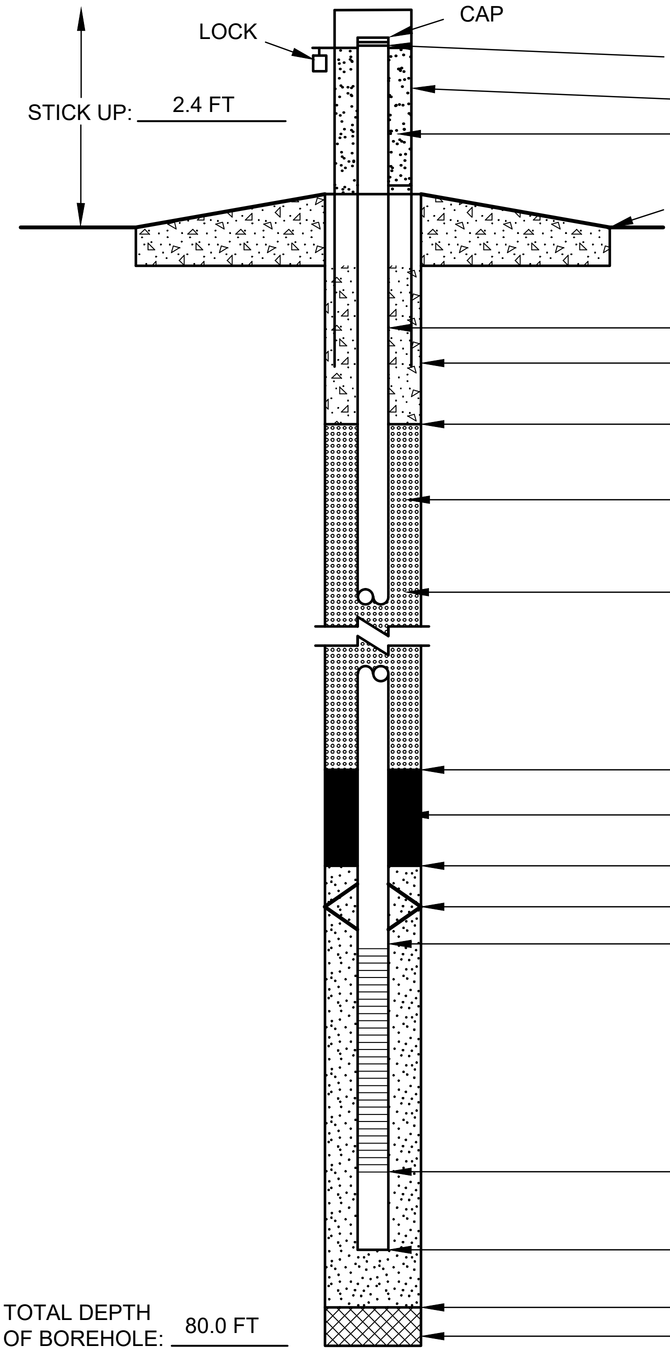
DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-8

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-8
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 421.0 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 935303.6
EASTING: 866797.8
DRILLER: J. DRABEK
STATIC WATER LEVEL: 38.20 FT BTOC
COMPLETION DATE: 1/24/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.4 FT

TOP OF CASING ELEVATION: 423.37 FT MSL
PROTECTIVE CASING ([✓ yes]/ no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 421.0 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 3.5 BAGS
TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 4 BAGS
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 58.0
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 1 BAG
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 63.0 FINE: 62.5
CENTRALIZER ([✓ yes]/ no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 65.2
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2.5 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 75.0
BOTTOM OF WELL DEPTH (ft. bgs): 75.4
BOTTOM OF FILTER PACK (ft. bgs): 80.0
TYPE AND AMOUNT OF BACKFILL: NONE

TOTAL DEPTH OF BOREHOLE: 80.0 FT

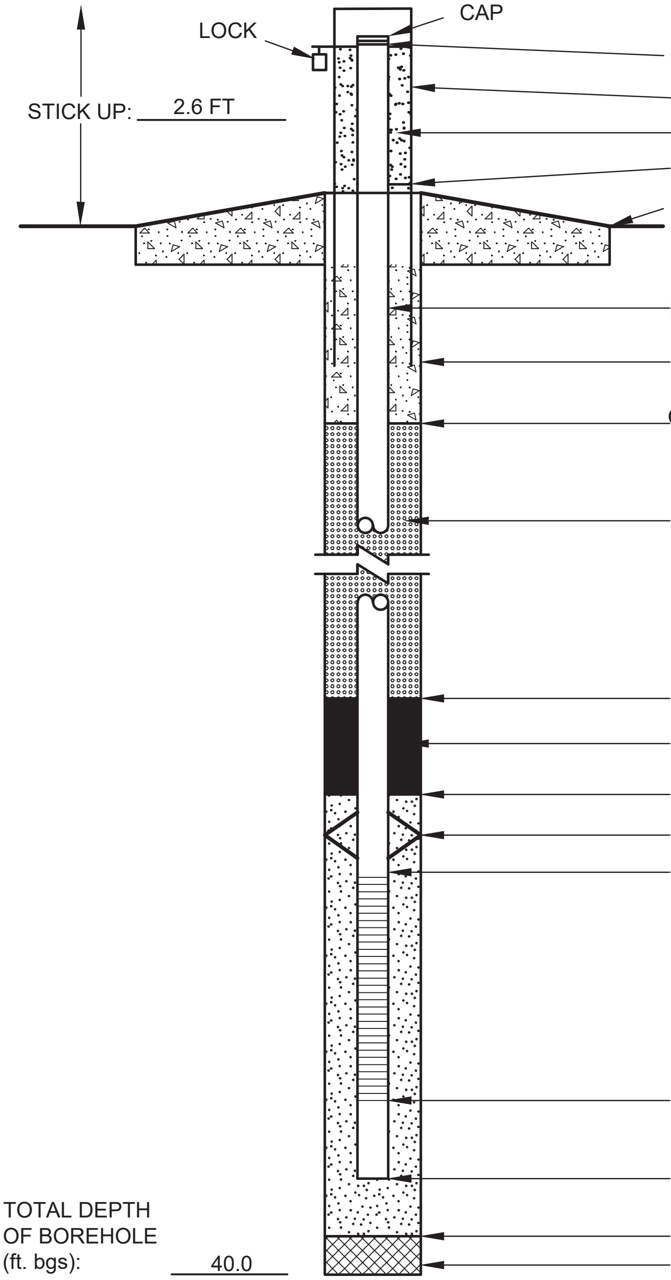
ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 250 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

GOLDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-9 (AMW-1)

PROJECT NAME: AMEREN NATURE AND EXTENT		PROJECT NUMBER: 153-1406.0004C
SITE NAME: MERAMEC ENERGY CENTER		LOCATION: MW-9 (AMW-1)
CLIENT: AMEREN MISSOURI		SURFACE ELEVATION: 391.12 FT MSL
GEOLOGIST: R. FELDMANN	NORTHING: 935106.5	EASTING: 864425.3
DRILLER: M. PATRICK	STATIC WATER LEVEL: 11.23 FT BGS	COMPLETION DATE: 06/20/2018
DRILLING COMPANY: M&W DRILLING		DRILLING METHODS: SONIC



STICK UP: 2.6 FT

TOP OF CASING ELEVATION: 393.71 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 6 in. ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 391.12 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (FT. BGS): 2.0

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (FT.BGS): 2.0

AMOUNT OF 3/8 in. BENTONITE CHIPS: 2 - 5 GALLON BUCKETS

TOP OF SAND PACK DEPTH (FT.BGS): 18.0

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (FT.BGS): 21.3

TYPE OF SCREEN: 2 in. X 9.8 FT SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: COARSE: #1: 20/40

AMOUNT OF SAND: 6 BAGS

BOTTOM OF SCREEN DEPTH (FT.BGS): 31.1

BOTTOM OF WELL DEPTH (FT.BGS): 31.6

TOTAL DEPTH OF BOREHOLE (ft. bgs): 40.0

BOTTOM OF FILTER PACK (FT.BGS): 35.0

TYPE AND AMOUNT OF BACKFILL: 2 BAGS OF BENTONITE

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
100 GALLONS OF H20 USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88 WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON JULY 23, 2018.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. PEREZ
DATE CHECKED: 10/09/2018

PREPARED BY: E.SCHNEIDER

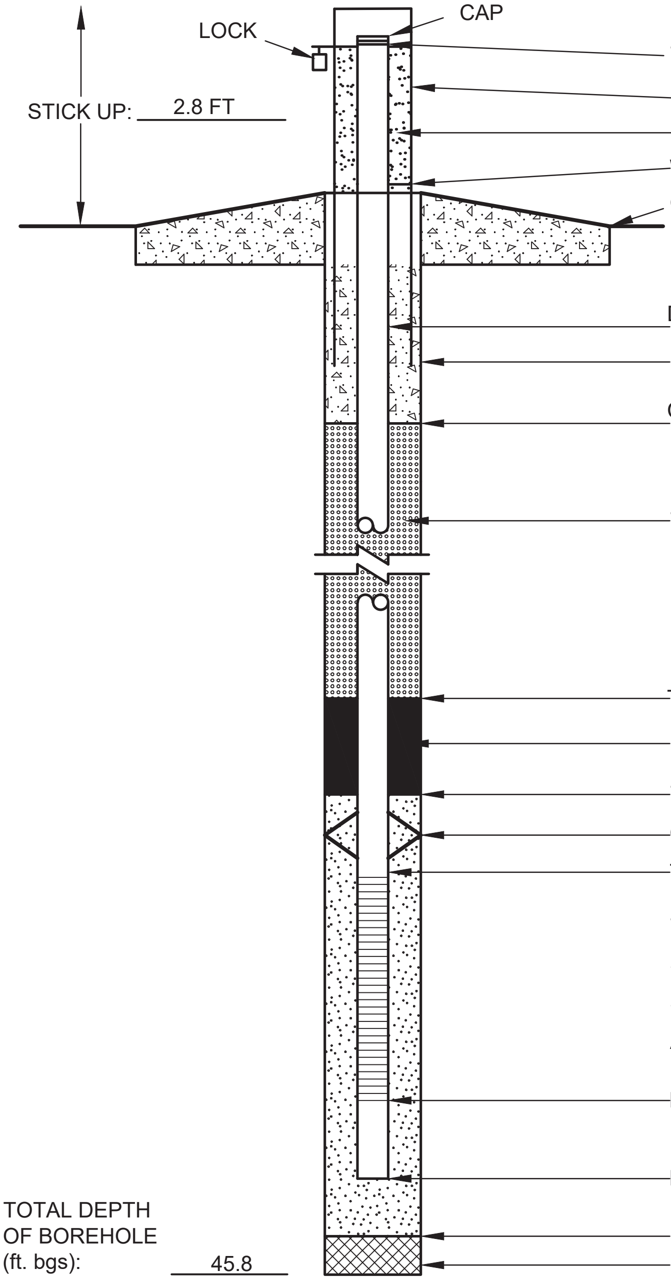
GOLDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-10 (AMW-2)

PROJECT NAME: AMEREN NATURE AND EXTENT	PROJECT NUMBER: 153-1406.0004C
SITE NAME: MERAMEC ENERGY CENTER	LOCATION: MW-10 (AMW-2)
CLIENT: AMEREN MISSOURI	SURFACE ELEVATION: 402.83 FT MSL

GEOLOGIST: R. FELDMANN	NORTHING: 934137.4	EASTING: 867158 .9
DRILLER: M. PATRICK	STATIC WATER LEVEL 23.18 FT BGS	COMPLETION DATE: 06/19/2018

DRILLING COMPANY: M&W DRILLING	DRILLING METHODS: SONIC



STICK UP: 2.8 FT

TOP OF CASING ELEVATION: 405.62 FT MSL

PROTECTIVE CASING ([✓ yes]/ no): 6 in. ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 402.83 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.0

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 4 BAGS

TOP OF BENTONITE SEAL DEPTH (FT.BGS): 27.0

AMOUNT OF 3/8 in. BENTONITE CHIPS: 1 - 5 GALLON BUCKET

TOP OF SAND PACK DEPTH (FT. BGS): 33.0

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (FT.BGS): 35.5

TYPE OF SCREEN: 2 in. X 9.8 FT SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: COARSE: #1: 20/40

AMOUNT OF SAND: 5 BAGS

BOTTOM OF SCREEN DEPTH (FT.BGS): 45.3

BOTTOM OF WELL DEPTH (FT.BGS): 45.8

TOTAL DEPTH OF BOREHOLE (ft. bgs): 45.8

BOTTOM OF FILTER PACK(FT.BGS): 45.8

TYPE AND AMOUNT OF BACKFILL: NONE

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 100 GALLONS OF H20 USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88 WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON JULY 23, 2018. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. PEREZ

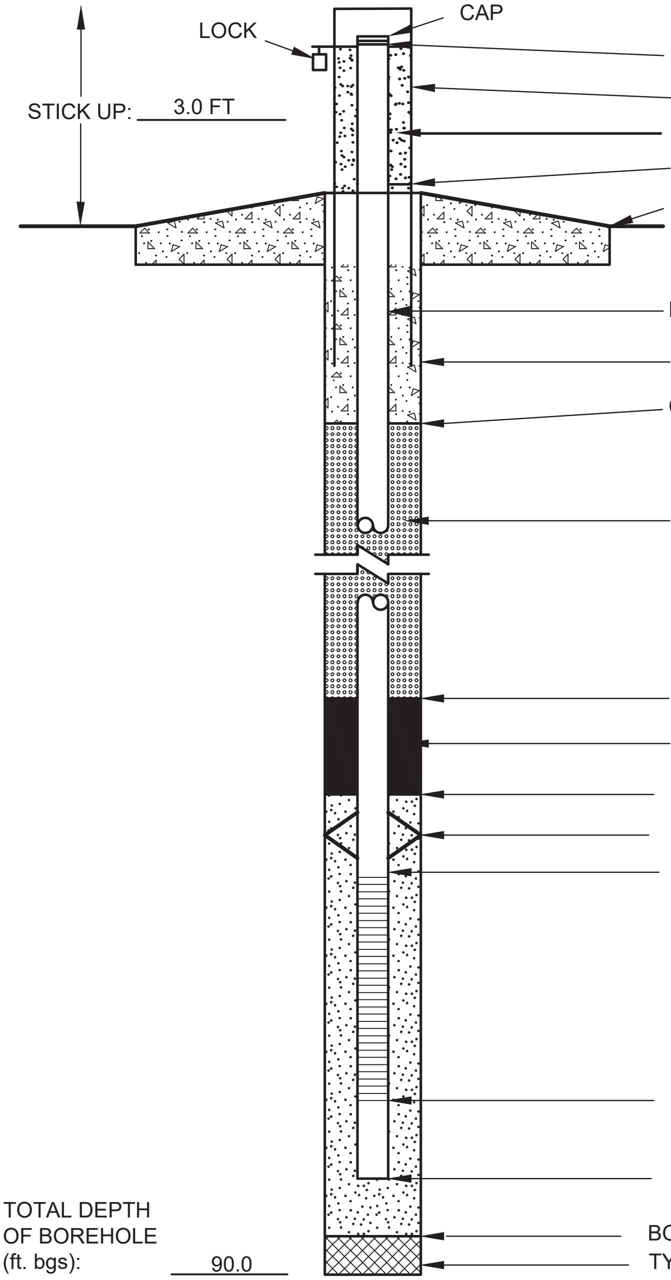
DATE CHECKED: 10/09/2018

PREPARED BY: E.SCHNEIDER

GOLDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG TP-1

PROJECT NAME: AMEREN NATURE AND EXTENT
PROJECT NUMBER: 153-1406.0004C
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: TP-1
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 390.68 FT MSL
GEOLOGIST: R. FELDMANN
NORTHING: 935109.7
EASTING: 864437.0
DRILLER: M. PATRICK
STATIC WATER LEVEL: 10.52 FT BGS
COMPLETION DATE: 06/20/2018
DRILLING COMPANY: M&W DRILLING
DRILLING METHODS: SONIC



STICK UP: 3.0 FT

TOP OF CASING ELEVATION: 393.71 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 6 in. ALUMINUM
PEA GRAVEL OR SAND
WEEP HOLE
GROUND SURFACE ELEVATION: 390.68 FT MSL
DIAMETER OF RISER PIPE (in.): 1.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (FT. BGS): 2.0
TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 8 BAGS
TOP OF BENTONITE SEAL DEPTH (FT. BGS): 76.0
AMOUNT OF 3/8 in. BENTONITE CHIPS: 1 - 5 GALLON BUCKET
TOP OF SAND PACK DEPTH (FT. BGS): 82.5
CENTRALIZER (yes / [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (FT. BGS): 84.6
TYPE OF SCREEN: 1 in X 4.7 FT SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010
SIZE OF SAND PACK: COARSE: #1: 20/40
AMOUNT OF SAND: 3 BAGS
BOTTOM OF SCREEN DEPTH (FT. BGS): 89.3
BOTTOM OF WELL DEPTH (FT. BGS): 89.7
BOTTOM OF FILTER PACK (FT.BGS): 89.7
TYPE AND AMOUNT OF BACKFILL: 0.3 FT NATURAL CAVE-IN

TOTAL DEPTH OF BOREHOLE (ft. bgs): 90.0

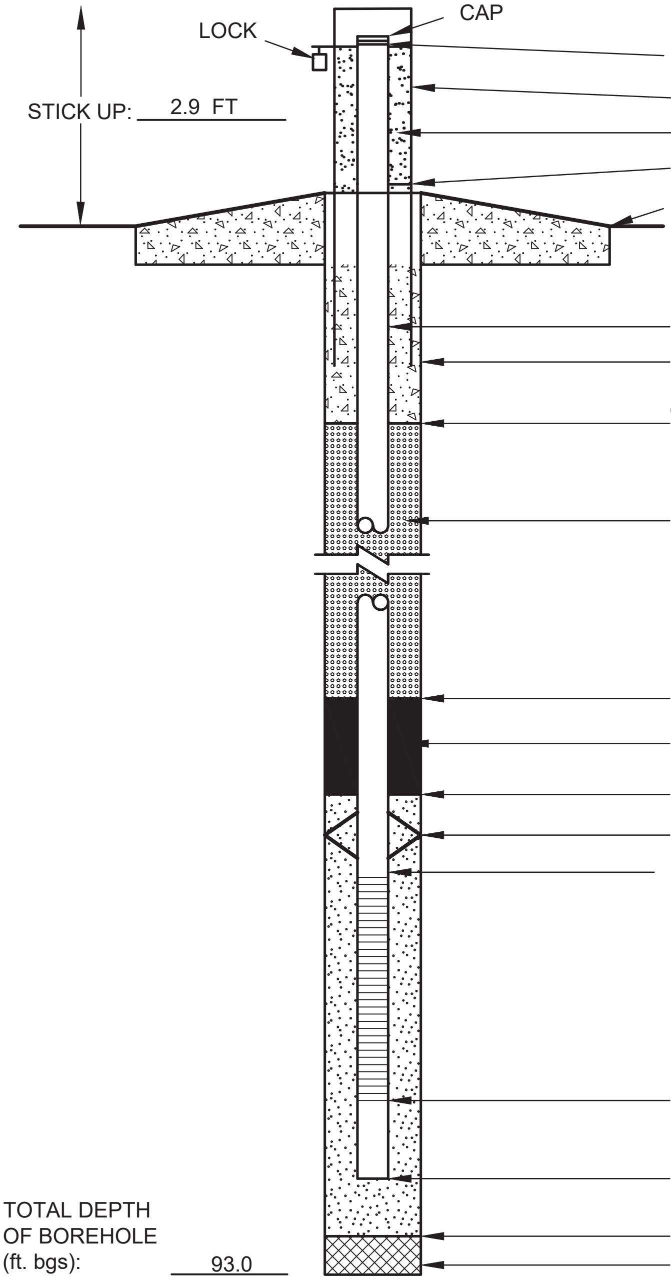
ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 280 GALLONS OF H20 USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88 WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON JULY 23, 2018. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH. in.=INCHES.

CHECKED BY: J. PEREZ
DATE CHECKED: 10/09/2018
PREPARED BY: E. SCHNEIDER

GOLDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG TP-2

PROJECT NAME: AMEREN NATURE AND EXTENT	PROJECT NUMBER: 153-1406.0004C
SITE NAME: MERAMEC ENERGY CENTER	LOCATION: TP-2
CLIENT: AMEREN MISSOURI	SURFACE ELEVATION: 402.35 FT MSL
GEOLOGIST: R. FELDMANN	NORTHING: 934151.5 — EASTING: 867171.1
DRILLER: M. PATRICK	STATIC WATER LEVEL: 22.66 FT BGS — COMPLETION DATE: 06/18/2018
DRILLING COMPANY: M&W DRILLING	DRILLING METHODS: SONIC



STICK UP: 2.9 FT

TOTAL DEPTH OF BOREHOLE (ft. bgs): 93.0

TOP OF CASING ELEVATION: 405.22 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 6 in. ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 402.35 FT MSL

DIAMETER OF RISER PIPE (in.): 1.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (FT. BGS): 2.0

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 8 BAGS

TOP OF BENTONITE SEAL DEPTH (FT. BGS): 78.0

AMOUNT OF 3/8 in. BENTONITE CHIPS: 1 - 5 GALLON BUCKET

TOP OF SAND PACK DEPTH (FT. BGS): 83.5

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (FT. BGS): 85.5

TYPE OF SCREEN: 1 in X 4.7 FT SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: COARSE: #1: 20/40

AMOUNT OF SAND: 3 BAGS

BOTTOM OF SCREEN DEPTH (FT. BGS): 90.2

BOTTOM OF WELL DEPTH (FT. BGS): 90.6

BOTTOM OF FILTER PACK (FT.BGS): 90.6

TYPE AND AMOUNT OF BACKFILL: 2.4 FT OF SAND

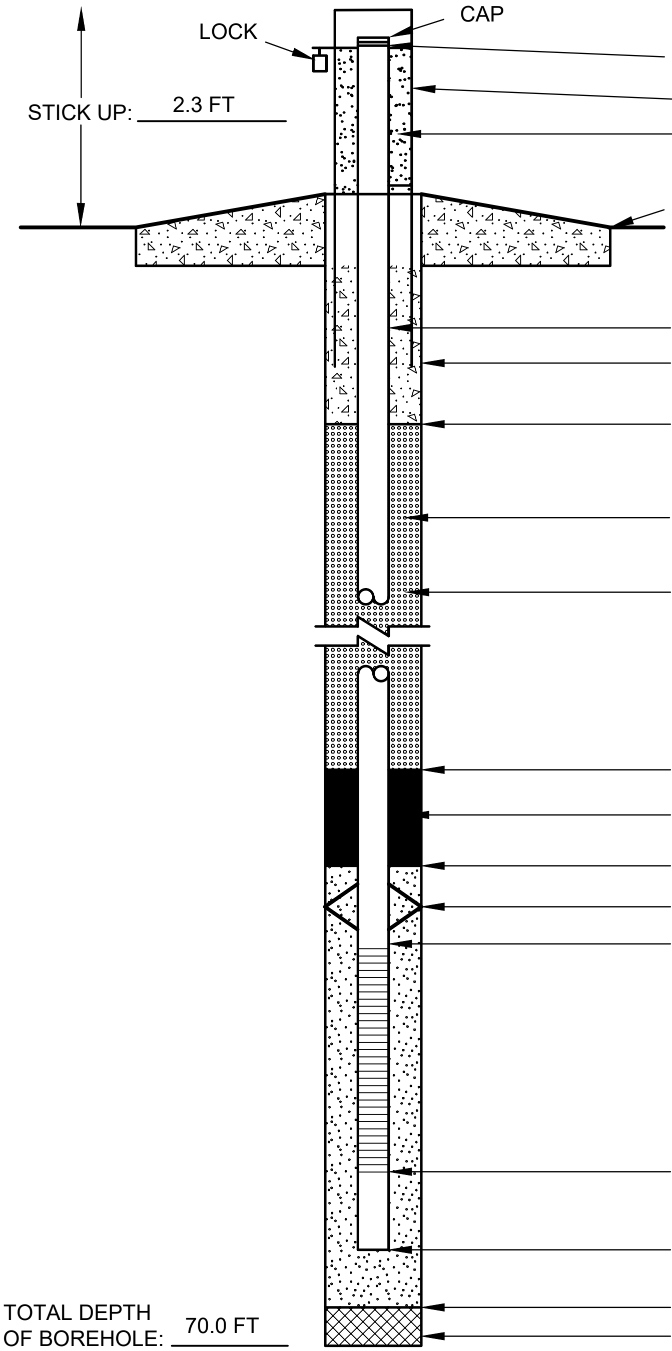
ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
275 GALLONS OF H20 USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88 WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON JULY 23, 2018.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH. in.=INCHES.
in.=INCHES.

CHECKED BY: J. PEREZ
DATE CHECKED: 10/09/2018

PREPARED BY: E. SCHNEIDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG BMW-1

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: BMW-1
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 416.8 FT MSL
GEOLOGIST: J. INGRAM
NORTHING: 935220.4
EASTING: 867989.4
DRILLER: J. DRABEK
STATIC WATER LEVEL: 25.42 FT BTOC
COMPLETION DATE: 4/7/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.3 FT

TOP OF CASING ELEVATION: 419.08 FT MSL
PROTECTIVE CASING ([✓ yes]/ no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 416.8 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 2 BAGS
TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 3 BAGS
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 40.0
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 1 BAG
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 46.5 FINE: 45.0
CENTRALIZER ([✓ yes]/ no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 50.4
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 4 BAGS FINE: 0.5 BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 60.2
BOTTOM OF WELL DEPTH (ft. bgs): 60.6
BOTTOM OF FILTER PACK (ft. bgs): 62.0
TYPE AND AMOUNT OF BACKFILL: $\frac{3}{8}$" CHIPS: 62.0-68.0 ft. bgs
CAVE IN: 68.0-70.0 ft. bgs

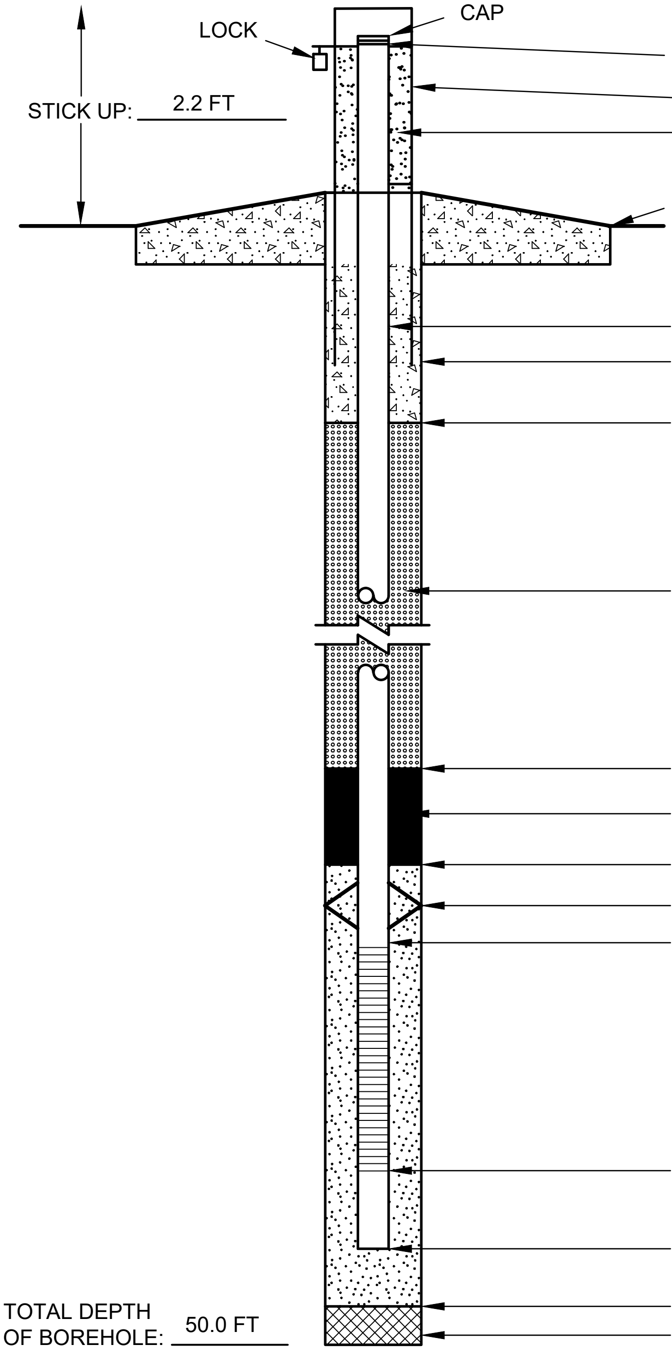
TOTAL DEPTH OF BOREHOLE: 70.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON APRIL 28, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 6/2/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG BMW-2

PROJECT NAME: AMEREN CCR GW MONITORING		PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER		LOCATION: BMW-2
CLIENT: AMEREN MISSOURI		SURFACE ELEVATION: 406.8 FT MSL
GEOLOGIST: J. SUOZZI	NORTHING: 937927.1	EASTING: 866342.2
DRILLER: J. DRABEK	STATIC WATER LEVEL: 14.11 FT BTOC	COMPLETION DATE: 1/25/2016
DRILLING COMPANY: CASCADE		DRILLING METHODS: SONIC



STICK UP: 2.2 FT

TOP OF CASING ELEVATION: 409.02 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 406.8 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 6 $\frac{1}{2}$ BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 34.7 FINE: 34.0

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 37.5

TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 1.75 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 42.3

BOTTOM OF WELL DEPTH (ft. bgs): 42.7

BOTTOM OF FILTER PACK (ft. bgs): 44.0

TYPE AND AMOUNT OF BACKFILL: BENTONITE CHIPS - 1 BAG - 6.0 FT

TOTAL DEPTH OF BOREHOLE: 50.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
120 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

Attachment 4

Groundwater Flow Maps

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

- - - Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - JANUARY 9, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2018-12-21
PREPARED	RJF
DESIGN	JSI
REVIEW	KAB
APPROVED	MNH

PROJECT No. 153-140601
PHASE 0004
FIGURE **P1**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\Jan Pot Map UPDATED 1-09-2019 (2).mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

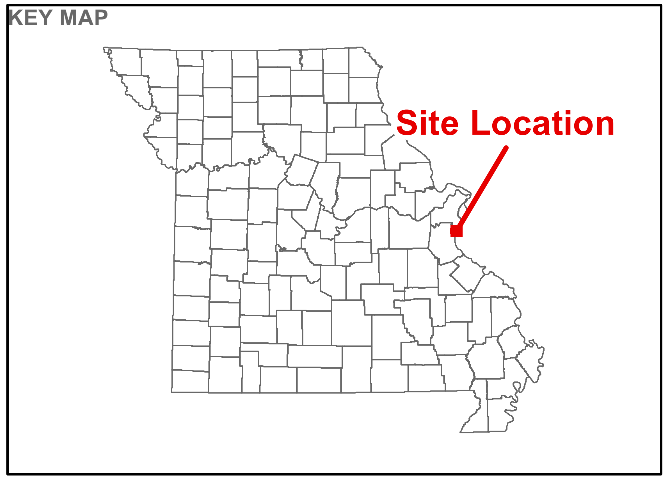
Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP JANUARY 28, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2020-01-29
PREPARED	EMS
DESIGN	JSI
REVIEW	TJG
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004D	0.0	P2

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 BMW Pot Maps\Pot Map Draft MEC 01-31-2019 (3).mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

― Groundwater Elevation Contour (FT MSL)

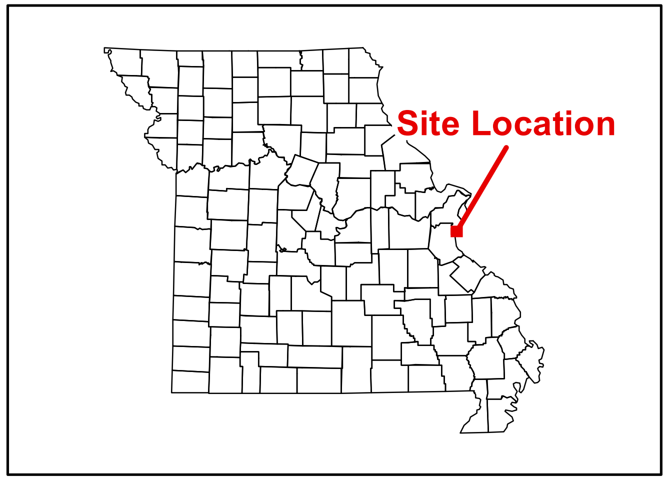
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

↖ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.
7. MW-9 (AMW-1) AND TP-1 ACCESS BLOCKED DUE TO HIGH WATER, NO GROUNDWATER ELEVATION DATA RECORDED.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - FEBRUARY 26, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2020-01-29
PREPARED	EMS
DESIGN	JSI
REVIEW	RJF/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	P3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019-02-19 Map for XDD\2019-02-26 Pot Map\Pot Map Draft MEC 2019-02-26 (1).mxd

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

━ Groundwater Elevation Contour (FT MSL)

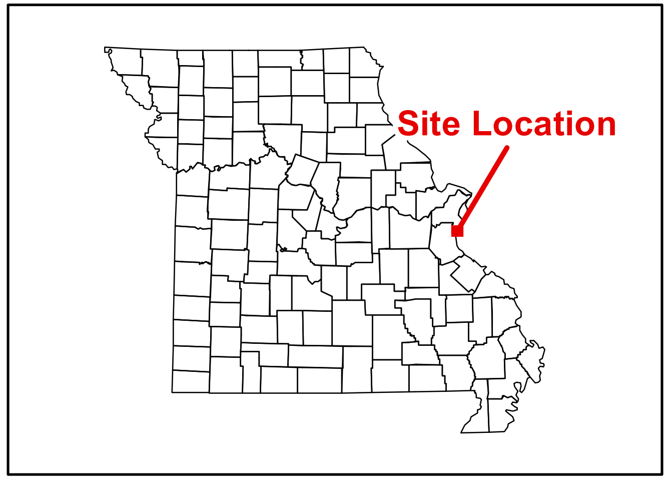
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

● Mississippi River Gauge

↖ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - AUGUST 12, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2019-08-29
PREPARED	JSI
DESIGN	JSI
REVIEW	KAB/EMS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	**P4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-08 - Pot Map.mxd

LEGEND

- Meramec Energy Center Property Boundary
- All Surface Impoundments

Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)
- Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- Groundwater Flow Direction

KEY MAP

NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATION MEASUREMNTS COULD NOT BE COLLECTED AT MW-2, MW-3, MW-9 (AMW-1), BMW-3, BMW-4, AND BMW-5 DUE TO FLOODING.
6. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
7. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - OCTOBER 3, 2019

CONSULTANT

YYYY-MM-DD	2019-10-18
PREPARED	AMM
DESIGN	JSI
REVIEW	RJF
APPROVED	MNH

PROJECT No. 153-140601
PHASE 0004
FIGURE P5

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-10-03 - Pot Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

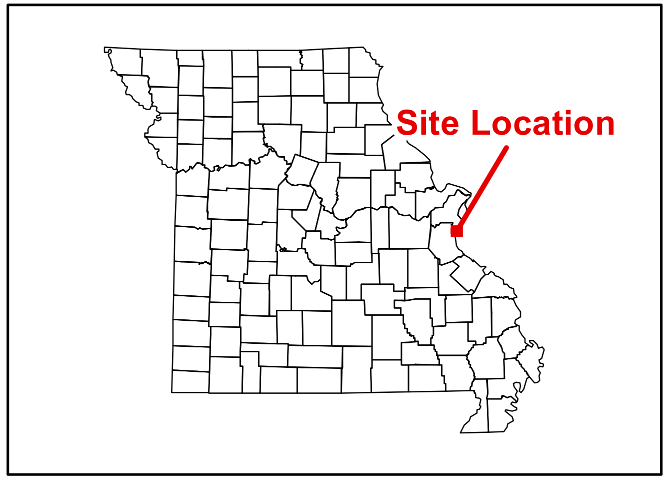
Groundwater Elevation Contours

- ━ Groundwater Elevation Contour (FT MSL)
- ╍ Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- ↖ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.
7. MW-9 (AMW-1) ACCESS BLOCKED DUE TO HIGH WATER, NO GROUNDWATER ELEVATION DATA RECORDED.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000 1,500 2,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - NOVEMBER 18, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2019-11-22
PREPARED	AMM
DESIGN	JSI
REVIEW	BTT
APPROVED	CMR

PROJECT No.	PHASE	FIGURE
153-140601	0004	P6

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\Figure 6 - 2019-11-18 - Pot Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

Attachment 5

Groundwater Monitoring Results

Table 4
November 2018 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	PREDICTION LIMITS	BACKGROUND		GROUNDWATER MONITORING WELLS							
			BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
November 2018 Detection Monitoring Event												
DATE	NA	NA	11/19/2018	11/19/2018	11/20/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018
pH	SU	6.352-7.76	7.24	7.03	6.84	6.73	6.90	7.20	7.54	6.56	6.97	6.79
BORON, TOTAL	µg/L	476.5	468	98.0 J	52.3 J	4,380	9,320	9,630	7,040	12,800	23,700	9,130
CALCIUM, TOTAL	µg/L	115,956	103,000	98,000	132,000	119,000	152,000	179,000	137,000	358,000	390,000	171,000
CHLORIDE, TOTAL	mg/L	248	137	12.8	43.1	31.3	35.7	51.1	43.9	18.0	54.4	24.5
FLUORIDE, TOTAL	mg/L	0.5034	0.43	0.35	0.30	ND	ND	ND	0.22	ND	0.31 J	0.22
SULFATE, TOTAL	mg/L	127	63.4	25.7	103	315	388	483	277	632	1,210	470
TOTAL DISSOLVED SOLIDS	mg/L	832	640	481	628	796	875	895	817	1,430	1,960	936

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Prediction Limits calculated using Sanitas Software.
6. If all background values are less than the Practical Quantitation Limit (PQL) then the Double Quantification Rule (DQR) is used.
7. Values highlighted in yellow indicate a Statistically Significant Increase (SSI).
8. Values highlighted in green indicate an initial exceedance above the prediction limit that was not confirmed by Verification Sampling (not an SSI).
9. There were no new initial exceedances for the November 2018 event; therefore, no Verification Sampling was necessary.

Prepared By: EMS
Checked By: TJG
Reviewed By: CMR

Table 5
August 2019 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, Missouri

ANALYTE	UNITS	PREDICTION LIMITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
			BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
August 2019 Detection Monitoring Event														
DATE	NA	NA	8/12/2019	8/13/2019	8/14/2019	8/12/2019	8/12/2019	8/12/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/14/2019
pH	SU	6.441-7.704	7.72	6.80	6.77	6.47	6.63	6.85	6.49	6.53	7.07	6.87	6.85	6.71
BORON, TOTAL	µg/L	697.4	354	81.4 J	48.4 J	4,980	9,420	9,120	6,710	14,500	22,700	8,880	5,420	1,740
CALCIUM, TOTAL	µg/L	123,335	102,000	104,000	131,000	135,000	175,000	181,000	162,000	320,000	354,000	197,000	135,000	197,000
CHLORIDE, TOTAL	mg/L	248	96.2	13.0	44.2	27.5	22.0 J	48.9	41.3	8.3	53.0	30.9	35.2	82.7
FLUORIDE, TOTAL	mg/L	0.5057	0.46	0.29	0.24	0.15 J	0.13 J	0.18 J	0.24	0.24	0.82	0.37	0.20 J	0.21
SULFATE, TOTAL	mg/L	212	53.0	25.9	106	324	363 J	465	339	516	841	462	222	211
TOTAL DISSOLVED SOLIDS	mg/L	832	620	483	696	817	968 J	1,090	957	1,310	1,840	1,060	830	1,110
October-December 2019 Verification Sampling Event														
DATE	NA	NA							10/3/2019		10/3/2019		12/10/2019	10/17/2019
pH	SU	6.441-7.704							6.87		6.87		7.12	6.85
BORON, TOTAL	µg/L	697.4											3,860	1,780
CALCIUM, TOTAL	µg/L	123,335											118,000	208,000
CHLORIDE, TOTAL	mg/L	248												
FLUORIDE, TOTAL	mg/L	0.5057									0.54			
SULFATE, TOTAL	mg/L	212											133	
TOTAL DISSOLVED SOLIDS	mg/L	832							898					961

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Prediction Limits calculated using Sanitas Software.
6. If all background values are less than the Practical Quantitation Limit (PQL) then the Double Quantification Rule (DQR) is used.
7. Values highlighted in yellow indicate a Statistically Significant Increase (SSI).
8. Values highlighted in green indicate an initial exceedance above the prediction limit that was not confirmed by Verification Sampling (not an SSI).
9. Only analytes/wells that were detected above the prediction limit and that had not already been verified were tested during Verification Sampling.

Prepared By: EMS
Checked By: KAB
Reviewed By: CMR

Table 6
November-December 2019 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
November-December 2019 Detection Monitoring Event													
DATE	NA	11/18/2019	11/18/2019	11/18/2019	11/19/2019	11/19/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	12/20/2019	11/18/2019
pH	SU	6.64	6.86	6.71	6.45	6.61	6.85	7.03	6.70	7.09	6.92	6.99	6.78
BORON, TOTAL	µg/L	485	118	45.6 J	5,000	9,110	9,740	7,670	14,000	27,500	9,880	3,440	1,720
CALCIUM, TOTAL	µg/L	122,000	107,000	137,000	134,000	171,000	190,000	170,000	333,000	431,000	186,000	106,000	226,000
CHLORIDE, TOTAL	mg/L	94.4	13.3	46.1	27.8	23.9	50.3	42.3	20.2	67.5	26.1	33.1	65.1
FLUORIDE, TOTAL	mg/L	0.62	0.31	0.30	0.17 J	0.13 J	0.16 J	0.23	0.11 J	0.55	0.28	0.21	0.15 J
SULFATE, TOTAL	mg/L	32.9	26.4	110	305	315	472	352	557	960	497	127	197
TOTAL DISSOLVED SOLIDS	mg/L	599	468	655	770	848	1,000	932	1,270	1,870	937	634	1,030

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect.
   Values displayed as ND.
4. NA - Not applicable.

Prepared By: TJG
Checked By: KAB
Reviewed By: CMR

Table 7
November 2018 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS							
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
Field Parameters											
DATE	NA	11/19/2018	11/19/2018	11/20/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018
DISSOLVED OXYGEN	mg/L	0.18	0.15	0.12	0.86	0.71	0.58	0.83	0.15	6.03	0.11
pH	SU	7.24	7.03	6.84	6.73	6.90	7.20	7.54	6.56	6.97	6.79
REDOX POTENTIAL	mV	41.7	-136.9	-33.0	-39.8	-39.0	-45.0	-37.5	-33.7	-29.3	-41.6
SPECIFIC CONDUCTIVITY	mS/cm	1.266	0.985	0.820	1.060	1.171	1.292	1.083	1.230	1.570	0.880
TURBIDITY	NTU	4.50	4.18	4.88	2.81	3.21	4.30	4.61	1.60	0.02	4.74
Appendix IV Parameters											
ARSENIC, TOTAL	µg/L	1.4	1.1	0.68 J	1.7	7.8	14.8	19.7	2.9	2.6	5.8
BARIUM, TOTAL	µg/L	204	524	370	299	232	200	195	49.4	37.9	168
CHROMIUM, TOTAL	µg/L	0.11 J	0.45 J	0.36 J	0.31 J	ND	0.25 J	0.14 J	0.12 J	0.25 J	ND
FLUORIDE, TOTAL	mg/L	0.43	0.35	0.30	ND	ND	ND	0.22	ND	0.31 J	0.22
LITHIUM, TOTAL	µg/L	15.0	6.5 J	5.3 J	6.4 J	ND	23.3	18.1	131	48.6	33.7
MOLYBDENUM, TOTAL	µg/L	4.6 J	ND	ND	ND	3.6 J	51.1	101	135	461	183
RADIUM [226 + 228]	pCi/L	2.676	1.607	1.663 J	2.160	2.410	ND	1.399	ND	1.376 J	2.474

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.
6. Statistical Analysis for the Assessment Monitoring data is provided in Appendix C.
7. Arsenic result at MW-5 is from the January 2019 re-sample.

Prepared By: RJF
Checked By: EMS
Reviewed By: CMR

Table 8
August 2019 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS											
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-9	MW-10
Field Parameters															
DATE	NA	8/13/2019	8/13/2019	8/14/2019	8/12/2019	8/12/2019	8/12/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/14/2019	12/10/2019	10/17/2019
DISSOLVED OXYGEN	mg/L	0.36	1.08	0.34	0.20	0.41	1.51	0.23	0.46	5.69	0.62	0.93	0.37	31.05	0.16
pH	SU	7.72	6.80	6.77	6.47	6.63	6.85	6.49	6.53	7.07	6.87	6.85	6.71	7.12	6.85
REDOX POTENTIAL	mV	-134.7	-99.2	13.1	-103.5	-108.9	-114.0	89.2	68.4	19.8	-69.4	53.8	104.2	-81.9	57.9
SPECIFIC CONDUCTIVITY	mS/cm	0.928	0.882	1.03	1.196	1.291	1.458	1.36	1.63	2.130	1.353	1.23	1.53	2.692	1.58
TURBIDITY	NTU	7.32	0.74	4.68	4.88	4.26	5.07	4.16	8.22	1.40	9.80	4.44	4.73	0.23	4.18
Appendix IV Parameters															
ANTIMONY, TOTAL	µg/L	0.23 J	ND	ND	ND	ND	ND	0.11 J	ND	0.39 J	ND	ND	ND	ND	-
ARSENIC, TOTAL	µg/L	2.1	0.86 J	0.66 J	1.5	7.5	13.9	23.0	2.6	2.8	5.7	15.8	11.8	17.1	12.5
BARIUM, TOTAL	µg/L	210	502	341	301	196	168	230	44.1	37.0	102	247	162	207	181
BERYLLIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
CADMIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	0.048 J	0.31 J	0.36 J	0.099 J	ND	ND	ND	-
CHROMIUM, TOTAL	µg/L	0.086 J	0.16 J	0.22 J	0.32 J	0.11 J	ND	0.18 J	ND	0.18 J	ND	ND	0.11 J	0.10 J	-
COBALT, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	5.4	ND	ND	ND	1.6 J	ND	ND
FLUORIDE, TOTAL	mg/L	0.46	0.29	0.24	0.15 J	0.13 J	0.18 J	0.24	0.24	0.82	0.37	0.20 J	0.21	0.25	0.29
LEAD, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.0 J	ND	-
LITHIUM, TOTAL	µg/L	6.8 J	ND	ND	ND	ND	14.0	12.2	122	36.2	27.8	13.8	37.4	9.8 J	35.0
MERCURY, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
MOLYBDENUM, TOTAL	µg/L	3.7 J	ND	ND	ND	7.5 J	51.5	96.3	123	463	186	37.8	4.5 J	37.6	6.6 J
RADIUM [226 + 228]	pCi/L	1.514 J	ND	ND	ND	1.092 J	ND	1.599	ND	ND	ND	1.706 J	1.865 J	ND	ND
SELENIUM, TOTAL	µg/L	0.12 J	ND	0.11 J	0.15 J	0.10 J	ND	ND	0.087 J	8.6	0.11 J	ND	ND	ND	ND
THALLIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.
6. Statistical Analysis for the Assessment Monitoring data is provided in Appendix D.
7. "-" Not Sampled.

Prepared By: RJF
Checked By: EMS/KAB
Reviewed By: CMR

Table 9
November-December 2019 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
Field Parameters													
DATE	NA	11/18/2019	11/18/2019	11/18/2019	11/19/2019	11/19/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	12/20/2019	11/18/2019
DISSOLVED OXYGEN	mg/L	0.21	0.29	0.27	0.18	0.18	0.13	0.65	2.13	3.81	0.62	0.48	0.13
pH	SU	6.64	6.86	6.71	6.45	6.61	6.85	7.03	6.70	7.09	6.92	6.99	6.78
REDOX POTENTIAL	mV	-16.0	-150.4	144.4	29.9	43.3	-154.2	-161.7	-50.7	82.5	-104.0	-146.0	-121.2
SPECIFIC CONDUCTIVITY	mS/cm	1.05	0.86	1.06	1.20	1.26	1.442	1.326	1.596	2.201	1.230	1.018	1.560
TURBIDITY	NTU	9.80	3.43	4.30	3.44	3.05	8.66	4.13	8.66	2.59	8.63	2.27	1.82
Appendix IV Parameters													
ARSENIC, TOTAL	µg/L	4.7	1.3	0.69 J	1.8	7.4	16.1	21.8	3.9	2.6	6.4	18.6	10.7
BARIUM, TOTAL	µg/L	292	558	368	309	200	199	240	51.0	42.6	142	192	180
COBALT, TOTAL	µg/L	3.2 J	ND	ND	ND	ND	ND	ND	4.2 J	ND	ND	ND	2.8 J
FLUORIDE, TOTAL	mg/L	0.62	0.31	0.30	0.17 J	0.13 J	0.16 J	0.23	0.11 J	0.55	0.28	0.21	0.15 J
LITHIUM, TOTAL	µg/L	14.4	6.5 J	ND	7.7 J	7.4 J	18.6	17.9	127	52.2	36.5	16.1	36.6
MOLYBDENUM, TOTAL	µg/L	5.9 J	ND	ND	ND	7.7 J	52.4	98.6	132	373	221	34.2	2.7 J
RADIUM [226 + 228]	pCi/L	1.839	1.386	ND	ND	ND	ND	1.761	ND	ND	ND	ND	ND
SELENIUM, TOTAL	µg/L	0.15 J	ND	ND	0.12 J	0.089 J	0.093 J	0.093 J	ND	8.2	0.088 J	ND	0.093 J

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, and pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.

Prepared By: JSI
Checked By: KAB
Reviewed By: CMR

Attachment 6

Annual Groundwater Monitoring and Corrective Action Report

2019 Annual Groundwater Monitoring and Corrective Action Report

Meramec Energy Center, St. Louis County, Missouri, USA

Submitted to:

Ameren Missouri
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Submitted by:

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Project No. 153-140601

January 31, 2020

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APPENDICES

1.0 INTRODUCTION

This annual report was developed to meet the requirements of United States Environmental Protection Agency (USEPA) 40 CFR Part 257 “Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule” (the CCR Rule). The CCR Rule requires owners or operators of existing CCR units to produce an Annual Groundwater Monitoring and Corrective Action Report (Annual Report) each year (§ 257.90(e)). Ameren Missouri (Ameren) has determined that the Surface Impoundments at the Meramec Energy Center (MEC) are subject to the requirements of the CCR Rule. This Annual Report for the MEC describes CCR Rule groundwater monitoring activities from January 1, 2019 through December 31, 2019.

1.1 Overview of CCR Rule Activities Prior to 2019

The CCR Rule was published in the Federal Register on April 17, 2015. This rule required CCR surface impoundments and landfills to monitor groundwater around these CCR units. Prior to the first major deadline of October 17, 2017, Ameren completed the following tasks: (1) installation of a groundwater monitoring well system; (2) a Statistical Method Certification; (3) a Groundwater Monitoring Plan (GMP) that details design, installation, development, sampling procedures, as well as statistical methods; and (4) eight baseline groundwater sampling events for all Appendix III and Appendix IV parameters of the CCR Rule. In November 2017, the first Detection Monitoring event was completed. Results from this event demonstrated some Appendix III parameters were present at concentrations that were a Statistically Significant Increase (SSI) over background and were then verified in January 2018 testing. In accordance with the CCR Rule, Ameren placed a “Notification of the Establishment of a CCR Assessment Monitoring Program” and began Assessment Monitoring within 90 days. Results from the Assessment Monitoring events for the MEC indicated the presence of molybdenum, lithium, and arsenic at a Statistically Significant Level (SSL) over the site-specific Groundwater Protection Standard (GWPS) in several of the compliance monitoring wells. As required, Ameren placed a “Notification of the Detection of Statistically Significant Levels Above CCR Groundwater Protection Standards” on its website and commenced an assessment of potential Corrective Measures.

2.0 2019 ACTIVITIES AND CURRENT STATUS OF THE MEC GROUNDWATER MONITORING PROGRAM

The Surface Impoundments at the MEC are currently in Corrective Action with Detection and Assessment Monitoring continuing concurrently. In 2019, Ameren Missouri completed a Corrective Measures Assessment (CMA). Due to the complexities of the site, the 60-day extension was used for the completion of the CMA. The CMA was placed on Ameren’s publicly available website (Ameren’s publicly available website is at: https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion) in May 2019 as required by the CCR Rule (§257.96(a)) and is provided in **Appendix A**. On May 30, 2019 Ameren held its public meeting on the findings of the CMA and accepted public comments. Ameren reviewed the comments and in August 2019 provided a response to the public comments, which is provided on Ameren’s publicly available website. After reviewing the options from the CMA and public comments, on August 30, 2019, Ameren selected a final remedy of source control through installation of a low permeability cover system and use of Monitored Natural Attenuation (MNA). As required by the CCR Rule (§257.97(a)), a report discussing this remedy selection as well as a certification by a Professional Engineer was placed in the operating record. After selecting a remedy, a Corrective Action Groundwater Monitoring Program was established within 90 days as required by the CCR Rule (§257.98(a)). Certifications of the Corrective Action Statistical Analysis Plan (SAP) and Groundwater Monitoring System (GMS) are provided on Ameren’s publicly available website. Additionally, Ameren plans to finish closure for all of the surface impoundments at the MEC by the end of 2022. Detection and Assessment Monitoring continued on a semi-annual basis and the results are discussed in more detail below.

3.0 INSTALLATION OR DECOMMISSIONING OF MONITORING WELLS

There are currently two (2) different networks used for monitoring the MEC Surface Impoundments, the monitoring well network established under §257.91 used for Detection and Assessment Monitoring and the network established under §257.98 used for Corrective Action Monitoring. **Table 1** (in text) provides a list of the monitoring wells used for each program and the location of the monitoring wells is provided in **Figure 1**. In addition, a summary of well construction details is provided in **Table 2**.

For the Detection and Assessment Groundwater Monitoring Network, all but two (2) monitoring wells are the same as in years past. Well construction diagrams for the previously used wells are provided in the 2017 Annual Report for this CCR Unit. MW-9 (AMW-1) and MW-10 (AMW-2) were added to the network to satisfy the requirements of §257.95(g)(1), which required at least one (1) additional monitoring well be installed at the downgradient facility boundary. The well construction diagrams for these wells can be found in the 2018 Annual Report for the MEC.

MW-11S, MW-11D, MW-12S, and MW-12D are currently proposed monitoring wells and their proposed locations are provided in **Figure 1**. Well construction diagrams for these monitoring wells will be provided in the 2020 Annual Report.

Table 1 - MEC Groundwater Monitoring Programs Monitoring Wells

Detection and Assessment Groundwater Monitoring Program Wells	Corrective Action Groundwater Monitoring Program Wells
BMW-1	TP-1
BMW-2	TP-2
MW-1	MW-11S*
MW-2	MW-11D*
MW-3	MW-12S*
MW-4	MW-12D*
MW-5	Notes: 1) * - MW-11S, MW-11D, MW-12S, and MW-12D have not yet been installed and the locations are proposed.
MW-6	
MW-7	
MW-8	
MW-9 (AMW-1)	
MW-10 (AMW-2)	

4.0 GROUNDWATER SAMPLING RESULTS AND DISCUSSION

The following sections review the sampling events completed for the MEC Surface Impoundments in 2019. **Table 3** provides a summary of the groundwater samples collected in 2019 including the number of samples, the date of the sample collection, and the monitoring program for the samples. **Appendix B** provides laboratory analytical data for CCR Rule sampling events.

4.1 Detection Monitoring Program

A Detection Monitoring event was completed November 19-20, 2018. The statistical analyses to evaluate for SSIs for the November 2018 event were not completed until 2019 and are included in this report. No new SSIs were determined for the November 2018 event. **Table 4** summarizes the results and the statistical analysis of the November 2018 Detection Monitoring event.

A Detection Monitoring event was scheduled for May 2019, however due to flooding the event was completed August 12-14, 2019, and testing was completed for all Appendix III analytes. Statistical analysis of the data determined that there were SSIs. Detections of Appendix III analytes triggered a verification sampling event, which was completed October-December 2019. **Table 5** summarizes the results and the statistical analysis of the August 2019 Detection Monitoring event. MW-9 (AMW-1) and MW-10 (AMW-2) were added to the Detection and Assessment Monitoring Well Networks for this event.

As outlined in the Statistical Analysis Plan for this site, updates to the statistical limits are completed once four (4) to eight (8) new sample results are available. During the statistical analysis of the August 2019 sampling event, the statistical limits used to determine an SSI were updated according to the Statistical Analysis Plan.

A Detection Monitoring event was completed November-December 2019 and testing was performed for all Appendix III analytes. Statistical analyses to evaluate for SSIs in the November-December 2019 data were not completed in 2019 and this statistical evaluation will be included in the 2020 Annual Report. **Table 6** summarizes the results of the November-December 2019 Detection Monitoring event.

4.2 Assessment Monitoring Program

An Assessment Monitoring event was completed November 19-20, 2018 and testing was completed for Appendix IV parameters that were detected during the April 2018 sampling event. The statistical evaluation for this event was completed in 2019 and therefore is included in this report. **Table 7** summarizes the results of the November 2018 Assessment Monitoring event. Based on the results from the analysis, one new SSL over the GWPS was noted for lithium at MW-7 during the November 2018 sampling event. The results from this analysis and a table that displays the site-specific GWPS are provided in **Appendix C**. A summary of the SSLs at corresponding wells is as follows:

- Arsenic at MW-4 and MW-5
- Lithium at MW-6 and MW-7
- Molybdenum at MW-6, MW-7 and MW-8

An Assessment Monitoring event was completed August 2019, and testing was completed for all Appendix IV analytes. Statistical analysis of the data is provided in **Appendix D**. Lithium at MW-7, which was added as an SSL in the November 2018 sampling event, is no longer an SSL. The other SSLs at the MEC have not changed, and a summary of SSLs from the August 2019 event is as follows:

- Arsenic at MW-4 and MW-5
- Lithium at MW-6
- Molybdenum at MW-6, MW-7 and MW-8

Table 8 summarizes the results of the August 2019 Assessment Monitoring event. MW-9 (AMW-1) and MW-10 (AMW-2) were added to the Detection and Assessment Monitoring Well Networks for this event. During the statistical analysis of the August 2019 sampling event, the site specific GWPS used to determine SSLs were updated in accordance with the Statistical Analysis Plan.

Since the August 2019 event was the first Assessment Monitoring sampling event for monitoring wells MW-9 (AMW-1) and MW-10 (AMW-2), resampling for all detected Appendix IV parameters was completed in October-

December 2019 and the results for this sampling event are included in the August 2019 Assessment Monitoring sampling results shown in **Table 8**.

On November 18-19 and December 20, 2019, the November-December 2019 Assessment Monitoring event was completed. This sampling event analyzed the Appendix IV constituents detected in groundwater during the initial Assessment Monitoring event of 2019 (detected parameters from the August 2019 event). **Table 9** summarizes the results of the November-December 2019 Assessment Monitoring event; however, statistical analyses to evaluate for SSLs over GWPS were not completed in 2019. Results of the statistical evaluation will be included in the 2020 Annual Report.

Statistical evaluations to determine if there is a concentration at an SSL above the site GWPS for MW-9 (AMW-1) and MW-10 (AMW-2) were not completed in 2019. As outlined in the Statistical Analysis Plan for this site, a minimum of four (4) samples are required to complete an SSL statistical evaluation. Statistical analysis for these monitoring wells will begin with the analysis of the November 2019 data, and will be included in the 2020 Annual Report.

4.2.1 Nature and Extent Evaluation

As required by the CCR Rule, after an SSL is determined to be above the site GWPS, an investigation into the nature and extent of impacts to groundwater must be initiated. Groundwater sampling for nature and extent was completed with an initial event in November 2018 and a second event in August 2019. A technical memorandum summarizing the results is provided in **Appendix E**. Results from this investigation were used for the CMA, remedy selection, and to select the Corrective Action monitoring well network.

4.3 Groundwater Elevation, Flow Rate and Direction

To meet the requirements of §257.93(c), water level measurements were taken at all monitoring wells prior to the start of groundwater purging and sampling. Static water levels were measured within a 24-hour period in each monitoring well using an electronic water level indicator.

Groundwater elevations were used to generate potentiometric surface maps included in **Appendix F**. As shown on the potentiometric surface maps, groundwater flow within the uppermost aquifer is dynamic and influenced by seasonal changes in the water level in the adjacent Mississippi and Meramec Rivers. Water flows into and out of the alluvial aquifer as a result of fluctuating river water levels that produce “bank recharge” and “bank discharge” conditions. Overall, based on potentiometric surface maps, a general flow direction from the northeast (bluffs) to the southwest (Mississippi and Meramec Rivers) under normal river conditions is expected. However, during periods of high river levels, groundwater flow can temporarily reverse in localized areas. During these times of high river stage and temporary flow direction changes, horizontal groundwater gradients generally decrease, and little net movement of groundwater occurs.

Groundwater flow direction and hydraulic gradient were estimated for the monitoring wells at the MEC using commercially available software. Results from this assessment indicate that while groundwater flow direction is somewhat variable, the overall net groundwater flow at the Meramec Surface Impoundments is from the bluffs toward the rivers. Horizontal gradients calculated by the program for the CCR Rule wells (excluding MW-1) range from 0.0002 to 0.004 feet/foot with an estimated net annual groundwater velocity of approximately 79 feet per year in the prevailing downgradient direction.

4.4 Sampling Issues

Some of the wells used for sampling at the MEC are located in the floodplain near the confluence of the Meramec and Mississippi Rivers. Of these, MW-9 (AMW-1) and TP-1 are very close to the Meramec River on the west side of the MEC property. These monitoring wells can be submerged by very minor flooding events that occur multiple times per year. This flooding caused a delay in the planned sampling dates and in 2019, it is estimated that these wells were at least partially submerged during the following dates:

- January 1-5
- February 26-March 2
- March 11-August 8
- August 22-September 3
- September 18-December 1

In addition to MW-9 (AMW-1) and TP-1, other monitoring wells at the MEC are also located in the floodplain near the confluence of the Meramec and Mississippi Rivers. These monitoring wells can be submerged by minor flooding events that can occur multiple times per year. This caused a delay in the planned sampling dates of some of the monitoring wells. In 2019, it is estimated that at least one of the other monitoring wells was partially submerged during the following dates:

- March 14-July 31
- October 2-November 4

On January 9, July 18, August 7, August 12, November 18, and December 10, 2019, Golder performed post-flood monitoring well inspections at the MEC and during 2019, the following monitoring wells had been impacted by flooding at least one (1) time:

- MW-3
- MW-5
- TP-1

After determination that flooding impacts had affected monitoring wells, the wells were re-developed to remove floodwater impacts to the wells prior to groundwater elevation measurements or the collection of groundwater samples. After successful re-development each monitoring well was returned to service.

On October 3, 2019 during the collection of water levels, it was discovered that TP-2 had been hit by a piece of equipment and the protective cover for the well had been bent. Further inspection of the monitoring well determined that no damaged had been sustained by the PVC riser pipe of the piezometer, just the protective cover. Replacement of the protective cover is scheduled for 2020.

During the November 2018 sampling at MW-5, an arsenic value was detected that appeared to be an anomaly. On January 25, 2019 a re-sample at MW-5 was completed and confirmed that the November result was an anomaly. The January result is used for the statistical analysis.

No other notable sampling issues were encountered in 2019.

5.0 ACTIVITIES PLANNED FOR 2020

Detection and Assessment Monitoring is scheduled to continue on a semi-annual basis in the second and fourth quarters of 2020. Statistical analysis of the November 2019 Detection and Assessment Monitoring data will be completed in 2020 and included in the 2020 Annual Report.

Corrective Action sampling is also scheduled to begin in the second quarter of 2020. After the initial sampling event, a subsequent event for all Appendix III and detected Appendix IV parameters will be completed. A second semi-annual Corrective Action event for all Appendix III and the detected Appendix IV parameters is also scheduled to be completed in the fourth quarter 2020.

Tables

Table 2
Summary of Well Construction Details
MEC Surface Impoundments
Meramec Energy Center, St. Louis County , MO

Monitoring Well ID	Installation Date	Location[4]		Top of Casing Elevation	Ground Surface Elevation	Top of Screen Elevation	Base of Well	Total Depth
		Northing[1]	Easting[1]	(FT MSL)[2]	(FT MSL)[2]	(FT MSL)[2]	(FT MSL)[2]	(FT BGS)[3]
CCR RULE COMPLIANCE NETWORK								
MW-1	1/23/2016	937676.9	865954.1	406.43	404.1	370.2	365.0	39.1
MW-2	1/23/2016	937325.1	864864.5	398.62	396.1	367.0	361.8	34.3
MW-3	1/22/2016	936750.8	864447.2	397.12	394.6	369.2	364.0	30.6
MW-4	1/22/2016	935618.0	864629.8	404.10	402.0	364.1	358.9	43.1
MW-5	1/22/2016	934874.4	864781.0	402.93	400.8	350.4	340.2	60.6
MW-6	1/21/2016	933905.2	865153.5	418.12	415.8	373.4	363.2	52.7
MW-7	1/24/2016	934334.4	866242.5	417.94	415.7	373.2	363.0	52.7
MW-8	1/24/2016	935303.6	866797.8	423.37	421.0	355.8	345.6	75.4
BMW-1	4/7/2016	935220.4	867989.4	419.08	416.8	366.4	356.2	60.6
BMW-2	1/25/2016	937927.1	866342.2	409.02	406.8	369.3	364.1	42.7
MW-9 (AMW-1)	6/20/2018	935106.5	864425.3	393.71	391.1	369.8	359.5	31.6
MW-10 (AMW-2)	6/19/2018	934137.4	867158.9	405.62	402.8	367.3	357.0	45.8
CORRECTIVE ACTION MONITORING WELL NETWORK								
TP-1	6/20/2018	935109.7	864437.0	393.71	390.7	306.1	301.0	89.7
TP-2	6/18/2018	934151.5	867171.1	405.22	402.4	316.9	311.8	90.6

Notes:

1) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone feet.
2) FT MSL- Feet above mean sea level.
3) FT BGS - Feet below ground surface.
4) Vertical Datum: NAVD88 feet.

Created By: EMS
Checked By: TJG
Reviewed By: CMR

Table 3
Summary of Groundwater Sampling Dates
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Groundwater Monitoring Wells	Date of Sample Collection					
	January 2019 MW-5 Statistical Resample	August 2019 Assessment/ Detection Monitoring Sampling	August 2019 Nature and Extent Sampling	October - December 2019 Verification/ Assessment Monitoring Sampling	November - December 2019 Assessment/ Detection Monitoring Sampling	Number of Samples
CCR Rule Compliance Monitoring Well Network						
BMW-1	-	8/13/2019	-	-	11/18/2019	2
BMW-2	-	8/13/2019	-	-	11/18/2019	2
MW-1	-	8/14/2019	-	-	11/18/2019	2
MW-2	-	8/12/2019	-	-	11/19/2019	2
MW-3	-	8/12/2019	-	-	11/19/2019	2
MW-4	-	8/12/2019	-	-	11/18/2019	2
MW-5	1/24/2019	8/13/2019	-	10/3/2019	11/18/2019	4
MW-6	-	8/13/2019	-	-	11/18/2019	2
MW-7	-	8/13/2019	-	10/3/2019	11/18/2019	3
MW-8	-	8/13/2019	-	-	11/18/2019	2
MW-9	-	8/13/2019	-	12/10/2019	12/20/2019	3
MW-10	-	8/14/2019	-	10/17/2019	11/18/2019	3
Nature and Extent Sampling						
TP-1	-	-	8/14/2019	-	-	1
TP-2	-	-	8/13/2019	-	-	1
Detection or Assessment Monitoring	Assessment	Assessment/ Detection	Assessment/ Detection	Assessment/ Detection	Assessment/ Detection	NA

Notes:

1.) Detection Monitoring Events tested for Appendix III Parameters.

2.) Verification Sampling Events tested for Appendix III Parameters with initial exceedances that have not already been verified.

3.) Assessment Monitoring Events tested for Appendix IV Parameters.

4.) "-" No sample collected.

5.) NA - Not applicable.

Prepared by: EMS
Checked by: TJG
Reviewed by: CMR

Table 4
November 2018 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	PREDICTION LIMITS	BACKGROUND		GROUNDWATER MONITORING WELLS							
			BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
November 2018 Detection Monitoring Event												
DATE	NA	NA	11/19/2018	11/19/2018	11/20/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018
pH	SU	6.352-7.76	7.24	7.03	6.84	6.73	6.90	7.20	7.54	6.56	6.97	6.79
BORON, TOTAL	µg/L	476.5	468	98.0 J	52.3 J	4,380	9,320	9,630	7,040	12,800	23,700	9,130
CALCIUM, TOTAL	µg/L	115,956	103,000	98,000	132,000	119,000	152,000	179,000	137,000	358,000	390,000	171,000
CHLORIDE, TOTAL	mg/L	248	137	12.8	43.1	31.3	35.7	51.1	43.9	18.0	54.4	24.5
FLUORIDE, TOTAL	mg/L	0.5034	0.43	0.35	0.30	ND	ND	ND	0.22	ND	0.31 J	0.22
SULFATE, TOTAL	mg/L	127	63.4	25.7	103	315	388	483	277	632	1,210	470
TOTAL DISSOLVED SOLIDS	mg/L	832	640	481	628	796	875	895	817	1,430	1,960	936

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Prediction Limits calculated using Sanitas Software.
6. If all background values are less than the Practical Quantitation Limit (PQL) then the Double Quantification Rule (DQR) is used.
7. Values highlighted in yellow indicate a Statistically Significant Increase (SSI).
8. Values highlighted in green indicate an initial exceedance above the prediction limit that was not confirmed by Verification Sampling (not an SSI).
9. There were no new initial exceedances for the November 2018 event; therefore, no Verification Sampling was necessary.

Prepared By: EMS
Checked By: TJG
Reviewed By: CMR

Table 5
August 2019 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, Missouri

ANALYTE	UNITS	PREDICTION LIMITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
			BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
August 2019 Detection Monitoring Event														
DATE	NA	NA	8/12/2019	8/13/2019	8/14/2019	8/12/2019	8/12/2019	8/12/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/14/2019
pH	SU	6.441-7.704	7.72	6.80	6.77	6.47	6.63	6.85	6.49	6.53	7.07	6.87	6.85	6.71
BORON, TOTAL	µg/L	697.4	354	81.4 J	48.4 J	4,980	9,420	9,120	6,710	14,500	22,700	8,880	5,420	1,740
CALCIUM, TOTAL	µg/L	123,335	102,000	104,000	131,000	135,000	175,000	181,000	162,000	320,000	354,000	197,000	135,000	197,000
CHLORIDE, TOTAL	mg/L	248	96.2	13.0	44.2	27.5	22.0 J	48.9	41.3	8.3	53.0	30.9	35.2	82.7
FLUORIDE, TOTAL	mg/L	0.5057	0.46	0.29	0.24	0.15 J	0.13 J	0.18 J	0.24	0.24	0.82	0.37	0.20 J	0.21
SULFATE, TOTAL	mg/L	212	53.0	25.9	106	324	363 J	465	339	516	841	462	222	211
TOTAL DISSOLVED SOLIDS	mg/L	832	620	483	696	817	968 J	1,090	957	1,310	1,840	1,060	830	1,110
October-December 2019 Verification Sampling Event														
DATE	NA	NA							10/3/2019		10/3/2019		12/10/2019	10/17/2019
pH	SU	6.441-7.704							6.87		6.87		7.12	6.85
BORON, TOTAL	µg/L	697.4											3,860	1,780
CALCIUM, TOTAL	µg/L	123,335											118,000	208,000
CHLORIDE, TOTAL	mg/L	248												
FLUORIDE, TOTAL	mg/L	0.5057									0.54			
SULFATE, TOTAL	mg/L	212											133	
TOTAL DISSOLVED SOLIDS	mg/L	832							898					961

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Prediction Limits calculated using Sanitas Software.
6. If all background values are less than the Practical Quantitation Limit (PQL) then the Double Quantification Rule (DQR) is used.
7. Values highlighted in yellow indicate a Statistically Significant Increase (SSI).
8. Values highlighted in green indicate an initial exceedance above the prediction limit that was not confirmed by Verification Sampling (not an SSI).
9. Only analytes/wells that were detected above the prediction limit and that had not already been verified were tested during Verification Sampling.

Prepared By: EMS
Checked By: KAB
Reviewed By: CMR

Table 6
November-December 2019 Detection Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
November-December 2019 Detection Monitoring Event													
DATE	NA	11/18/2019	11/18/2019	11/18/2019	11/19/2019	11/19/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	12/20/2019	11/18/2019
pH	SU	6.64	6.86	6.71	6.45	6.61	6.85	7.03	6.70	7.09	6.92	6.99	6.78
BORON, TOTAL	µg/L	485	118	45.6 J	5,000	9,110	9,740	7,670	14,000	27,500	9,880	3,440	1,720
CALCIUM, TOTAL	µg/L	122,000	107,000	137,000	134,000	171,000	190,000	170,000	333,000	431,000	186,000	106,000	226,000
CHLORIDE, TOTAL	mg/L	94.4	13.3	46.1	27.8	23.9	50.3	42.3	20.2	67.5	26.1	33.1	65.1
FLUORIDE, TOTAL	mg/L	0.62	0.31	0.30	0.17 J	0.13 J	0.16 J	0.23	0.11 J	0.55	0.28	0.21	0.15 J
SULFATE, TOTAL	mg/L	32.9	26.4	110	305	315	472	352	557	960	497	127	197
TOTAL DISSOLVED SOLIDS	mg/L	599	468	655	770	848	1,000	932	1,270	1,870	937	634	1,030

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect.
   Values displayed as ND.
4. NA - Not applicable.

Prepared By: TJG
Checked By: KAB
Reviewed By: CMR

Table 7
November 2018 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS							
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
Field Parameters											
DATE	NA	11/19/2018	11/19/2018	11/20/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018
DISSOLVED OXYGEN	mg/L	0.18	0.15	0.12	0.86	0.71	0.58	0.83	0.15	6.03	0.11
pH	SU	7.24	7.03	6.84	6.73	6.90	7.20	7.54	6.56	6.97	6.79
REDOX POTENTIAL	mV	41.7	-136.9	-33.0	-39.8	-39.0	-45.0	-37.5	-33.7	-29.3	-41.6
SPECIFIC CONDUCTIVITY	mS/cm	1.266	0.985	0.820	1.060	1.171	1.292	1.083	1.230	1.570	0.880
TURBIDITY	NTU	4.50	4.18	4.88	2.81	3.21	4.30	4.61	1.60	0.02	4.74
Appendix IV Parameters											
ARSENIC, TOTAL	µg/L	1.4	1.1	0.68 J	1.7	7.8	14.8	19.7	2.9	2.6	5.8
BARIUM, TOTAL	µg/L	204	524	370	299	232	200	195	49.4	37.9	168
CHROMIUM, TOTAL	µg/L	0.11 J	0.45 J	0.36 J	0.31 J	ND	0.25 J	0.14 J	0.12 J	0.25 J	ND
FLUORIDE, TOTAL	mg/L	0.43	0.35	0.30	ND	ND	ND	0.22	ND	0.31 J	0.22
LITHIUM, TOTAL	µg/L	15.0	6.5 J	5.3 J	6.4 J	ND	23.3	18.1	131	48.6	33.7
MOLYBDENUM, TOTAL	µg/L	4.6 J	ND	ND	ND	3.6 J	51.1	101	135	461	183
RADIUM [226 + 228]	pCi/L	2.676	1.607	1.663 J	2.160	2.410	ND	1.399	ND	1.376 J	2.474

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.
6. Statistical Analysis for the Assessment Monitoring data is provided in Appendix C.
7. Arsenic result at MW-5 is from the January 2019 re-sample.

Prepared By: RJF
Checked By: EMS
Reviewed By: CMR

Table 8
August 2019 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS											
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-9	MW-10
Field Parameters															
DATE	NA	8/13/2019	8/13/2019	8/14/2019	8/12/2019	8/12/2019	8/12/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/14/2019	12/10/2019	10/17/2019
DISSOLVED OXYGEN	mg/L	0.36	1.08	0.34	0.20	0.41	1.51	0.23	0.46	5.69	0.62	0.93	0.37	31.05	0.16
pH	SU	7.72	6.80	6.77	6.47	6.63	6.85	6.49	6.53	7.07	6.87	6.85	6.71	7.12	6.85
REDOX POTENTIAL	mV	-134.7	-99.2	13.1	-103.5	-108.9	-114.0	89.2	68.4	19.8	-69.4	53.8	104.2	-81.9	57.9
SPECIFIC CONDUCTIVITY	mS/cm	0.928	0.882	1.03	1.196	1.291	1.458	1.36	1.63	2.130	1.353	1.23	1.53	2.692	1.58
TURBIDITY	NTU	7.32	0.74	4.68	4.88	4.26	5.07	4.16	8.22	1.40	9.80	4.44	4.73	0.23	4.18
Appendix IV Parameters															
ANTIMONY, TOTAL	µg/L	0.23 J	ND	ND	ND	ND	ND	0.11 J	ND	0.39 J	ND	ND	ND	ND	-
ARSENIC, TOTAL	µg/L	2.1	0.86 J	0.66 J	1.5	7.5	13.9	23.0	2.6	2.8	5.7	15.8	11.8	17.1	12.5
BARIUM, TOTAL	µg/L	210	502	341	301	196	168	230	44.1	37.0	102	247	162	207	181
BERYLLIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
CADMIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	0.048 J	0.31 J	0.36 J	0.099 J	ND	ND	ND	-
CHROMIUM, TOTAL	µg/L	0.086 J	0.16 J	0.22 J	0.32 J	0.11 J	ND	0.18 J	ND	0.18 J	ND	ND	0.11 J	0.10 J	-
COBALT, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	5.4	ND	ND	ND	1.6 J	ND	ND
FLUORIDE, TOTAL	mg/L	0.46	0.29	0.24	0.15 J	0.13 J	0.18 J	0.24	0.24	0.82	0.37	0.20 J	0.21	0.25	0.29
LEAD, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.0 J	ND	-
LITHIUM, TOTAL	µg/L	6.8 J	ND	ND	ND	ND	14.0	12.2	122	36.2	27.8	13.8	37.4	9.8 J	35.0
MERCURY, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
MOLYBDENUM, TOTAL	µg/L	3.7 J	ND	ND	ND	7.5 J	51.5	96.3	123	463	186	37.8	4.5 J	37.6	6.6 J
RADIUM [226 + 228]	pCi/L	1.514 J	ND	ND	ND	1.092 J	ND	1.599	ND	ND	ND	1.706 J	1.865 J	ND	ND
SELENIUM, TOTAL	µg/L	0.12 J	ND	0.11 J	0.15 J	0.10 J	ND	ND	0.087 J	8.6	0.11 J	ND	ND	ND	ND
THALLIUM, TOTAL	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.
6. Statistical Analysis for the Assessment Monitoring data is provided in Appendix D.
7. "-" Not Sampled.

Prepared By: RJF
Checked By: EMS/KAB
Reviewed By: CMR

Table 9
November-December 2019 Assessment Monitoring Results
MEC Surface Impoundments
Meramec Energy Center, St. Louis County, MO

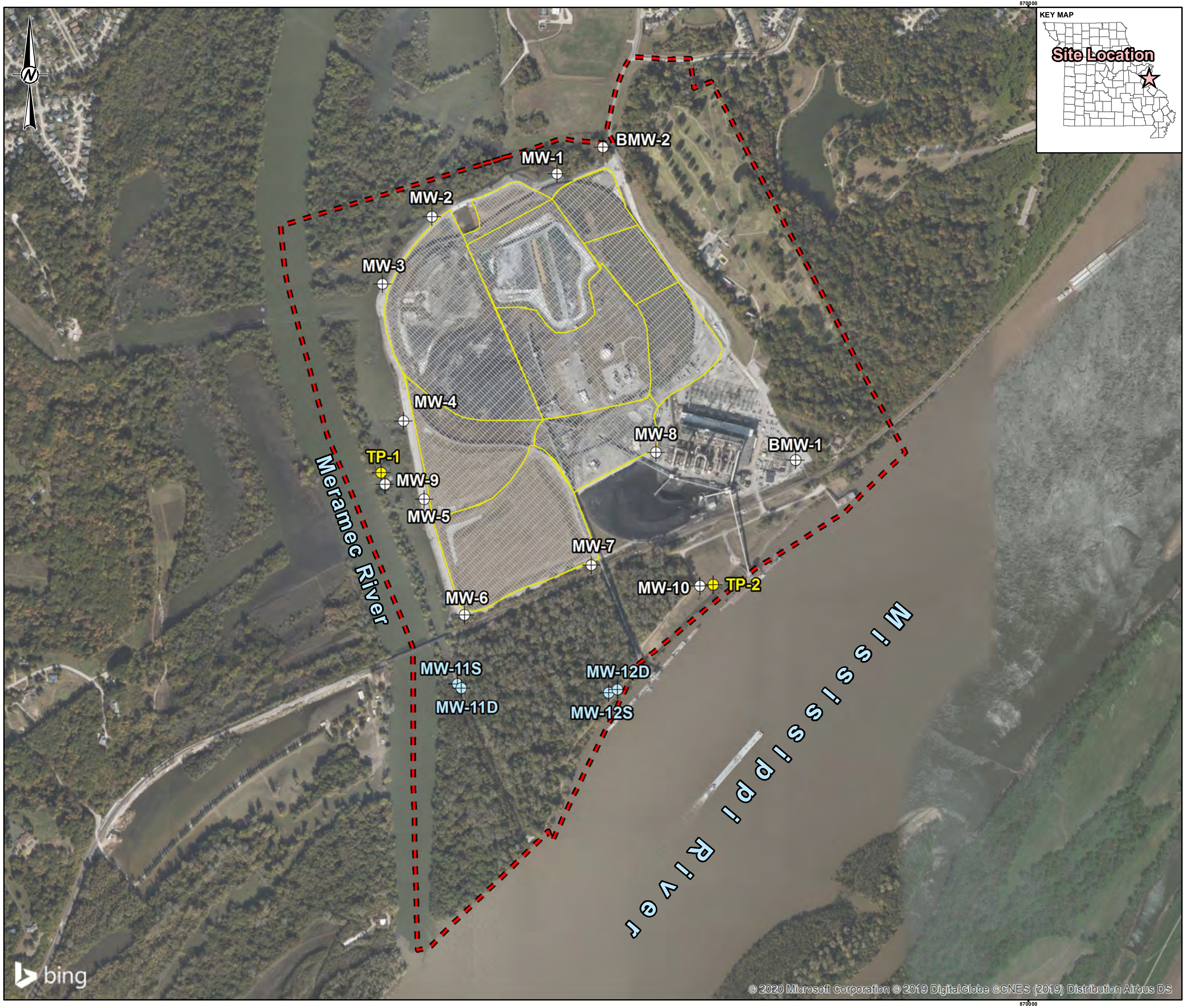
ANALYTE	UNITS	BACKGROUND		GROUNDWATER MONITORING WELLS									
		BMW-1	BMW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
Field Parameters													
DATE	NA	11/18/2019	11/18/2019	11/18/2019	11/19/2019	11/19/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	11/18/2019	12/20/2019	11/18/2019
DISSOLVED OXYGEN	mg/L	0.21	0.29	0.27	0.18	0.18	0.13	0.65	2.13	3.81	0.62	0.48	0.13
pH	SU	6.64	6.86	6.71	6.45	6.61	6.85	7.03	6.70	7.09	6.92	6.99	6.78
REDOX POTENTIAL	mV	-16.0	-150.4	144.4	29.9	43.3	-154.2	-161.7	-50.7	82.5	-104.0	-146.0	-121.2
SPECIFIC CONDUCTIVITY	mS/cm	1.05	0.86	1.06	1.20	1.26	1.442	1.326	1.596	2.201	1.230	1.018	1.560
TURBIDITY	NTU	9.80	3.43	4.30	3.44	3.05	8.66	4.13	8.66	2.59	8.63	2.27	1.82
Appendix IV Parameters													
ARSENIC, TOTAL	µg/L	4.7	1.3	0.69 J	1.8	7.4	16.1	21.8	3.9	2.6	6.4	18.6	10.7
BARIUM, TOTAL	µg/L	292	558	368	309	200	199	240	51.0	42.6	142	192	180
COBALT, TOTAL	µg/L	3.2 J	ND	ND	ND	ND	ND	ND	4.2 J	ND	ND	ND	2.8 J
FLUORIDE, TOTAL	mg/L	0.62	0.31	0.30	0.17 J	0.13 J	0.16 J	0.23	0.11 J	0.55	0.28	0.21	0.15 J
LITHIUM, TOTAL	µg/L	14.4	6.5 J	ND	7.7 J	7.4 J	18.6	17.9	127	52.2	36.5	16.1	36.6
MOLYBDENUM, TOTAL	µg/L	5.9 J	ND	ND	ND	7.7 J	52.4	98.6	132	373	221	34.2	2.7 J
RADIUM [226 + 228]	pCi/L	1.839	1.386	ND	ND	ND	ND	1.761	ND	ND	ND	ND	ND
SELENIUM, TOTAL	µg/L	0.15 J	ND	ND	0.12 J	0.089 J	0.093 J	0.093 J	ND	8.2	0.088 J	ND	0.093 J

NOTES:

1. Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - standard units, and pCi/L - picocuries per liter, mV - millivolts, mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit.
2. J - Result is an estimated value.
3. ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect. Values displayed as ND.
4. NA - Not applicable.
5. Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.

Prepared By: JSI
Checked By: KAB
Reviewed By: CMR

Figures



LEGEND

- ▬ Meramec Energy Center Property Boundary
- ▨ Meramec Surface Impoundments

Groundwater Monitoring Wells Used for CCR Rule Monitoring

- ⊕ Detection/Assessment Monitoring Well Network
- ⊕ Corrective Action Monitoring Well Network
- ⊕ Proposed Corrective Action Monitoring Wells

0 500 1,000 1,500 2,000 2,500
Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
2.) LOCATIONS FOR MW-11 AND MW-12 ARE PROPOSED, THESE WELLS HAVE NOT YET BEEN INSTALLED.
3.) SOME MONITORING WELLS OFFSET FOR CLARIFICATION.

REFERENCE(S)

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION AERIAL MAP AND MONITORING WELL LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-01-22
DESIGNED	JSI
PREPARED	EMS
REVIEWED	TJG
APPROVED	CMR

PROJECT NO.	REV.	FIGURE
153140601	0	1

PATH: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 Annual Report\Figure 1 - Monitoring Well Location Map.mxd PRINTED ON: 2020-01-29 AT: 5:06:05 PM

0 1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

Corrective Measures Assessment and Certification

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

April 2019
Project No. 132002

SUBJECT: **Demonstration for 60-Day Extension – Corrective Measures Assessment (CMA)**
Coal Combustion Residual (CCR) Surface Impoundments
(MCPA, MCPB, MCPC, and MCPD)
Ameren Missouri Meramec Energy Center
St. Louis County, Missouri

Pursuant to CFR Title 40 Chapter I Subchapter I Part 257 Subpart D §257.96(a) (CCR Rule), I certify that Ameren Missouri, St. Louis, Missouri (Ameren) has demonstrated the need for additional time beyond the regulatory time period of 90 days to complete the assessment of corrective measures due to site-specific conditions and the evaluation of remedial treatment alternatives in support of an informed CMA process.

In the case of the assessment for the following surface impoundments; MCPA, MCPB, MCPC, and MCPD the site has complex hydrogeological conditions. In addition, Ameren is in the process of reviewing possible groundwater remedies, and ongoing discussions with third-party experts regarding effectivity and implementation of critical steps in the treatment and remedy assessment process. Based on these site-specific conditions and related groundwater treatment alternatives evaluations in support of the CMA by Ameren, the CCR Rule allows for a 60-day extension to complete the CMA process.

This certification as submitted, is to the best of my knowledge, accurate and complete.

Signed:

Certifying Engineer
Print Name: Steven F. Putrich, P.E.
Missouri License No.: 2014035813
Title: CCR Practice Lead, Senior Consulting Engineer
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal

4/11/19
STEVEN F.
PUTRICH
NUMBER
PE-2014035813

www.haleyaldrich.com

CORRECTIVE MEASURES ASSESSMENT
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

by
Haley & Aldrich, Inc.
Cleveland, Ohio

for
Ameren Missouri
St. Louis, Missouri

May 2019

Overview

This Corrective Measures Assessment (CMA) was prepared by Haley & Aldrich, Inc. (Haley & Aldrich) for Union Electric Company d/b/a Ameren Missouri (Ameren) to evaluate five regulated Coal Combustion Residual (CCR) surface impoundments (CCR Units) located at the Ameren Meramec Energy Center (MEC) located in St. Louis County, Missouri. The CMA was completed in accordance with requirements stated in the U.S. Environmental Protection Agency's (USEPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36435 (July 30, 2018) (amending 40 CFR §257.61) (CCR Rule).

Ameren implemented groundwater monitoring under the CCR Rule through a phased approach to allow for a graduated response and evaluation of steps to address groundwater quality associated with the CCR Units. Assessment monitoring completed in 2018 evaluated the presence and concentration of constituents in groundwater specified in the CCR Rule (i.e. Appendix IV). Of the CCR 23 parameters evaluated, only three constituents of concern (COC), arsenic, lithium and molybdenum, exceeded the Groundwater Protection Standards (GWPS) established for the MEC in a very limited number of wells and to a limited extent. More specifically, arsenic excursions occur in only two wells; lithium in only one well and molybdenum in only three wells. As described in **Section 3.3.1**, 95% of Appendix IV parameters tested complied with CCR Rule requirements.

Ameren completed a detailed environmental evaluation of the regulated surface impoundments and surrounding area, including voluntary, supplemental surface water sampling. In 2018, risk evaluations were undertaken to identify whether current groundwater conditions pose an unacceptable risk to human health and the environment, and whether corrective measures mitigate such an unacceptable risk, if present. The risk evaluations concluded that there are **no adverse effects on human health or the environment currently or under reasonably anticipated future uses** from either surface water or groundwater due to CCR management practices at MEC.

In performing this CMA, Haley & Aldrich considered the following: presence and distribution of arsenic, lithium and molybdenum, site configuration, hydrogeologic setting, and the results of the detailed risk evaluation. CCR is managed in impoundments that extend to a depth of approximately 30 feet (ft) below ground surface (bgs). Groundwater within the Meramec and Mississippi River valley alluvium ranges in thickness from not present (zero thickness) at the aquifer pinch-out along the bedrock bluff to the northeast of the MEC, up to greater than 95 ft thick where the bedrock surface has been eroded by the Meramec and Mississippi Rivers. Although groundwater flow direction is influenced by elevation changes of surface water in the Mississippi and Meramec Rivers, groundwater generally/predominantly flows to the southwest, flowing from the bluffs toward the rivers.

To provide a comprehensive CMA, this effort included four CCR Unit closure and groundwater remediation alternatives, including:

- Alternative 1: Closure in place (CIP) with low permeability capping and monitored natural attenuation (MNA);
- Alternative 2: CIP with low permeability capping and in-situ groundwater treatment;
- Alternative 3: CIP with low permeability capping, hydraulic containment (HC) of groundwater, and ex-situ groundwater treatment; and

- Alternative 4: Closure by removal (CBR) with MNA.

These four alternatives were evaluated based on the threshold criteria provided in the CCR Rule and then compared to three of the four balancing criteria stated in the CCR Rule. The four balancing criteria consider:

1. The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
2. The effectiveness of the remedy in controlling the source to reduce further releases;
3. The ease or difficulty of implementing a potential remedy; and
4. The degree to which community concerns are addressed by a potential remedy.

Balancing criteria four, which considers community concerns, will be evaluated following a public information session scheduled for May 2019.

The following observations are made regarding closure scenarios and groundwater remedial alternatives for the CCR Units and are described more fully in this report:

- **Cap Integrity and Hydrogeologic Conditions:** For all CIP alternatives, Ameren intends to install a geomembrane cap and cover system that exceeds by two orders-of-magnitude the performance criteria set forth in the CCR Rule and is referred to in this CMA as a "low permeability cap." Vertical infiltration via precipitation is virtually eliminated following installation of the geomembrane cover system. The CCR Units are situated **above** the groundwater table during normal river conditions which could account for such limited groundwater impacts notwithstanding the MEC's 65 years of operation.

- **No Risk:** Risk assessment evaluations confirm that the CCR Units, even prior to closure, present **no unacceptable risk** to human health or the environment. In fact, concentration levels of arsenic, lithium and molybdenum would need to be **more than 600, more than 24,000 and more than 13,000 times higher**, respectively, than currently measured levels before an adverse impact in the Mississippi River could occur. Therefore, since no adverse risk currently exists, implementation of any of the remedies considered will not result in a meaningful reduction in risk.

- **Groundwater Compliance:** Post-closure, and based on the outcome of geochemical attenuation modeling, concentration levels for lithium and molybdenum are predicted to reduce below GWPS within five years following in situ treatment (See **Figures 4-2, 4-3 and 4-4),** with arsenic reduction modeled to occur in 11 years. Ameren has retained XDD Environmental (XDD) to evaluate and develop in-situ groundwater treatment methods to address arsenic, lithium and molybdenum.

- **Excavation Timeframe:** As described in an Extraction & Transportation Study prepared by the Lochmueller Group, removal of large volumes of CCR stored at the MEC creates extensive logistical challenges – including excavation, transportation, and disposal, and could take decades to complete during which time the impoundments would remain open and would be subject to ongoing infiltration from precipitation.

- **Groundwater Treatment:** Laboratory testing performed by XDD indicates that through modifications to groundwater pH, arsenic concentrations can decrease to below action levels earlier than the modeled estimates. Bench-scale testing and in-situ treatment evaluations are ongoing and will be completed this summer.

In accordance with §257.98, Ameren will implement a groundwater monitoring program to document the effectiveness of the selected remedial alternative. Corrective measures are considered complete when monitoring reflects groundwater downgradient of the CCR Units does not exceed the Appendix IV GWPS for three consecutive years. USEPA is in the process of modifying certain CCR Rule requirements and, depending upon the nature of such changes, assessments made herein could be modified or supplemented to reflect such future regulatory revisions. See *Federal Register (March 15, 2018; 83 FR 11584*).

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List of Acronyms and Abbreviations

Ameren	Ameren Missouri
AMSL	Above Mean Sea Level
bgs	Below Ground Surface
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
CBR	Closure by Removal
CCR	Coal Combustion Residuals
CIP	Closure In-Place
CMA	Corrective Measures Assessment
cm/sec	Centimeters per Second
COC	Constituents of Concern
CSM	Conceptual Site Model
ft	Feet
Golder	Golder Associates Inc.
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standards
Haley & Aldrich	Haley & Aldrich, Inc.
HC	Hydraulic Containment
Lochmueller	Lochmueller Group
MM CY	Million Cubic Yards
MEC	Meramec Energy Center
MSD	Metropolitan Sewer District
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
MNA	Monitored Natural Attenuation
N&E	Nature and Extent
NAS	U.S. National Academy of Sciences
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
ppm	Parts per Million
PRB	Permeable Reactive Barrier
RDA	Recommended Daily Allowance
RO	Reverse Osmosis
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
ug/L	Micrograms per liter
UL	Tolerable Upper Limit
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
XDD	XDD Environmental

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this Corrective Measures Assessment (CMA) for the Coal Combustion Residual (CCR) surface impoundments (CCR Units) located at the Ameren Missouri (Ameren) Meramec Energy Center (MEC) located in St. Louis County, Missouri. Ameren has conducted detailed geologic and hydrogeologic investigations under the USEPA rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36435 (July 30, 2018) (amending 40 CFR §257.61) (CCR Rule). These investigations were, in part, related to determination of requirements related to the potential for both closure and groundwater corrective action.

This CMA includes a summary of the results of groundwater and site investigations at the MEC. Groundwater impacted by the surface impoundments exceeds statistically-derived GWPS for only three constituents: arsenic, lithium and molybdenum at only five monitoring locations. Of these parameters, USEPA has developed drinking water standards only for arsenic. This report evaluates potential corrective measures to address these limited exceedances of the GWPS.

1.1 FACILITY DESCRIPTION/BACKGROUND

Meramec Energy Center

The MEC was constructed in the 1950's in a then- rural area of St Louis County on approximately 480-acres (**Figure 1-1**). A Metropolitan Sewer District (MSD) treatment plant is located to the immediate north of the facility and residential homes are located in the bluffs area above the MEC. Multiple impoundments are located on the property. In 2018, Ameren proactively closed 36 acres located adjacent to the Meramec River[1] with additional closures scheduled for 2021 and in 2023 following retirement of the facility. Site features are shown on **Figure 1-2**.

Over the past 17 years, Ameren has been able to beneficially use approximately 79% of the fly ash and 26% of the bottom ash produced by the MEC with the remaining CCR managed in the active on-site surface impoundments. The estimated volume of CCR within the CCR Units and exempt units is estimated at approximately 5.2 million cubic yards (MM CY).

1.2 SITE CHARACTERIZATION WORK SUMMARY

Hydrogeologic Assessments were completed in 1988 by Woodward-Clyde Consultants and CH2MHill in 1997. Golder Associates Inc. (Golder) completed subsurface investigations pursuant to the CCR Rule.

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[1] The cover system installed by Ameren complied with the performance requirements set forth in 40 CFR part §257.102(3)

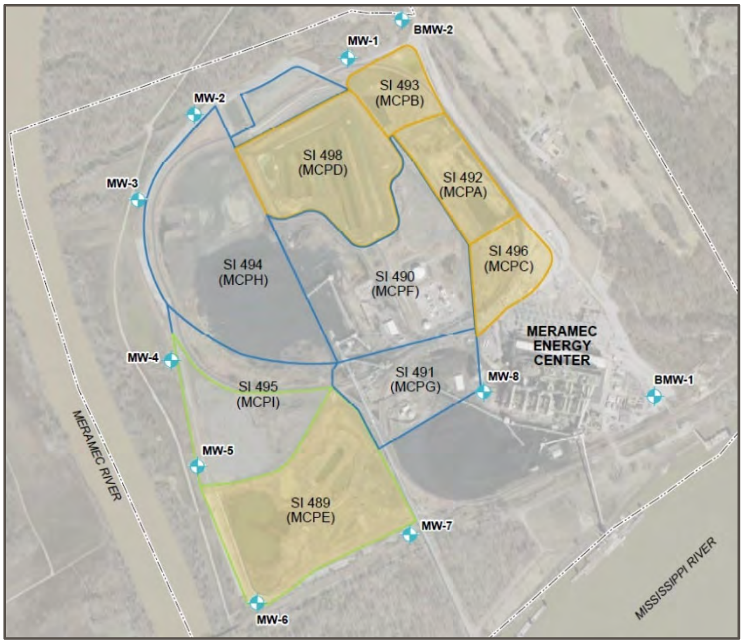
Ameren also voluntarily conducted surface water sampling. All these activities delineated the site-specific geology and hydrogeology to support the development of a hydrogeologic Conceptual Site Model (CSM). The investigation activities at the MEC included:

- Soil borings and sampling;
- Geotechnical testing;
- Well and piezometer installation;
- Slug testing; and
- Groundwater sampling.

Findings from these extensive and updated series of geologic, hydrogeologic and surface water investigations have produced a robust CSM that supports the CMA activities discussed in this report.

1.3 GROUNDWATER MONITORING

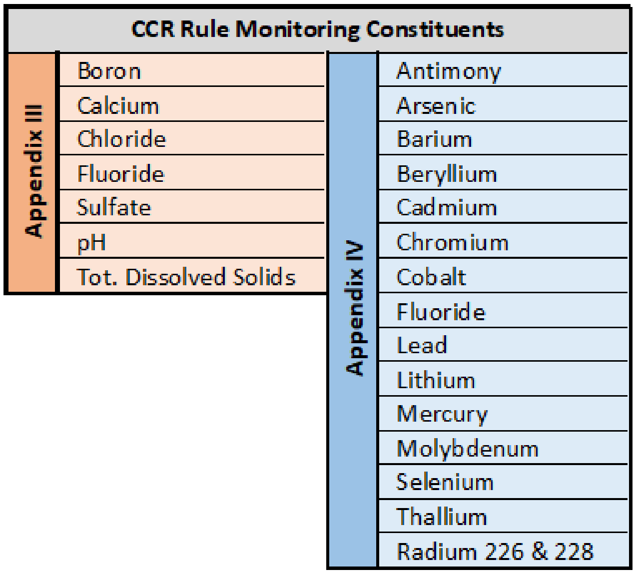
One groundwater monitoring system encompasses all MEC impoundments and is used to monitor facility groundwater. Groundwater monitoring under the CCR Rule occurs through a phased approach to allow for a graduated response (i.e., baseline, detection, and assessment monitoring as applicable) and evaluation of steps to address groundwater quality associated with a CCR unit. Golder prepared a Groundwater Monitoring Plan (GMP) as required by the CCR Rule. The GMP presents the design of the groundwater monitoring system, groundwater sampling and analysis procedures, and groundwater statistical analysis methods.



Groundwater Monitoring Well Locations

Monitoring wells were installed in January and April 2016 and includes two background wells (BMW-1 and BMW-2) and eight downgradient monitoring wells (MW-1 through MW-8) located around the perimeter of the various impoundments. The monitoring wells are screened in the alluvial aquifer below the base elevation of the CCR Units.

Detection monitoring sampling events occurred in 2017 and 2018. The results of the sampling events were then compared to background, or natural groundwater values, using statistical methods to determine if Appendix III constituents at the base of the CCR Units were present at concentrations above background, called statistically significant increases (SSI). Detection of Appendix III analytes triggered a verification sampling event in January 2018 and verified SSIs. The results of this analysis indicated SSIs necessitating the establishment of an Assessment Monitoring Program and respective notification of the same.



CCR Rule Monitoring Constituents

Appendix III	Appendix IV
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
Sulfate	Cadmium
pH	Chromium
Tot. Dissolved Solids	Cobalt
	Fluoride
	Lead
	Lithium
	Mercury
	Molybdenum
	Selenium
	Thallium
	Radium 226 & 228

During the Assessment Monitoring phase, CCR groundwater monitoring well samples were collected during April, May and November 2018 and subsequently analyzed for Appendix IV constituents. Appendix IV analytical results for the baseline and Assessment Monitoring events are summarized in **Table I**.

1.4 CORRECTIVE MEASURES ASSESSMENT PROCESS

The CMA process involves development of groundwater remediation technologies that will result in the following threshold criteria: protection of human health and the environment, attainment of GWPS, source control, COC removal and compliance with standards for waste management. Once these technologies are demonstrated to meet these criteria, they are then compared to one another with respect to long- and short-term effectiveness, source control, and implementability. Input from the community on such proposed measures will occur as part of a public meeting scheduled for May 2019.

1.5 RISK REDUCTION AND OF REMEDY

The CCR Rule at §257.97 (Selection of Remedy) at (b)(1) requires that remedies must be protective of human health and the environment. Further, at (c) the CCR Rule requires that in selecting a remedy, the owner or operator of the CCR unit shall consider specific evaluation factors, including the risk reduction achieved by each of the proposed corrective measures. Each of the evaluation factors listed here and discussed in **Section 4** are those that consider risk to human health or the environment.

> (1)(i) Magnitude of reduction of existing risks;
>
> (1)(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;
>
> (1)(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;

(1)(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy[2];

(5)(i) Current and future uses of the aquifer;

(5)(ii) Proximity and withdrawal rate of users; and

(5)(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents.

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[2] Factors 4 and 5 are not part of the CMA evaluation process as described in §257.97(d)(4), §257.97(d)(5)(i)(ii)(iv); rather they are factors the owner or operator must consider as part of the schedule for remedy implementation.

2. Groundwater Conceptual Site Model

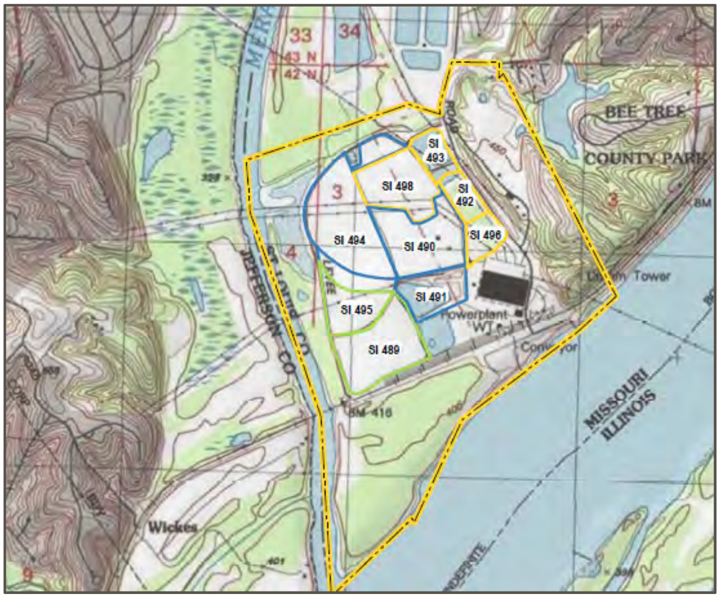
To evaluate the magnitude of risk reduction, the degree of existing risk must first be identified. Prior risk evaluations and data collected are summarized below.

2.1 SITE SETTING

The MEC Site is at the southernmost point in St. Louis County, Missouri approximately 18 miles southwest of downtown St. Louis. The area around the facility is fully developed and public drinking water is provided by American Water of Missouri. There are no users of groundwater at or near the MEC site.

2.2 SITE TOPOGRAPHY

The MEC is in a topographically low area in a valley at the confluence of the Meramec and Mississippi Rivers. Ground surface elevation around the surface impoundments ranges between 395 ft to 421 ft above mean sea level (AMSL). The existing Site grade is as much as 20 ft above the original ground surface. Topographically higher terrain is located west of the Meramec River Valley. The terrain to the east of the Site consists of topographically higher terrain, at elevations generally ranging from 450 AMSL ft to as high as 550 ft AMSL.



Topographic Map

2.3 GEOLOGY AND HYDROGEOLOGY

The geology immediately surrounding the MEC is composed of two distinctly different geological terrains; (1) floodplain deposits of the Mississippi and Meramec River Valleys and (2) older sedimentary bedrock formations. Most of the MEC, including all the plant infrastructure and the CCR Units lie within these floodplain deposits. The river valley area is comprised of floodplain and alluvial deposits that are the result of the water flow and deposition of the Mississippi and Meramec River[3].

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[3] 40 CFR Part 257, Groundwater Monitoring Plan Meramec Energy Center, St. Louis County, Missouri (Golder 2017)

Geologic Cross Section (West to East)

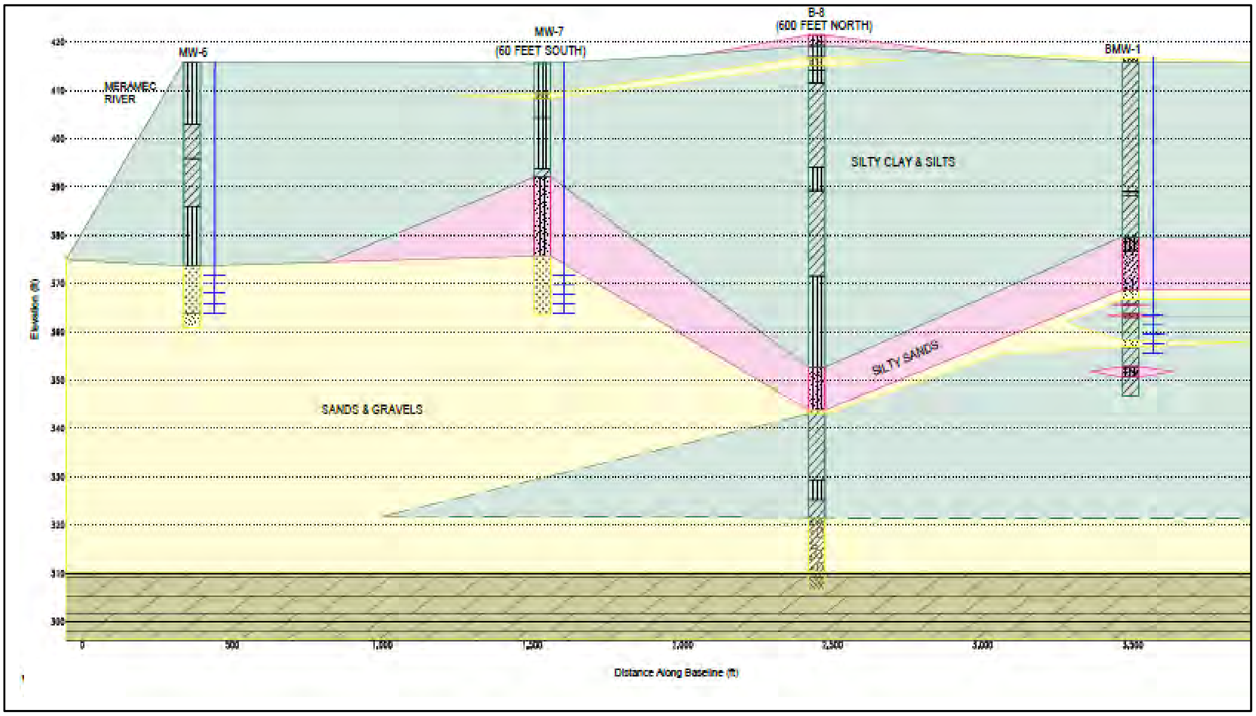

Image from Figure A-3, 2017 Groundwater Monitoring Plan (Golder 2017)

As shown in the geologic cross-section the alluvial materials on the east side of the MEC tend to have more silty clays and fine sands. Alluvial materials to the west, closer to the Meramec River, include coarser materials, including fine-to medium-grained sand with clay, silt, and some gravels[4].

The uppermost aquifer is the alluvial silt, sand and gravel deposits associated with the Meramec and Mississippi River Valley alluvium. These channel deposits are intermixed with a wide variety of clay/silty clay floodplain deposits and, therefore, can appear at varying depths. However, sandy/gravelly units were encountered at many locations at approximately 360-370 ft AMSL, likely deposited from a historic meander of the Meramec River. These alluvial deposits overlie Mississippian-age limestone and shale of the Meramecian Series. The alluvial aquifer varies in thickness from 0 ft thick at the aquifer pinch-out along the bedrock bluff to the northeast of the MEC, up to greater than 95 ft thick where the bedrock surface has been eroded by the Meramec and Mississippi Rivers.

Groundwater flow direction and levels within the alluvial aquifer is dynamic and influenced by seasonal changes in water levels of the adjacent rivers. Under normal conditions, groundwater flows from the bluffs toward the rivers and generally towards the southwest. However, during periods of high river levels, groundwater flow can temporarily reverse in localized areas and decrease in horizontal gradient with little net movement of groundwater occurs[5].

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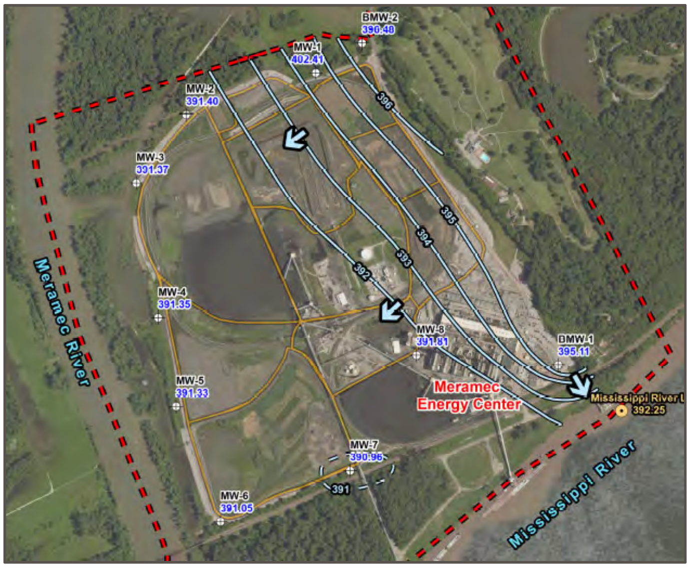
[4] Hydrogeologic Assessment (CH2MHILL, 1997).

[5] 2018 Annual Groundwater Monitoring and Corrective Action Report (Golder 2019).

Groundwater flow direction and gradient were estimated for the downgradient CCR Units monitoring wells using the USEPA's On-line Tool for Site Assessment Calculation for Hydraulic Gradient (Magnitude and Direction) (USEPA, 2016). Results from this assessment indicate that while groundwater flow direction is variable, the overall net groundwater flow is from the bluffs toward the rivers. There are no users of groundwater of the alluvial aquifer at MEC. All private and public wells recorded within a one-mile radius of the facility are upgradient of the facility or located on the opposite side of the Meramec River and are therefore isolated from the MEC. Horizontal gradients determined by CCR Rule compliance wells (not including background or MW-1) range from 0.0002 to 0.0005 ft/ft with an estimated net annual groundwater velocity of approximately 16 ft per year.



Groundwater Flow Map-May 17, 2018

Image from Figure C2, 2018 Annual Groundwater Monitoring and Corrective Action Report (Golder 2019)

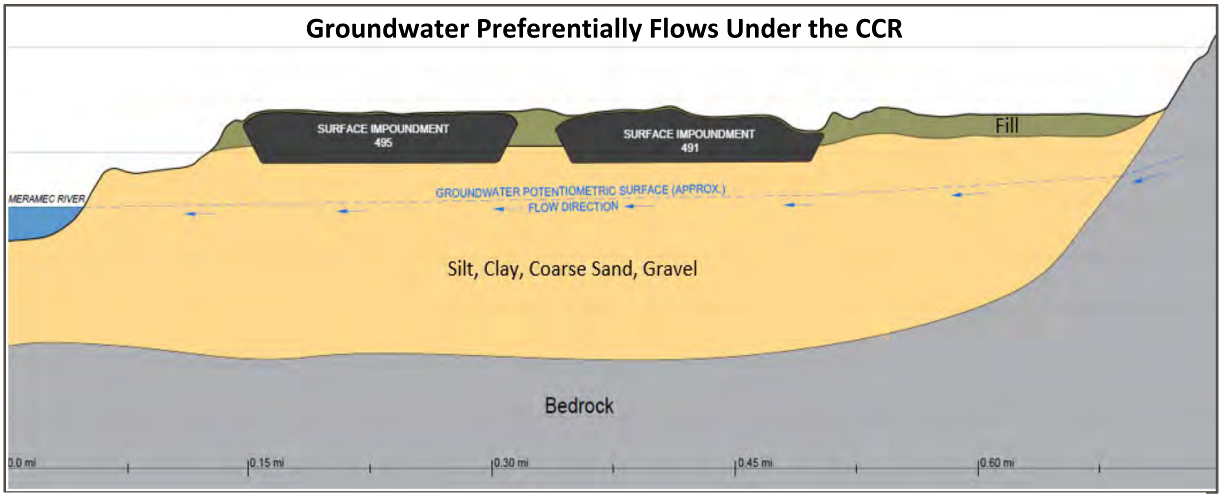

Groundwater Preferentially Flows Under the CCR

Image from Figure 2-2, MEC Groundwater Model Report (Burns & McDonnell 2019)

The existing Site grade is as much as 20 ft above the original ground surface the original grade of the plant was increased during construction by using fill material. The surface impoundments were made by excavating silts and clays and using the materials as fill beneath the plant as well as for surface impoundment berms (CH2MHILL, 1997). The surface impoundments were excavated approximately 10-20 ft below the original grade. Therefore, present day CCR thickness is estimated to be typically 20 to 30 ft below the present Site grade. As reflected above, the bottom elevations of the CCR is **higher** than the normal groundwater table. As such, groundwater flows under the surface impoundments.

Vertical hydraulic gradients are based on comparing the groundwater elevations in the monitoring wells to the water levels in the active surface impoundments. On average, the groundwater elevation of the impoundments is approximately 9 to 30 ft higher than the alluvial groundwater zone but can change seasonally based on river levels. During high river level conditions, the difference in groundwater elevation between the surface impoundments and the alluvial groundwater zone is the smallest.

2.4 GROUNDWATER PROTECTION STANDARDS

Golder completed a statistical evaluation of groundwater samples using the methods and procedures outlined in the Groundwater Monitoring Plan's *Statistical Analysis Plan* (Golder 2017) to develop site-specific GWPS for each Appendix IV constituents.

Groundwater results were compared to the site-specific GWPS. As shown on **Figure 2-1,** statistically significant levels (SSL) above the GWPS are limited to five monitoring wells: arsenic at MW-4, MW-5; lithium at MW-6; molybdenum at MW-6, MW-7 and MW-8.

Parameter	Site GWPS	Units
Antimony	6	µg/L
Arsenic	10	µg/L
Barium	2000	µg/L
Beryllium	4	µg/L
Cadmium	5	µg/L
Chromium	100	µg/L
Cobalt	6	µg/L
Fluoride	4	mg/l
Lead	15	µg/L
Lithium	40	µg/L
Mercury	2	µg/L
Molybdenum	100	µg/L
Radium 226+228	5	pCi/L
Selenium	50	µg/L
Thallium	2	µg/L

Groundwater Protection Standards
ug/L – micrograms per liter
mg/l – milligrams per liter
pCi/L – picoCuries per liter

2.5 NATURE AND EXTENT OF GROUNDWATER IMPACTS

Ameren initiated a nature and extent (N&E) investigation as required by the CCR Rule in 2018 by installing two monitoring wells and two temporary piezometers (N&E wells). The N&E wells are screened in two different, depth zones of the alluvial aquifer: shallow zone and deep zone. Well screen lengths range from 5 to 10 ft long and total depths range from approximately 31 to 91 ft bgs.

Analytical results from the N&E wells indicate arsenic concentrations are limited in their extent to the shallow zone of the alluvial aquifer to the west of the CCR Units. Arsenic concentrations to the west of the CCR Units are similar to the Assessment Monitoring results, but decrease to less than the GWPS, 10 micrograms per liter (ug/L) in the deep alluvial zone. Monitoring wells to the south near the Mississippi River are similar to those near the CCR Units to the north, with concentrations below the GWPS for arsenic.

Based on the analytical results from the N&E wells molybdenum concentrations are limited in extent in the alluvial aquifer towards both the Meramec River to the west and toward the Mississippi River to the south. Results from the N&E wells are below the GWPS (100 ug/L) in both the shallow and deep alluvial aquifer samples.

Analytical results from the N&E wells also indicate that lithium concentrations west of the CCR Units are below the GWPS. Results to the south of the CCR Units nearer to the Mississippi River are consistent with the Assessment Monitoring wells to the south of the CCR Units with results that are very close in range (36 to 42.7 ug/L) to the GWPS of Lithium (40 ug/L).

The extent of contamination is limited to the alluvial aquifer and the results from the N&E wells were used to develop corrective measures alternatives.

2.6 SURFACE WATER SAMPLING

Ash management operations at the MEC have not impacted adjacent surface water bodies. Ameren voluntarily collected samples of surface water from the Mississippi River, Meramec River and Creek/Drainage surface water along the northern boundary of the facility. Golder collected surface water samples from 12 locations in the Mississippi River and 9 locations in the Meramec River. At each sample location, shallow samples were collected near the surface of the river. Where the depth of water was greater than four feet, a second sample was collected mid-depth in the river (referred to here as a deep sample). A total of 40 samples were collected from the Mississippi River and a total of 26 samples were collected in the Meramec River. In addition, shallow surface water samples were collected from three locations in the creek / drainage bed that runs along the northwestern boundary of the MEC. A total of six samples were collected in the creek. Surface water sampling locations are shown on **Figure 2-2.**

Samples were analyzed for the same Appendix III and Appendix IV CCR constituents listed in **Section 1.3**, with the exception of radium (all CCR monitoring well data are below the GWPS for radium). Sample results were also compared to human health and ecological risk-based screening levels. The screening levels and comparison of the surface water results to the screening levels are provided in **Appendix A.**

In summary, the results of this investigation demonstrate that the Mississippi River and Meramec River sampling **do not** show evidence of impact of CCR constituents derived from the surface impoundments[6].

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[6] In some samples, the concentrations of arsenic, lead, or thallium are above risk-based screening levels, however, the results are statistically **no different** in upstream and downstream samples indicating that the CCR Units are not the source of the constituents detected in the rivers.

3. Risk Assessment and Exposure Evaluation

As described in this report, Ameren has conducted detailed environmental evaluations of the MEC and its environs. These investigations have been detailed in a risk evaluation report available to the public on the Ameren website:

- February 2018: Human Health and Ecological Assessment of the Meramec Energy Center. Available at: https://www.ameren.com/-/media/corporate-site/files/environment/ccr-rule/2017/groundwater-monitoring/Meramec-haley-aldrich-report.ashx?la=en&hash=76A0B8C34676EA9D3A7C8F61284917F50E02ED46

The purpose of this risk evaluation was to identify whether current groundwater conditions pose a risk to human health and the environment and, if so, whether the corrective measures identified in this report mitigate such risk.

3.1 APPROACH

The risk evaluation provided in the 2018 risk assessment report evaluated the environmental setting of the MEC, which has been in operation for 65 years, including its location and ash management operations at the facility. Golder provided information on groundwater location and direction, the rate(s) of groundwater flow, and where waterbodies may intercept groundwater flow.

A conceptual model was then developed based on this physical setting information and used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify locations where ecological populations could come into contact with surface water. Based on this conceptual model approach, Ameren's environmental consultants and risk assessors identified surface water sampling locations to allow evaluation of potential impact to the environment. Sampling results were then evaluated, as appropriate, on both a human health and ecological risk basis.

Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people. Generally, there are four components to the process (USEPA, 1989): (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

The USEPA develops "screening levels" of constituent concentrations in groundwater (and other media) that are considered protective of specific human exposures. These screening levels are referred to as "Regional Screening Levels" and are published by USEPA and updated twice yearly (USEPA, 2018a). In developing the screening levels, USEPA uses a specific target risk level (component 4) combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water). Similarly, ecological screening levels for surface water are developed by Federal agencies to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects.

Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists but indicate that further evaluation may be warranted.

The surface water and groundwater data were evaluated using human health risk-based and ecological risk-based screening levels drawn from Federal sources. The screening levels are used to determine if the concentration levels of constituents could pose an unacceptable risk to human health or the environment. The evaluation also considers whether constituents are present in groundwater and surface water above screening levels, and if so, if the results could be due to the ash management operations.

3.2 CONCEPTUAL SITE MODEL

There are no on-site users of alluvial groundwater adjacent to the MEC. As documented in the 2018 risk assessment report, all private and public wells recorded within a one-mile radius of the facility are upgradient of the facility or located on the opposite side of the Meramec River and, therefore, such groundwater is isolated from the facility (see the February 2018 report for more details).

3.3 RESULTS

3.3.1 Alluvial Aquifer

Figure 1-2 shows the location of the CCR monitoring wells at the MEC CCR Unit. A summary of the screening results is presented in the following table.

Table: Assessment Monitoring Reflects High Percentage Compliance

	Meramec Energy Center – Shallow Alluvial Aquifer
Percent of Assessment Monitoring Parameter Compliance	95%
Percent of Assessment Monitoring Parameter Results Requiring Corrective Action (Constituents)	5% Arsenic, Lithium, Molybdenum

The striking aspect of the analysis is how few results are above conservative GWPS applicable to the Site, given that the wells are located directly adjacent to and at the base of the surface impoundments, and the facility has been in operation for 65 years. Note that out of the 1,818 groundwater analyses conducted, only 76 results are above the GWPS. Put another way, over 95% of the groundwater results for the CCR Rule monitoring wells located at the edges of the MEC surface impoundments (MW-1 through MW-8) are below the GWPS.

3.3.2 Surface Water

The Mississippi River and the Meramec River sampling results do not show evidence of impact of constituents derived from MEC[7].

There are no analytical results for the Mississippi River that are above drinking water screening levels with the exception of arsenic and thallium in one sampling location and the MEC is not the source[8].

3.3.3 National Pollutant Discharge Elimination System Outfall

The outfalls for the MEC are identified as 003 and 009 and are shown on **Figure 2-2**. These are permitted outfalls under the National Pollutant Discharge Elimination System program. The outfall effluent water is tested for toxicity on a periodic basis as required by the permit. The biological toxicity testing results for Outfalls 003 and 009 at the MEC shows no evidence of aquatic toxicity in the outfall effluent.

3.4 CONCLUSION

The sampling results for the Mississippi River, the Meramec River, and the adjacent creek-drainage area are important. Although groundwater at the edge of the impoundment(s) shows that three constituents are present in some wells to a very limited extent above the GWPS, less than 5% of the results are above a GWPS, and the adjacent surface water bodies do not show evidence of impact of constituents derived from the surface impoundments at MEC. This is important because the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Impacts to groundwater do not mean that surface waters are impaired. The degree of interface between groundwater and surface waters is variable and complex and dependent upon a variety of factors including gradient and flow rate. It is possible, however, to determine the maximum concentration level that would need to be present on-site in groundwater and still be protective of the surface water environment. Groundwater and surface waters flow at very different rates and volumes and ultimately all such waters near the MEC flow towards the Mississippi River. The Mississippi is the largest river system in North America and as groundwater at the facility flows into the river, it is diluted by more than 100,000 times.

This conservative estimate of dilution is used to further understand how high an arsenic, lithium, or molybdenum groundwater concentration would have to be to potentially have an adverse impact on the Mississippi River. The tables below show how this factor is applied to the most conservative of the human health and ecological risk-based screening levels for surface water.

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[7] There are no analytical results for the Meramec River that are above drinking water screening levels, with the exception of lead. The total lead results upstream and downstream are similar and, thus, indicative of normal river conditions. Furthermore, all dissolved concentrations of lead are below the screening level, indicating that lead is associated with particulate in the river. In addition, groundwater samples on-site indicate that lead is either below screening levels or non-detected, thus, indicating that lead in the river is not attributable to the surface impoundments. Lead is not a COC at the MEC under the CCR Rule.

[8] The arsenic concentrations in the Mississippi River, Meramec River, and the creek/drainage along the northern portion of the facility are slightly above the human health recreational screening levels, however, the concentrations are statistically no different in upstream and downstream samples for both arsenic and thallium indicating that the facility is not the source of the arsenic and thallium detected in the rivers.

CALCULATING RISK-BASED SCREENING LEVELS FOR MEC GROUNDWATER BASED ON THE MISSISSIPPI RIVER

	Estimated Dilution Factor for the Mississippi River	100,000			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum MEC Groundwater Concentration**
Arsenic	0.00014	14	0.0221	M-MW-5	>600
Lithium	0.04	4000	0.164	M-MW-6	>24,000
Molybdenum	0.1	10000	0.717	M-MW-7	>13,000

CALCULATING RISK-BASED SCREENING LEVELS FOR MEC GROUNDWATER BASED ON THE MERAMEC RIVER

	Estimated Dilution Factor for the Meramec River	700			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Target Level and the Maximum MEC Groundwater Concentration**
Arsenic	0.00014	0.098	0.0221	M-MW-5	>4
Lithium	0.04	28	0.164	M-MW-6	>100
Molybdenum	0.1	70	0.717	M-MW-7	>90

***Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.**

The groundwater alternative risk-based screening levels are calculated in units of milligrams of constituent per liter of water (mg/L). One mg/L is equivalent to one part per one million parts.

The tables identify the maximum groundwater concentrations of arsenic, lithium, and molybdenum detected in the MEC monitoring wells. The comparison between the target levels and the maximum concentrations indicates that there is a wide margin of safety between the two values. This margin is shown in the last column of each table. To illustrate, concentration levels of arsenic, lithium, and molybdenum would need to be **more than 600, 24,000, and 13,000 times higher,** respectively, than currently measured levels before an adverse impact in the Mississippi River could occur.

The comprehensive evaluation summarized here demonstrates that there are no adverse impacts on human health from either surface water or groundwater uses resulting from coal ash management practices at the MEC.

3.4.1 Trace Elements in Coal Ash

All of the inorganic minerals and elements that are present in coal ash are also present naturally in our environment. Arsenic, lithium, and molybdenum are referred to as trace elements, so called because they are present in soils (and in coal ash) at such low concentrations (in the milligrams per kilogram (mg/kg) or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

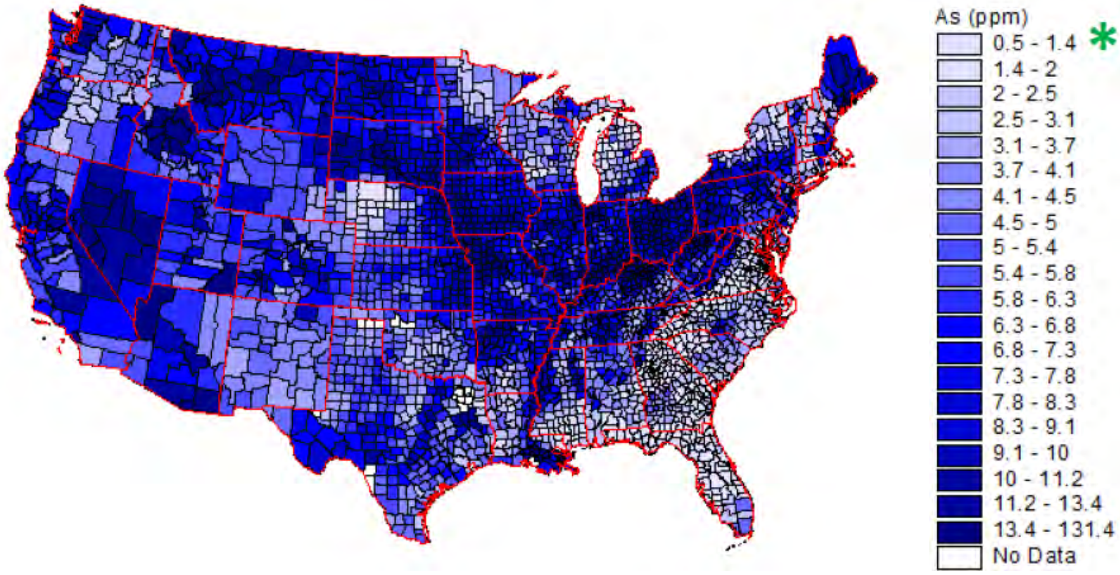
- 1 penny in a large container holding $10,000 worth of pennies, or
- 1 second in 11.5 days, or
- 1 inch in 15.8 miles

All of the constituents present in coal ash occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S. These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in our vitamins, such as molybdenum. Thus, we are exposed to these trace elements in our natural environment every day, and in many ways.

3.4.2 Arsenic

Arsenic is present in soils across the U.S. The USGS map of arsenic in surface soils in the U.S. is shown below.

Arsenic is Present in our Natural Environment – Background Levels in Soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

*The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg (USEPA, 2018a). Thus, the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Because arsenic is naturally present in soils and rocks, it is also naturally present in our groundwaters and surface waters. Just as for soil, there are background levels of constituents in groundwater. Constituent concentrations in groundwater that is upgradient of a source represent background conditions. To demonstrate a release to groundwater by a source, concentrations downgradient of the source must be greater than the background/upgradient concentrations at a statistically significant level for a consistent period of time. Thus, it is not surprising that arsenic is present in both of the CCR background wells for the MEC.

3.4.3 Lithium

Lithium is present in groundwater at the MEC at levels above the GWPS in one well location. The fact sheet in **Appendix B** provides information on lithium so that the groundwater data can be considered in context. There is no public exposure to groundwater at the MEC and concentration levels of lithium in adjacent surface waters are all well below health-based regulatory standards.

Lithium is naturally occurring in soils and water. Primary dietary sources of lithium are grains and vegetables, dairy products and meat. Estimates for daily dietary intake of lithium have been reported from different sources and varies amongst different countries. Ranges have included 0.0168 – 0.105 mg Li/day to 2.310 – 5.600 mg Li/day from food and water.

Lithium is used medicinally in the U.S. and globally as the leading treatment for bipolar disease. Adult daily dosages are approximately 900 mg/day or higher, and recommended doses for children are approximately 600 mg/day.

However, there are limited studies on lithium of the type upon which to base a toxicity value to use in human health risk assessment. USEPA has derived a provisional toxicity value (i.e., the value does not have the normal level of review or confidence compared to final toxicity values published by USEPA) that equates to a drinking water screening level of 0.04 mg/L, and a general intake of 0.14 mg/day for an adult. Note that this level is below many estimates of daily intake in humans presented above, and well below the typical therapeutic doses presented above.

3.4.4 Molybdenum

Haley & Aldrich has prepared a fact sheet (**Appendix C**) that provides information on molybdenum so that the groundwater data can be considered in context. There is no public exposure to groundwater at the MEC and concentration levels of molybdenum in adjacent surface waters are all well below health-based regulatory standards.

As discussed in more detail in **Appendix C**, molybdenum is an essential nutrient for humans, and the Institute of Medicine of the U.S. National Academy of Sciences (NAS) has provided recommended daily allowances (RDA) and tolerable upper limits (UL) to be used as guidelines for vitamins and supplements and other exposures (NAS, 2001).

The RDA for a nutrient is "the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) health individuals" (NAS, 2001). The RDA for molybdenum for adults set by the NAS in 2001 is 0.045 mg/day and is based on the amount of molybdenum needed to achieve a steady healthy balance in the body for the majority of the population.
The UL for molybdenum set by the NAS is 2 mg/day. This level is based on an evaluation of the potential toxicity of molybdenum at high levels of intake. Based on the UL, a safe drinking water level for molybdenum is 0.6 mg/L or 600 ug/L, or six-fold higher than the level set by USEPA of 0.1 mg/L or 100 ug/L in the CCR Rule. This difference serves to underscore the conservatism of the USEPA value when evaluating groundwater under the CCR Rule. Below is a chart that depicts groundwater and surface

water samples collected from Ameren's four energy centers and compares concentration levels based on both the NAS tolerable upper limit and the GWPS established by the USEPA in the CCR Rule. As reflected in the chart, over 90% of the groundwater results across all four energy centers and all but **one sample** at Meramec are below the standard the National Academy of Science developed for vitamins and supplements.

	Labadie	Meramec	Rush Island	Sioux
Groundwater				
Number of Samples	208	88	77	244
Molybdenum greater than CCR GWPS of 0.1 mg/L (a)	81	35	38	77
Molybdenum greater than NAS standard of 0.6 mg/L (b)	3	1	11	49
Surface Water				
Number of Samples	67	74	50	80
Molybdenum greater than 0.1 mg/L (a)	0	0	0	0

Notes:
mg/L - milligrams per liter.
(a) - Drinking water-based groundwater protection standard specified in the CCR Rule.
(b) - Alternative health-protective drinking water screening level based on the National Academy of Sciences review of molybdenum.

3.5 EVALUATION OF RISK IN THE CORRECTIVE MEASURES ASSESSMENT

In summary, there are no adverse impacts resulting from coal ash management practices at the MEC on human health or the environment from either surface water or groundwater uses. There are no users of groundwater near the MEC or its CCR units. In fact, as described above, concentrations of arsenic, lithium, and molybdenum detected in groundwater would need to be **more than 600, 24,000, and 13,000 times higher**, respectively**,** before such an unacceptable risk could exist under current and reasonable anticipated future uses.

Although the purpose of this CMA is to evaluate remedies to address assumed risks from the SSLs, the current conditions at the MEC, even prior to closure, do not pose an unacceptable risk to human health or the environment. Therefore, the risk-based evaluation provides additional support for the selection of a remedy moving forward.

4. Corrective Measures Alternatives

4.1 CORRECTIVE MEASURES ASSESSMENT GOALS

The overall goal of this CMA is to identify and evaluate the appropriateness of potential corrective measures to prevent further releases of Appendix IV constituents above their GWPS, to remediate releases of Appendix IV constituents detected during groundwater monitoring above their GWPS that have already occurred, and to restore groundwater in the affected area to conditions that do not exceed the GWPS for these Appendix IV constituents. The corrective measures evaluation that is discussed below and subsequent sections provides an analysis of the effectiveness of four potential corrective measures in meeting the requirements and objectives of remedies as described under §257.97 (also shown graphically on **Figure 4-1**). This assessment also meets the requirements promulgated in §257.96 which require the assessment to evaluate:

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to residual contamination;
- The time required to complete the remedy; and
- The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy.

The criteria listed above are included in the balancing criteria considered during the corrective measures evaluation, described in **Section 5**.

4.2 GROUNDWATER MODELING

Modeling is an analytical tool used to create estimates based on computer-simulated conditions. Groundwater flow and geochemical modeling[9] performed by Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) evaluated the hydrogeologic and geochemical conditions at the CCR Unit. Burns & McDonnell used the numerical computer code MODFLOW to simulate groundwater flow and the software package MT3DMS to simulate groundwater transport of dissolved phase constituents.

4.3 GROUNDWATER TREATMENT EVALUATION

In-situ treatment to reduce the concentrations of dissolved metals in groundwater can occur via stabilization of metals through precipitation of a metal compound, co-precipitation of the target metal within the structure of another compound, and/or sorption of the target metal onto other compounds in the subsurface. In simple terms, groundwater amendments are injected into the aquifer to create a chemical reaction that attenuates metals through precipitation or sorption.

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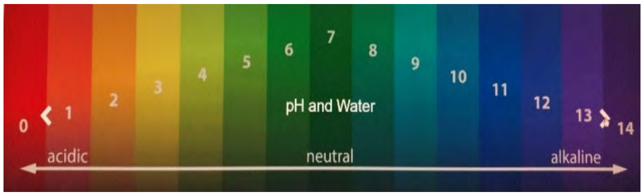
[9] Groundwater flow modeling was performed using MODFLOW 2000 supported by Groundwater Vistas as the graphical user interface.

Chemical precipitation is an available and demonstrated groundwater treatment technology recognized by USEPA [10]. Groundwater geochemistry (including oxidation reduction potential (ORP)) can greatly impact metals mobility at a site, where some metal compounds may be more soluble under highly oxidative (positive ORP) conditions while others are more soluble under reduced conditions (negative ORP). Also, the solubilities of many metal compounds are highly dependent on pH.



pH and Water (USGS - Water Science School publication).

Ameren has retained XDD Environmental to research and develop appropriate treatment options for arsenic, lithium, and molybdenum and is performing bench-scale treatability studies to demonstrate the effectiveness of treatment options on a site-specific basis. Laboratory results indicate that through pH adjustments arsenic concentrations at the MEC will fall to below action levels. Appropriate treatment trains for molybdenum and lithium at the MEC are under evaluation and bench-scale treatment results for all four of Ameren's energy centers are expected to be completed in the Summer of 2019.

4.4 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures can terminate when groundwater impacted by the CCR Units does not exceed the Appendix IV GWPS for three consecutive years of groundwater monitoring. In accordance with §257.97, the groundwater corrective measures to be considered must meet, at a minimum, the following threshold criteria:

1. Be protective of human health and the environment;
2. Attain the GWPS;
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of COCs to the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, considering factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for waste management.

The remedial alternatives presented below contemplate both CIP (Alternative 1 through 3) and CBR (Alternative 4) of the unit. Both closure methods are expressly authorized under the CCR Rule.

4.4.1 Alternative 1 – Closure in Place with Capping and Monitored Natural Attenuation

The regulated surface impoundments would be closed in place with a low-permeability geomembrane and soil protective layer to reduce infiltration of surface water to groundwater thereby isolating source material. This cap selection exceeds regulatory requirements by more than two orders of magnitude ($<1x10^{-7}$ centimeters per second (cm/sec) planned versus $1x10^{-5}$ cm/sec required by the CCR Rule). Over time, decreased surface water infiltration and porewater flux through the CCR would allow the concentration of COCs in downgradient groundwater to decline and overall groundwater concentrations

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[10] EPA, "Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category: EPA's Response to Public Comments; Part 7 of 10", SE05958A6, p. 7-20

of COCs to attenuate. Geochemical modeling results indicate that the dissolved phase plume of arsenic, lithium, and molybdenum remaining above the GWPS post-closure would remain stable and within the MEC property boundary long-term as such levels attenuate. The timelines for MNA duration for arsenic, lithium, and molybdenum are shown on **Figures 4-2, 4-3, and 4-4**, respectively.

CIP can be completed safely, in compliance with applicable federal and state regulations, and be protective of public health and the environment. In general, CIP consists of installing a cap/cover designed to significantly reduce infiltration from surface water or rainwater, resist erosion, contain CCR materials, and prevent exposures to CCR. For this alternative, Ameren would install a geomembrane cover layer with a permeability that is 100 times lower than what the CCR Rule requires thus further reducing infiltration. At the MEC, site preparation, construction and installation of cap and cover systems take approximately 12 to 18 months and additional closure activities are planned for 2021 with all remaining closures expected to be completed within four years.

MNA is a viable remedial technology recognized by both state and federal regulators that is applicable to inorganic compounds in groundwater. The USEPA defines MNA as “the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods”. The ‘natural attenuation processes’ that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants (USEPA, 2015). When combined with a low-permeability cap to address the source by limiting the infiltration of precipitation into and through the CCR, MNA can over time reduce concentrations of arsenic, lithium, and molybdenum in groundwater at the waste boundary.

Following the installation of the cap system, Ameren would implement post-closure care activities. Post closure care includes long-term groundwater monitoring until such time that groundwater conditions return to below regulatory levels and cap system maintenance. Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.2 Alternative 2 – CIP with Capping and In-Situ Groundwater Treatment

Similar to Alternative 1, the regulated surface impoundments would be CIP with a low-permeability ($<1 \times 10^{-7}$ cm/sec) geomembrane to reduce infiltration of surface water to groundwater and to isolate source material. COCs would be addressed through in-situ injection of groundwater amendments downgradient of the regulated surface impoundments, or through the installation of a permeable reactive barrier (PRB). Over time, decreased surface water infiltration and porewater flux would allow the concentration of COCs to attenuate and active remediation (injections or PRB replenishment) could cease.

Following the installation of the low-permeability cover and in-situ treatment system (via a trench or injection wells), Ameren would implement post-closure care activities that include periodic amendment injections or periodic replenishment of the treatment reagents within the PRB, long-term groundwater sampling to monitor treatment system performance, and cover system maintenance. Based upon laboratory testing performed by XDD, the timeline for in-situ treatment is expected to be less than Alternative 1 as shown on **Figures 4-2, 4-3, and 4-4**.

Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.3 Alternative 3 – CIP with Capping and Hydraulic Containment Through Groundwater Pumping and Ex-situ Treatment

The regulated surface impoundments would be closed in place with a low-permeability (<1 x 10^{-7} cm/sec) geomembrane to reduce infiltration of surface water to groundwater and isolate source material. Pumping wells would be used to hydraulically control the migration of constituents downgradient. However, pumping wells would generate large volumes of effluent that would require ex-situ treatment, likely with an ion exchange or a reverse osmosis (RO) treatment system. Both treatment systems are complex with ongoing operation and maintenance and would generate a secondary waste stream – including regeneration/replacement of the ion exchange media or concentration reject water from the RO system. Approvals and permitting would be required for the construction and installation of the treatment systems and discharge of the treated groundwater.

Implementation of a large-scale hydraulic containment (HC) system will require a detailed design effort with bench scale testing to verify groundwater treatment. Pilot testing, such as pumping tests and additional groundwater modeling, will be needed to verify the hydraulic capture zone. While HC is a widely used remediation technology, it has not been commonly used as part of a large-scale CCR unit closure strategy.

The timeline for active treatment is expected to be comparable to Alternatives 1 and 2 because treatment would continue until source concentrations attenuate to levels less than the GWPS. With active groundwater pumping along the boundary of the impoundments, such process creates a waste stream that must be permitted and managed prior to discharge back into the Meramec River.

Following the installation of the low-permeability cover, groundwater pumping well network, and ex-situ treatment system, Ameren would implement post-closure care activities that includes operation and maintenance of the hydraulic containment (HC) system, long-term groundwater sampling to monitor HC system performance, and cover system maintenance. Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.4 Alternative 4 – Closure by Removal with Monitored Natural Attenuation

This alternative evaluates the removal of CCR from the impoundments at the Site. While this alternative would eliminate (through removal) the source, it takes over 20 years to implement during which time the impoundments would remain open and the ponded ash subject to ongoing infiltration for the duration of the removal activities. As with Alternatives 1 and 2, concentrations of COCs in downgradient groundwater would decline via natural attenuation processes.

The MEC is located in a heavily developed area of St. Louis County and, as a consequence, any large scale excavation operation would have several potential community impacts, safety concerns and challenges. Given the magnitude of the total estimated haul volume (5.2 MM CY) along with the travel distance to one or more off-site and potentially out of state landfills, injuries and fatalities would be likely. A study completed by the Lochmueller Group (Lochmueller) **(Appendix D)** estimated that the time period needed to transport material off-site to a commercial landfill could be 20 years or greater.

As the report makes clear, there is simply a limit on how much excavation and roundtrip truck hauls can occur on a given eight-hour workday. The Lochmueller study bases its time estimate on assumed productivity rates that are subject to potential disruptions (e.g., weather conditions, truck synchronizing, available landfill capacity, travel route traffic congestion, road enhancements, etc.) that could impact overall CBR timeframe. The study identified productivity targets for other Ameren facilities at approximately 200 truckloads a day (**one every 2.5 minutes**).

The presence of a nearby school just up the road from the MEC negatively impacts transportation to and from the site. It is likely that the frequency of hauling trips would need to be reduced during school days to accommodate community concerns. Haulers would need to avoid trips past the school during school arrival and departure times, thereby reducing the hauling workday from 8 hours to 5 ½ to 6 hours. Additionally, further review of local restrictions and approvals would be required to verify that any selected landfill, particularly if located in Illinois, could receive the ash for disposal.

Excavated materials from the MEC would not be suitable for beneficial use applications, due to the ash production quality and chemical reactions that occurred during the placement of class C fly ash via wet sluicing. Traditional beneficial use applications for class C fly ash, such as replacement for cement in the production of ready-mix concrete and concrete related products require the materials to be capable of reacting chemically to produce cementitious bonds. The capability to produce these chemical reactions have been expended with the wet-sluicing process of CCR into the surface impoundments. In addition, historical F ash materials at MEC site have already been recovered and utilized as part of the Taum Sauk reconstruction project. No recoverable F ash is available from the site[11].

Technical and logistical challenges of implementing a large-scale ash removal project also need to be considered (removal of CCR over 30-ft deep adjacent to the Meramec and Mississippi rivers). Removal activities will be difficult and require implementation of CCR stabilization methods and temporary staging/stockpiling of material for drying prior to transportation off-site; these considerations will affect productivity and increase removal duration. Excavation and construction safety during the removal duration is another major concern due to heavy equipment (bulldozers, excavators, front end loaders, off-road trucks) and dump truck operation within the active MEC site. Additional community impacts associated with the use of heavy equipment and truck traffic are also a consideration for this alternative. During the long removal period (20-years or more), the ash in the non-closed impoundments remain exposed to infiltration via precipitation.

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[11] Information provided by Ameren technical staff, May 10, 2019.

5. Comparison of Corrective Measures Alternatives

The purpose of this section is to evaluate, compare, and rank the six corrective measures alternatives using the balancing criteria described in §257.97.

5.1 EVALUATION CRITERIA

In accordance with §257.97, remedial alternatives that satisfy the threshold criteria are then compared to four balancing (evaluation) criteria. The balancing criteria allow a comparative analysis for each corrective measure, thereby providing the basis for final corrective measure selection. The four balancing criteria include the following:

1. The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
2. The effectiveness of the remedy in controlling the source to reduce further releases;
3. The ease or difficulty of implementing a potential remedy; and
4. The degree to which community concerns are addressed by a potential remedy.

Public input and feedback will be considered following the public information session to be held in May 2019.

5.2 COMPARISON OF ALTERNATIVES

This section compares the alternatives to each other based on evaluation of the balancing criteria listed above. The goal of this analysis is to identify the alternative that is technologically feasible, relevant and readily implementable, provides adequate protection to human health and the environment, and minimizes impacts to the community.

A graphic is provided within each subsection below to provide a visual snapshot of the favorability of each alternative, where green represents favorable, yellow represents less favorable, and red represents unfavorable.

5.2.1 The Long- and Short-Term Effectiveness and Protectiveness of the Potential Remedy, along with the Degree of Certainty that the Remedy will Prove Successful

This balancing criterion takes into consideration the following sub criteria relative to the long-term and short-term effectiveness of the remedy, along with the anticipated success of the remedy.

5.2.1.1 Magnitude of reduction of existing risks

As summarized in **Section 3**, no unacceptable risk to human health and the environment exists with respect to the surface impoundments. Therefore, none of the remedial alternatives are necessary to reduce an assumed risk posed by Appendix IV constituents in groundwater because no such adverse risk currently exists. However, other types of impacts can be posed by the various remedial alternatives considered here. The remedial alternatives that pose the least external impact are Alternative 1 (CIP with MNA) because it involves the least amount of construction and operations and maintenance activities and associated impacts, and Alternative 2 (CIP with in-situ treatment) since treatment will reduce concentrations of constituents in groundwater short-term without generating a secondary waste stream. Alternative 4 (CBR with MNA) has the highest risk to human health and the environment related to excessive and prolonged truck traffic, which increases the likelihood of roadway accidents during the period of time needed to complete the CBR project. Construction of the treatment system and the cap will be required for Alternative 3 (CIP with HC) and a waste stream including a high volume of effluent will be generated posing additional risk but this alternative, like Alternatives 1 and 2, pose a lesser risk than Alternative 4.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria i) Magnitude of reduction of risks	🟩	🟩	🟩	🟥

5.2.1.2 *Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy*

Alternative 4 (CBR with MNA) has the lowest long-term residual risk in that the source material is removed. However, implementation of this alternative would take 20 years or greater to implement during which time the source material (ash) is subject to ongoing infiltration (because it remains open to the environment during removal), relative to the other alternatives. For Alternatives 1 through 3, the CCR would be CIP with the installation of a low permeability (<1 x 10^{-7} cm/s) geomembrane that virtually eliminates infiltration of precipitation and isolates the source material. Dissolved phase COCs to groundwater are addressed through MNA process. Alternatives 2 and 3 also provide additional measures to address potential groundwater impacts through in-situ treatment and hydraulic controls. but Alternative 3 will result in an additional waste stream.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria ii) Magnitude of residual risk in terms of likelihood of further release	🟩	🟩	🟩	🟩

5.2.1.3 *The type and degree of long-term management required, including monitoring, operation, and maintenance*

Alternative 1 (CIP with MNA) is the most favorable alternative with respect to this criterion because it requires the least amount of long-term management and involves no mechanical systems as part of the remedy. Alternative 4 (CBR with MNA) is least favorable because off-site removal is estimated to take 20 years or greater to complete and is logistically complex with transportation and coordination with off-site disposers (commercial landfills). The remaining alternatives fall between Alternatives 1 and 4 because they involve active remediation systems to implement and/or maintain throughout their remediation life cycle.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria iii) Type and degree of long-term management required	🟩	🟨	🟨	🟥

5.2.1.4 Short-term risks that might be posed to the community or the environment during implementation of such a remedy

The highest short-term impact posed to the community or environment would be during implementation of Alternative 4 (CBR with MNA), making this alternative the least favorable. Potential environmental impacts include noise and emissions from heavy equipment, the potential for a release during excavation and dewatering, and fugitive dust emissions. Community impacts include general impacts to the community due to increased truck traffic on public roads during the entire project duration, along with an increased potential for traffic accidents and fatalities, noise, and truck emissions.

For Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC), risk to the community during implementation is considered the same and would be minimal compared to Alternative 4. Periodic sampling of the monitoring well network to verify treatment system effectiveness will pose no risk to the community.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria iv) Short term risk to community or environment during implementation	🟩	🟩	🟩	🟥

5.2.1.5 Time until full protection is achieved

There is currently no unacceptable risk to human health and the environment associated with groundwater at the regulated surface impoundments; therefore, protection is already achieved. Based upon predictive modeling, Alternative 1 (CIP with MNA) arsenic concentrations will attain GWPS in approximately 27 years (see **Figures 4-2, 4-3, and 4-4**). Alternatives 2 (CIP with in-situ treatment) and 3 (CIP with HC) take the least amount of time for COC concentrations to attain the GWPS (see **Figures 4-2, 4-3, and 4-4**) but a waste stream is produced by implementation of Alternative 3. These two alternatives are favorable given the shorter timeframe to achieve concentrations less than the GWPS.

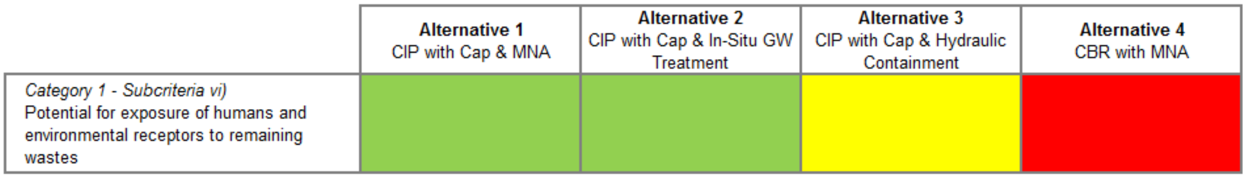
Alternative 4 (CBR with MNA) could take approximately 20 years or greater to fully implement followed by a period of groundwater monitoring to verify natural attenuation of the existing groundwater plume, which makes this alternative unfavorable. As detailed in the Lochmueller report, implementation is limited mainly by the amount of material that can be excavated and hauled during a workday, disposal facility capacity, and the volume of ash.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria v) Time until full protection is achieved	🟨	🟩	🟩	🟥

5.2.1.6 *Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment*

Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) all have similar, minimal potential for exposure of humans and environmental receptors during regrading and cap construction; monitoring well system installation; and installation of the in-situ treatment system, or HC system. Alternative 1 (CIP with MNA) is the most favorable alternative since, aside from capping, no additional contact with CCR or impacted groundwater would be needed. Alternative 2 (CIP with in-situ treatment) is also favorable because treatment occurs below ground and no waste stream is generated. Alternative 3 (CIP with HC) is slightly less favorable since a secondary waste stream will be generated and will need to be managed either onsite or offsite, which creates a potential for exposure.

Alternative 4 (CBR with MNA) has high potential for exposure which makes this alternative the least favorable remedy for this criterion. A high potential for exposure exists during the excavation and transport of the CCR over local roadways, if Alternative 4 is implemented.



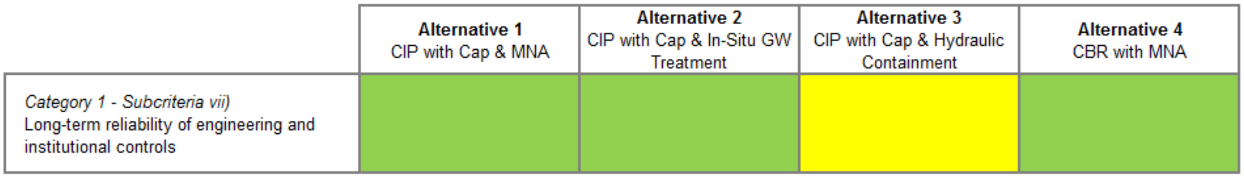
	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria vi) Potential for exposure of humans and environmental receptors to remaining wastes	🟩	🟩	🟨	🟥

5.2.1.7 *Long-term reliability of the engineering and institutional controls*

Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) are expected to have high long-term reliability, as capping and long-term monitoring are common methods for long-term waste management. HC and ex-situ treatment (Alternatives 3) are considered reliable, proven technologies and would have high long-term reliability, but rely require bench scale testing and rely on mechanical systems to operate. Of the CIP alternatives, Alternative 1 (CIP with MNA) is considered the most favorable because no additional ongoing Operations and Maintenance (O&M) would be needed, other than periodic groundwater sampling and verification of decreasing concentrations.

For Alternatives 1 through 3, which include CIP, institutional controls such as the recording of an environmental covenant restricting the use of groundwater can easily be implemented because the surface impoundments are located on property owned by Ameren.

Alternative 4 (CBR with MNA) engineering and institutional controls would have high long-term reliability because the CCR will have been removed from the surface impoundments. With the CCR no longer in place, no additional engineering and institutional controls are anticipated.

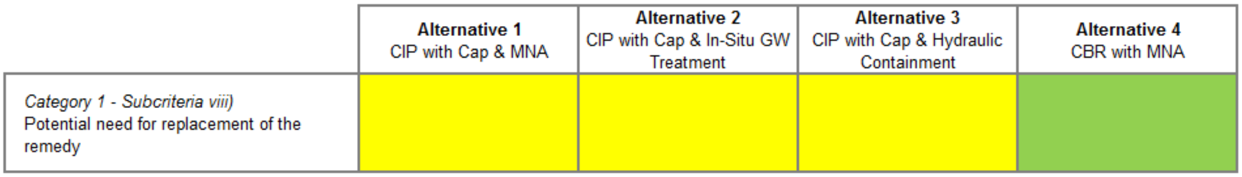


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria vii) Long-term reliability of engineering and institutional controls	🟩	🟩	🟨	🟩

5.2.1.8 Potential need for replacement of the remedy

Closure of the surface impoundments by CBR (Alternative 4) is considered permanent and can be effective in appropriate circumstances. From the perspective of needing to replace the remedy, source removal (Alternative 4) is permanent but takes decades to implement.

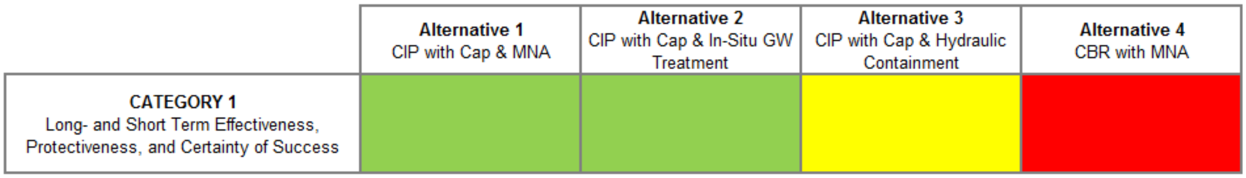
Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) are expected to have permanent closures with capping in place. Should monitoring results indicate that the selected remedial alternative is not effective at reducing the concentration of COCs over time, alternate and/or additional active remedial methods for groundwater may be considered in the future.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria viii) Potential need for replacement of the remedy	🟨	🟨	🟨	🟩

5.2.1.9 Long- and short-term effectiveness and protectiveness criterion summary

The graphic below provides a summary of the long- and short-term effectiveness and protectiveness of the potential remedy, along with the degree of certainty that the remedy will prove successful. Alternative 1 (CIP with MNA) is the most favorable, while Alternative 4 (CBR with MNA) is the least favorable. Alternative 1 is expected to be effective both short- and long-term and does not include additional treatment technology aside from MNA. Alternative 2 (CIP with in-situ treatment) is comparable to Alternative 1 because it has a shorter potential timeframe to meet the GWPS despite requiring treatment, but no secondary waste stream is generated. A secondary waste stream is generated under Alternative 3 (CIP with HC). Alternative 4 (CBR with MNA) will require a lengthy construction period, and therefore is not effective in the short-term, and creates short-term risk (for 20 plus years) to the community during construction. Further, to implement Alternative 4 (CBR and MNA) the CCR Units will be open to the environment during the 20 plus year removal process resulting in no source control for decades.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 1 Long- and Short Term Effectiveness, Protectiveness, and Certainty of Success	🟩	🟩	🟨	🟥

5.2.2 The Effectiveness of the Remedy in Controlling the Source to Reduce Further Releases

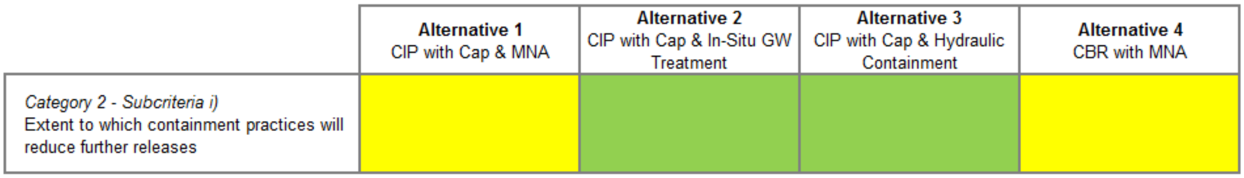
This balancing criterion takes into consideration the ability of the remedy to control a future release, and the extensiveness of treatment technologies that will be required.

5.2.2.1 The extent to which containment practices will reduce further releases

For remedial Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) installation of the low permeability cap will reduce the infiltration of surface water into the surface impoundments and decrease the flux of COCs to groundwater over time. Groundwater mounding and an associated outward hydraulic gradient present during operation is expected to dissipate after closure. Alternatives 2 and 3 are considered the most favorable because treatment technologies will be implemented to further limit down-gradient migration of COCs in groundwater.

Under Alternative 4 (CBR with MNA), no further releases are anticipated following removal of the CCR material. However, the implementation of Alternative 4 is anticipated to require multiple decades to complete with MNA monitoring following completion of construction. During the period of construction, there would be no source control of the Appendix IV constituents because the CCR Units will be open to the environment.

For Alternatives 2 (CIP with in-situ treatment) and 3 (CIP with HC), additional containment or treatment practices (in-situ treatment and HC with ex-situ treatment) will address COCs in groundwater migrating downgradient from the surface impoundments, achieving the performance criteria at the waste boundary. Alternative 3, however, will create additional waste streams requiring management on and off-site. Alternative 1 will not have an additional containment technology beyond natural attenuation but is expected to reduce the concentrations below the GWPS over time.

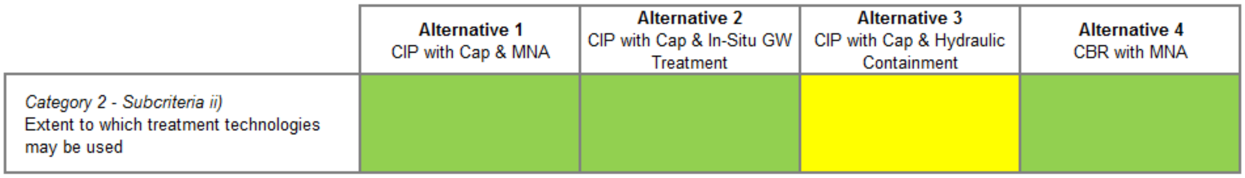


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 2 - Subcriteria i) Extent to which containment practices will reduce further releases	🟨	🟩	🟩	🟨

5.2.2.2 *The extent to which treatment technologies may be used*

No groundwater treatment technologies, other than natural attenuation, will be used for Alternatives 1 and 4. There would be no ongoing operation and maintenance of a treatment technology, other than periodic groundwater monitoring. Alternative 1 relies only on low-permeability capping, and therefore is the most favorable.

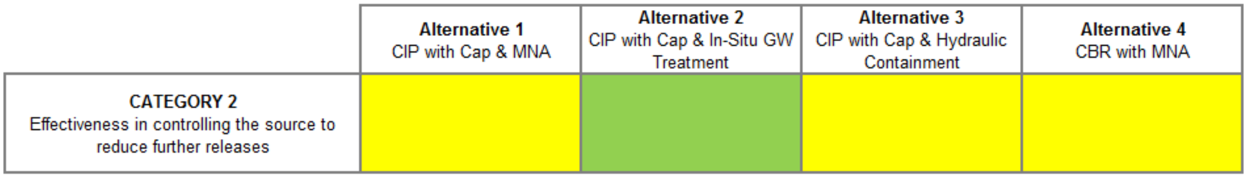
Alternative 2 will use one additional technology, in-situ treatment, while Alternatives 3 will use two additional technologies, HC and ex-situ treatment. The operation of an ex-situ treatment system will create a secondary waste stream, such as concentrated reject water (RO) requiring off-site disposal, or depleted resin (ion exchange) requiring regeneration or off-site disposal.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 2 - Subcriteria ii) Extent to which treatment technologies may be used	🟩	🟩	🟨	🟩

5.2.2.3 *Effectiveness of the remedy in controlling the source to reduce further releases summary*

The graphic below provides a summary of the effectiveness of the remedial alternatives to control the source to reduce further releases. Alternative 2 (CIP with in-situ treatment) is the most favorable, while Alternatives 1 (CIP with MNA), 3 (CIP with HC), and 4 (CBR with MNA) are the least favorable. The construction period for Alternative 2 (CIP with in-situ treatment) is expected to be brief and will begin treating groundwater at the unit boundary immediately. Further releases under Alternative 4 (CBR with MNA) will not be addressed until construction is complete.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 2 Effectiveness in controlling the source to reduce further releases	🟨	🟩	🟨	🟨

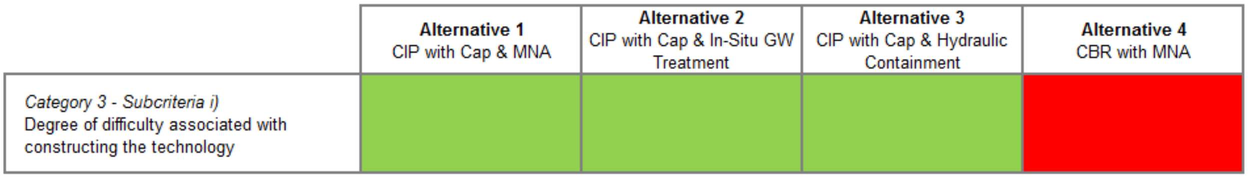
5.2.3 The Ease or Difficulty of Implementing a Potential Remedy

This balancing criterion takes into consideration technical and logistical challenges required to implement a remedy, including practical considerations such as equipment availability and disposal facility capacity.

5.2.3.1 Degree of difficulty associated with constructing the technology

CIP with a low permeability cap will be straightforward and can be implemented with common construction methods for Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC). No construction difficulties are anticipated if Alternatives 1, 2, and 3 are implemented. Specialty equipment or contractors are not required. Alternative 2 may be slightly more difficult to implement should a subsurface trench be required for a permeable barrier and Alternative 3 does require construction and installation of a treatment system. For Alternative 1, no additional treatment technology is needed other than monitoring wells for groundwater monitoring.

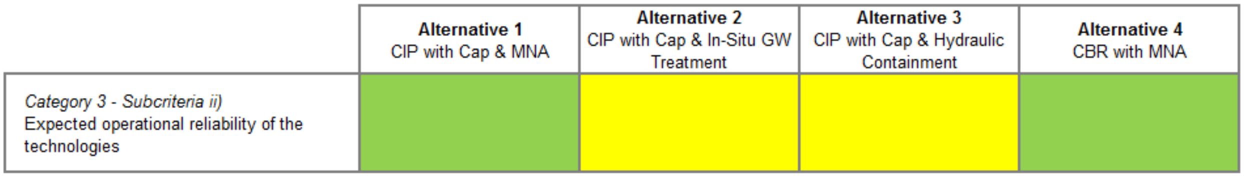
Alternative 4 (CBR with MNA) will be difficult to implement due to technical and logistical challenges. Alternative 4 will include large-scale excavation adjacent to the Meramec River and the transportation of 5.2 MM CY of CCR over local roadways. Alternative 4 will include large-scale construction, specialty equipment and contractors, long project durations, and significant technical challenges.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria i) Degree of difficulty associated with constructing the technology	🟩	🟩	🟩	🟥

5.2.3.2 Expected operational reliability of the technologies

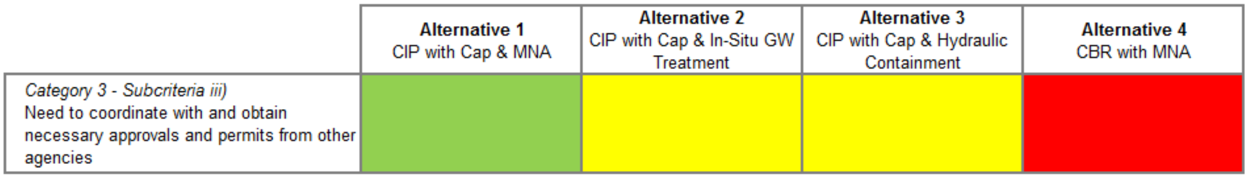
Alternative 1 (CIP with MNA) is considered the most favorable from an operational perspective because capping with MNA has a proven track record and requires limited O&M. Alternatives 2 and 3 are expected to be reliable but will utilize additional groundwater treatment technologies. Alternative 4 (CBR with MNA) is considered a reliable alternative as all CCR material would be removed, although implementation would be challenging.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria ii) Expected operational reliability of the technologies	🟩	🟨	🟨	🟩

5.2.3.3 Need to coordinate with and obtain necessary approvals and permits from other agencies

Alternative 1 (CIP with MNA) is the most favorable since the implementation of the remedy is straightforward and only includes capping and MNA. Alternative 4 (CBR with MNA) will require confirmation that off-site landfills are permitted to accept the ash and that there are no local siting restrictions that apply and permitting for large-scale construction will likely be required. Permitting is expected to be straightforward for CIP Alternatives 2 and 3. Additional approval and permitting may be required for Alternative 2 (CIP with in-situ treatment) because this alternative includes subsurface application of groundwater amendments and permitting would likely be required for Alternative 3 for treated groundwater discharge.

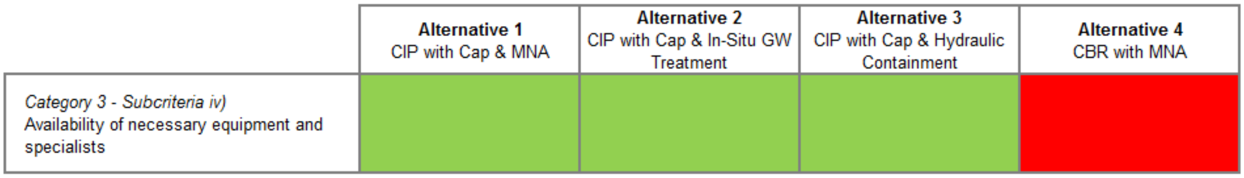


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria iii) Need to coordinate with and obtain necessary approvals and permits from other agencies	🟩	🟨	🟨	🟥

5.2.3.4 Availability of necessary equipment and specialists

Alternative 1 (CIP with MNA) is the most favorable since specialty equipment and specialists will not be required to implement the MNA remedy. Equipment needed to implement Alternatives 2 and 3 are expected to be readily available.

Alternative 4 (CBR with MNA) is the least favorable since specialty remediation contractors will be needed to implement full removal, which will include large-scale construction and transportation of material to off-site disposal facilities.

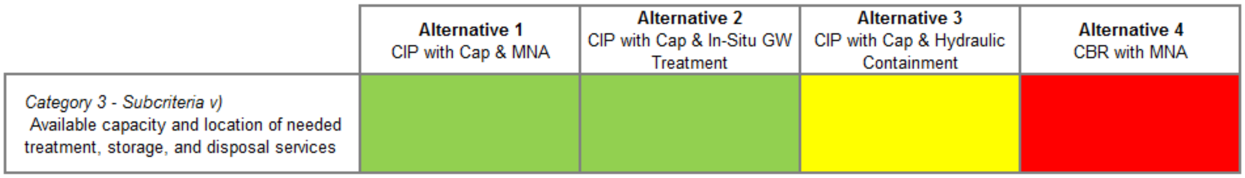


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria iv) Availability of necessary equipment and specialists	🟩	🟩	🟩	🟥

5.2.3.5 Available capacity and location of needed treatment, storage, and disposal services

The Lochmueller Study assists in the evaluation of the CBR alternative (Alternative 4) by evaluating available capacity at an Illinois landfill reasonably proximate to the MEC that could potentially receive CCR for disposal. Three such landfills were identified in the main report text associated with material disposal from a separate Ameren site. However, further work would be required to confirm that the landfills identified are permitting to accept the ash for disposal and that there are no local siting restrictions preventing those landfills from accepting the ash material. Due to the disposal requirements, Alternative 4 (CBR with MNA) is the least favorable alternative.

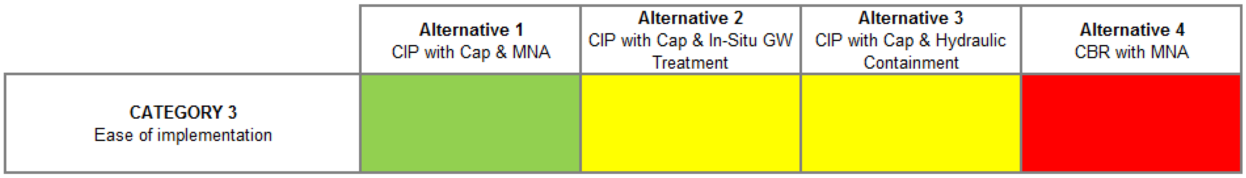
Because the regulated surface impoundments will be CIP for Alternatives 1, 2, and 3, treatment, storage, and disposal services for CCR material will not be needed. Temporary stockpiling of CCR during regrading and capping can be completed within the current boundaries of the ash unit. Alternative 1 is the most favorable alternative since no active treatment is included. For Alternative 3, the ex-situ treatment system will generate a concentrated waste stream which will require off-site transportation and disposal that the other alternatives would not require.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria v) Available capacity and location of needed treatment, storage, and disposal services	🟩	🟩	🟨	🟥

5.2.3.6 Ease or difficulty of implementation summary

The graphic below provides a summary of the ease or difficulty that will be needed to implement each alternative. Alternative 1 (CIP with MNA) is the most favorable, while Alternative 4 (CBR with MNA) is the least favorable.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 3 Ease of implementation	🟩	🟨	🟨	🟥

6. Summary

This Corrective Measures Assessment has evaluated the following alternatives:

- Alternative 1 – Closure in Place with Capping and Monitored Natural Attenuation
- Alternative 2 – CIP with Capping and In-Situ Groundwater Treatment
- Alternative 3 – CIP with Capping and Hydraulic Containment Through Groundwater Pumping and Ex-situ Treatment
- Alternative 4 – Closure by Removal with Monitored Natural Attenuation

In accordance with §257.97, each of these alternatives has been evaluated in the context of the following threshold criteria:

- Be protective of human health and the environment;
- Attain the GWPS;
- Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of COCs to the environment;
- Remove from the environment as much of the contaminated material that was released from the CCR units as is feasible, considering factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
- Comply with standards (regulations) for waste management.

In addition, in accordance with §257.97(c), each of the alternatives has been evaluated in the context of the following balancing criteria:

- The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of eight factors.
- The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the extent to which containment practices will reduce further releases and the extent to which treatment technologies may be used.
- The ease or difficulty of implementing a potential remedy(s) based on consideration of five types of factors

This Corrective Measures Assessment, and the input received during the public comment period, will be used to identify a final corrective measure for implementation at the MEC.

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TABLES

TABLE I
GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total	Arsenic Total	Barium Total	Beryllium Total	Cadmium Total	Chromium Total	Fluoride Total	Cobalt Total	Lead Total	Lithium Total	Mercury Total	Molybdenum Total	Selenium Total	Thallium Total
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Site GWPS	**6**	**10**	**2000**	**4**	**5**	**100**	**4**	**6**	**15**	**40**	**2**	**100**	**50**	**2**
BMW-1	5/13/2016	0.71 J	1.2	254	1 U	0.5 U	1 U	0.42	5 U	5 U	16	0.2 U	5.6 J	0.39 J	1 U
	6/16/2016	1 U	1.3	239	1 U	0.5 U	0.50 J	0.42	5 U	5 U	12	0.2 U	6.6 J	0.32 J	1 U
	7/19/2016	0.081 J	5.5	232	1 U	0.5 U	0.47 J	0.37	5 U	5 U	15.2	0.2 U	6.8 J	1 U	1 U
	9/7/2016	0.62 J	0.99 J	237	1 U	0.5 U	1 U	0.38	5 U	5 U	13.4	0.2 U	7.2 J	0.36 J	1 U
	11/10/2016	0.64 J	1.1	230	1 U	0.5 U	0.46 J	0.44	5 U	5 U	14.2	0.2 U	20 U	0.29 J	1 U
	1/6/2017	1 U	0.89 J	241	1 U	0.5 U	1 U	0.44	5 U	5 U	14.6	0.2 U	5.4 J	0.19 J	1 U
	3/7/2017	0.60 J	2.1	221	1 U	0.5 U	1.8	0.39	5 U	5 U	14.9	0.2 U	6.7 J	0.18 J	1 U
	6/14/2017	0.60 J	1.7	224	1 U	0.5 U	1 U	0.38	5 U	5 U	12.8	0.2 U	6.4 J	0.11 J	1 U
	11/6/2017							0.48							
	4/4/2018	0.51 J	1.9	237	1 U	0.5 U	0.11 J	0.18 J	5 U	10 U	13.8	0.2 U	4.3 J	1 U	1 U
	5/17/2018		1.5	251			1 U	0.36			500 UO		5.1 J		
	11/19/2018		1.4	204			0.11 J	0.43			15		4.6 J		
BMW-2	3/29/2016	1 U	0.80 J	485	1 U	0.5 U	0.62 J	0.38	5 U	5 U	5.7 J	0.2 U	20 U	1 U	1 U
	5/13/2016	1 U	1.3	538	1 U	0.5 U	1 U	0.34	5 U	3.1 J	8.3 J	0.2 U	20 U	1 U	1 U
	7/19/2016	0.63 J	1.2	503	1 U	0.5 U	0.36 J	0.25	5 U	5 U	6.8 J	0.2 U	0.53 J	0.28 J	1 U
	9/7/2016	1 U	1.2	534	1 U	0.5 U	0.65 J	0.34	5 U	3.5 J	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	1.6	528	1 U	0.5 U	0.66 J	0.28	5 U	5 U	6.9 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	1.8	553	1 U	0.5 U	1 U	0.26	5 U	5 U	7.5 J	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	1.5	566	1 U	0.5 U	1.2	0.28	5 U	5 U	7.4 J	0.2 U	20 U	1 U	1 U
	6/14/2017	1 U	1.8	547	1 U	0.5 U	1 U	0.27	5 U	2.5 J	5.6 J	0.2 U	20 U	1 U	1 U
	11/6/2017							0.28							
	4/4/2018	1 U	1.1	537	1 U	0.31 J	0.45 J	0.10 J	5 U	10 U	9.3 J	0.2 U	20 U	1 U	1 U
	5/17/2018		1.7	566			1 U	0.31			500 UO		10 U		
	11/19/2018		1.1	524			0.45 J	0.35			6.5 J		20 U		
MW-1	3/29/2016	0.063 J	0.83 J	352	1 U	0.042 J	0.97 J	0.3	1.5 J	5 U	10 U	0.2 U	20 U	1 U	1 U
	5/17/2016	1 U	0.63 J	375	1 U	0.5 U	1 U	0.3	5 U	4.3 J	10 U	0.041 J	0.84 J	1 U	1 U
	7/18/2016	1 U	0.49 J	374	1 U	0.5 U	0.79 J	0.25	5 U	4.9 J	10 U	0.2 U	20 U	1 U	1 U
	9/8/2016	1 U	0.62 J	378	1 U	0.5 U	0.88 J	0.22	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	0.46 J	364	1 U	0.5 U	0.77 J	0.24	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	0.38 J	357	1 U	0.5 U	1 U	0.25	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	0.67 J	372	1 U	0.5 U	1 U	0.25	5 U	5 U	10 U	0.2 U	20 U	1 U	0.064 J
	6/14/2017	0.032 J	1 U	374	0.23 J	0.5 U	1.6	0.23	5 U	5 U	10 U	0.2 U	20 U	1 U	0.076 J
	11/6/2017							0.26							
	4/4/2018	0.028 J	0.71 J	359	0.17 J	0.22 J	0.74 J	0.069 J	5 U	10 U	7.1 J	0.2 U	20 U	0.10 J	1 U
	5/18/2018		1.2	358			0.52 J	0.28			500 UO		10 U		
	11/20/2018		0.68 J	370			0.36 J	0.3			5.3 J		20 U		
MW-2	3/29/2016	1 U	2	471	1 U	0.5 U	0.74 J	0.17 J	5 U	2.6 J	10 U	0.2 U	1.2 J	1 U	1 U
	5/16/2016	1 U	2.5	500	1 U	0.5 U	1 U	0.16 J	5 U	2.8 J	6.0 J	0.040 J	20 U	1 U	1 U
	7/18/2016	1 U	1.4	490	1 U	0.5 U	0.43 J	0.11 J	5 U	5 U	6.1 J	0.2 U	2.1 J	1 U	1 U
	9/8/2016	1 U	1.6	515	1 U	0.5 U	1.3	0.088 J	5 U	2.7 J	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	1.3	491	1 U	0.5 U	0.70 J	0.11 J	5 U	5 U	6.0 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	1.5	456	1 U	0.5 U	1 U	0.093 J	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	1.8	466	1 U	0.5 U	1.7	0.11 J	5 U	5 U	5.2 J	0.2 U	20 U	1 U	1 U
	6/14/2017	1 U	1.6	393	1 U	0.5 U	1 U	0.2 U	5 U	2.4 J	3.2 J	0.2 U	2.5 J	1 U	1 U
	11/6/2017							0.11 J							
	1/2/2018							0.15 J							
	4/4/2018	0.16 J	1.8	324	1 U	0.5 U	0.16 J	0.2 U	5 U	10 U	8.2 J	0.2 U	20 U	1 U	1 U
	5/17/2018		2.5	328			1 U	0.13 J			500 UO		10 U		
	11/19/2018		1.7	299			0.31 J	0.2 U			6.4 J		20 U		
MW-3	3/29/2016	1 U	4.6	238	1 U	0.5 U	0.93 J	0.14 J	1.0 J	5 U	10 U	0.2 U	2.5 J	1 U	1 U
	5/17/2016	1 U	6.1	255	1 U	0.5 U	1 U	0.14 J	5 U	5 U	8.0 J	0.041 J	1.9 J	1 U	1 U
	7/18/2016	1 U	1 UO	253	1 U	0.5 U	0.50 J	0.082 J	5 U	5 U	7.1 J	0.2 U	3.4 J	1 U	1 U
	9/8/2016	1 U	7.7	270	1 U	0.5 U	1 U	0.076 J	1.0 J	5 U	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	7.8	244	1 U	0.5 U	0.52 J	0.091 J	1.5 J	5 U	5.6 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	6.6	201	1 U	0.5 U	1 U	0.079 J	5 U	5 U	5.1 J	0.2 U	3.1 J	1 U	1 U
	3/7/2017	1 U	7.9	217	1 U	0.5 U	1 U	0.13 J	5 U	5 U	8.1 J	0.2 U	5.0 J	1 U	0.053 J
	6/14/2017	0.031 J	7.1	206	1 U	0.5 U	1 U	0.2 U	1.7 J	2.5 J	3.7 J	0.2 U	5.2 J	1 U	0.061 J
	11/6/2017							0.2 U							
	4/4/2018	1 U	8.1	253	1 U	0.11 J	0.34 J	0.2 U	5 U	10 U	9.0 J	0.2 U	2.6 J	1 U	1 U
	5/17/2018		8.3	264			0.64 J	0.12 J			500 UO		10 U		
	11/19/2018		7.8	232			1 U	0.2 U			10 U		3.6 J		

TABLE I
GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total ug/L	Arsenic Total ug/L	Barium Total ug/L	Beryllium Total ug/L	Cadmium Total ug/L	Chromium Total ug/L	Fluoride Total mg/L	Cobalt Total ug/L	Lead Total ug/L	Lithium Total ug/L	Mercury Total ug/L	Molybdenum Total ug/L	Selenium Total ug/L	Thallium Total ug/L
	Site GWPS	**6**	**10**	**2000**	**4**	**5**	**100**	**4**	**6**	**15**	**40**	**2**	**100**	**50**	**2**
MW-4	3/29/2016	1 U	**10.5**	222	1 U	0.5 U	0.68 J	0.21	5 U	5 U	22.4	0.2 U	51.7	1 U	1 U
	5/16/2016	1 U	**13**	222	0.47 J	0.5 U	1 U	0.21	5 U	3.6 J	22.7	0.2 U	49.7	1 U	1 U
	7/19/2016	1 U	**13.3 J**	216	1 U	0.5 U	1	0.15 J	5 U	5 U	23.2	0.2 U	54	1 U	1 U
	9/8/2016	1 U	**13.7**	229	1 U	0.5 U	0.61 J	0.13 J	5 U	5 U	20.3	0.2 U	52.5	1 U	1 U
	11/10/2016	1 U	**14.5**	213	1 U	0.5 U	0.56 J	0.16 J	5 U	5 U	26.3	0.2 U	54.4	1 U	1 U
	1/6/2017	1 U	**13.3**	214	1 U	0.5 U	1 U	0.12 J	5 U	2.7 J	22.4	0.2 U	50.4	1 U	1 U
	3/7/2017	1 U	**14.6**	228	1 U	0.5 U	1 U	0.18 J	5 U	5 U	23.5	0.2 U	53.8	1 U	1 U
	6/14/2017	1 U	**14.8**	219	0.23 J	0.5 U	1 U	0.12 J	5 U	5 U	20.9	0.2 U	56	1 U	1 U
	11/6/2017							0.14 J							
	4/4/2018	0.027 J	**14.4**	214	0.28 J	0.16 J	0.33 J	0.2 U	5 U	10 U	27	0.2 U	55	0.12 J	1 U
	5/17/2018		**15**	218			1 U	0.18 J			500 UO		55.6		
	11/19/2018		**14.8**	200			0.25 J	0.2 U			23.3		51.1		
MW-5	3/29/2016	1 U	8	289	1 U	0.5 U	0.42 J	0.25	5 U	5 U	19.6	0.2 U	82.2	1 U	1 U
	5/13/2016	1 U	**13.4**	292	1 U	0.5 U	1 U	0.25	5 U	4.2 J	21.2	0.2 U	74.4	1 U	1 U
	7/19/2016	1 U	**17.1**	293	1 U	0.5 U	1 U	0.21	5 U	3.3 J	20.9	0.2 U	84	1 U	1 U
	9/8/2016	1 U	**18.7**	301	1 U	0.5 U	0.42 J	0.16 J	5 U	3.2 J	18.3	0.2 U	83.8	1 U	1 U
	11/10/2016	1 U	**19.9**	305	1 U	0.5 U	0.37 J	0.25 J	5 U	5 U	25.3	0.2 U	90.4	1 U	1 U
	1/6/2017	1 U	**20.6**	304	1 U	0.052 J	1 U	0.17 J	5 U	5 U	22.9	0.2 U	96.5	1 U	1 U
	3/7/2017	1 U	**21.9**	312	1 U	0.5 U	1 U	0.21	5 U	5 U	23.1	0.2 U	93.7	1 U	1 U
	6/14/2017	1 U	**21**	308	1 U	0.5 U	1 U	0.16 J	5 U	5 U	20.2	0.2 U	97.3	1 U	1 U
	11/6/2017							0.18 J							
	4/5/2018	1 U	**22.1**	245	1 U	0.5 U	0.22 J	0.10 J	5 U	10 U	26.2	0.2 U	98.3	1 U	1 U
	5/18/2018		**22.1**	259			1 U	0.24			500 UO		**105**		
	11/19/2018		1.8	195			0.14 J	0.22			18.1		**101**		
	1/24/2019		**19.7**												
MW-6	3/30/2016	0.062 J	5	75.4	1 U	0.5 U	0.37 J	0.17 J	0.86 J	5 U	**129**	0.2 U	**137**	1 U	1 U
	5/13/2016	1 U	8.3	94.4	1 U	0.5 U	1 U	0.15 J	0.74 J	5 U	**164**	0.2 U	**124**	1 U	1 U
	7/19/2016	1 U	1 U	72.5	1 U	0.5 U	1 U	0.13 J	5.7	5 U	**130**	0.2 U	**129**	1 U	1 U
	9/8/2016	1 U	4.8	69.3	1 U	0.5 U	1 U	0.097 J	3.8 J	5 U	**123**	0.2 U	**120**	1 U	1 U
	11/10/2016	0.066 J	3	66.8	1 U	0.5 U	0.54 J	0.38	**6.1**	5 U	**130**	0.2 U	**135**	1 U	1 U
	1/6/2017	1 U	2.5	66.5	1 U	0.050 J	1 U	0.10 J	**6.5**	5 U	**138**	0.2 U	**163**	1 U	1 U
	3/7/2017	0.030 J	4	66.3	1 U	0.5 U	1 U	0.16 J	5.7	2.7 J	**140**	0.2 U	**157**	1 U	0.038 J
	6/15/2017	0.073 J	2.3	59.6	1 U	0.027 J	1 U	0.12 J	**7.8**	5 U	**129**	0.2 U	**147**	1 U	1 U
	11/6/2017							0.3							
	4/3/2018	0.043 J	4.9	53.8	0.36 J	0.069 J	2.4	0.13 J	4.1 J	10 U	**144**	0.2 U	**134**	1 U	1 U
	5/18/2018		5.5	55			0.71 J	0.15 J			**419 J**		**140**		
	11/19/2018		2.9	49.4			0.12 J	0.2 U			**131**		**135**		
MW-7	3/29/2016	0.41 J	2.6	57.4	1 U	0.081 J	0.91 J	0.31	5 U	5 U	37.8	0.2 U	**451**	1.5	1 U
	5/13/2016	0.37 J	3.8	59.6	1 U	0.11 J	1 U	0.36	1.2 J	5 U	**40.3**	0.2 U	**338**	0.55 J	1 U
	7/19/2016	0.065 J	3.7	49.1	1 U	0.5 U	0.74 J	0.25	5 U	5 U	**50.9**	0.2 U	**359**	1 U	1 U
	9/7/2016	0.40 J	2.4	44.8	1 U	0.5 U	1 U	0.52	5 U	5 U	**43.6**	0.2 U	**351**	10.3	1 U
	11/10/2016	0.39 J	2.4	43.3	1 U	0.22 J	0.57 J	0.6	5 U	5 U	**58.3**	0.2 U	**331**	12.9	1 U
	1/6/2017	1 U	2.4	51.5	1 U	0.33 J	1 U	0.64	5 U	2.7 J	**71.1**	0.2 U	**297**	16.6	1 U
	3/7/2017	0.44 J	2.5	56	1 U	0.20 J	1 U	0.3	5 U	2.8 J	**74.2**	0.2 U	**314**	7.7	0.11 J
	6/15/2017	0.39 J	2.1	36.3	1 U	0.14 J	1.5	0.46	5 U	5 U	38.1	0.2 U	**717**	0.61 J	0.13 J
	11/6/2017							0.61							
	1/3/2018							0.35							
	4/3/2018	0.42 J	3.2	41.8	0.35 J	0.22 J	1 U	0.31 J	5 U	10 U	**62**	0.2 U	**502**	0.45 J	0.12 J
	5/18/2018		4.8	40.2			1 U	0.4			**287 J**		**560**		
	11/19/2018		2.6	37.9			0.25 J	0.31 J			**48.6**		**461**		

TABLE I
GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total ug/L	Arsenic Total ug/L	Barium Total ug/L	Beryllium Total ug/L	Cadmium Total ug/L	Chromium Total ug/L	Fluoride Total mg/L	Cobalt Total ug/L	Lead Total ug/L	Lithium Total ug/L	Mercury Total ug/L	Molybdenum Total ug/L	Selenium Total ug/L	Thallium Total ug/L
	Site GWPS	6	10	2000	4	5	100	4	6	15	40	2	100	50	2
MW-8	3/30/2016	0.060 J	6.6	179	1 U	0.5 U	0.88 J	0.29	5 U	5 U	27.6	0.2 U	**229**	1 U	1 U
	5/16/2016	1 U	6.2	218	1 U	0.5 U	1 U	0.28	5 U	4.8 J	30.4	0.047 J	**204**	1 U	1 U
	7/19/2016	0.38 J	2.1	236	1 U	0.11 J	1 U	0.23	5 U	5 U	32	0.2 U	**215**	9	1 U
	9/8/2016	1 U	5.6	234	1 U	0.5 U	1 U	0.20 J	5 U	5 U	26.1	0.2 U	**211**	1 U	1 U
	11/10/2016	1 U	5.9	211	1 U	0.5 U	1 U	0.21	5 U	5 U	30.8	0.2 U	**212**	1 U	1 U
	1/6/2017	1 U	5.2	226	1 U	0.052 J	1 U	0.34	5 U	5 U	32.2	0.2 U	**207**	1 U	1 U
	3/7/2017	0.37 J	6.1	240	1 U	0.5 U	1.2	0.22	5 U	5.2	33	0.2 U	**213**	1 U	1 U
	6/14/2017	1 U	5.8	227	1 U	0.5 U	1 U	0.2	5 U	5 U	31.4	0.2 U	**190**	1 U	1 U
	11/6/2017							0.23							
	4/5/2018	1 U	6	199	1 U	0.035 J	0.20 J	0.2 UO	5 U	3.4 J	32.4	0.2 U	**192**	1 U	1 U
	5/17/2018		6.5	196			1 U	0.23			500 UO		**205**		
	11/19/2018		5.8	168			1 U	0.22			33.7		**183**		
AMW-1	11/20/2018	1 U	**18**	325	1 U	0.5 U	0.19 J	0.19 J	5 U	10 U	16.4	0.2 U	39.1	1 U	1 U
AMW-2	11/19/2018	1 U	**11.7**	147	1 U	0.5 U	0.23 J	0.3	5 U	10 U	36	0.2 U	4.3 J	1 U	1 U
TP-1	11/20/2018	1 U	1.9	386	1 U	0.039 J	0.17 J	0.3	5 U	4.1 J	17.2	0.2 U	3.1 J	1 U	1 U
TP-2	11/19/2018	1 U	3.8	58.8	1 U	0.5 U	1 U	0.36	5 U	10 U	**42.7**	0.2 U	6.2 J	1 U	1 U

Notes:

49 Bold denotes concentration exceeding the GWPS

Blank cells - Constituent not included in this analysis.
mg/L - milligrams per liter.
ug/L - micrograms per liter.
GWPS - Groundwater Protection Standard.

Qualifiers:
J - Value is estimated.
U - Constituent was not detected, value is the reporting limit.
O - Value identified as an outlier.

Site GWPS is either the MCL/Health Based GWPS or based on background levels (calculated as described in the Statistical Analysis Plan for Assessment Monitoring), whichever is higher. GWPS and background values calculated using baseline sampling results from monitoring wells BMW-1 and BMW-2.

FIGURES

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0001_SITE_LOCUS.mxd — USER: hwachholz — LAST SAVED: 5/7/2019 10:43:41 AM

LEGEND

▭	MERMEC ENERGY CENTER PROPERTY BOUNDARY
🟨	ACTIVE SURFACE IMPOUNDMENT
🟦	EXEMPT SURFACE IMPOUNDMENT
🟩	CAPPED AND CLOSED SURFACE IMPOUNDMENT

N

0 1,000 2,000
SCALE IN FEET

NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. IMAGERY SOURCE: ESRI

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

SITE LOCATION MAP

MAY 2019

FIGURE 1-1

LEGEND

- ⊕ CCR GROUNDWATER MONITORING WELL
- ▨ REGULATED SURFACE IMPOUNDMENT
- ☐ ACTIVE SURFACE IMPOUNDMENT
- ☐ CAPPED AND CLOSED SURFACE IMPOUNDMENT
- ☐ EXEMPT SURFACE IMPOUNDMENT
- —·-·— MERAMEC ENERGY CENTER PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. CCR - COAL COMBUSTION RESIDUALS.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 800 1,600
SCALE IN FEET

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

SITE FEATURES

MAY 2019

FIGURE 1-2

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0002_SITE_FEATURES_.mxd — USER: hwachholz — LAST SAVED: 5/9/2019 10:17:06 AM

LEGEND

⌖ CCR GROUNDWATER MONITORING WELL

⊕ NATURE AND EXTENT MONITORING WELL

◐ NATURE AND EXTENT PIEZOMETER

🟨 REGULATED SURFACE IMPOUNDMENT

▭ ACTIVE SURFACE IMPOUNDMENT

🟩 CAPPED AND CLOSED SURFACE IMPOUNDMENT

🟦 EXEMPT SURFACE IMPOUNDMENT

—·-·— MERAMEC ENERGY CENTER PROPERTY BOUNDARY

MW-4 MW-5 ⌖ As = ARSENIC CONCENTRATION ABOVE THE GWPS

MW-6 ⌖ Li = LITHIUM CONCENTRATION ABOVE THE GWPS

MW-6 MW-7 MW-8 ⌖ Mo = MOLYBDENUM CONCENTRATION ABOVE THE GWPS

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. CCR - COAL COMBUSTION RESIDUALS.
3. GWPS- GROUNDWATER PROTECTION STANDARD
4. AERIAL IMAGERY SOURCE: ESRI

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

MONITORING WELL LOCATIONS WITH STATISTICALLY SIGNIFICANT LEVELS ABOVE THE GWPS

MAY 2019

FIGURE 2-1

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0002_MW_ABOVE_GWPS_.mxd — USER: hwachholz — LAST SAVED: 5/14/2019 9:27:28 AM

Path: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\Meramec Energy Center\MEC River Sampling\MEC - Surface Water Sampling Locations - V2.mxd

LEGEND

- ▭ Meramec Energy Center Property Boundary
- ━ Unnamed Creek/Drainage
- ⊙ NPDES Outfall Location
- ▭ All Surface Impoundments

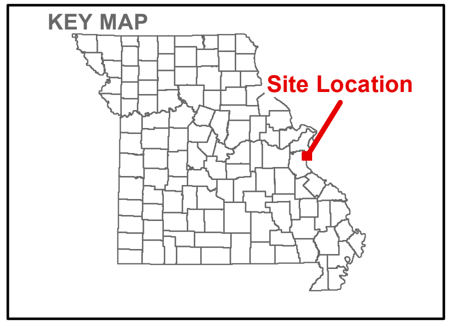
May 2018 Surface Water Samples (M2)

- △ Small Creek/Drainage Sample
- ▲ Meramec River Sample
- ▲ Mississippi River Sample

September 2017 Surface Water Samples (M)

- ⊗ Small Creek/Drainage Sample
- ⊗ Meramec River Sample
- ⊗ Mississippi River Sample
- ⬋ Surface Water Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. SAMPLE LOCATIONS BASED ON HANDHELD TRIMBLE GPS MEASUREMENTS. SAMPLE LOCATION REPRESENTS CENTERPOINT BETWEEN SAMPLE STARTING AND ENDING LOCATION.
3. PREFIX M- USED FOR SAMPLES COLLECTED IN SEPTEMBER 2017 AND M2- USED FOR SAMPLES COLLECTED IN MAY 2018.
4. NPDES - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 2,000 2,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
AMEREN HYDROGEOLGICAL CONSULTING

TITLE
SURFACE WATER SAMPLING LOCATIONS
MERAMEC ENERGY CENTER

CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-31
PREPARED	JS
DESIGN	JS
REVIEW	JSI
APPROVED	MNH

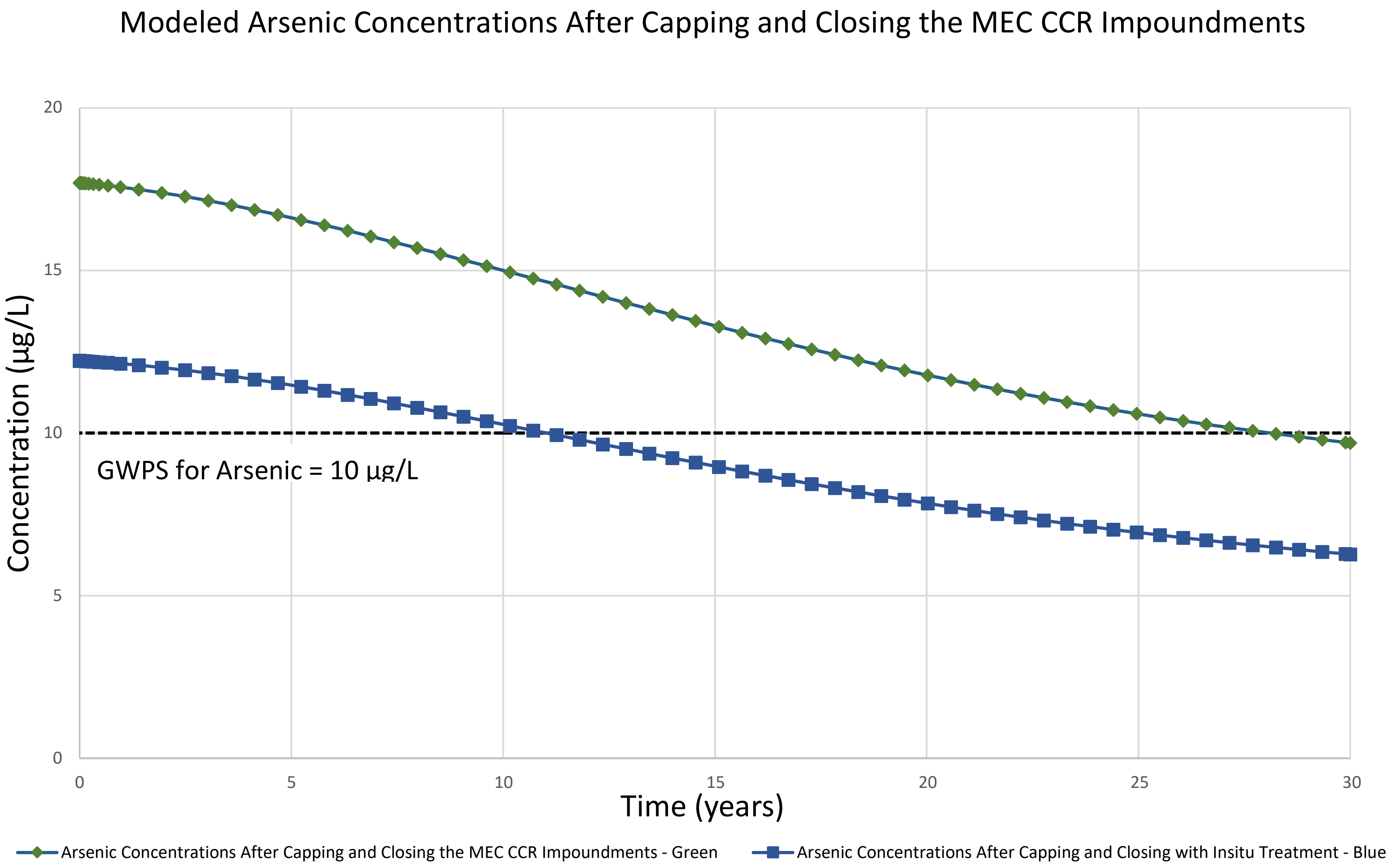
PROJECT No. 130-1560
PHASE 0006

Figure 2-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

FIGURE 4-1
REMEDIAL ALTERNATIVE ROADMAP
CORRECTIVE MEASURES ASSESSMENT
COAL COMBUSTION RESIDUAL (CCR) SURFACE IMPOUNDMENTS
MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Alternative Number	**Remedial Alternative Description**	**Surface Impoundments Closure Description**	**Groundwater Remedy Components**		
			A. Groundwater Remedy Approach	**B. Groundwater Treatment Method**	**C. Post-Closure Actions**
1	**Closure In Place (CIP) with Capping and Monitored Natural Attenuation (MNA)**	**CIP with Geomembrane and Soil Cap**	**Natural Attenuation with Monitoring** Mitigate off-site migration of groundwater with CCR constituents above GWPS through process of natural attenuation	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**MNA** Long-term groundwater monitoring to confirm reduction of CCR constituents
2	**CIP with Capping and In-Situ Groundwater Treatment**	**CIP with Geomembrane and Soil Cap**	**Subsurface Treatment System** Mitigate off-site migration of groundwater with CCR constituents above GWPS using in-situ treatment technology	**In-Situ Treatment** Subsurface treatment to reduce Appendix IV constituent concentrations in groundwater	**In-Situ Treatment Long-Term** Continue periodic in-situ treatment of groundwater to maintain reduction of CCR constituents in groundwater
3	**CIP with Capping and Hydraulic Containment through Groundwater Pumping and Ex-Situ Treatment**	**CIP with Geomembrane and Soil Cap**	**Hydraulic Containment** Mitigate off-site migration of groundwater with CCR constituents above GWPS using extraction wells	**Ex-Situ Treatment** Treatment system (ion exchange or reverse osmosis) to remove CCR constituents from groundwater	**Pump & Treat Long-Term** Operate groundwater treatment system long-term to maintain reduction of CCR constituents in groundwater
4	**Closure by Removal (CBR) with MNA**	**CBR**	**Natural Attenuation with Monitoring** Mitigate off-site migration of groundwater with CCR constituents above GWPS through process of natural attenuation	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**MNA** Long-term groundwater monitoring to confirm reduction of CCR constituents



Notes:

µg/L = micrograms per Liter

CCR = Coal Combustion Residual

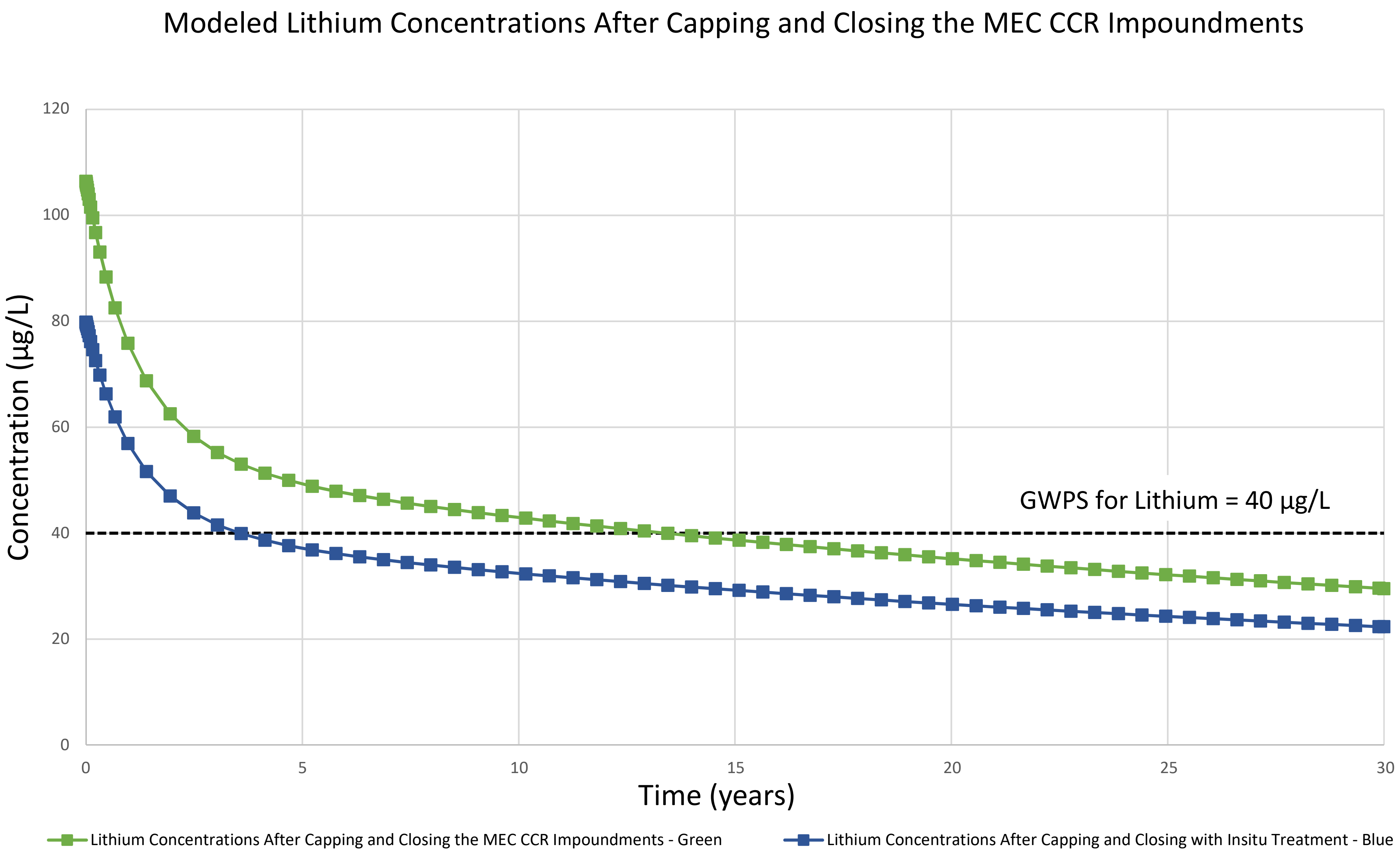
GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

BURNS McDONNELL

Figure 4-2

Modeled Arsenic Concentrations After Capping and Closing the CCR Units and Groundwater Remediation



Notes:

µg/L = micrograms per Liter

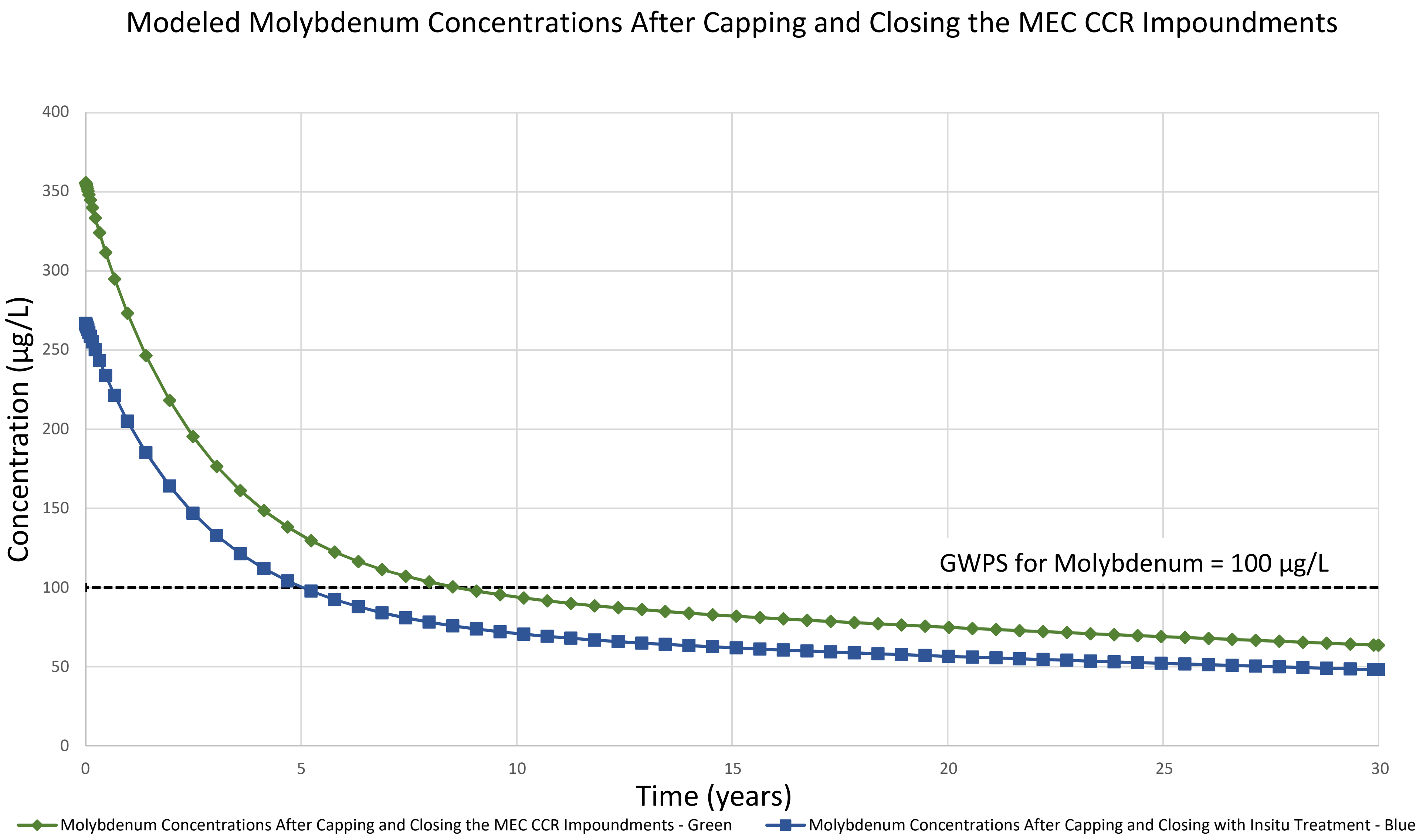
CCR = Coal Combustion Residuals

GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

Figure 4-3

Modeled Lithium Concentrations After Capping and Closing the CCR Units and Groundwater Remediation



Notes:

µg/L = micrograms per Liter

CCR = Coal Combustion Residuals

GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

BURNS McDONNELL

Figure 4-4

Modeled Molybdenum Concentrations After Capping and Closing the CCR Units and Groundwater Remediation

APPENDIX A

Surface Water Screening Tables

Appendix A
Meramec Energy Center Surface Water Screening Tables – TOC

TABLES

TABLE 1
HUMAN HEALTH SCREENING LEVELS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Drinking Water Screening Levels (mg/L)			Surface Water Screening Levels (mg/L)	
Constituent	**CASRN**	**MCLs (b)**	**SMCLs (b)**	**November 2018 USEPA Tapwater RSLs (c)**	**Drinking Water (d)**	**Recreational Use (a) (e)**
Antimony	7440-36-0	0.006	NA	0.0078 (m)	0.006	0.64
Arsenic	7440-38-2	0.01	NA	0.000052	0.01	0.00014 (i)
Barium	7440-39-3	2	NA	3.8	2	NA
Beryllium	7440-41-7	0.004	NA	0.025	0.004	NA
Boron	7440-42-8	NA	NA	4	4	NA
Cadmium	7440-43-9	0.005	NA	0.0092	0.005	NA
Calcium	7440-70-2	NA	NA	NA	NA	NA
Chloride	7647-14-5	NA	250	NA	250	NA
Chromium	16065-83-1 (g)	0.1 (j)	NA	22 (n)	0.1	NA
Cobalt	7440-48-4	NA	NA	0.006	0.006	NA
Fluoride	16984-48-8	4	2	0.8	4	NA
Lead	7439-92-1	0.015 (k)	NA	0.015	0.015	NA
Lithium	7439-93-2	NA	NA	0.04	0.04	NA
Mercury	7487-94-7 (h)	0.002 (l)	NA	0.0057 (o)	0.002	NA
Molybdenum	7439-98-7	NA	NA	0.1	0.1	NA
Radium 226/228 (pCi/L)	RADIUM226228	5	NA	NA	5	NA
Selenium	7782-49-2	0.05	NA	0.1	0.05	4.2
Sulfate	7757-82-6	NA	250	NA	250	NA
Thallium	7440-28-0	0.002	NA	0.0002 (f)	0.002	0.00047
Total Dissolved Solids	TDS	NA	500	NA	500	NA
pH (std)	PHFLD	NA	6.5 - 8.5	NA	6.5 - 8.5	NA

Notes:

AWQC - Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Re
GWPS - Groundwater Protection Standar
HI - Hazard Index (noncancer child).
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.

NA - not available.
pCi/L - picoCurie per liter.
RSL - Risk-based Screening Levels (USEPA).
TR - Target Risk (carcinogenic).
USEPA - United States Environmental Protection Agency.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.
(e) - The selected Human Health Recreational Use Screening Level is the Federal USEPA AWQC for Human Health Consumption of Orga
(f) - RSL for Thallium (Soluble Salts) used for Thallium.
(g) - CAS number for Trivalent Chromium.
(h) - CAS number for Mercuric Chloride.
(i) - Value applies to inorganic form of arsenic only.
(j) - Value for Total Chromium.
(k) - Lead Treatment Technology Action Level is 0.015 mg/L.
(l) - Value for Inorganic Mercury.
(m) - RSL for Antimony (metallic) used for Antimony.
(n) - RSL for Chromium (III), Insoluble Salts used for Chromium.
(o) - RSL for Mercuric Chloride used for Mercury.

TABLE 2
ECOLOGICAL SCREENING LEVELS - MISSISSIPPI AND MERAMEC RIVERS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Federal Water Quality Criteria (mg/L)							
		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Acute (a)		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Chronic (a)		Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Acute (b)		Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Chronic (b)	
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	0.34	0.34	0.15	0.15	0.34	0.34	0.15	0.15
Barium	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.0036 (c)	0.0033 (d)	0.0013 (c)	0.0012 (d)	0.0042 (f)	0.0038 (g)	0.0015 (f)	0.0013 (g)
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	860	NA	230	NA	860	NA	230	NA
Chromium	7440-47-3	3.1 (e,c)	0.97 (e,d)	0.15 (e,c)	0.13 (e,d)	3.5 (e,f)	1.1 (e,g)	0.17 (e,f)	0.14 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	NA	NA	NA
Lead	7439-92-1	0.19 (c)	0.13 (d)	0.0073 (c)	0.0051 (d)	0.23 (f)	0.15 (g)	0.0089 (f)	0.0060 (g)
Lithium	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0016	0.0014	0.00091	0.00077	0.0016	0.0014	0.00091	0.00077
Molybdenum	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	3.1	NA	NA	NA	3.1	NA
Sulfate	14808-79-8	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	TDS	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in May 2018 - see note (c).
USEPA provides AWQC for both total and dissolved results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in September 2017 - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 192 mg/L as CaCO3 used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 192 mg/L as CaCO3 used.
(e) - Value for trivalent chromium used.
(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 224 mg/L as CaCO3 used.
(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 224 mg/L as CaCO3 used.

TABLE 3
ECOLOGICAL SCREENING LEVELS - UNAMED CREEK/DRAINAGE
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Federal Water Quality Criteria (mg/L)							
		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Acute (a)		**Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Chronic (a)**		**Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Acute (b)**		**Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Chronic (b)**	
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	0.34	0.34	0.15	0.15	0.34	0.34	0.15	0.15
Barium	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.0040 (c)	0.0037 (d)	0.0015 (c)	0.0013 (d)	0.0048 (f)	0.0043 (g)	0.0017 (f)	0.0015 (g)
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	860	NA	230	NA	860	NA	230	NA
Chromium	7440-47-3	3.4 (e,c)	1.1 (e,d)	0.16 (e,c)	0.14 (e,d)	3.9 (e,f)	1.2 (e,g)	0.19 (e,f)	0.16 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	NA	NA	NA
Lead	7439-92-1	0.22 (c)	0.15 (d)	0.0084 (c)	0.0057 (d)	0.27 (f)	0.18 (g)	0.011 (f)	0.0069 (g)
Lithium	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0016	0.0014	0.00091	0.00077	0.0016	0.0014	0.00091	0.00077
Molybdenum	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	3.1	NA	NA	NA	3.1	NA
Sulfate	14808-79-8	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	TDS	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in May 2018 - see note (c).
USEPA provides AWQC for both total and dissolved results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in September 2017 - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.
(e) - Value for trivalent chromium used.
(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.
(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Meramec River - Human Health Drinking Water						Meramec River - Human Health Recreational					
	Dissolved			Total			Dissolved			Total		
Constituent	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream
Antimony												
Arsenic							9 : 9 100%	9 : 9 100%	10 : 10 100%	9 : 9 100%	9 : 9 100%	10 : 10 100%
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead				3 : 9 33%	2 : 9 22%	1 : 10 10%						
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium												
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Meramec River - Ecological						Mississippi River - Human Health Drinking Water					
	Dissolved			Total			Dissolved			Total		
Constituent	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream
Antimony												
Arsenic								2 : 20 10%				
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead				8 : 9 89%	6 : 9 67%	7 : 10 70%						
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium								2 : 20 10%				
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Mississippi River - Human Health Recreational						Mississippi River - Ecological					
	Dissolved			Total			Dissolved			Total		
Constituent	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**
Antimony												
Arsenic	10 : 10 100%	20 : 20 100%	10 : 10 100%	10 : 10 100%	20 : 20 100%	10 : 10 100%						
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead										1 : 10 10%		
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium		2 : 20 10%										
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Unnamed Creek/Drainage - Human Health Drinking Water		**Unnamed Creek/Drainage - Human Health Recreational**		**Unnamed Creek/Drainage - Ecological**	
Constituent	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**
Antimony						
Arsenic			6 : 6 100%	6 : 6 100%		
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chloride						
Chromium						
Cobalt						
Fluoride						
Lead						
Lithium						
Mercury						
Molybdenum						
pH						
Selenium						
Sulfate						
Thallium						
TDS		1 : 6 17%				
Radium 226/228						

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA	NA	4	4						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	NA	250	NA	250	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006														0.00089 J	
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04															
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1															
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Sulfate	14808-79-8	mg/L	NA	250	NA	250	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:

Blank cells - Non-detect value.	mg/L - milligrams per liter.
* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Upstream					Mississippi River Adjacent									
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	NA	250	NA	250	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	250	NA	250	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:

Blank cells - Non-detect value.	mg/L - milligrams per liter.
* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006					
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	NA	250	NA	250	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002					
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05					
Sulfate	14808-79-8	mg/L	NA	250	NA	250	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002					
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	303	423	404	351	348

Notes:

Blank cells - Non-detect value.	mg/L - milligrams per liter.
* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004						0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA	NA	4	4									0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006															
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015															
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04															
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1															
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002															

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Upstream					Mississippi River Adjacent									
Constituent	CAS	Units	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0023	0.0021	0.0022	0.0015	0.0016	0.002 J	0.0521	0.052	0.0014	0.0015	0.0024	0.0023	0.0021	0.0014	0.0014
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004															
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005													0.00046 J		
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006															
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002							0.0506	0.0512							

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006					
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005					
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1					
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006					
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002					
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05					
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002					

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River												
							River Upstream				River Adjacent				River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			0.0038										
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004													
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005													
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	NA	250	NA	250	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002													
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1						0.0016					0.0014		
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05													
Sulfate	14808-79-8	mg/L	NA	250	NA	250	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River																			
							River Upstream					River Adjacent										River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004																				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005																				
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	NA	250	NA	250	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006											0.0008									
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	250	NA	250	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:

Blank cells - Non-detect value.

* - Constituent was not detected in any samples.

CAS - Chemical Abstracts Service.

J - Estimated value.

MCL - Maximum Contaminant Level.

mg/L - milligrams per liter.

NA - Not Available.

RSL - Regional Screening Level.

SMCL - Secondary Maximum Contaminant Level.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.

(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm

(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

(d) - RSL for Mercuric Chloride used for Mercury.

(e) - The drinking water standard or MCL for chromium is based on total chromium.

(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.

(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.

(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels				Meramec River												
							River Upstream				River Adjacent				River Downstream				
Constituent	**CAS**	**Units**	**USEPA MCLs (b)**	**USEPA SMCLs (b)**	**USEPA Tapwater RSLs (c)**	**Selected Drinking Water Screening Level (h)**	**M-MEC-7S**	**M-MEC-8S**	**M-MEC-9D**	**M-MEC-9S**	**M-MEC-4S**	**M-MEC-5S**	**M-MEC-6D**	**M-MEC-6S**	**M-MEC-1S**	**M-MEC-2D**	**M-MEC-2S**	**M-MEC-3D**	**M-MEC-3S**
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006													
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004													
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005													
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1													
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006									0.00073		0.00074		
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015													
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04													
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002													
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1						0.0013							
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05													
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Risk-Based Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium
that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River																			
							River Upstream					River Adjacent										River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006																				
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004								0.0014												
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005																				
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006																				
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05	0.0036									0.0051						0.0043		0.0039		
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Risk-Based Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium
that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			AWQC (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	NA	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	NA	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	NA															
Calcium	7440-70-2	mg/L	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	NA	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	NA															
Cobalt	7440-48-4	mg/L	NA														0.00089 J	
Fluoride	16984-48-8	mg/L	NA	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	NA	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA															
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA															
Selenium	7782-49-2	mg/L	4.2															
Sulfate	14808-79-8	mg/L	NA	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	0.00047															
Total Hardness as CaCO3	471-34-1	mg/L	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Mississippi River Upstream					Mississippi River Adjacent									
			AWQC (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	NA	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	NA	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	NA															
Calcium	7440-70-2	mg/L	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	NA	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	NA	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	NA	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	NA	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	4.2				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	0.00047															
Total Hardness as CaCO3	471-34-1	mg/L	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
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apply to total concentrations.
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TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Mississippi River Downstream M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.64					
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	NA	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	NA		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	NA	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	NA	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	NA	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	NA	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	NA	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	NA					
Molybdenum	7439-98-7	mg/L	NA	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	4.2					
Sulfate	14808-79-8	mg/L	NA	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	0.00047					
Total Hardness as CaCO3	471-34-1	mg/L	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	303	423	404	351	348

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
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NA - Not Available.
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🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
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USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			AWQC (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	NA	0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	NA						0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA									0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	NA															
Calcium	7440-70-2	mg/L	NA	28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	NA															
Cobalt*	7440-48-4	mg/L	NA															
Lead	7439-92-1	mg/L	NA															
Lithium	7439-93-2	mg/L	NA															
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA															
Selenium	7782-49-2	mg/L	4.2															
Thallium	7440-28-0	mg/L	0.00047															

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
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🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
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USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
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TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			USEPA	**Mississippi River Upstream**					**Mississippi River Adjacent**									
Constituent	**CAS**	**Units**	**AWQC (b)**	**M2-MIS-10S**	**M2-MIS-11D**	**M2-MIS-11S**	**M2-MIS-12D**	**M2-MIS-12S**	**M2-MIS-4S**	**M2-MIS-5D**	**M2-MIS-5S**	**M2-MIS-6D**	**M2-MIS-6S**	**M2-MIS-7S**	**M2-MIS-8D**	**M2-MIS-8S**	**M2-MIS-9D**	**M2-MIS-9S**
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0023	0.0021	0.0022	0.0015	0.0016	0.002 J	0.0521	0.052	0.0014	0.0015	0.0024	0.0023	0.0021	0.0014	0.0014
Barium	7440-39-3	mg/L	NA	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	NA															
Boron	7440-42-8	mg/L	NA	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	NA													0.00046 J		
Calcium	7440-70-2	mg/L	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	NA															
Cobalt*	7440-48-4	mg/L	NA															
Lead	7439-92-1	mg/L	NA		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	4.2															
Thallium	7440-28-0	mg/L	0.00047							0.0506	0.0512							

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
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🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
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USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Mississippi River Downstream				
			AWQC (b)	M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.64					
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	NA	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	NA	0.00018 J				
Boron	7440-42-8	mg/L	NA	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	NA					
Calcium	7440-70-2	mg/L	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	NA					
Cobalt*	7440-48-4	mg/L	NA					
Lead	7439-92-1	mg/L	NA		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	NA					
Molybdenum	7439-98-7	mg/L	NA	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	4.2					
Thallium	7440-28-0	mg/L	0.00047					

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Meramec River												
				River Upstream				River Adjacent				River Downstream				
				M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.64			0.0038										
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	NA	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	NA													
Boron	7440-42-8	mg/L	NA	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	NA													
Calcium	7440-70-2	mg/L	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	NA	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	NA	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	NA	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	NA	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	NA													
Molybdenum	7439-98-7	mg/L	NA						0.0016					0.0014		
Selenium	7782-49-2	mg/L	4.2													
Sulfate	14808-79-8	mg/L	NA	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium*	7440-28-0	mg/L	0.00047									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

				Mississippi River																			
			USEPA	River Upstream					River Adjacent										River Downstream				
Constituent	CAS	Units	AWQC (b)	M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.64														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	NA	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	NA																				
Boron	7440-42-8	mg/L	NA	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	NA																				
Calcium	7440-70-2	mg/L	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	NA	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	NA	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA											0.0008									
Fluoride	16984-48-8	mg/L	NA	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	NA	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	NA																				
Molybdenum	7439-98-7	mg/L	NA	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	4.2						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium*	7440-28-0	mg/L	0.00047											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Meramec River												
				River Upstream				River Adjacent				River Downstream				
			AWQC (b)	M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.64													
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	NA	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	NA													
Boron	7440-42-8	mg/L	NA	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	NA													
Calcium	7440-70-2	mg/L	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	NA													
Cobalt	7440-48-4	mg/L	NA									0.00073		0.00074		
Lead	7439-92-1	mg/L	NA													
Lithium	7439-93-2	mg/L	NA													
Mercury*	7439-97-6	mg/L	NA													
Molybdenum	7439-98-7	mg/L	NA						0.0013							
Selenium	7782-49-2	mg/L	4.2													
Thallium*	7440-28-0	mg/L	0.00047									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			USEPA	Mississippi River																			
				River Upstream					River Adjacent											River Downstream			
Constituent	**CAS**	**Units**	**AWQC (b)**	**M-MIS-10S**	**M-MIS-11D**	**M-MIS-11S**	**M-MIS-12D**	**M-MIS-12S**	**M-MIS-4S**	**M-MIS-5D**	**M-MIS-5S**	**M-MIS-6D**	**M-MIS-6S**	**M-MIS-7S**	**M-MIS-8D**	**M-MIS-8S**	**M-MIS-9D**	**M-MIS-9S**	**M-MIS-1S**	**M-MIS-2D**	**M-MIS-2S**	**M-MIS-3D**	**M-MIS-3S**
Antimony*	7440-36-0	mg/L	0.64																				
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	NA	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	NA								0.0014												
Boron	7440-42-8	mg/L	NA	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	NA																				
Calcium	7440-70-2	mg/L	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	NA	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA																				
Lead	7439-92-1	mg/L	NA	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	NA																				
Molybdenum	7439-98-7	mg/L	NA	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	4.2	0.0036									0.0051						0.0043		0.0039		
Thallium*	7440-28-0	mg/L	0.00047																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M2-MEC-7S**	**M2-MEC-8D**	**M2-MEC-8S**	**M2-MEC-9D**	**M2-MEC-9S**	**M2-MEC-4S**	**M2-MEC-5D**	**M2-MEC-5S**	**M2-MEC-6D**	**M2-MEC-6S**	**M2-MEC-1S**	**M2-MEC-2D**	**M2-MEC-2S**	**M2-MEC-3D**	**M2-MEC-3S**
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	NA	NA	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	NA	NA	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA	NA						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)															
Calcium	7440-70-2	mg/L	NA	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	860	230	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)															
Cobalt	7440-48-4	mg/L	NA	NA														0.00089 J	
Fluoride	16984-48-8	mg/L	NA	NA	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA	NA															
Mercury*	7439-97-6	mg/L	0.0016	0.00091															
Molybdenum	7439-98-7	mg/L	NA	NA															
Selenium	7782-49-2	mg/L	NA	3.1															
Sulfate	14808-79-8	mg/L	NA	NA	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	NA	NA															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	NA	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River Upstream					Mississippi River Adjacent									
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	NA	NA	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	NA	NA	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)															
Calcium	7440-70-2	mg/L	NA	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	860	230	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	NA	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	NA	NA	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	NA	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	0.0016	0.00091															
Molybdenum	7439-98-7	mg/L	NA	NA	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	NA	3.1				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	NA	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	NA	NA															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	NA	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	NA	NA					
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	NA	NA	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	NA	NA		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	NA	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	860	230	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	NA	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	NA	NA	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	NA	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	0.0016	0.00091					
Molybdenum	7439-98-7	mg/L	NA	NA	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	NA	3.1					
Sulfate	14808-79-8	mg/L	NA	NA	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	NA	NA					
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	NA	303	423	404	351	348

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b

COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)

AMEREN MISSOURI MERAMEC ENERGY CENTER

ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	NA	NA	0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	NA	NA						0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA	NA									0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)															
Calcium	7440-70-2	mg/L	NA	NA	28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)															
Cobalt*	7440-48-4	mg/L	NA	NA															
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)															
Lithium	7439-93-2	mg/L	NA	NA															
Mercury*	7439-97-6	mg/L	0.0014	0.00077															
Molybdenum	7439-98-7	mg/L	NA	NA															
Selenium	7782-49-2	mg/L	NA	NA															
Thallium	7440-28-0	mg/L	NA	NA															

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

AWQC - USEPA Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

J - Estimated value.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.

🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River Upstream					Mississippi River Adjacent									
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0023	0.0021	0.0022	0.0015	0.0016	0.002 J	0.0521	0.052	0.0014	0.0015	0.0024	0.0023	0.0021	0.0014	0.0014
Barium	7440-39-3	mg/L	NA	NA	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	NA	NA															
Boron	7440-42-8	mg/L	NA	NA	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)													0.00046 J		
Calcium	7440-70-2	mg/L	NA	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)															
Cobalt*	7440-48-4	mg/L	NA	NA															
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	NA	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	0.0014	0.00077															
Molybdenum	7439-98-7	mg/L	NA	NA	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	NA	NA															
Thallium	7440-28-0	mg/L	NA	NA							0.0506	0.0512							

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	NA	NA					
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	NA	NA	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	NA	NA	0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)					
Calcium	7440-70-2	mg/L	NA	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)					
Cobalt*	7440-48-4	mg/L	NA	NA					
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	NA	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	0.0014	0.00077					
Molybdenum	7439-98-7	mg/L	NA	NA	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	NA	NA					
Thallium	7440-28-0	mg/L	NA	NA					

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS
TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Meramec River												
					River Upstream				River Adjacent				River Downstream				
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M-MEC-7S**	**M-MEC-8S**	**M-MEC-9D**	**M-MEC-9S**	**M-MEC-4S**	**M-MEC-5S**	**M-MEC-6D**	**M-MEC-6S**	**M-MEC-1S**	**M-MEC-2D**	**M-MEC-2S**	**M-MEC-3D**	**M-MEC-3S**
Antimony	7440-36-0	mg/L	NA	NA			0.0038										
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	NA	NA	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	NA	NA													
Boron	7440-42-8	mg/L	NA	NA	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	0.0042 (d)	0.0015 (d)													
Calcium	7440-70-2	mg/L	NA	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	860	230	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	3.5 (c,d)	0.17 (c,d)	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA	NA			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	NA	NA	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	0.23 (d)	0.0089 (d)	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA	NA				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	0.0016	0.0009													
Molybdenum	7439-98-7	mg/L	NA	NA						0.0016					0.0014		
Selenium	7782-49-2	mg/L	NA	3.1													
Sulfate	14808-79-8	mg/L	NA	NA	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium	7440-28-0	mg/L	NA	NA									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	NA	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River																			
					River Upstream					River Adjacent										River Downstream				
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony	7440-36-0	mg/L	NA	NA														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	NA	NA	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	NA	NA																				
Boron	7440-42-8	mg/L	NA	NA	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	0.0042 (d)	0.0015 (d)																				
Calcium	7440-70-2	mg/L	NA	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	860	230	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	3.5 (c,d)	0.17 (c,d)	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA	NA											0.0008									
Fluoride	16984-48-8	mg/L	NA	NA	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	0.23 (d)	0.0089 (d)	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	NA	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	0.0016	0.0009																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	NA	3.1						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	NA	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium	7440-28-0	mg/L	NA	NA											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	NA	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Meramec River												
					River Upstream				River Adjacent				River Downstream				
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	NA	NA													
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	NA	NA	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	NA	NA													
Boron	7440-42-8	mg/L	NA	NA	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	0.0038 (d)	0.0013 (d)													
Calcium	7440-70-2	mg/L	NA	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)													
Cobalt	7440-48-4	mg/L	NA	NA									0.00073		0.00074		
Lead	7439-92-1	mg/L	0.15 (d)	0.0060 (d)													
Lithium	7439-93-2	mg/L	NA	NA													
Mercury*	7439-97-6	mg/L	0.0014	0.00077													
Molybdenum	7439-98-7	mg/L	NA	NA						0.0013							
Selenium	7782-49-2	mg/L	NA	NA													
Thallium	7440-28-0	mg/L	NA	NA									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River																			
					River Upstream					River Adjacent										River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	NA	NA																				
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	NA	NA	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	NA	NA								0.0014												
Boron	7440-42-8	mg/L	NA	NA	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	0.0038 (d)	0.0013 (d)																				
Calcium	7440-70-2	mg/L	NA	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA	NA																				
Lead	7439-92-1	mg/L	0.15 (d)	0.0060 (d)	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	NA	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	0.0014	0.00077																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	NA	NA	0.0036									0.0051						0.0043		0.0039		
Thallium	7440-28-0	mg/L	NA	NA																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 8a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Unnamed Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004		0.00021 J	
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	NA	250	NA	250	146	30.2	20.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.56	0.71	0.33
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0037 J	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Sulfate	14808-79-8	mg/L	NA	250	NA	250	58.5	140	77.3
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002			
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	🟩 570	374	283

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.

NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Unnamed Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0788	0.165	0.137
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4		0.964	0.246
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	82.6	53.4	42.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1		0.0069	
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006			
Lead*	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015			
Lithium*	7439-93-2	mg/L	NA	NA	0.04	0.04			
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05		0.0124 J	
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002			

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.5	69.7	69.4
Chloride	16887-00-6	mg/L	NA	250	NA	250	54.8	44	44.1
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.63	0.56	0.56
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0035	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Sulfate	14808-79-8	mg/L	NA	250	NA	250	49.1	97.6	97.8
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	386	414	407

Notes:

Blank cells - Non-detect value.

* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.
mg/L - milligrams per liter.	

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.

(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm

(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

(d) - RSL for Mercuric Chloride used for Mercury.

(e) - The drinking water standard or MCL for chromium is based on total chromium.

(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA’s Science Advisory Board.

(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.

(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015			
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002	0.000053	0.000041	0.000085

Notes:
Blank cells - Non-detect value.

* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.
mg/L - milligrams per liter.	

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 9a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Unnamed Creek / Drainage M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	NA	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	NA		0.00021 J	
Boron	7440-42-8	mg/L	NA	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	NA	146	30.2	20.6
Chromium	7440-47-3	mg/L	NA	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	NA	0.56	0.71	0.33
Lead	7439-92-1	mg/L	NA		0.0037 J	
Lithium	7439-93-2	mg/L	NA		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	4.2			
Sulfate	14808-79-8	mg/L	NA	58.5	140	77.3
Thallium*	7440-28-0	mg/L	0.00047			
Total Hardness as CaCO3	471-34-1	mg/L	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	570	374	283

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* - Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 9b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Unnamed Creek / Drainage M2-C-1	Unnamed Creek / Drainage M2-C-2	Unnamed Creek / Drainage M2-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	NA	0.0788	0.165	0.137
Beryllium	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA		0.964	0.246
Cadmium	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	82.6	53.4	42.6
Chromium*	7440-47-3	mg/L	NA		0.0069	
Cobalt*	7440-48-4	mg/L	NA			
Lead	7439-92-1	mg/L	NA			
Lithium	7439-93-2	mg/L	NA			
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	4.2		0.0124 J	
Thallium	7440-28-0	mg/L	0.00047			

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 9c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Creek / Drainage		
				M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	NA	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.5	69.7	69.4
Chloride	16887-00-6	mg/L	NA	54.8	44	44.1
Chromium	7440-47-3	mg/L	NA	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA			
Fluoride	16984-48-8	mg/L	NA	0.63	0.56	0.56
Lead	7439-92-1	mg/L	NA		0.0035	
Lithium	7439-93-2	mg/L	NA	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	4.2			
Sulfate	14808-79-8	mg/L	NA	49.1	97.6	97.8
Thallium*	7440-28-0	mg/L	0.00047		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	386	414	407

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - Value applies to inorganic form of arsenic only.

TABLE 9d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			USEPA	Creek / Drainage		
Constituent	**CAS**	**Units**	**AWQC (b)**	**M-C-1**	**M-C-2**	**M-C-3**
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	NA	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	NA		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA			
Lead	7439-92-1	mg/L	NA			
Lithium	7439-93-2	mg/L	NA	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	4.2			
Thallium*	7440-28-0	mg/L	0.00047	0.000053	0.000041	0.000085

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - Value applies to inorganic form of arsenic only.

TABLE 10a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Unnamed Creek / Drainage		
			Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	NA	NA	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	NA	NA		0.00021 J	
Boron	7440-42-8	mg/L	NA	NA	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	0.0040 (d)	0.0015 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	860	230	146	30.2	20.6
Chromium	7440-47-3	mg/L	3.4 (c,d)	0.16 (c,d)	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	NA	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	NA	NA	0.56	0.71	0.33
Lead	7439-92-1	mg/L	0.22 (d)	0.0084 (d)		0.0037 J	
Lithium	7439-93-2	mg/L	NA	NA		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	0.0016	0.00091			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	NA	3.1			
Sulfate	14808-79-8	mg/L	NA	NA	58.5	140	77.3
Thallium*	7440-28-0	mg/L	NA	NA			
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	NA	570	374	283

Notes:

Blank cells - Non-detect value.
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.

J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.

TABLE 10b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Unnamed Creek / Drainage		
			Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	NA	NA	0.0788	0.165	0.137
Beryllium	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA		0.964	0.246
Cadmium	7440-43-9	mg/L	0.0037 (d)	0.0013 (d)			
Calcium	7440-70-2	mg/L	NA	NA	82.6	53.4	42.6
Chromium*	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)		0.0069	
Cobalt*	7440-48-4	mg/L	NA	NA			
Lead	7439-92-1	mg/L	0.15 (d)	0.0057 (d)			
Lithium	7439-93-2	mg/L	NA	NA			
Mercury*	7439-97-6	mg/L	0.0014	0.00077			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	NA	NA		0.0124 J	
Thallium	7440-28-0	mg/L	NA	NA			

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.

TABLE 10c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a) AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Creek / Drainage		
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-C-1	M-C-2	M-C-3
Antimony	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	NA	NA	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	0.0048 (d)	0.0017 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.5	69.7	69.4
Chromium	7440-47-3	mg/L	3.9 (c,d)	0.19 (c,d)	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA	NA			
Fluoride	16984-48-8	mg/L	NA	NA	0.63	0.56	0.56
Lead	7439-92-1	mg/L	0.27 (d)	0.011 (d)		0.0035	
Lithium	7439-93-2	mg/L	NA	NA	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	0.0016	0.00091			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	NA	3.1			
Sulfate	14808-79-8	mg/L	NA	NA	49.1	97.6	97.8
Thallium	7440-28-0	mg/L	NA	NA		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	NA	386	414	407

Notes:

Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
ND - Not Detected.
USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 256mg/L as CaCO3 used.

TABLE 10d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		**Creek / Drainage**		
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M-C-1**	**M-C-2**	**M-C-3**
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	NA	NA	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	0.0043 (d)	0.0015 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	1.2 (c,d)	0.16 (c,d)		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA	NA			
Lead	7439-92-1	mg/L	0.18 (d)	0.0069 (d)			
Lithium	7439-93-2	mg/L	NA	NA	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	0.0014	0.00077			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	NA	NA			
Thallium	7440-28-0	mg/L	NA	NA	0.000053	0.000041	0.000085

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - USEPA Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

J - Estimated value.

mg/L - milligrams per liter.

NA - Not Available.

U - Constituent was not detected.

USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.

🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.

APPENDIX B

What You Need to Know About Lithium

WHAT YOU NEED TO KNOW ABOUT LITHIUM

Lithium is present in at least one groundwater sample from two monitoring wells at the Ameren Meramec Energy Center (MEC) in Missouri above the screening level used by the U.S. Environmental Protection Agency (USEPA) under the Coal Combustion Residuals (CCR) Rule. The purpose of this fact sheet is to provide information on lithium so that data can be considered in context. There is no public exposure to groundwater at the Meramec Energy Center and concentration levels of litium in adjacent surface waters of the Mississippi River and the Missouri River are all well below health-based regulatory standards. In fact, for lithium to pose a risk to surface water, concentration levels would need to be more than **24,000 times higher** than the level observed at Meramec.

LITHIUM IS NATURALLY OCCURING

Lithium is naturally occurring in soils and water. Based on a literature review, Aral and Vecchio-Sadus (2008) reported that typical background lithium concentrations are between 0.001 and 0.01 mg/L (milligrams of lithium per liter of water) in surface waters, approximately 0.17 mg/L in seawater, and around 0.003 mg/L in rivers. Some natural mineral waters may contain up to 100 mg/L of lithium (Schrauzer, 2002). Lithium is also present in soil between 3 and 350 mg/kg (milligrams of lithium per kilogram of soil) and in the earth's crust between 20 and 60 mg/kg (Aral and Vecchio-Sadus, 2008). Lithium is typically found in sediment at concentrations of approximately 56 mg/kg. United States Geological Survey (USGS, 2013) estimates the average concentration of lithium in soil in the U.S. is 21 mg/kg.

Lithium is not routinely evaluated in groundwater samples as it is not a typical constituent of concern and the concentrations are often below instrument detection limits. The USGS conducted the first comprehensive analysis of trace-element concentrations in groundwater that were evaluated from samples collected between 1992 and 2003 from aquifers across the U.S. (USGS, 2011). Lithium was one of the trace elements evaluated in the study and samples from drinking-water wells in dry regions had greater concentrations than other areas. The study found that the maximum concentration of lithium in the analysis of 936 groundwater samples was 1.2 mg/L with a 90th percentile concentration of 0.054 mg/L and a median concentration of 0.006 mg/L (USGS, 2011).

Lithium is Present in Our Diet

Primary dietary sources of lithium are grains and vegetables, dairy products and meat. Estimates for daily dietary intake of lithium have been reported from different sources and varies amongst different countries. Ranges have included 0.0168 to 0.105 mg lithium/day with other authors estimating daily intake from food and tap water ranging from 2.31 to 5.6 mg lithium/day (USEPA, 2008). Schrauzer (2002) reports the daily estimate to be from 0.65 to 3.1 mg lithium/day for a 70 kg (154 lb) adult. The

U.S. Food and Drug Administration has not established a recommended daily value for lithium; however, a provisional recommended daily allowance (RDA) has been proposed to be 1 mg lithium/day for a 70 kg adult based on the lithium intake data in different countries (Schrauzer, 2002).

The USEPA provisional toxicity value (2008; see below) is roughly equivalent to an intake of 0.14 mg lithium/day for a 70 kg (154 lb) adult (i.e., USEPA would suggest that a safe intake of lithium is at or below this level). However, many of the estimated daily exposures and the recommended daily allowances for lithium from the diet and tapwater are above the USEPA level, and there have been no reported findings that these lithium exposures have resulted in any toxicological effects; this suggests that the current USEPA level overestimates potential risks associated with lithium exposures.

Lithium is Used Medicinally

Lithium is used medicinally in the U.S. and globally as the leading treatment for bipolar disease. Adult daily dosages are approximately 900 mg lithium/day or higher, and recommended doses for children are approximately 600 mg lithium/day. These intakes are much higher than the USEPA provisional level.

USEPA’S ORAL TOXICITY VALUE FOR LITHIUM

There are limited studies on lithium of the type upon which to base a toxicity value to use in human health risk assessment. USEPA has derived a provisional toxicity value (i.e., the value does not have the normal level of review or confidence compared to final toxicity values published by USEPA) that equates to a drinking water screening level of 0.04 mg/L, and a general intake of 0.14 mg/day for an adult. As noted above, this level is below many estimates of daily intake in humans presented above, and well below the typical therapeutic doses presented above.

DRINKING WATER SCREENING LEVELS FOR LITHIUM

Using this toxicity value, the USEPA regional screening level (RSL) for lithium for tapwater (drinking water) is 0.04 mg/L (USEPA, 2018b). This is also the screening level identified by USEPA for the CCR Rule (USEPA, 2018a). Surface water samples taken by Ameren of the Mississippi and Meramec Rivers near the MEC and evaluated for lithium were all below the drinking water screening level. Lithium was rarely detected in the Meramec River; lithium concentrations detected in the Mississippi River were similar upstream and downstream indicating that MEC is not the source of lithium in the Mississippi River.

OTHER LITHIUM TOXICITY EVALUATIONS

In 1990, Schauzer et al. published data for 27 Texas counties showing that incidence rates of suicide, homicide, and rape were significantly higher in counties whose drinking water contained little or no lithium compared to counties with water lithium levels ranging from 0.7 – 0.17 mg/L. The authors suggested that continuous exposure to low dose lithium may have a generally beneficial effect on human behavior. Since that publication, additional studies investigating the anti-suicidal effects of lithium as a trace element in drinking water have been conducted throughout the world.

A review of these studies published recently by Liaugaudaite (2016) found that 7 of the 9 studies reported an association between low levels of lithium and suicide rates suggesting that lithium levels in drinking water could reduce the suicide risk in the general population. The mean lithium levels in the drinking water from these 7 studies ranged from 0.0007 to 0.219 mg/L, which is around less than a thousandth of the minimum daily dose of lithium given for bipolar disorders and depression.

For example, Ohgami et al. (2009) examined lithium levels in tap water in 18 municipalities of Oita prefecture in Japan and found that the levels ranged from 0.0007 to 0.059 mg/L. The standardized mortality ratio of suicide across the municipalities was significantly and negatively associated with lithium levels in males as well as females (Ohgami et al, 2009).

Additional studies conducted in Japan, Austria, Texas, Greece, and Austria corroborate these results finding that higher lithium levels in the drinking water were associated with lower suicide rates. One negative study has been reported in England. However, the evidence that has been accumulating over the years, especially in the last 5-10 years, that small doses of lithium can have beneficial effects has even recently been the topic of an opinion editorial piece in the New York Times by a psychiatrist and faculty member at Weill Cornell Medical College who cites the different studies and questions why more research is not being conducted to evaluate this trend in the literature that shows lithium at low levels in drinking water could have an impact on suicide levels, violent acts and even dementia (Fels, 2014). She concludes that for the public health issue of suicide prevention alone, studies should be conducted with lithium to determine if it should be considered an essential trace element nutrient which would then allow its addition to vitamins, foods, etc. which could result in beneficial clinical, societal, and behavioral outcomes.

These data suggest that long term exposure to low levels of lithium in drinking water, which can range from 0.0007 to 0.219 mg/L may actually have beneficial effects in humans. The tap water screening level of 0.04 mg/L used by USEPA in the CCR Rule is well below the high end of this range. Therefore, lithium levels could be as high as 0.219 mg/L without adverse effect, well above the maximum concentration level observed at Meramec of 0.164 mg/L.

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APPENDIX C

What You Need to Know About Molybdenum

WHAT YOU NEED TO KNOW ABOUT MOLYBDENUM

Molybdenum is the one constituent that is present in at least one groundwater sample at each of the four Ameren energy centers in Missouri above the screening level used by the U.S. Environmental Protection Agency (USEPA) under the Coal Combustion Residuals (CCR) Rule. The purpose of this fact sheet is to provide information on molybdenum so that data can be considered in context. There is no public exposure to groundwater at the Ameren energy centers and concentration levels of molybdenum in adjacent surface waters are all well below health-based regulatory standards.

SOURCES OF INFORMATION ON MOLYBDENUM

Molybdenum had been evaluated by regulatory and health agencies in the U.S. As discussed below, molybdenum is an essential nutrient for humans, and the Institute of Medicine of the U.S. National Academy of Sciences (NAS) has provided recommended daily allowances and tolerable upper limits to be used as guidelines for vitamins and supplements and other exposures (NAS, 2001).

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency within the U.S. Department of Health and Human Services. The ATSDR Toxicological Profile for Molybdenum (ATSDR, 2017) provides a comprehensive summary and interpretation of available toxicological and epidemiological information on molybdenum and provides information on the naturally occurring levels in our environment and in our diet.

The U.S. Environmental Protection Agency (USEPA) published an oral toxicity value for molybdenum in 1992 (USEPA, 1992); this value serves as the basis for the tapwater screening level for molybdenum of 0.1 milligrams per liter (mg/L) or 100 micrograms per liter (ug/L) that was included in the Phase 1 Part update to the CCR Rule (USEPA, 2018a).

MOLYBDENUM IS NATURALLY OCCURRING AND AN ESSENTIAL NUTRIENT FOR PLANTS AND HUMANS

Molybdenum is a naturally occurring trace element that can be found extensively in nature. Biologically, molybdenum plays an important role as a micronutrient in plants and animals, including humans.

Molybdenum in Our Natural Environment

Molybdenum naturally accumulates in poorly drained soils and soils with high organic content (for example, peat bogs and wetlands). It is also present at high concentrations in “black shales,” which are shale deposits with high organic content. The U.S. Geological Survey (USGS, 2013) reports that the average concentration in U.S. soils is approximately 1 milligram per kilogram of soil (mg/kg). USGS (2011) estimates the median concentration of molybdenum in groundwater is 0.001 milligrams per liter (mg/L), with most concentrations below 0.008 mg/L.

Molybdenum in Our Diet

Molybdenum is considered an essential nutrient or trace element for living beings. It is required in several mammalian enzyme systems and is present in most adult multi-vitamins. A deficiency syndrome has only been seen in people with a genetic defect that prevents the synthesis of a specific enzyme for which molybdenum is a cofactor. The deficiency leads to severe neurological damage and early death.

Because it is present in soils, it is also present in our diet. Food derived from above ground plants, such as legumes, leafy vegetables, and cauliflower generally has a relatively higher concentration of molybdenum in comparison to food from tubers or animals. Beans, cereal grains, leafy vegetables, legumes, liver, and milk are reported as the richest sources of molybdenum in the average diet (ATSDR, 2017). The amount of molybdenum in plants varies according to the amount in the soil. The National Academy of Sciences (NAS) has estimated that the average dietary intakes of molybdenum by adult men and women are 0.109 and 0.076 milligrams per day (mg/day), respectively. A study of the dietary intake of adult residents in Denver, Colorado reported a mean molybdenum ingestion rate of 180 µg/day (range 120–240 µg/day) (ATSDR, 2017).

Molybdenum for Health

How Much Do You Need - Daily Allowance:

The Institute of Medicine of the NAS sets dietary intake values for essential nutrients. The recommended dietary allowance (RDA) for a nutrient is “the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) health individuals” (NAS, 2001). The RDA for molybdenum for adults set by the NAS in 2001 is 0.045 milligram per day (mg/day) and is based on the amount of molybdenum needed to achieve a steady healthy balance in the body for the majority of the population.

How Much is Too Much - Upper Limits:

In addition to the RDA, the NAS also defines a Tolerable Upper Intake Level (UL) for essential nutrients. The UL is “the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population.” Thus, the RDA is a level that is considered to be sufficient for the health of the general population, while intake can be as high as the UL and pose no adverse health effects.

The UL for molybdenum set by the NAS is 2 mg/day. This level is based on an evaluation of the potential toxicity of molybdenum at high levels of intake. The most sensitive effect in the literature is associated with reproductive outcomes in rats, and the study was used to develop an oral toxicity value for humans of 0.03 milligrams of molybdenum ingested per day per kilogram of body weight (mg/kg-day). This value is used with an average adult body weight of 68-70 kg (154 lbs) to set the UL[1].

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[1] The oral toxicity value identifies a level of intake in terms of milligrams of constituent per kilogram of body weight per day (mg/kg-day) that is considered to be safe for daily exposure for a lifetime. The oral toxicity value is used to calculate a safe drinking water level as follows: if the oral toxicity value is 0.03 mg/kg-day, and a 70 kg adult that consumes 2 liters of water per day, then the safe drinking water level = (0.03 mg/kg-day) x (70 kg) ÷ (2 liters water/day) = 1.05 milligrams per liter (mg/L).

USEPA'S ORAL TOXICITY VALUE FOR MOLYBDENUM

USEPA developed a lower oral toxicity value for molybdenum of 0.005 mg/kg-day (USEPA, 1992) based on a 1962 study of a small population (52 exposure subjects) in Armenia that had a high level of molybdenum in their diet. This population had high levels of uric acid and experienced gout. The findings from the Armenian study have not been replicated, and other regulatory bodies such as the NAS and ATSDR have rejected the study due to its many deficiencies. [It is likely that the observance of gout in the Armenian population had some other cause.]

The NAS concluded that there were "serious methodological difficulties with the [Armenian] study" and noted that no other studies in humans or animals have replicated this effect. The NAS toxicity value is 0.03 mg/kg-day, six-fold higher than the USEPA value. Based on the NAS toxicity value and USEPA assumptions (for body weight and drinking water intake) results in a calculated safe drinking water level of 0.6 mg/L or 600 ug/L.

ATSDR noted the study of the Armenian population was not considered suitable for derivation of a chronic-duration oral toxicity value for molybdenum due to deficiencies in the control group size and composition, and a lack of controlling for confounders, such as diet and alcohol, that could affect the results. ATSDR developed an oral toxicity value of 0.008 mg/kg-day, using the same study reproductive outcomes in rats as the NAS, but applying different assumptions, most notably a 3-fold higher uncertainty factor. Based on the ATSDR toxicity value and USEPA assumptions (for body weight and drinking water intake) results in a calculated safe drinking water level of 0.16 mg/L or 160 ug/L.

MOLYBDENUM UNDER THE CCR RULE

When the CCR Rule was published in 2015, groundwater standards were provided only for those Appendix IV constituents that have primary drinking water standards published by the USEPA under the Safe Drinking Water Act – values known as MCLs or maximum contaminant levels. Molybdenum does not have an MCL[2]. In a subsequent 2018 CCR rule-making, USEPA designated a health-based groundwater protection standard for molybdenum of 0.1 mg/L or 100 ug/L. That is the value used to evaluate groundwater at the Ameren facilities. This level is very conservative and could be much higher and still protective of human health, as described above. [Note that in its March 3, 2019 report the Environmental Integrity Project used a screening level for molybdenum of 0.04 mg/L (or 40 ug/L), which is not the level USEPA has required in the CCR Rule.]

However, based on the USEPA toxicity value, the drinking water levels USEPA has developed for molybdenum are:

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[2] USEPA is in the process of gathering information on the occurrence of molybdenum in public drinking water systems. The decision to develop an MCL (which is a multi-year process) is based on occurrence in public drinking water systems, the severity of adverse health effects, whether the constituent is present in public drinking water systems at levels of public health concern, and whether regulation would provide a meaningful opportunity for health risk reduction. No decision has yet been made as to whether molybdenum will be a candidate for the development of a drinking standard. Note that when USEPA included molybdenum for public water supply testing, it cited USEPA 1992, ATSDR 2017, and NAS 2001 as toxicity references. No mention was made of the differences in toxicity studies used or the values developed.

- 0.1 mg/L – The USEPA tapwater value in its Regional Screening Level (RSL) table and the value identified by USEPA for the CCR Rule (USEPA, 2018b). This is the value USEPA uses in the CCR Rule (USEPA, 2018a).
- 0.2 mg/L – The USEPA Office of Water value for the Drinking Water Equivalent Level (DWEL), which is a *lifetime exposure* concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a constituent is from drinking water (USEPA, 2018c).
- 0.04 mg/L – The USEPA Office of Water value for the Health Advisory Level (HA), which is based on the DWEL, but using a default assumption that only 20% of intake can come from water (USEPA, 2018c).

Therefore, drinking water concentrations of molybdenum up to 0.2 mg/L to are expected to be **without** adverse health effects. Based on the NAS review, daily exposure to drinking water concentrations of molybdenum up to 0.6 mg/L would be **without** adverse health effects.

WHAT THIS MEANS FOR THE AMEREN ENERGY CENTERS

This information from the NAS has been used to evaluate the levels of molybdenum in groundwater at the Ameren Energy Centers and in nearby surface waters. A total of 930 groundwater and surface water samples were collected from the four energy centers. The concentration levels in approximately 866 samples were below the screening level based on the National Academy of Science Tolerable Upper Intake Level (UL), while 241 are above the GWPS established by USEPA in the CCR Rule.

	Labadie	**Meramec**	**Rush Island**	**Sioux**
Groundwater				
Number of Samples	208	88	77	244
Molybdenum greater than CCR GWPS of 0.1 mg/L (a)	81	35	38	77
Molybdenum greater than NAS standard of 0.6 mg/L (b)	3	1	11	49
Surface Water				
Number of Samples	67	74	50	80
Molybdenum greater than 0.1 mg/L (a)	0	0	0	0

Notes:
mg/L - milligrams per liter.
(a) - Drinking water-based groundwater protection standard specified in the Coal Combustion Residuals Rule.
(b) - Alternative health-protective drinking water screening level based on the National Academy of Sciences review of molybdenum.

The groundwater results were collected from monitoring wells placed as close as practical to the ash basins' boundaries and provide near-source groundwater monitoring results. The groundwater downgradient of each of the Ameren ash basins is not used as a source of drinking water. Deep bedrock groundwater used as drinking water in the vicinity of Labadie and in the vicinity of Rush Island was sampled and demonstrated no impacts from CCR.

Surface water adjacent to each of the energy centers was sampled and all results for molybdenum in surface water are well below the USEPA drinking water screening level of 0.1 mg/L.

Thus, although there are some results for molybdenum in groundwater that are above the USEPA drinking water screening level, the groundwater at these facilities is not used as a source of drinking water, and molybdenum is not present in any of the adjacent water bodies above the drinking water screening level. These results confirm that molybdenum does not pose a risk to human health or the environment at any of the Ameren facilities.

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APPENDIX D

Extraction and Transportation Assessment

LOCHMUELLER GROUP

ADDENDUM

Meramec, Labadie and Sioux Ash Pond Closure: Extraction and Transportation Assessment

Lochmueller Group applied the methodology from the Extraction and Transportation Study for the Rush Island Energy Center to develop high-level estimates of the costs and timeframes associated with hypothetical CCR excavation processes at the Labadie, Sioux and Meramec Energy Centers. Specifically, the formula used to estimate daily productivity (i.e. number of trucks hauling excavated material offsite) was adapted for use at Labadie, Sioux and Meramec along with site-specific considerations.

Estimates from the Rush Island Study assumed a maximum of 192 truck loads per day over an 8-hour work day (24 per hour), with 155 to 193 days of annual operation. Once loaded, trucks would make multiple roundtrips to the closest available commercial landfill. Such estimates assume that the excavation, staging, and loading process is capable of accommodating a steady stream of trucks loading **every 2.5 minutes** and that such material can be quickly unloaded at the receiving commercial landfill without significant delay. While such productivity rates are undoubtedly optimistic, the resulting estimates nevertheless are useful in capturing the enormity of such projects and are sufficient at a planning-level.

It is important to note that the existing onsite utility waste landfills (UWLs) at Labadie and Sioux were designed and permitted to manage production needs of the energy centers through each facility's retirement date. To facilitate permanent storage, excavated CCR material would need to be transported offsite to a commercial landfill **or** Ameren Missouri would need to permit and construct new onsite landfills. Given the absence of an existing utility waste landfill at Meramec, onsite disposal options were considered for the Labadie and Sioux locations only.

Each facility presents unique challenges that are likely to impact cost estimates and closure times beyond the scope of this assessment. For example, the regulatory process for construction of an onsite landfill would require multiple levels of approval, including environmental permits, zoning or land use authorization, and potentially a certificate of issuance from the Missouri Public Service Commission. Opposition to such projects may further delay the regulatory approval process such that it would be years *before* construction could commence.[1]

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[1] Efforts to permit and construct the Labadie UWL commenced in 2008 with the completion of Preliminary Site Investigation (PSI). The landfill was placed in service in 2016 after years of opposition from environmental groups and litigation. See *Petition for Writ of Certiorari [to invalidate county landfill ordinance] Franklin County Circ. Ct., 11/23/11, Case # 11AB-C286; Appeal to Franklin County Board of Adjustment, #14-00002, Filed 1/8/14 (of Land Use Administrator 10/10/13 and 12/10/13 Decisions), Denied by BZA 6/24/14; Appealed to Circ. Ct. by Writ of Certiorari, Cause # 14AB-CC00155, 7/24/14; Intervention and Motion to Dismiss in PSC Case EA 2012-0281, Ameren Application to PSC for CCN to operate landfill (PSC overruled Motion to Dismiss on 4/17/13); Administrative Hearing Commission Petition for Review [of MDNR Solid Waste Disposal Construction Permit], Filed 1-30-15, #15-0136, dismissed by AHC 3/5/15.* See also *Campbell v. County Commission of Franklin County, 453 S.W.3d 762 (Mo. banc 2015).*

Based on experience, it would be virtually impossible to sustain productivity at the planning level rate over extended, multi-year timeframe due to a variety of unpredictable factors. Excavation activities could be limited or precluded for several days following weather events. Other potential disruptions could include:

- loading equipment failure
- site restrictions that limit the number of excavation equipment
- traffic congestion on travel route
- truck breakdown
- staffing
- weather conditions
- commercial landfill available capacity in Illinois and Missouri
- landfill unloading equipment failure

In addition, site specific conditions can impact productivity. For example, an elementary school is located along Fine Road between the Meramec Energy Center and Telegraph Road. To accommodate local safety concerns, the hauling company would likely limit trips during the beginning and end of the school day, thereby limiting effective hauling hours to 5-6 per day during the school year.

Route 94 east of the Sioux Energy Center travels beneath multiple narrow, low-clearance railroad overpasses in the West Alton area. An entirely new roadway by-passing West Alton would avoid the railroad entirely, but would require regulatory approvals, land acquisition, and potentially eminent domain. Assumptions were adjusted to account for these impacts, but it is not possible to foresee every challenge and quantify every impact likely to surface.

Scenarios:

The following summarizes the assessment of five scenarios for CCR removal for the Meramec, Labadie and the Sioux Energy Centers. The assessment utilized the same methodology, assumptions, and unit costing information as for Rush Island. The volume of ash, hauling distances, and the anticipated infrastructure upgrades were adjusted for each site.

For each scenario, the total volume of excavated ash, total cost of removal, and closure duration are summarized. The reported volume of ash incorporates a swell factor. The closure duration is measured from the time the decision is made to close the ponds (i.e. removal from service) until such time that the CCR material is fully removed. It was assumed that 5 years of preparation time would be needed in advance of starting an offsite removal operation, whereas an onsite removal operation would require 10 years of preparation time to account for the regulatory process to secure approvals for construction of new onsite landfills.

The five scenarios are as follows:

1. Labadie Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill
2. Labadie Bottom Ash and Fly Ash Pond CCR Removal to an Onsite Landfill

3. Sioux Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill
4. Sioux Bottom Ash and Fly Ash Pond CCR Removal to an Onsite Landfill
5. Meramec Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill

Scenario 1: Offsite CCR Removal for Labadie

This scenario assumes offsite removal for the Labadie ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Hauling to an offsite landfill in Missouri;
- Landfill placement; and
- Loading and transportation infrastructure.

Labadie Energy Center	**Estimated Ash Volume (CY)** [2]	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	17,325,126	**\$2,440 M – \$2,930 M**	**35 plus years**

Scenario 2: Onsite CCR Removal for Labadie

This scenario assumes onsite disposal the Labadie ash pond sites and includes the following:

- Pre-CCR removal preparation (10 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an onsite landfill located near the existing ponds;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading infrastructure.

Labadie Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	17,325,126	**\$1,270 M - \$1,520 M**	**40 plus years**

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[2] Estimated volumes do not include any dry amendment materials.

Scenario 3: Offsite CCR Removal for Sioux

This scenario assumes offsite removal for the Sioux ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an offsite landfill in Illinois[3];
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading and transportation infrastructure.

Sioux Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	6,079,808	**$890 M - $1,060 M**	**15 plus years**

Scenario 4: Onsite CCR Removal for Sioux

This scenario assumes onsite disposal the Sioux ash pond sites and includes the following:

- Pre-CCR removal preparation (10 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an onsite landfill located near the existing ponds;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading infrastructure.

Sioux Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	6,079,808	**$470 M - $570 M**	**20 plus years**

Scenario 5: Onsite CCR Removal for Meramec

This scenario assumes offsite removal for the Meramec ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);

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[3] Lochmueller did not review local siting requirements but many Illinois counties contain such restrictions.

- Stabilization, loading, and pond restoration;
- Hauling to an offsite landfill in Illinois;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Site specific constraints with transportation access and associated limitations;
- Landfill placement; and
- Loading and transportation infrastructure.

Meramec Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	5,194,923	**$740 M - $890 M**	**20 plus years**

APRIL 29, 2019

EXTRACTION & TRANSPORTATION STUDY: Rush Island
Ash Pond Closure Assessment

Rush Island Site

Jefferson County, Missouri

Prepared for:

AMEREN
1901 Chouteau Avenue
St. Louis, Missouri 63103
314.621.3222

Prepared by:

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Table of Contents

Introduction

Lochmueller Group completed the following planning-level assessment of the costs and logistics associated with extracting, stabilizing, and transporting coal combustion residuals (CCR) from the existing ash pond system at the Rush Island Power Generation Center to existing offsite, commercially available landfill facilities. The Rush Island site is located along the Mississippi River in Jefferson County, Missouri approximately nine (9) miles southeast of Festus, Missouri. The purpose of this assessment is to describe the methods, determine the impacts, and quantify the order-of-magnitude costs associated with removing and transporting all CCR from its current disposal location at the Rush Island site to a private landfill for permanent storage.

Extraction & Stabilization

Description of Method

Extraction and stabilization of the CCR material from the CCR unit at Rush Island Energy Center is complicated due to its depth and location. In addition, the CCR unit contains both Class C and F fly ash that complicates excavation methods. CCR material from the unit would need to be excavated at depths of up to 100 feet, dewatered, dried and conditioned, before being and loaded into trucks and transported offsite.

Removal of the CCR material would require multiple phases including dry extraction, partially wet extraction and fully submerged extraction. The various phases are described below:

Dry Extraction:

This phase includes the handling and removal of the existing CCR material from the current surface elevation down to the groundwater elevation (approximately 18’ below the ground surface (BGS) elevation) (Geotechnical Investigation and Report, prepared by CEC and dated December 20, 2011). Generally, it is assumed that this material can be direct loaded and transported without additional drying or conditioning procedures (moisture content between approximately 25% and 35%). The work associated with this phase includes the extraction, on-site transportation to Staging/Loading Areas, storage, and loading onto transportation for off-site removal. Standard earth-moving equipment and procedures would be utilized including dozers, loaders, and excavators. In general, dozers would be used to excavate and move the CCR material into piles and loaders would be used to load the CCR material into the waiting trucks for transport off-site. Excavators would be used in a support role to dig in areas where dozers are not efficient. Sub-areas of the pond area would need to be established to facilitate extraction operations. The general size of these sub-areas, laterally and vertically, will be determined based on on-site conditions as the operation progresses and the CCR material is removed.

Partially Wet Extraction:

This phase includes the handling and removal of the existing CCR material from the groundwater elevation to a point in which hydraulic excavation is feasible (18’ below ground surface to 28’ below ground surface). This material is assumed to be in acceptable condition for loading and transportation with no additional drying and conditioning after the dewatering procedure described below is completed.

Dewatering of this material would involve excavation of channels to promote material drying prior to excavation and transportation. Water would be diverted from excavated depressions utilizing pumps and piping systems to transport the water away from the material excavation area. After sufficient dewatering and drying time, the CCR materials would be removed using the same means as described for dry excavation.

Fully Submerged Extraction:

CCR materials located further down in the pond (28’ below ground surface to 100’ below ground surface) may be saturated and would require drying and conditioning prior to off-site transport. Such materials would need to be extracted via hydraulic dredging methods. The complexities and potential costs associated with such dredging efforts are significantly higher per unit volume than the “Dry Extraction” and “Partially Wet Extraction” phases. In fact, successful pond closures at the depths required for the Rush Island site could were not discovered. Removal operations for CCR ponds with depths up to 50 feet were found.

This method employs equipment that removes the CCR material directly from the bottom of the CCR unit and pumps the “slurry” through a piping system to “geotubes” located in nearby drying areas. Geotubes are a geotextile filtration “bag” manufactured by sewing together multiple sheets of geotextiles using polyester or polypropylene. As the dredged water enters the geotubes, the geotextile captures the CCR materials as the water drains. Chemical addition during the pumping and piping operation using coagulants and flocculants will be necessary to aid in the dewatering process. The specific makeup of CCR materials are site specific. Therefore, selection of the most effective and efficient coagulants and flocculants will require bench testing. Maintenance of the dredging equipment, piping system, drying areas, settling ponds, and temporary roads will be necessary to facilitate the operation.

Significantly large drying areas will be required to accommodate the multi-week week drying procedure. After dewatering is complete, the geotubes are opened and the CCR material is loaded onto transportation for off-site removal. The transportation of material for off-site removal was the assumed limiting factor for the overall CCR disposal process flow based on the analysis performed in this study. However, extended, unforeseen weather conditions can contribute to additional lost working time due to icy conditions, mechanical system freeze-ups, or flooding.

Site Restoration:

This phase includes the final restoration of the site. This would include removal of all temporary access roads and residual ash in project area. Backfilling would likely need to occur for at least some volume of the remaining pond in conjunction with excavation activities to minimize infiltration from the Mississippi River. The closest source of backfill material would be sand dredged from the Mississippi River. Stabilization of the site with vegetative practices would be required for erosion control. The river banks and the remaining embankment along the river would require additional analysis and appropriate stabilization, but may include a combination of vegetation, large rocks or manufactured concrete products.

Extraction and Stabilization Impacts

Safety

Accidents

Workforce safety during the operation is a significant risk factor. With several unit processes operating with heavy machinery, proper safety planning is important. Accidents can be minimized during operations, but the planning and implementation of a safety plan will have significant costs associated with the effort.

Exposure

There is not only immediate physical injury risks, but there is also exposure risk to the people working on the site. Proper safety equipment will be necessary to limit exposure to potentially harmful substances in the CCR material removal process such as flocculants and coagulant used for the dewatering process.

Environment

Floodplain

The project area is currently shown within the 100 year floodplain for both the current and pending FIRM maps. The potential for the area to experience flooding during excavation activities creates additional risk to the extraction and stabilization operations.

River Embankment

The existing ash ponds are adjacent to the Mississippi River. There is a strip of land that separates these surface water bodies and serves and an embankment that separates the pond from the river. Proper excavation techniques and monitoring will need to be employed to ensure the land between the two surface water bodies remains stable during excavation and dredging activities. After dredging activities are complete, the embankment will require analysis to confirm stability. Removal of the embankment and/or significant re-stabilization may be necessary for the restoration of the site.

Emissions

The heavy equipment used during the extraction and stabilization phase of the project includes dozers, loaders, excavators, hydraulic dredges, and onsite hauling trucks. These types of equipment typically utilize diesel fuel and would generate emissions during operations. These emissions are in addition to the emissions discussed in the transportation impacts section of this assessment.

Fugitive Ash Particulate

As the CCR material is being extracted and stabilized, fugitive ash particulate will be created and would need to be managed through an ash management plan.

Capital Projects

Onsite Access Roads

The onsite access road utilized for the offsite hauling trucks is discussed in the transportation section of this assessment. The construction of temporary on-site hauling roads will be required throughout the extraction and stabilization process. These haul roads will need to be modified frequently in order to provide efficient transportation of the CCR to the stabilization and loading areas and to maintain dust control.

Geotube Staging Areas

Geotube staging areas will need to be constructed within the project area that are relatively flat to allow for proper dewatering of the CCR. These staging areas will be temporary and will need to be moved throughout the closure process as CCR is removed during different phases of the operation. Filtrate from the geotubes would be directed back to the settling ponds for treatment.

Water Treatment Facilities

The existing ponds could be utilized throughout the CCR removal process for settling any remaining solids from the filtrate from the drying process. There may be a need for the construction of new settling ponds toward the end of the process to fully remove CCR from the existing ponds. The filtrate will likely contain suspended solids and some form of treatment or settling may need to be evaluated depending on the final characteristics of the filtrate.

Loading Areas

Once the CCR is stabilized, the material may require some additional layout and loading area to ensure the material is dry enough for offsite hauling and ultimate placement in a landfill. The loading areas will need to be constructed as appropriate for the CCR removal areas that are active. The loading areas will require the construction of scales for measuring the weight of trucks and truck washing facilities to wash down tires of residual ash material.

Restoration of Former Ash Ponds

The post-CCR-removal condition of the ponds will be dependent on the final planned use of the area. Some options may include backfilling, removing embankment, creating or restoring habitat, etc. Achieving the desired future use may include utilizing the soil material that would remain between the pond and the river to backfill some of the remaining pond area. Sand backfill material could also be dredged from the Mississippi river for additional backfill material. Overall stabilization of the site would be required and would include vegetative, natural rock, and manufactured products to meet regulatory requirements.

Transportation & Disposal

This section addresses the transportation of CCR material from the site and its permanent disposal at a private landfill.

Modal Options (Truck, Rail, Barge)

The Rush Island site is located along the Mississippi River. Additionally, a BNSF rail line runs adjacent to the site. Therefore, the ability to haul CCR by barge and rail from Rush Island may be possible. However, significant infrastructure improvements would be required at the Rush Island site to provide ash loading capabilities for these modes.

The preferred landfill locations are all located within 80 miles of Rush Island. None of the sites have direct water access. Therefore, any CCR transported by barge from Rush Island would need to be transferred from barge to truck to reach the landfill destinations. The inefficiency of this transfer would render barge transportation considerably more costly than truck hauling. Moreover, most of the landfill sites are located further inland (east or west) from Rush Island such that north-south travel along the Mississippi River would not be beneficial.

With regards to rail, none of the preferred landfill sites have direct rail access. Several sites are located adjacent to rail corridors but spurs would need to be constructed to facilitate direct landfill access and allow for the temporary storage and unloading of rail cars. Additionally, three of the four preferred landfill sites are located in Illinois, which would require trains to travel through the congested St. Louis rail network to cross the Mississippi River. Rail is most efficient when transporting bulk materials over long distances. Given the relatively short travel distance to each landfill site, rail would not be cost-competitive with truck hauling.

This assessment assumed truck hauling to be the most cost-effective and feasible mode of transport. All subsequent analyses reflect truck hauling.

Truck Hauling

To determine a timeframe for extraction and removal of all CCR from its current, impounded location, the following was assumed:

- Truck hauling via 40-foot end load dump trucks loaded via conventional equipment – each trailer has a payload capacity of 25 tons based on a typical 80,000 lb. gross loaded maximum;
- 8-hour daily operation and a range of 155 to 193 days of annual operation (accounting for weekends, holidays, and time lost due to weather and imperfect execution);
- Loading operations on the Rush Island site occur adjacent to the impoundment and on the south portion of the site; and
- A maximum daily haul rate of 5,000 tons.

The resulting transportation haul assumptions are summarized in **Table 1**.

Table 1: Transportation Haul Summary

Total Tons of CCR Removed	Annual Tons of CCR Removed	Closure Duration*
21.6 million	742,772 to 928,465	28-34 Years

*Measured from the decision to begin extraction until fully removed

To accommodate the volume of truck traffic identified in **Table 1**, roadways internal to the Rush Island site would need to be improved. Specifically, a heavy-duty concrete roadway would need to be constructed along the western perimeter of the site extending from Big Hollow Road south to the ash pond area. Multiple at-grade railroad crossings with the site's rail spur would be required.

In the vicinity of the pond area, staging would need to be provided to accommodate several trucks in queue for multiple loading stations. Hence, a large loading station would need to be constructed. Once loaded, trucks would need to proceed to a washout area and scaled to verify the truck is loaded properly. A quick route back to the loading pad from the scale area would be needed for any overweight trucks.

Landfill Options

Four preferred landfills were identified as potential destinations for the CCR removed from the Rush Island site as shown in **Table 2**. Landfill disposal costs supplied by Ameren are similar across the four locations. With costs paid to the landfill being essentially equal, transportation costs would drive the landfill location decision. Assumed haul rates per ton to each landfill location were also supplied by Ameren. The lowest cost haul rate would be to the Progressive Waste site in Richwoods, which is also significantly closer to Rush Island than the other sites. Therefore, this assessment prioritized CCR disposal at the Progressive Waste landfill.

Table 2: Preferred Landfill Locations

Landfill Site	Address	Distance to Site (mi)	Travel Time to Site (min)
Progressive Waste	12581 State Hwy H, Richwoods, MO	34.7	44
Republic Services	4601 Cahokia Road, Roxana, IL	67.3	67
Waste Management	10400 Hillstown Road, Marissa, IL	73.4	82
Perry Ridge	6305 Sacred Heart Road, DuQuoin, IL	79.8	97

Capacity calculations were performed to determine the total space available for CCR disposal in aggregate. The annual disposal amount currently received by the landfill was assumed to remain constant over time and the incremental annual disposal amount due to the Rush Island CCR was added. Based on the capacity of the Progressive Waste site, at the combined disposal volume, it was estimated that the Progressive Waste landfill would become full upon receiving approximately 80 percent of the total CCR from Rush Island.

It was also assumed that the Progressive Waste site could feasibly accept the maximum daily load of trucks (192) and that Progressive Waste would be willing to receive the maximum amount of CCR possible and dedicate the necessary space on site for monofill construction to isolate the CCR material from other waste on site.

Given these assumptions, the calculations indicate that a second landfill site with available capacity would need to receive the final 20 percent of Rush Island CCR material once Progressive Waste reaches capacity. However, for purposes of the subsequent routing and transportation evaluations, it was assumed that the entire Rush Island CCR volume would be disposed at Progressive Waste.

Transportation Route

Many factors were considered when establishing a preferred route suitable for the removal of the CCR from the Rush Island site to the Progressive Waste landfill, including roadway functional classification and the available connectivity between the two sites using the existing roadway network. The selected route is approximately 36.5 miles long and utilizes the following roadways:

- Begin at the Rush Island site on Big Hollow Road
- Johnson Road west
- Danby Road west
- Highway 61 south
- Highway TT west
- Interstate 55 north
- Highway 67 south
- MO-110 west
- MO-21 south
- Highway H west
- End off Highway H at Progressive Waste

This route prioritizes roadways with the highest functional classifications along a reasonably direct line of travel. While a shorter route may be possible, it would rely upon roadways less suitable for truck traffic and therefore was not considered. The selected route emphasizes major numbered state routes, with the exception of leaving the Rush Island site (via Big Hollow Road, Johnson Road, and Danby Road) and accessing Progressive Waste (via Highway H).

The egress route from the Rush Island site utilizes Johnson Road and Danby Road instead of remaining on Big Hollow Road to Drury Road. Johnson Road/Danby Road is the designated route for truck traffic in and out of the Rush Island site. This route also promotes use of the half diamond interchange on Interstate 55 at Route TT, which was constructed approximately 10 years ago for purposes of serving truck traffic to/from the nearby Holcim Cement Plant.

Transportation Impacts

The following transportation impacts would be anticipated as a result of the hauling operation.

Traffic Flow

The selected route between Rush Island and Progressive Waste was evaluated in terms of its ability to accommodate the additional truck traffic, including both loaded and unloaded trucks. Overall, the truck volume distributed over the course of the day would not be expected to generate significant traffic flow impacts. The route emphasizes major roadways, which would be capable of handling the additional traffic. In fact, no improvements were assumed for Interstate 55 or Highway 67.

That said, the following transportation improvements would be recommended to mitigate anticipated impacts of the additional truck traffic at select locations:

- Big Hollow Road, Johnson Road, and Danby Road, which connect the Rush Island site with Highway 61, are not suitable for the volume of truck traffic anticipated. These roadways typically have 11-foot lanes and no shoulders. The horizontal and vertical geometry is substandard in places. The existing asphalt pavement would not likely withstand the effects of heavy truck traffic. It is recommended that this corridor be upgraded to provide an appropriate truck route between Rush Island and Highway 61. The assumed improvements consist of heavy-duty concrete pavement and alignment corrections along the existing roadway.
- The intersection of Danby Road with Highway 61 should be improved to include a dedicated northbound right-turn lane on Highway 61 and enlarged right-turn radius. This turn lane would serve trucks en route to Rush Island from Interstate 55. This intersection would be expected to remain unsignalized.
- The intersection of Route TT with Highway 61 should be improved to include a dedicated southbound right-turn lane on Highway 61 and enlarged right-turn radius. This turn lane would serve trucks en route to Progressive Waste. This intersection would be expected to remain unsignalized.
- The intersection of Highway 21 and Highway 110 was recently realigned and upgraded to current standards, so it should be well-equipped to serve truck turning maneuvers. However, the intersection remains unsignalized. Installation of a signal would be recommended in order to safely and efficiently serve trucks turning from westbound Highway 110 to southbound Highway 21 en route to Progressive Waste.
- The intersection of Highway 21 with Route H is signalized and currently includes a dedicated southbound right-turn lane and dedicated eastbound left-turn lane to serve truck turning movements along the selected route. It is recommended that the eastbound left-turn lane be extended to provide additional storage capacity. The existing turn lane is approximately 75 feet in length, which would accommodate only a single truck and possibly one additional vehicle.
- Route H is a low-volume and narrow two-lane highway with lane widths of approximately 10 feet, low shoulders, and substandard alignment in select areas. While upgrades to this corridor would be beneficial, given the length of the route, significant upgrades for purposes of the hauling operation would likely be deemed cost prohibitive.

Safety & Environment

The safety implications of the truck hauling operation were evaluated using information provided in the Highway Safety Manual (HSM), published by the American Association of State Highway and Transportation Officials (AASHTO). The HSM relates traffic volumes and roadway character to crash expectancy. Changes in volumes would then cause an increase or decrease in the crash expectancy. It is anticipated that the additional truck traffic would result in an increase of 6 crashes total on an annual basis along the entirety of the haul route, as follows:

- Net increase of 2 Severe (Fatal or Injury) Crashes per year
- Net increase of 4 PDO (Property Damage Only) Cashes per year

Additional environmental costs would also be incurred as a result of the hauling operation.[1] In total, transportation safety and environmental costs are estimated to be approximately $490 million to $611 million over the duration of the hauling operation. These costs would not be borne directly by Ameren but instead would be incurred by the general population.

Pavement

The additional truck volume would depreciate the pavement design life and accelerate pavement deterioration along the selected route. To compensate for the increased wear, pavement mill and overlay were assumed at 5-year increments along all segments of the route, with the exception of Interstate 55 (which as an interstate should be build to withstand truck traffic) and the upgraded access route to the Rush Island site (which would be reconstructed with heavy duty concrete).

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[1] According to the Environmental Protection Agency’s (EPA) publication on National Average In-Use Emissions from Heavy-Duty Trucks, semi-tractor trailer rigs are responsible for emitting 12.5 grams of pollutants per mile into the air. The economic cost attributable to truck emissions using EPA's methodology was estimated to be $434M. This accounts for increased healthcare costs, lost productivity, welfare costs, environmental remediation, etc.

Conclusion

Lochmueller Group completed the preceding planning-level assessment of the methods and impacts associated with extracting, stabilizing, and transporting CCR from the existing Rush Island Power Generation Center. The purpose of this assessment was to determine the impacts and quantify the order-of-magnitude costs associate with completely removing all CCR from the Rush Island site and transporting it to a private landfill for permanent storage. The information contained herein is provided at a planning-level.

This study assumed that 12,725,000 cubic yards of coal combustion residuals would ultimately need to be removed from the Rush Island site. This would equate to approximately 21,650,000 tons of material to transport. This transport weight was calculated by multiplying the in place cubic yards by a swell factor to account for the uncompacted volume after excavation. The weight of the uncompacted unit volume was established from geotechnical testing data that provided the pounds per cubic foot and the percent moisture content. Based on a range of operating days per calendar year, it would take from 28 to 34 years to extract all material from the site.

Restoration of the site would include backfilling and stabilization with vegetative and structural practices. Restoration costs could be significant in that the resulting 70 – 100 foot depression may need to be backfilled via a dredging operation within the Mississippi River.

The total cost to extract, stabilize, transport, and dispose of the CCR material is summarized below in 2019 dollars. The total cost to Ameren could range from $1.9 to $2.1 Billion, depending upon the total period of removal operations. This includes transportation infrastructure upgrades both internal and external to the Rush Island site as discussed.

Extraction of CCR and Transport to Offsite Landfill	
Ameren Project Costs	
Extraction, Stabilization, Loading, and Restoration	$773-891 Million
Hauling	$372-375 Million
Landfill Placement Costs	$691-757 Million
Transportation Infrastructure (on and off-site)	$66-77 Million
Project Cost Total	**$1.9-$2.1 Billion**

Costs in 2019 Dollars

APPENDIX B

Laboratory Analytical Data

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

December 10, 2018

Mark Haddock
Golder Associates
820 S. Main St
Suite 100
Saint Charles, MO 63301

RE: Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Dear Mark Haddock:

Enclosed are the analytical results for sample(s) received by the laboratory between November 20, 2018 and November 21, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Jeffrey Ingram, Golder Associates
John Suozzi, Golder Associates

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

CERTIFICATIONS

Project:	AMEREN MEC N&E, 153-1406.0004C
Pace Project No.:	60287289

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Certification Number: 10090
Arkansas Drinking Water
WY STR Certification #: 2456.01
Arkansas Certification #: 18-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116 / E10426

Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070
Missouri Certification Number: 10090

SAMPLE SUMMARY

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60287289001	**M-TP-2**	Water	11/19/18 11:35	11/20/18 04:15
60287289002	**M-NE-FB-1**	Water	11/19/18 11:30	11/20/18 04:15
60287289003	**M-TP-1**	Water	11/20/18 13:05	11/21/18 03:30
60287289004	**M-NE-DUP-1**	Water	11/20/18 13:05	11/21/18 03:30

SAMPLE ANALYTE COUNT

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60287289001	**M-TP-2**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2320B	RLG	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K
60287289002	**M-NE-FB-1**	EPA 200.7	EMR, JGP	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2320B	RLG	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K
60287289003	**M-TP-1**	EPA 200.7	EMR, JGP	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2320B	RMT	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K
60287289004	**M-NE-DUP-1**	EPA 200.7	EMR, JGP	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2320B	RMT	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Sample: M-TP-2 **Lab ID: 60287289001** Collected: 11/19/18 11:35 Received: 11/20/18 04:15 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**58.8**	ug/L	5.0	1.5	1	12/03/18 16:08	12/04/18 18:11	7440-39-3	
Beryllium	**<0.16**	ug/L	1.0	0.16	1	12/03/18 16:08	12/04/18 18:11	7440-41-7	
Boron	**2550**	ug/L	100	12.5	1	12/03/18 16:08	12/04/18 18:11	7440-42-8	
Calcium	**217000**	ug/L	200	53.5	1	12/03/18 16:08	12/04/18 18:11	7440-70-2	M1
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/03/18 16:08	12/04/18 18:11	7440-48-4	
Iron	**15900**	ug/L	50.0	6.1	1	12/03/18 16:08	12/04/18 18:11	7439-89-6	
Lead	**<3.0**	ug/L	10.0	3.0	1	12/03/18 16:08	12/04/18 18:11	7439-92-1	
Lithium	**42.7**	ug/L	10.0	4.6	1	12/03/18 16:08	12/04/18 18:11	7439-93-2	
Magnesium	**56200**	ug/L	50.0	14.0	1	12/03/18 16:08	12/04/18 18:11	7439-95-4	
Manganese	**578**	ug/L	5.0	0.73	1	12/03/18 16:08	12/04/18 18:11	7439-96-5	
Molybdenum	**6.2J**	ug/L	20.0	0.90	1	12/03/18 16:08	12/04/18 18:11	7439-98-7	
Potassium	**7890**	ug/L	500	79.3	1	12/03/18 16:08	12/04/18 18:11	7440-09-7	
Sodium	**167000**	ug/L	500	157	1	12/03/18 16:08	12/04/18 18:11	7440-23-5	M1
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 12:55	7440-36-0	
Arsenic	**3.8**	ug/L	1.0	0.065	1	12/03/18 15:40	12/04/18 12:55	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/03/18 15:40	12/04/18 12:55	7440-43-9	
Chromium	**0.17J**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 12:55	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/03/18 15:40	12/04/18 12:55	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/03/18 15:40	12/04/18 12:55	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:09	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**403**	mg/L	20.0	4.9	1		11/29/18 16:04		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1450**	mg/L	5.0	5.0	1		11/21/18 14:48		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**13.8**	mg/L	0.050		1		12/06/18 16:38	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**2.1**	mg/L	0.20	0.012	1		11/21/18 12:10		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**242**	mg/L	50.0	14.5	50		12/10/18 11:43	16887-00-6	
Fluoride	**0.36**	mg/L	0.20	0.19	1		12/09/18 23:02	16984-48-8	
Sulfate	**475**	mg/L	50.0	12.0	50		12/10/18 11:43	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**0.68**	mg/L	0.10	0.050	1		11/26/18 14:14	7723-14-0	

ANALYTICAL RESULTS

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Sample: M-NE-FB-1 **Lab ID: 60287289002** Collected: 11/19/18 11:30 Received: 11/20/18 04:15 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**<1.5**	ug/L	5.0	1.5	1	12/04/18 12:45	12/05/18 13:59	7440-39-3	
Beryllium	**0.25J**	ug/L	1.0	0.16	1	12/04/18 12:45	12/05/18 13:59	7440-41-7	
Boron	**12.5J**	ug/L	100	12.5	1	12/04/18 12:45	12/05/18 13:59	7440-42-8	
Calcium	**<53.5**	ug/L	200	53.5	1	12/04/18 12:45	12/05/18 13:59	7440-70-2	
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/04/18 12:45	12/05/18 13:59	7440-48-4	
Iron	**<6.1**	ug/L	50.0	6.1	1	12/04/18 12:45	12/05/18 13:59	7439-89-6	
Lead	**<3.0**	ug/L	10.0	3.0	1	12/04/18 12:45	12/05/18 13:59	7439-92-1	
Lithium	**<4.6**	ug/L	10.0	4.6	1	12/04/18 12:45	12/05/18 14:54	7439-93-2	
Magnesium	**<14.0**	ug/L	50.0	14.0	1	12/04/18 12:45	12/05/18 13:59	7439-95-4	
Manganese	**<0.73**	ug/L	5.0	0.73	1	12/04/18 12:45	12/05/18 13:59	7439-96-5	
Molybdenum	**<0.90**	ug/L	20.0	0.90	1	12/04/18 12:45	12/05/18 13:59	7439-98-7	
Potassium	**<79.3**	ug/L	500	79.3	1	12/04/18 12:45	12/05/18 13:59	7440-09-7	
Sodium	**<157**	ug/L	500	157	1	12/04/18 12:45	12/05/18 13:59	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 13:03	7440-36-0	
Arsenic	**<0.065**	ug/L	1.0	0.065	1	12/03/18 15:40	12/04/18 13:03	7440-38-2	
Cadmium	**0.065J**	ug/L	0.50	0.033	1	12/03/18 15:40	12/04/18 13:03	7440-43-9	
Chromium	**0.16J**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 13:03	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/03/18 15:40	12/04/18 13:03	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/03/18 15:40	12/04/18 13:03	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:16	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**<4.9**	mg/L	20.0	4.9	1		11/29/18 16:13		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**6.0**	mg/L	5.0	5.0	1		11/21/18 14:48		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**0.0J**	mg/L	0.050		1		12/06/18 16:38	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**<0.012**	mg/L	0.20	0.012	1		11/21/18 12:09		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**0.43J**	mg/L	1.0	0.29	1		12/10/18 00:38	16887-00-6	B
Fluoride	**<0.19**	mg/L	0.20	0.19	1		12/10/18 00:38	16984-48-8	
Sulfate	**<0.24**	mg/L	1.0	0.24	1		12/10/18 00:38	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**<0.050**	mg/L	0.10	0.050	1		11/26/18 14:19	7723-14-0	

ANALYTICAL RESULTS

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Sample: M-TP-1 **Lab ID: 60287289003** Collected: 11/20/18 13:05 Received: 11/21/18 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**386**	ug/L	5.0	1.5	1	12/04/18 12:45	12/05/18 13:46	7440-39-3	
Beryllium	**<0.16**	ug/L	1.0	0.16	1	12/04/18 12:45	12/05/18 13:46	7440-41-7	
Boron	**640**	ug/L	100	12.5	1	12/04/18 12:45	12/05/18 13:46	7440-42-8	
Calcium	**77100**	ug/L	200	53.5	1	12/04/18 12:45	12/05/18 13:46	7440-70-2	
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/04/18 12:45	12/05/18 13:46	7440-48-4	
Iron	**8420**	ug/L	50.0	6.1	1	12/04/18 12:45	12/05/18 13:46	7439-89-6	
Lead	**4.1J**	ug/L	10.0	3.0	1	12/04/18 12:45	12/05/18 13:46	7439-92-1	
Lithium	**17.2**	ug/L	10.0	4.6	1	12/04/18 12:45	12/05/18 14:41	7439-93-2	
Magnesium	**31300**	ug/L	50.0	14.0	1	12/04/18 12:45	12/05/18 13:46	7439-95-4	
Manganese	**110**	ug/L	5.0	0.73	1	12/04/18 12:45	12/05/18 13:46	7439-96-5	
Molybdenum	**3.1J**	ug/L	20.0	0.90	1	12/04/18 12:45	12/05/18 13:46	7439-98-7	
Potassium	**3160**	ug/L	500	79.3	1	12/04/18 12:45	12/05/18 13:46	7440-09-7	
Sodium	**44900**	ug/L	500	157	1	12/04/18 12:45	12/05/18 13:46	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 15:55	7440-36-0	
Arsenic	**1.9**	ug/L	1.0	0.065	1	12/05/18 10:24	12/05/18 15:55	7440-38-2	
Cadmium	**0.039J**	ug/L	0.50	0.033	1	12/05/18 10:24	12/05/18 15:55	7440-43-9	
Chromium	**0.17J**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 15:55	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/05/18 10:24	12/05/18 15:55	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/05/18 10:24	12/05/18 15:55	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:21	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**387**	mg/L	20.0	4.9	1		12/03/18 16:40		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**404**	mg/L	5.0	5.0	1		11/26/18 09:09		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**6.5**	mg/L	0.050		1		12/06/18 16:38	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**1.9**	mg/L	0.20	0.012	1		11/21/18 15:54		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**21.3**	mg/L	2.0	0.58	2		12/07/18 15:24	16887-00-6	
Fluoride	**0.30**	mg/L	0.20	0.19	1		12/07/18 15:10	16984-48-8	
Sulfate	**<0.24**	mg/L	1.0	0.24	1		12/07/18 15:10	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**0.58**	mg/L	0.10	0.050	1		11/28/18 11:48	7723-14-0	

ANALYTICAL RESULTS

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Sample: M-NE-DUP-1 **Lab ID: 60287289004** Collected: 11/20/18 13:05 Received: 11/21/18 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**383**	ug/L	5.0	1.5	1	12/04/18 12:45	12/05/18 13:52	7440-39-3	
Beryllium	**<0.16**	ug/L	1.0	0.16	1	12/04/18 12:45	12/05/18 13:52	7440-41-7	
Boron	**625**	ug/L	100	12.5	1	12/04/18 12:45	12/05/18 13:52	7440-42-8	
Calcium	**76100**	ug/L	200	53.5	1	12/04/18 12:45	12/05/18 13:52	7440-70-2	
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/04/18 12:45	12/05/18 13:52	7440-48-4	
Iron	**8380**	ug/L	50.0	6.1	1	12/04/18 12:45	12/05/18 13:52	7439-89-6	
Lead	**<3.0**	ug/L	10.0	3.0	1	12/04/18 12:45	12/05/18 13:52	7439-92-1	
Lithium	**16.1**	ug/L	10.0	4.6	1	12/04/18 12:45	12/05/18 14:47	7439-93-2	
Magnesium	**31600**	ug/L	50.0	14.0	1	12/04/18 12:45	12/05/18 13:52	7439-95-4	
Manganese	**109**	ug/L	5.0	0.73	1	12/04/18 12:45	12/05/18 13:52	7439-96-5	
Molybdenum	**3.9J**	ug/L	20.0	0.90	1	12/04/18 12:45	12/05/18 13:52	7439-98-7	
Potassium	**3210**	ug/L	500	79.3	1	12/04/18 12:45	12/05/18 13:52	7440-09-7	
Sodium	**44400**	ug/L	500	157	1	12/04/18 12:45	12/05/18 13:52	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 15:57	7440-36-0	
Arsenic	**1.8**	ug/L	1.0	0.065	1	12/05/18 10:24	12/05/18 15:57	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/05/18 10:24	12/05/18 15:57	7440-43-9	
Chromium	**0.11J**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 15:57	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/05/18 10:24	12/05/18 15:57	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/05/18 10:24	12/05/18 15:57	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:23	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**387**	mg/L	20.0	4.9	1		12/03/18 16:45		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**388**	mg/L	5.0	5.0	1		11/26/18 09:09		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**8.0**	mg/L	0.050		1		12/06/18 16:38	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**0.40**	mg/L	0.20	0.012	1		11/21/18 15:55		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**21.3**	mg/L	5.0	1.4	5		12/07/18 15:52	16887-00-6	
Fluoride	**0.31**	mg/L	0.20	0.19	1		12/07/18 15:38	16984-48-8	
Sulfate	**<0.24**	mg/L	1.0	0.24	1		12/07/18 15:38	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**0.61**	mg/L	0.10	0.050	1		11/28/18 11:50	7723-14-0	

QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558279 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 60287289001, 60287289002, 60287289003, 60287289004

METHOD BLANK: 2290334 Matrix: Water
Associated Lab Samples: 60287289001, 60287289002, 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.090	0.20	0.090	12/05/18 10:53	

LABORATORY CONTROL SAMPLE: 2290335

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290336 2290337

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.090	5	5	4.8	4.8	95	96	75-125	1	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290338 2290339

Parameter	Units	60287289001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.090	5	5	4.9	4.9	97	98	75-125	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558137
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60287289001

METHOD BLANK: 2289783
Matrix: Water
Associated Lab Samples: 60287289001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.5	5.0	1.5	12/04/18 17:22	
Beryllium	ug/L	<0.16	1.0	0.16	12/04/18 17:22	
Boron	ug/L	<12.5	100	12.5	12/04/18 17:22	
Calcium	ug/L	54.6J	200	53.5	12/04/18 17:22	
Cobalt	ug/L	<0.87	5.0	0.87	12/04/18 17:22	
Iron	ug/L	<6.1	50.0	6.1	12/04/18 17:22	
Lead	ug/L	<3.0	10.0	3.0	12/04/18 17:22	
Lithium	ug/L	<4.6	10.0	4.6	12/04/18 17:22	
Magnesium	ug/L	<14.0	50.0	14.0	12/04/18 17:22	
Manganese	ug/L	<0.73	5.0	0.73	12/04/18 17:22	
Molybdenum	ug/L	<0.90	20.0	0.90	12/04/18 17:22	
Potassium	ug/L	<79.3	500	79.3	12/04/18 17:22	
Sodium	ug/L	<157	500	157	12/04/18 17:22	

LABORATORY CONTROL SAMPLE: 2289784

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	951	95	85-115	
Beryllium	ug/L	1000	951	95	85-115	
Boron	ug/L	1000	952	95	85-115	
Calcium	ug/L	10000	9540	95	85-115	
Cobalt	ug/L	1000	990	99	85-115	
Iron	ug/L	10000	9260	93	85-115	
Lead	ug/L	1000	961	96	85-115	
Lithium	ug/L	1000	940	94	85-115	
Magnesium	ug/L	10000	9620	96	85-115	
Manganese	ug/L	1000	961	96	85-115	
Molybdenum	ug/L	1000	976	98	85-115	
Potassium	ug/L	10000	9540	95	85-115	
Sodium	ug/L	10000	9810	98	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2289785 2289786

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	147	1000	1000	1120	1080	98	94	70-130	3	20	
Beryllium	ug/L	<0.16	1000	1000	974	946	97	95	70-130	3	20	
Boron	ug/L	1980	1000	1000	2990	2860	101	88	70-130	5	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2289785 2289786

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	190000	10000	10000	203000	194000	132	43	70-130	4	20	M1
Cobalt	ug/L	<0.87	1000	1000	973	946	97	95	70-130	3	20	
Iron	ug/L	16300	10000	10000	25800	24800	96	85	70-130	4	20	
Lead	ug/L	<3.0	1000	1000	944	918	94	92	70-130	3	20	
Lithium	ug/L	36.0	1000	1000	1010	976	98	94	70-130	4	20	
Magnesium	ug/L	47700	10000	10000	57900	55200	102	75	70-130	5	20	
Manganese	ug/L	704	1000	1000	1680	1610	97	91	70-130	4	20	
Molybdenum	ug/L	4.3J	1000	1000	1010	974	100	97	70-130	3	20	
Potassium	ug/L	7780	10000	10000	17800	17100	100	94	70-130	4	20	
Sodium	ug/L	49000	10000	10000	59800	57400	109	85	70-130	4	20	

MATRIX SPIKE SAMPLE: 2289787

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	58.8	1000	1020	97	70-130	
Beryllium	ug/L	<0.16	1000	963	96	70-130	
Boron	ug/L	2550	1000	3510	96	70-130	
Calcium	ug/L	217000	10000	222000	44	70-130	M1
Cobalt	ug/L	<0.87	1000	965	96	70-130	
Iron	ug/L	15900	10000	24800	89	70-130	
Lead	ug/L	<3.0	1000	932	93	70-130	
Lithium	ug/L	42.7	1000	1000	96	70-130	
Magnesium	ug/L	56200	10000	65000	88	70-130	
Manganese	ug/L	578	1000	1530	95	70-130	
Molybdenum	ug/L	6.2J	1000	1000	100	70-130	
Potassium	ug/L	7890	10000	17700	98	70-130	
Sodium	ug/L	167000	10000	173000	62	70-130	M1

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558212 Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60287289002, 60287289003, 60287289004

METHOD BLANK: 2290148 Matrix: Water
Associated Lab Samples: 60287289002, 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.5	5.0	1.5	12/05/18 13:33	
Beryllium	ug/L	<0.16	1.0	0.16	12/05/18 13:33	
Boron	ug/L	<12.5	100	12.5	12/05/18 13:33	
Calcium	ug/L	<53.5	200	53.5	12/05/18 13:33	
Cobalt	ug/L	0.98J	5.0	0.87	12/05/18 13:33	
Iron	ug/L	<6.1	50.0	6.1	12/05/18 13:33	
Lead	ug/L	<3.0	10.0	3.0	12/05/18 13:33	
Lithium	ug/L	<4.6	10.0	4.6	12/05/18 14:28	
Magnesium	ug/L	<14.0	50.0	14.0	12/05/18 13:33	
Manganese	ug/L	<0.73	5.0	0.73	12/05/18 13:33	
Molybdenum	ug/L	<0.90	20.0	0.90	12/05/18 13:33	
Potassium	ug/L	<79.3	500	79.3	12/05/18 13:33	
Sodium	ug/L	<157	500	157	12/05/18 13:33	

LABORATORY CONTROL SAMPLE: 2290149

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	1010	101	85-115	
Beryllium	ug/L	1000	1010	101	85-115	
Boron	ug/L	1000	985	98	85-115	
Calcium	ug/L	10000	10000	100	85-115	
Cobalt	ug/L	1000	1000	100	85-115	
Iron	ug/L	10000	9940	99	85-115	
Lead	ug/L	1000	974	97	85-115	
Lithium	ug/L	1000	919	92	85-115	
Magnesium	ug/L	10000	10000	100	85-115	
Manganese	ug/L	1000	996	100	85-115	
Molybdenum	ug/L	1000	1010	101	85-115	
Potassium	ug/L	10000	10100	101	85-115	
Sodium	ug/L	10000	10400	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290150 2290151

Parameter	Units	60287289003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	386	1000	1000	1380	1370	100	99	70-130	1	20	
Beryllium	ug/L	<0.16	1000	1000	1040	1030	104	103	70-130	1	20	
Boron	ug/L	640	1000	1000	1610	1640	97	100	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290150 2290151

Parameter	Units	60287289003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	77100	10000	10000	86200	85000	91	80	70-130	1	20	
Cobalt	ug/L	<0.87	1000	1000	973	987	97	99	70-130	1	20	
Iron	ug/L	8420	10000	10000	17900	17700	95	93	70-130	1	20	
Lead	ug/L	4.1J	1000	1000	944	950	94	95	70-130	1	20	
Lithium	ug/L	17.2	1000	1000	923	911	91	89	70-130	1	20	
Magnesium	ug/L	31300	10000	10000	41200	41500	98	102	70-130	1	20	
Manganese	ug/L	110	1000	1000	1110	1120	100	101	70-130	1	20	
Molybdenum	ug/L	3.1J	1000	1000	1020	1030	101	103	70-130	1	20	
Potassium	ug/L	3160	10000	10000	13600	13500	105	103	70-130	1	20	
Sodium	ug/L	44900	10000	10000	54600	54300	98	94	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558139
Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2289794
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	12/04/18 12:25	
Arsenic	ug/L	<0.065	1.0	0.065	12/04/18 12:25	
Cadmium	ug/L	<0.033	0.50	0.033	12/04/18 12:25	
Chromium	ug/L	<0.078	1.0	0.078	12/04/18 12:25	
Selenium	ug/L	<0.085	1.0	0.085	12/04/18 12:25	
Thallium	ug/L	<0.099	1.0	0.099	12/04/18 12:25	

LABORATORY CONTROL SAMPLE: 2289795

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	39.3	98	85-115	
Arsenic	ug/L	40	39.5	99	85-115	
Cadmium	ug/L	40	39.2	98	85-115	
Chromium	ug/L	40	39.8	99	85-115	
Selenium	ug/L	40	39.3	98	85-115	
Thallium	ug/L	40	37.8	94	85-115	

MATRIX SPIKE SAMPLE: 2289796

Parameter	Units	60287288010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	39.8	100	70-130	
Arsenic	ug/L	11.7	40	51.8	100	70-130	
Cadmium	ug/L	<0.033	40	38.1	95	70-130	
Chromium	ug/L	0.23J	40	43.8	109	70-130	
Selenium	ug/L	<0.085	40	37.7	94	70-130	
Thallium	ug/L	<0.099	40	39.3	98	70-130	

MATRIX SPIKE SAMPLE: 2289797

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	39.4	99	70-130	
Arsenic	ug/L	3.8	40	43.6	99	70-130	
Cadmium	ug/L	<0.033	40	37.1	93	70-130	
Chromium	ug/L	0.17J	40	42.2	105	70-130	
Selenium	ug/L	<0.085	40	37.1	93	70-130	
Thallium	ug/L	<0.099	40	39.9	100	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558318
Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60287289003, 60287289004

METHOD BLANK: 2290488
Matrix: Water
Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	12/05/18 15:42	
Arsenic	ug/L	<0.065	1.0	0.065	12/05/18 15:42	
Cadmium	ug/L	<0.033	0.50	0.033	12/05/18 15:42	
Chromium	ug/L	<0.078	1.0	0.078	12/05/18 15:42	
Selenium	ug/L	<0.085	1.0	0.085	12/05/18 15:42	
Thallium	ug/L	<0.099	1.0	0.099	12/05/18 15:42	

LABORATORY CONTROL SAMPLE: 2290489

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.7	97	85-115	
Arsenic	ug/L	40	37.9	95	85-115	
Cadmium	ug/L	40	38.4	96	85-115	
Chromium	ug/L	40	38.8	97	85-115	
Selenium	ug/L	40	38.2	95	85-115	
Thallium	ug/L	40	37.0	92	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290490 2290491

Parameter	Units	60287167001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	0.20J	40	40	38.1	38.3	95	95	70-130	1	20	
Arsenic	ug/L	1.0	40	40	38.5	38.3	94	93	70-130	1	20	
Cadmium	ug/L	0.38J	40	40	36.7	36.7	91	91	70-130	0	20	
Chromium	ug/L	<0.078	40	40	37.7	37.7	94	94	70-130	0	20	
Selenium	ug/L	0.12J	40	40	35.5	35.6	88	89	70-130	0	20	
Thallium	ug/L	<0.099	40	40	38.4	38.5	96	96	70-130	0	20	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 557524
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2287246
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<4.9	20.0	4.9	11/29/18 13:19	

LABORATORY CONTROL SAMPLE: 2287247

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	501	100	90-110	

SAMPLE DUPLICATE: 2287252

Parameter	Units	60287288010 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	525	543	3	10	

SAMPLE DUPLICATE: 2287253

Parameter	Units	60287289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	403	406	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 557603
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60287289003, 60287289004

METHOD BLANK: 2287625
Matrix: Water
Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<4.9	20.0	4.9	12/03/18 16:29	

LABORATORY CONTROL SAMPLE: 2287626

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	484	97	90-110	

SAMPLE DUPLICATE: 2287630

Parameter	Units	60287288017 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	394	396	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 556373
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2282777
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/21/18 14:47	

LABORATORY CONTROL SAMPLE: 2282778

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	965	96	80-120	

SAMPLE DUPLICATE: 2282781

Parameter	Units	60287081003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	505	510	1	10	

SAMPLE DUPLICATE: 2282799

Parameter	Units	60287289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1450	1450	0	10	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 556732
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60287289003, 60287289004

METHOD BLANK: 2284609
Matrix: Water
Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/26/18 09:06	

LABORATORY CONTROL SAMPLE: 2284610

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	983	98	80-120	

SAMPLE DUPLICATE: 2284611

Parameter	Units	60287327002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1010	971	4	10	

SAMPLE DUPLICATE: 2284612

Parameter	Units	60287289004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	388	404	4	10	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 556509
Analysis Method: SM 3500-Fe B#4
QC Batch Method: SM 3500-Fe B#4
Analysis Description: Iron, Ferrous
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2283283
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Iron, Ferrous	mg/L	<0.012	0.20	0.012	11/21/18 12:09	H6

LABORATORY CONTROL SAMPLE: 2283284

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Ferrous	mg/L	2	2.0	100	90-110	H6

SAMPLE DUPLICATE: 2283286

Parameter	Units	60287289002 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	<0.012	<0.012		20	H6

SAMPLE DUPLICATE: 2283287

Parameter	Units	60287289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	2.1	2.1	2	20	H6

SAMPLE DUPLICATE: 2283288

Parameter	Units	60287288010 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	2.4	2.5	4	20	H6

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QUALITY CONTROL DATA

Project:	AMEREN MEC N&E, 153-1406.0004C
Pace Project No.:	60287289

QC Batch:	556555	Analysis Method:	SM 3500-Fe B#4
QC Batch Method:	SM 3500-Fe B#4	Analysis Description:	Iron, Ferrous

Associated Lab Samples: 60287289003, 60287289004

METHOD BLANK: 2283493 Matrix: Water

Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Iron, Ferrous	mg/L	<0.012	0.20	0.012	11/21/18 15:26	H6

LABORATORY CONTROL SAMPLE: 2283494

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Ferrous	mg/L	2	2.0	100	90-110	H6

SAMPLE DUPLICATE: 2283495

Parameter	Units	60287288006 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	<0.012	<0.012		20	H6

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 558974
QC Batch Method: EPA 300.0
Associated Lab Samples: 60287289003, 60287289004

Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions

METHOD BLANK: 2293702
Matrix: Water
Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.29	1.0	0.29	12/07/18 13:53	
Fluoride	mg/L	<0.19	0.20	0.19	12/07/18 13:53	
Sulfate	mg/L	<0.24	1.0	0.24	12/07/18 13:53	

LABORATORY CONTROL SAMPLE: 2293703

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.5	90	90-110	
Fluoride	mg/L	2.5	2.4	94	90-110	
Sulfate	mg/L	5	4.8	96	90-110	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 559127
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2294915
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	0.34J	1.0	0.29	12/09/18 15:07	
Fluoride	mg/L	<0.19	0.20	0.19	12/09/18 15:07	
Sulfate	mg/L	<0.24	1.0	0.24	12/09/18 15:07	

LABORATORY CONTROL SAMPLE: 2294916

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.6	92	90-110	
Fluoride	mg/L	2.5	2.4	97	90-110	
Sulfate	mg/L	5	4.8	95	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2294917 2294918

Parameter	Units	60287289001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Fluoride	mg/L	0.36	2.5	2.5	2.7	2.8	94	96	90-110	1	15	

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 559201
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60287289001

METHOD BLANK: 2295155
Matrix: Water
Associated Lab Samples: 60287289001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.29	1.0	0.29	12/10/18 08:43	
Sulfate	mg/L	<0.24	1.0	0.24	12/10/18 08:43	

LABORATORY CONTROL SAMPLE: 2295156

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	90-110	
Sulfate	mg/L	5	5.1	103	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2295157 2295158

Parameter	Units	60287044033 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	10.6	5	5	12.7	14.4	44	76	90-110	12	15	M1

MATRIX SPIKE SAMPLE: 2295159

Parameter	Units	60287044038 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	88.2	250	461	149	90-110	M1
Sulfate	mg/L	29.0	250	698	267	90-110	M1

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QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 556707
QC Batch Method: EPA 365.4
Analysis Method: EPA 365.4
Analysis Description: 365.4 Phosphorus
Associated Lab Samples: 60287289001, 60287289002

METHOD BLANK: 2284390
Matrix: Water
Associated Lab Samples: 60287289001, 60287289002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Phosphorus	mg/L	<0.050	0.10	0.050	11/26/18 13:42	

LABORATORY CONTROL SAMPLE: 2284391

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	2	1.9	95	90-110	

MATRIX SPIKE SAMPLE: 2284393

Parameter	Units	60287288010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.69	2	2.5	91	90-110	

MATRIX SPIKE SAMPLE: 2284394

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.68	2	2.5	91	90-110	

SAMPLE DUPLICATE: 2284392

Parameter	Units	60287443001 Result	Dup Result	RPD	Max RPD	Qualifiers
Phosphorus	mg/L	1.4	1.4	3	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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without the written consent of Pace Analytical Services, LLC.

QUALITY CONTROL DATA

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

QC Batch: 557188
QC Batch Method: EPA 365.4
Analysis Method: EPA 365.4
Analysis Description: 365.4 Phosphorus
Associated Lab Samples: 60287289003, 60287289004

METHOD BLANK: 2285943
Matrix: Water
Associated Lab Samples: 60287289003, 60287289004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Phosphorus	mg/L	<0.050	0.10	0.050	11/28/18 11:17	

LABORATORY CONTROL SAMPLE: 2285944

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	2	1.9	96	90-110	

MATRIX SPIKE SAMPLE: 2285945

Parameter	Units	60285327001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	8.8	2	15.6	341	90-110	M1

MATRIX SPIKE SAMPLE: 2285947

Parameter	Units	60287428005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.50	2	2.4	96	90-110	

SAMPLE DUPLICATE: 2285946

Parameter	Units	60287380002 Result	Dup Result	RPD	Max RPD	Qualifiers
Phosphorus	mg/L	9.2	9.7	6	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MEC N&E, 153-1406.0004C
Pace Project No.:	60287289

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MEC N&E, 153-1406.0004C
Pace Project No.: 60287289

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60287289001	**M-TP-2**	EPA 200.7	558137	EPA 200.7	558173
60287289002	**M-NE-FB-1**	EPA 200.7	558212	EPA 200.7	558388
60287289003	**M-TP-1**	EPA 200.7	558212	EPA 200.7	558388
60287289004	**M-NE-DUP-1**	EPA 200.7	558212	EPA 200.7	558388
60287289001	**M-TP-2**	EPA 200.8	558139	EPA 200.8	558167
60287289002	**M-NE-FB-1**	EPA 200.8	558139	EPA 200.8	558167
60287289003	**M-TP-1**	EPA 200.8	558318	EPA 200.8	558523
60287289004	**M-NE-DUP-1**	EPA 200.8	558318	EPA 200.8	558523
60287289001	**M-TP-2**	EPA 7470	558279	EPA 7470	558376
60287289002	**M-NE-FB-1**	EPA 7470	558279	EPA 7470	558376
60287289003	**M-TP-1**	EPA 7470	558279	EPA 7470	558376
60287289004	**M-NE-DUP-1**	EPA 7470	558279	EPA 7470	558376
60287289001	**M-TP-2**	SM 2320B	557524		
60287289002	**M-NE-FB-1**	SM 2320B	557524		
60287289003	**M-TP-1**	SM 2320B	557603		
60287289004	**M-NE-DUP-1**	SM 2320B	557603		
60287289001	**M-TP-2**	SM 2540C	556373		
60287289002	**M-NE-FB-1**	SM 2540C	556373		
60287289003	**M-TP-1**	SM 2540C	556732		
60287289004	**M-NE-DUP-1**	SM 2540C	556732		
60287289001	**M-TP-2**	SM 3500-Fe B#4	558862		
60287289002	**M-NE-FB-1**	SM 3500-Fe B#4	558862		
60287289003	**M-TP-1**	SM 3500-Fe B#4	558862		
60287289004	**M-NE-DUP-1**	SM 3500-Fe B#4	558862		
60287289001	**M-TP-2**	SM 3500-Fe B#4	556509		
60287289002	**M-NE-FB-1**	SM 3500-Fe B#4	556509		
60287289003	**M-TP-1**	SM 3500-Fe B#4	556555		
60287289004	**M-NE-DUP-1**	SM 3500-Fe B#4	556555		
60287289001	**M-TP-2**	EPA 300.0	559127		
60287289001	**M-TP-2**	EPA 300.0	559201		
60287289002	**M-NE-FB-1**	EPA 300.0	559127		
60287289003	**M-TP-1**	EPA 300.0	558974		
60287289004	**M-NE-DUP-1**	EPA 300.0	558974		
60287289001	**M-TP-2**	EPA 365.4	556707		
60287289002	**M-NE-FB-1**	EPA 365.4	556707		
60287289003	**M-TP-1**	EPA 365.4	557188		
60287289004	**M-NE-DUP-1**	EPA 365.4	557188		

WO#: 60287289

60287289

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Sample Condition Upon Receipt

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☒ Other ☐

Thermometer Used: 301 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 4.0 **Corr. Factor** ±0.0 **Corrected** 4.0

Date and initials of person examining contents: JB 11/20 JLS

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	Fe2+
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO$_3$, H$_2$SO$_4$, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jamie Church Date: 11/20/18

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page: 1 of 1

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	maddock@golder.com
Phone:	636-724-9191
Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center MEC N&E
Project Number:	153-1406.0004C (COC #23)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / -)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other
1	M-TP-1	WT	G														
2	(6)BP2U (3)BP3S 2- M-TP-2 (3)BP3N 2-	WT	G			11/15/18	1135		12	6	3	3					
3	M-NE-DUP-1	WT	G														
4	(7)BP2U BP3S 2- M-NE-FB-1 BP3N 2-	WT	G			11/15/18	1130		4	2	1	1					
5		WT	G														
6		WT	G														
7		WT	G														
8		WT	G														
9		WT	G														
10		WT	G														
11		WT	G														
12		WT	G														

Requested Analysis Filtered (Y/N)

ITEM #	Analysis Test ↓	Metals*	Mercury	Chloride/Fluoride/Sulfate	Alkalinity	TDS	Total Phosphorus	Ferros Iron	Ferric Iron	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
	Y/N →	N	N	N	N	N	N	N	N		60287289
1											
2		✓	✓	✓	✓	✓	✓	✓	✓		MS/MSD @ TP-2 001
3											
4		✓	✓	✓	✓	✓	✓	✓	✓		002
5											
6											
7											
8											
9											
10											
11											
12											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	Golder /	11/19/18	1610		11/20	0415	4.0	Y	Y	Y
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl										

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: Eric Schneider

DATE Signed (MM/DD/YY): 11/19/18

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

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Sample Condition Upon Receipt

WO# : 60287289

60287289

Client Name: Golder Associates

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Zplc

Thermometer Used: T300 Type of Ice: [✓ Wet] Blue None

Cooler Temperature (°C): As-read 0.8 Corr. Factor +0.2 Corrected 1.0

Date and initials of person examining contents: JLG 11-21-18 47

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	Fe+2
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: ______ Date: 11/21/18

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www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	maddock@golder.com
Phone: 636-724-9191	Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center MEC N&E
Project Number:	153-1406.0004C (COC #23)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Mercury	Chloride/Fluoride/Sulfate	Alkalinity	TDS	Total Phosphorus	Ferros Iron	Ferric Iron					Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60287289
																			N	N	N	N	N	N	N	N						
1	M-TP-1	WT	G			11/20/18	1305		4	2	1	1							✓	✓	✓	✓	✓	✓	✓	✓	2BP2U, BP3S, BP3N					003
2	M-TP-2	WT	G																													
3	M-NE-DUP-1	WT	G			11/20/18	—		4	2	1	1							✓	✓	✓	✓	✓	✓	✓	✓	2BP2U, BP3S, BP3N					004
4	M-NE-FB-1	WT	G																													
5		WT	G																													
6		WT	G																													
7		WT	G																													
8		WT	G																													
9		WT	G																													
10		WT	G																													
11		WT	G																													
12		WT	G																													

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	/ Golder	11/20/18	1640	/ PACE	11/20/18	1640				
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl	/ PACE	11/20/18	1720	[illegible]	11/2/18	0530	1.0	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 11/2018

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

GOLDER

MEMORANDUM

DATE January 7, 2019 **Project No.** 1531406

TO Project File
Golder Associates

CC

FROM Tommy Goodwin **EMAIL tgoodwin@golder.com**

DATA VALIDATION SUMMARY: AMEREN – MERAMEC ENERGY CENTER – NOVEMBER 2018 – N&E – DATA PACKAGE 60287289

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- Analysis of Ferrous Iron for all samples was initiated outside of the 15-minute EPA required holding time, the detections in samples were qualified as estimates (J) or non-detect and estimates (UJ).
- When analytes exceeded the recovery criteria for MS/MSD of a sample, the sample result was not qualified on MS/MSD data alone.
- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field, rinsate), and the sample results were greater than the MDL and less than the PQL the results were recorded at the PQL value and qualified as non-detects (U). When a compound was detected in a blank (i.e. method, field, rinsate), and the sample results were greater than the PQL and less than ten times the blank results the results were recorded at the result value and qualified as estimates (J).
- When a sample or field duplicate RPD was not met, associated samples were qualified as estimates (J). If the results were less than the MDL (MDC for radionuclide analysis) or detected in a blank below the PQL the results were qualified as non-detects and estimates (UJ).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren - MEC - Nov 2018 - N+E
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 1531406
Validation Date: 1/7/19

Laboratory: Pace Analytical
SDG #: 60287289
Analytical Method (type and no.): Metals(200.7+200.8), Hg(7470), Alk(2320B), TDS(2540C), Fe(3500), Anions(300.0), P(365.4)
Matrix: ☐ Air ☐ Soil/Sed. ☒ Water ☐ Waste ☐
Sample Names M-TP-2, M-NE-FB-1, M-TP-1, M-NE-DUP-1

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	11/19 - 11/20/18
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated (grab/composite)?	☒	☐	☐	Grab
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Cond, Turb, Temp, DO, ORP, Flow, DTW
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☐	☐	☒	
b) Were hold times met for sample analysis?	☐	☒	☐	Fe^{2+}
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☐	☐	☐	
g) Were any matrix problems noted?	☐	☐	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☑	☐	☐	[9001] Ca(54.6), [9001-02] Cl^-(0.34)
b) Were analytes detected in the field blank(s)?	☑	☐	☐	[9002-04] Co(0.98),
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	FB#1: Be(0.25), B(12.5), Cd(0.065), Cr(0.16), TDS(60), Cl(0.
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☑	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	☒	☐	☐	Dup-1@ M-TP-1 FB-1@ M-TP-2
b) Were field dup. precision criteria met (note RPD)?	☐	☑	☐	DUP-1: Pb(200), Mo(23), Cr(43), Fe^{3+}(21), Fe^{2+}(130)
c) Were lab duplicates analyzed (note original and duplicate samples)?	☒	☐	☐	
d) Were lab dup. precision criteria met (note RPD)?	☑	☐	☐	

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☐	☒	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☑	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☑	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☑	☐	☐	

Comments/Notes:

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-TP-2	Chromium (Cr)	1.0	U	Detected in Field Blank (FB); MDL < Result < PQL
⊥	Ferrous Iron (Fe^{2+})	2.1	J	Analyzed outside EPA Hold time; Result > MDL
M-NE-FB-1	⊥	0.012	UJ	⊥ ; Result < MDL
⊥	Chloride (Cl^-)	1.0	U	MB; MDL < Result < PQL
M-TP-1	Fe^{2+}	1.9	J	Hold time; Result > MDL
⊥	Ferric Iron (Fe^{3+})	6.5	J	RPD exceeded limit; Result > MDL
M-NE-DUP-1	⊥	8.0	J	⊥ ⊥
⊥	Lead (Pb)	3.0	UJ	⊥ ; Result < MDL

Signature:

Date: 1/9/19

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

December 28, 2018

Mark Haddock
Golder Associates
820 S. Main St
Suite 100
Saint Charles, MO 63301

RE: Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Dear Mark Haddock:

Enclosed are the analytical results for sample(s) received by the laboratory between November 20, 2018 and November 21, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Jeffrey Ingram, Golder Associates
Eric Schneider, Golder Associates

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CERTIFICATIONS

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Arkansas Drinking Water
Missouri Certification Number: 10090
WY STR Certification #: 2456.01
Arkansas Certification #: 18-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116 / E10426
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070
Missouri Certification Number: 10090

SAMPLE SUMMARY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60287288010	**M-AMW-2**	Water	11/19/18 09:55	11/20/18 04:15
60287288015	**M-AMW-2 MS**	Water	11/19/18 09:55	11/20/18 04:15
60287288016	**M-AMW-2 MSD**	Water	11/19/18 09:55	11/20/18 04:15
60287288018	**M-AMW-1**	Water	11/20/18 12:10	11/21/18 03:30

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60287288010	**M-AMW-2**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2320B	RLG	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K
60287288015	**M-AMW-2 MS**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
60287288016	**M-AMW-2 MSD**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
60287288018	**M-AMW-1**	EPA 200.7	EMR, JGP	13	PASI-K
		EPA 200.8	JDH	6	PASI-K
		EPA 7470	JDE	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	RMT	1	PASI-K
		SM 2540C	RLG	1	PASI-K
		SM 3500-Fe B#4	LDB	1	PASI-K
		SM 3500-Fe B#4	RMT	1	PASI-K
		EPA 300.0	WNM	3	PASI-K
		EPA 365.4	BLA	1	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Sample: M-AMW-2 **Lab ID: 60287288010** Collected: 11/19/18 09:55 Received: 11/20/18 04:15 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**147**	ug/L	5.0	1.5	1	12/03/18 16:08	12/04/18 17:51	7440-39-3	
Beryllium	**<0.16**	ug/L	1.0	0.16	1	12/03/18 16:08	12/04/18 17:51	7440-41-7	
Boron	**1980**	ug/L	100	12.5	1	12/03/18 16:08	12/04/18 17:51	7440-42-8	
Calcium	**190000**	ug/L	200	53.5	1	12/03/18 16:08	12/04/18 17:51	7440-70-2	M1
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/03/18 16:08	12/04/18 17:51	7440-48-4	
Iron	**16300**	ug/L	50.0	6.1	1	12/03/18 16:08	12/04/18 17:51	7439-89-6	
Lead	**<3.0**	ug/L	10.0	3.0	1	12/03/18 16:08	12/04/18 17:51	7439-92-1	
Lithium	**36.0**	ug/L	10.0	4.6	1	12/03/18 16:08	12/04/18 17:51	7439-93-2	
Magnesium	**47700**	ug/L	50.0	14.0	1	12/03/18 16:08	12/04/18 17:51	7439-95-4	
Manganese	**704**	ug/L	5.0	0.73	1	12/03/18 16:08	12/04/18 17:51	7439-96-5	
Molybdenum	**4.3J**	ug/L	20.0	0.90	1	12/03/18 16:08	12/04/18 17:51	7439-98-7	
Potassium	**7780**	ug/L	500	79.3	1	12/03/18 16:08	12/04/18 17:51	7440-09-7	
Sodium	**49000**	ug/L	500	157	1	12/03/18 16:08	12/04/18 17:51	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 12:46	7440-36-0	
Arsenic	**11.7**	ug/L	1.0	0.065	1	12/03/18 15:40	12/04/18 12:46	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/03/18 15:40	12/04/18 12:46	7440-43-9	
Chromium	**0.23J**	ug/L	1.0	0.078	1	12/03/18 15:40	12/04/18 12:46	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/03/18 15:40	12/04/18 12:46	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/03/18 15:40	12/04/18 12:46	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:02	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**525**	mg/L	20.0	4.9	1		11/29/18 14:46		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**941**	mg/L	5.0	5.0	1		11/26/18 09:06		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**13.9**	mg/L	0.050		1		12/06/18 16:38	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**2.4**	mg/L	0.20	0.012	1		11/21/18 12:14		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**63.1**	mg/L	20.0	5.8	20		12/12/18 21:22	16887-00-6	B
Fluoride	**0.30**	mg/L	0.20	0.19	1		12/12/18 20:50	16984-48-8	M1
Sulfate	**200**	mg/L	20.0	4.8	20		12/12/18 21:22	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**0.69**	mg/L	0.10	0.050	1		11/26/18 14:07	7723-14-0	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Sample: M-AMW-1 **Lab ID: 60287288018** Collected: 11/20/18 12:10 Received: 11/21/18 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**325**	ug/L	5.0	1.5	1	12/04/18 12:45	12/05/18 14:03	7440-39-3	
Beryllium	**<0.16**	ug/L	1.0	0.16	1	12/04/18 12:45	12/05/18 14:03	7440-41-7	
Boron	**7690**	ug/L	100	12.5	1	12/04/18 12:45	12/05/18 14:03	7440-42-8	
Calcium	**170000**	ug/L	200	53.5	1	12/04/18 12:45	12/05/18 14:03	7440-70-2	
Cobalt	**<0.87**	ug/L	5.0	0.87	1	12/04/18 12:45	12/05/18 14:03	7440-48-4	
Iron	**19400**	ug/L	50.0	6.1	1	12/04/18 12:45	12/05/18 14:03	7439-89-6	
Lead	**<3.0**	ug/L	10.0	3.0	1	12/04/18 12:45	12/05/18 14:03	7439-92-1	
Lithium	**16.4**	ug/L	10.0	4.6	1	12/04/18 12:45	12/05/18 14:58	7439-93-2	
Magnesium	**56900**	ug/L	50.0	14.0	1	12/04/18 12:45	12/05/18 14:03	7439-95-4	
Manganese	**513**	ug/L	5.0	0.73	1	12/04/18 12:45	12/05/18 14:03	7439-96-5	
Molybdenum	**39.1**	ug/L	20.0	0.90	1	12/04/18 12:45	12/05/18 14:03	7439-98-7	
Potassium	**5340**	ug/L	500	79.3	1	12/04/18 12:45	12/05/18 14:03	7440-09-7	
Sodium	**45400**	ug/L	500	157	1	12/04/18 12:45	12/05/18 14:03	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 16:03	7440-36-0	
Arsenic	**18.0**	ug/L	1.0	0.065	1	12/05/18 10:24	12/05/18 16:03	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/05/18 10:24	12/05/18 16:03	7440-43-9	
Chromium	**0.19J**	ug/L	1.0	0.078	1	12/05/18 10:24	12/05/18 16:03	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/05/18 10:24	12/05/18 16:03	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/05/18 10:24	12/05/18 16:03	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.090**	ug/L	0.20	0.090	1	12/04/18 14:50	12/05/18 11:30	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**365**	mg/L	20.0	4.9	1		12/03/18 17:02		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**319**	mg/L	5.0	5.0	1		11/26/18 09:09		
Iron, Ferric (Calculation)	Analytical Method: SM 3500-Fe B#4								
Iron, Ferric	**14.7**	mg/L	0.050		1		12/14/18 09:15	7439-89-6	
Iron, Ferrous	Analytical Method: SM 3500-Fe B#4								
Iron, Ferrous	**4.7**	mg/L	0.20	0.012	1		11/21/18 15:43		H6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**38.4**	mg/L	5.0	1.4	5		12/13/18 21:30	16887-00-6	
Fluoride	**0.19J**	mg/L	0.20	0.19	1		12/13/18 21:15	16984-48-8	
Sulfate	**344**	mg/L	50.0	12.0	50		12/14/18 12:41	14808-79-8	
365.4 Total Phosphorus	Analytical Method: EPA 365.4								
Phosphorus	**1.1**	mg/L	0.10	0.050	1		11/28/18 11:52	7723-14-0	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 558279
Analysis Method: EPA 7470
QC Batch Method: EPA 7470
Analysis Description: 7470 Mercury
Associated Lab Samples: 60287288010, 60287288018

METHOD BLANK: 2290334
Matrix: Water
Associated Lab Samples: 60287288010, 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.090	0.20	0.090	12/05/18 10:53	

LABORATORY CONTROL SAMPLE: 2290335

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290336 2290337

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.090	5	5	4.8	4.8	95	96	75-125	1	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290338 2290339

Parameter	Units	60287289001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.090	5	5	4.9	4.9	97	98	75-125	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 558137
QC Batch Method: EPA 200.7
Associated Lab Samples: 60287288010

Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Total

METHOD BLANK: 2289783
Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.5	5.0	1.5	12/04/18 17:22	
Beryllium	ug/L	<0.16	1.0	0.16	12/04/18 17:22	
Boron	ug/L	<12.5	100	12.5	12/04/18 17:22	
Calcium	ug/L	54.6J	200	53.5	12/04/18 17:22	
Cobalt	ug/L	<0.87	5.0	0.87	12/04/18 17:22	
Iron	ug/L	<6.1	50.0	6.1	12/04/18 17:22	
Lead	ug/L	<3.0	10.0	3.0	12/04/18 17:22	
Lithium	ug/L	<4.6	10.0	4.6	12/04/18 17:22	
Magnesium	ug/L	<14.0	50.0	14.0	12/04/18 17:22	
Manganese	ug/L	<0.73	5.0	0.73	12/04/18 17:22	
Molybdenum	ug/L	<0.90	20.0	0.90	12/04/18 17:22	
Potassium	ug/L	<79.3	500	79.3	12/04/18 17:22	
Sodium	ug/L	<157	500	157	12/04/18 17:22	

LABORATORY CONTROL SAMPLE: 2289784

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	951	95	85-115	
Beryllium	ug/L	1000	951	95	85-115	
Boron	ug/L	1000	952	95	85-115	
Calcium	ug/L	10000	9540	95	85-115	
Cobalt	ug/L	1000	990	99	85-115	
Iron	ug/L	10000	9260	93	85-115	
Lead	ug/L	1000	961	96	85-115	
Lithium	ug/L	1000	940	94	85-115	
Magnesium	ug/L	10000	9620	96	85-115	
Manganese	ug/L	1000	961	96	85-115	
Molybdenum	ug/L	1000	976	98	85-115	
Potassium	ug/L	10000	9540	95	85-115	
Sodium	ug/L	10000	9810	98	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2289785 2289786

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	147	1000	1000	1120	1080	98	94	70-130	3	20	
Beryllium	ug/L	<0.16	1000	1000	974	946	97	95	70-130	3	20	
Boron	ug/L	1980	1000	1000	2990	2860	101	88	70-130	5	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2289785 2289786

Parameter	Units	60287288010 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	190000	10000	10000	203000	194000	132	43	70-130	4	20	M1
Cobalt	ug/L	<0.87	1000	1000	973	946	97	95	70-130	3	20	
Iron	ug/L	16300	10000	10000	25800	24800	96	85	70-130	4	20	
Lead	ug/L	<3.0	1000	1000	944	918	94	92	70-130	3	20	
Lithium	ug/L	36.0	1000	1000	1010	976	98	94	70-130	4	20	
Magnesium	ug/L	47700	10000	10000	57900	55200	102	75	70-130	5	20	
Manganese	ug/L	704	1000	1000	1680	1610	97	91	70-130	4	20	
Molybdenum	ug/L	4.3J	1000	1000	1010	974	100	97	70-130	3	20	
Potassium	ug/L	7780	10000	10000	17800	17100	100	94	70-130	4	20	
Sodium	ug/L	49000	10000	10000	59800	57400	109	85	70-130	4	20	

MATRIX SPIKE SAMPLE: 2289787

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	58.8	1000	1020	97	70-130	
Beryllium	ug/L	<0.16	1000	963	96	70-130	
Boron	ug/L	2550	1000	3510	96	70-130	
Calcium	ug/L	217000	10000	222000	44	70-130	M1
Cobalt	ug/L	<0.87	1000	965	96	70-130	
Iron	ug/L	15900	10000	24800	89	70-130	
Lead	ug/L	<3.0	1000	932	93	70-130	
Lithium	ug/L	42.7	1000	1000	96	70-130	
Magnesium	ug/L	56200	10000	65000	88	70-130	
Manganese	ug/L	578	1000	1530	95	70-130	
Molybdenum	ug/L	6.2J	1000	1000	100	70-130	
Potassium	ug/L	7890	10000	17700	98	70-130	
Sodium	ug/L	167000	10000	173000	62	70-130	M1

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 558212
Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60287288018

METHOD BLANK: 2290148
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.5	5.0	1.5	12/05/18 13:33	
Beryllium	ug/L	<0.16	1.0	0.16	12/05/18 13:33	
Boron	ug/L	<12.5	100	12.5	12/05/18 13:33	
Calcium	ug/L	<53.5	200	53.5	12/05/18 13:33	
Cobalt	ug/L	0.98J	5.0	0.87	12/05/18 13:33	
Iron	ug/L	<6.1	50.0	6.1	12/05/18 13:33	
Lead	ug/L	<3.0	10.0	3.0	12/05/18 13:33	
Lithium	ug/L	<4.6	10.0	4.6	12/05/18 14:28	
Magnesium	ug/L	<14.0	50.0	14.0	12/05/18 13:33	
Manganese	ug/L	<0.73	5.0	0.73	12/05/18 13:33	
Molybdenum	ug/L	<0.90	20.0	0.90	12/05/18 13:33	
Potassium	ug/L	<79.3	500	79.3	12/05/18 13:33	
Sodium	ug/L	<157	500	157	12/05/18 13:33	

LABORATORY CONTROL SAMPLE: 2290149

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	1010	101	85-115	
Beryllium	ug/L	1000	1010	101	85-115	
Boron	ug/L	1000	985	98	85-115	
Calcium	ug/L	10000	10000	100	85-115	
Cobalt	ug/L	1000	1000	100	85-115	
Iron	ug/L	10000	9940	99	85-115	
Lead	ug/L	1000	974	97	85-115	
Lithium	ug/L	1000	919	92	85-115	
Magnesium	ug/L	10000	10000	100	85-115	
Manganese	ug/L	1000	996	100	85-115	
Molybdenum	ug/L	1000	1010	101	85-115	
Potassium	ug/L	10000	10100	101	85-115	
Sodium	ug/L	10000	10400	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290150 2290151

Parameter	Units	60287289003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	386	1000	1000	1380	1370	100	99	70-130	1	20	
Beryllium	ug/L	<0.16	1000	1000	1040	1030	104	103	70-130	1	20	
Boron	ug/L	640	1000	1000	1610	1640	97	100	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290150 2290151

Parameter	Units	60287289003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	77100	10000	10000	86200	85000	91	80	70-130	1	20	
Cobalt	ug/L	<0.87	1000	1000	973	987	97	99	70-130	1	20	
Iron	ug/L	8420	10000	10000	17900	17700	95	93	70-130	1	20	
Lead	ug/L	4.1J	1000	1000	944	950	94	95	70-130	1	20	
Lithium	ug/L	17.2	1000	1000	923	911	91	89	70-130	1	20	
Magnesium	ug/L	31300	10000	10000	41200	41500	98	102	70-130	1	20	
Manganese	ug/L	110	1000	1000	1110	1120	100	101	70-130	1	20	
Molybdenum	ug/L	3.1J	1000	1000	1020	1030	101	103	70-130	1	20	
Potassium	ug/L	3160	10000	10000	13600	13500	105	103	70-130	1	20	
Sodium	ug/L	44900	10000	10000	54600	54300	98	94	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 558139 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 60287288010

METHOD BLANK: 2289794 Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	12/04/18 12:25	
Arsenic	ug/L	<0.065	1.0	0.065	12/04/18 12:25	
Cadmium	ug/L	<0.033	0.50	0.033	12/04/18 12:25	
Chromium	ug/L	<0.078	1.0	0.078	12/04/18 12:25	
Selenium	ug/L	<0.085	1.0	0.085	12/04/18 12:25	
Thallium	ug/L	<0.099	1.0	0.099	12/04/18 12:25	

LABORATORY CONTROL SAMPLE: 2289795

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	39.3	98	85-115	
Arsenic	ug/L	40	39.5	99	85-115	
Cadmium	ug/L	40	39.2	98	85-115	
Chromium	ug/L	40	39.8	99	85-115	
Selenium	ug/L	40	39.3	98	85-115	
Thallium	ug/L	40	37.8	94	85-115	

MATRIX SPIKE SAMPLE: 2289796

Parameter	Units	60287288010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	39.8	100	70-130	
Arsenic	ug/L	11.7	40	51.8	100	70-130	
Cadmium	ug/L	<0.033	40	38.1	95	70-130	
Chromium	ug/L	0.23J	40	43.8	109	70-130	
Selenium	ug/L	<0.085	40	37.7	94	70-130	
Thallium	ug/L	<0.099	40	39.3	98	70-130	

MATRIX SPIKE SAMPLE: 2289797

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	39.4	99	70-130	
Arsenic	ug/L	3.8	40	43.6	99	70-130	
Cadmium	ug/L	<0.033	40	37.1	93	70-130	
Chromium	ug/L	0.17J	40	42.2	105	70-130	
Selenium	ug/L	<0.085	40	37.1	93	70-130	
Thallium	ug/L	<0.099	40	39.9	100	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 558318
Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60287288018

METHOD BLANK: 2290488
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	12/05/18 15:42	
Arsenic	ug/L	<0.065	1.0	0.065	12/05/18 15:42	
Cadmium	ug/L	<0.033	0.50	0.033	12/05/18 15:42	
Chromium	ug/L	<0.078	1.0	0.078	12/05/18 15:42	
Selenium	ug/L	<0.085	1.0	0.085	12/05/18 15:42	
Thallium	ug/L	<0.099	1.0	0.099	12/05/18 15:42	

LABORATORY CONTROL SAMPLE: 2290489

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.7	97	85-115	
Arsenic	ug/L	40	37.9	95	85-115	
Cadmium	ug/L	40	38.4	96	85-115	
Chromium	ug/L	40	38.8	97	85-115	
Selenium	ug/L	40	38.2	95	85-115	
Thallium	ug/L	40	37.0	92	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2290490 2290491

Parameter	Units	60287167001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	0.20J	40	40	38.1	38.3	95	95	70-130	1	20	
Arsenic	ug/L	1.0	40	40	38.5	38.3	94	93	70-130	1	20	
Cadmium	ug/L	0.38J	40	40	36.7	36.7	91	91	70-130	0	20	
Chromium	ug/L	<0.078	40	40	37.7	37.7	94	94	70-130	0	20	
Selenium	ug/L	0.12J	40	40	35.5	35.6	88	89	70-130	0	20	
Thallium	ug/L	<0.099	40	40	38.4	38.5	96	96	70-130	0	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 557524
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60287288010

METHOD BLANK: 2287246
Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<4.9	20.0	4.9	11/29/18 13:19	

LABORATORY CONTROL SAMPLE: 2287247

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	501	100	90-110	

SAMPLE DUPLICATE: 2287252

Parameter	Units	60287288010 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	525	543	3	10	

SAMPLE DUPLICATE: 2287253

Parameter	Units	60287289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	403	406	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 557603
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60287288018

METHOD BLANK: 2287625
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<4.9	20.0	4.9	12/03/18 16:29	

LABORATORY CONTROL SAMPLE: 2287626

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	484	97	90-110	

SAMPLE DUPLICATE: 2287630

Parameter	Units	60287288017 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	394	396	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 556629
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60287288010

METHOD BLANK: 2283821
Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/26/18 09:06	

LABORATORY CONTROL SAMPLE: 2283822

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	966	97	80-120	

SAMPLE DUPLICATE: 2283824

Parameter	Units	60287297001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	864	843	2	10	

SAMPLE DUPLICATE: 2283825

Parameter	Units	60287288010 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	941	947	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch:	556732	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids

Associated Lab Samples: 60287288018

METHOD BLANK: 2284609 Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/26/18 09:06	

LABORATORY CONTROL SAMPLE: 2284610

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	983	98	80-120	

SAMPLE DUPLICATE: 2284611

Parameter	Units	60287327002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1010	971	4	10	

SAMPLE DUPLICATE: 2284612

Parameter	Units	60287289004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	388	404	4	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 556509 Analysis Method: SM 3500-Fe B#4
QC Batch Method: SM 3500-Fe B#4 Analysis Description: Iron, Ferrous
Associated Lab Samples: 60287288010

METHOD BLANK: 2283283 Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Iron, Ferrous	mg/L	<0.012	0.20	0.012	11/21/18 12:09	H6

LABORATORY CONTROL SAMPLE: 2283284

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Ferrous	mg/L	2	2.0	100	90-110	H6

SAMPLE DUPLICATE: 2283286

Parameter	Units	60287289002 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	<0.012	<0.012		20	H6

SAMPLE DUPLICATE: 2283287

Parameter	Units	60287289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	2.1	2.1	2	20	H6

SAMPLE DUPLICATE: 2283288

Parameter	Units	60287288010 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	2.4	2.5	4	20	H6

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 556555
Analysis Method: SM 3500-Fe B#4
QC Batch Method: SM 3500-Fe B#4
Analysis Description: Iron, Ferrous
Associated Lab Samples: 60287288018

METHOD BLANK: 2283493
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Iron, Ferrous	mg/L	<0.012	0.20	0.012	11/21/18 15:26	H6

LABORATORY CONTROL SAMPLE: 2283494

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Ferrous	mg/L	2	2.0	100	90-110	H6

SAMPLE DUPLICATE: 2283495

Parameter	Units	60287288006 Result	Dup Result	RPD	Max RPD	Qualifiers
Iron, Ferrous	mg/L	<0.012	<0.012		20	H6

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QUALITY CONTROL DATA

Project:	AMEREN MERAMEC MEC / MEC N&E
Pace Project No.:	60290697

QC Batch:	559762	Analysis Method:	EPA 300.0
QC Batch Method:	EPA 300.0	Analysis Description:	300.0 IC Anions

Associated Lab Samples: 60287288010

METHOD BLANK: 2297044 Matrix: Water

Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	0.33J	1.0	0.29	12/12/18 14:28	
Fluoride	mg/L	<0.19	0.20	0.19	12/12/18 14:28	
Sulfate	mg/L	<0.24	1.0	0.24	12/12/18 14:28	

LABORATORY CONTROL SAMPLE: 2297045

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	10	9.9	99	90-110	
Fluoride	mg/L	5	4.7	94	90-110	
Sulfate	mg/L	10	9.6	96	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2297046 2297047

Parameter	Units	60287946001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	155	250	250	387	409	93	102	90-110	6	15	
Fluoride	mg/L	ND	125	125	116	123	93	99	90-110	6	15	
Sulfate	mg/L	60.7	250	250	294	300	93	96	90-110	2	15	

MATRIX SPIKE SAMPLE: 2297048

Parameter	Units	60287288010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	63.1	100	158	95	90-110	
Fluoride	mg/L	0.30	2.5	5.1	193	90-110	M1
Sulfate	mg/L	200	100	299	99	90-110	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 559950
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60287288018

METHOD BLANK: 2297959
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.29	1.0	0.29	12/13/18 13:45	
Fluoride	mg/L	<0.19	0.20	0.19	12/13/18 13:45	

LABORATORY CONTROL SAMPLE: 2297960

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	94	90-110	
Fluoride	mg/L	2.5	2.3	94	90-110	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 560175
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60287288018

METHOD BLANK: 2299101
Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Sulfate	mg/L	<0.24	1.0	0.24	12/14/18 09:35	

LABORATORY CONTROL SAMPLE: 2299102

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	5.1	102	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2299103 2299104

Parameter	Units	60287288003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	483	250	250	748	749	106	106	90-110	0	15	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 556707
Analysis Method: EPA 365.4
QC Batch Method: EPA 365.4
Analysis Description: 365.4 Phosphorus
Associated Lab Samples: 60287288010

METHOD BLANK: 2284390
Matrix: Water
Associated Lab Samples: 60287288010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Phosphorus	mg/L	<0.050	0.10	0.050	11/26/18 13:42	

LABORATORY CONTROL SAMPLE: 2284391

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	2	1.9	95	90-110	

MATRIX SPIKE SAMPLE: 2284393

Parameter	Units	60287288010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.69	2	2.5	91	90-110	

MATRIX SPIKE SAMPLE: 2284394

Parameter	Units	60287289001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.68	2	2.5	91	90-110	

SAMPLE DUPLICATE: 2284392

Parameter	Units	60287443001 Result	Dup Result	RPD	Max RPD	Qualifiers
Phosphorus	mg/L	1.4	1.4	3	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch:	557188	Analysis Method:	EPA 365.4
QC Batch Method:	EPA 365.4	Analysis Description:	365.4 Phosphorus
Associated Lab Samples:	60287288018		

METHOD BLANK: 2285943 Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Phosphorus	mg/L	<0.050	0.10	0.050	11/28/18 11:17	

LABORATORY CONTROL SAMPLE: 2285944

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	2	1.9	96	90-110	

MATRIX SPIKE SAMPLE: 2285945

Parameter	Units	60285327001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	8.8	2	15.6	341	90-110	M1

MATRIX SPIKE SAMPLE: 2285947

Parameter	Units	60287428005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/L	0.50	2	2.4	96	90-110	

SAMPLE DUPLICATE: 2285946

Parameter	Units	60287380002 Result	Dup Result	RPD	Max RPD	Qualifiers
Phosphorus	mg/L	9.2	9.7	6	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Sample: M-AMW-2 **Lab ID: 60287288010** Collected: 11/19/18 09:55 Received: 11/20/18 04:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.693 ± 0.515 (0.678)** **C:NA T:92%**	pCi/L	12/13/18 12:03	13982-63-3	
Radium-228	EPA 904.0	**0.795 ± 0.387 (0.648)** **C:78% T:84%**	pCi/L	12/12/18 16:26	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Sample: M-AMW-2 MS **Lab ID: 60287288015** Collected: 11/19/18 09:55 Received: 11/20/18 04:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**89.18 %REC ± NA (NA) C:NA T:NA**	pCi/L	12/13/18 12:17	13982-63-3	
Radium-228	EPA 904.0	**89.69 %REC ± NA (NA) C:NA T:NA**	pCi/L	12/12/18 16:26	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC MEC / MEC N&E
Pace Project No.:	60290697

Sample: M-AMW-2 MSD **Lab ID: 60287288016** Collected: 11/19/18 09:55 Received: 11/20/18 04:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**86.36 %REC 3.22 RPD ± NA (NA) C:NA T:NA**	pCi/L	12/13/18 12:17	13982-63-3	
Radium-228	EPA 904.0	**102.86 %REC 13.68 RPD ± NA (NA) C:NA T:NA**	pCi/L	12/12/18 16:26	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC MEC / MEC N&E
Pace Project No.:	60290697

Sample: M-AMW-1 **Lab ID: 60287288018** Collected: 11/20/18 12:10 Received: 11/21/18 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.297 ± 0.351 (0.552)** **C:NA T:90%**	pCi/L	12/13/18 22:24	13982-63-3	
Radium-228	EPA 904.0	**0.741 ± 0.379 (0.658)** **C:78% T:85%**	pCi/L	12/13/18 12:52	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 321904
Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60287288010, 60287288015, 60287288016

METHOD BLANK: 1569446
Matrix: Water
Associated Lab Samples: 60287288010, 60287288015, 60287288016

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.545 ± 0.433 (0.563) C:NA T:94%	pCi/L	12/13/18 11:24	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch:	322725	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228

Associated Lab Samples: 60287288018

METHOD BLANK: 1572958 Matrix: Water

Associated Lab Samples: 60287288018

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.839 ± 0.342 (0.501) C:77% T:85%	pCi/L	12/13/18 12:52	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 321906
Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Associated Lab Samples: 60287288010, 60287288015, 60287288016

METHOD BLANK: 1569449
Matrix: Water
Associated Lab Samples: 60287288010, 60287288015, 60287288016

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.660 ± 0.402 (0.736) C:82% T:72%	pCi/L	12/12/18 16:25	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

QC Batch: 322681 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60287288018

METHOD BLANK: 1572864 Matrix: Water
Associated Lab Samples: 60287288018

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.200 ± 0.433 (0.799) C:NA T:83%	pCi/L	12/13/18 21:55	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC MEC / MEC N&E
Pace Project No.:	60290697

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC MEC / MEC N&E
Pace Project No.: 60290697

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60287288010	**M-AMW-2**	EPA 200.7	558137	EPA 200.7	558173
60287288018	**M-AMW-1**	EPA 200.7	558212	EPA 200.7	558388
60287288010	**M-AMW-2**	EPA 200.8	558139	EPA 200.8	558167
60287288018	**M-AMW-1**	EPA 200.8	558318	EPA 200.8	558523
60287288010	**M-AMW-2**	EPA 7470	558279	EPA 7470	558376
60287288018	**M-AMW-1**	EPA 7470	558279	EPA 7470	558376
60287288010	**M-AMW-2**	EPA 903.1	321904		
60287288015	**M-AMW-2 MS**	EPA 903.1	321904		
60287288016	**M-AMW-2 MSD**	EPA 903.1	321904		
60287288018	**M-AMW-1**	EPA 903.1	322681		
60287288010	**M-AMW-2**	EPA 904.0	321906		
60287288015	**M-AMW-2 MS**	EPA 904.0	321906		
60287288016	**M-AMW-2 MSD**	EPA 904.0	321906		
60287288018	**M-AMW-1**	EPA 904.0	322725		
60287288010	**M-AMW-2**	SM 2320B	557524		
60287288018	**M-AMW-1**	SM 2320B	557603		
60287288010	**M-AMW-2**	SM 2540C	556629		
60287288018	**M-AMW-1**	SM 2540C	556732		
60287288010	**M-AMW-2**	SM 3500-Fe B#4	558862		
60287288018	**M-AMW-1**	SM 3500-Fe B#4	560161		
60287288010	**M-AMW-2**	SM 3500-Fe B#4	556509		
60287288018	**M-AMW-1**	SM 3500-Fe B#4	556555		
60287288010	**M-AMW-2**	EPA 300.0	559762		
60287288018	**M-AMW-1**	EPA 300.0	559950		
60287288018	**M-AMW-1**	EPA 300.0	560175		
60287288010	**M-AMW-2**	EPA 365.4	556707		
60287288018	**M-AMW-1**	EPA 365.4	557188		

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Sample Condition Upon Receipt

WO# : 60287288

60287288

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ____________ Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☒ Other ☐

Thermometer Used: 301 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): As-read 4.0 3.7 3.6 / 3.0 2.7 **Corr. Factor** +0.0 **Corrected** 4.0 3.7 3.6 / 3.0 2.7

Temperature should be above freezing to 6°C

JLS

Date and initials of person examining contents: 11/20

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	Fe^{2+}
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ____________ Date/Time: ____________

Comments/ Resolution: ____________

Jamie Church 11/20/18

Project Manager Review: ____________ Date: ____________

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	maddock@golder.com
Phone:	636-724-9191
Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center-MEC N&E
Project Number:	153-1406.0004C (COC #22)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER ______

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Pace Project No./ Lab I.D.: 60287288

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test	Metals*	CCR App IV Metals**+Hg	Alkalinity	Total Phosphorus	Ferrous Iron	Ferric Iron	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																		Y/N	N	N	N	N	N	N		
1	M-MW-1	WT	G																							
2	(2) BP2U BP3S M-MW-2 BP3N (2) BP1N	WT	G			11/19/18	1025		6	2	1	3							✓		✓	✓	✓	✓		001
3	M-MW-3	WT	G				1245																			002
4	M-MW-4	WT	G				1425																			003
5	M-MW-5	WT	G				1530																			004
6	M-MW-6	WT	G				1235																			005
7	M-MW-7	WT	G				1325																			006
8	M-MW-8	WT	G				1500																			007
9	M-BMW-1	WT	G				1525																			008
10	M-BMW-2	WT	G				1120																			009
11	M-AMW-1	WT	G																							
12	(6) BP2U (3) BP3S M-AMW-2 (3) BP3N (6) BP1N	WT	G			11/19/18	0955		18	6	3	9							✓	✓	✓	✓	✓	✓		MS/MSD @ AMW-2 010

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: Fe, Mg, Mn, K, Na	Golder /	11/19/18	1810		11/20/18	0845	4.0	Y	Y	Y
**EPA 200.7: Be, Co, Pb **EPA 200.8: Sb, Cd, Se, Tl							3.7	Y	Y	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 11/19/18

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CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 2 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	maddock@golder.com
Phone:	636-724-9191
Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center-MEC N&E
Project Number:	153-1406.0004C (COC #22)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER ______

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	CCR App IV Metals**+Hg	Alkalinity	Total Phosphorus	Ferrous Iron	Ferric Iron							Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																			N	N	N	N	N	N								60287288
1	(2)BP2U BP3S M-DUP-1 BP3N (2)BP1N	WT	G			11/19/18	—		6	2	1	3							✓		✓	✓	✓	✓								011
2	↓ M-DUP-2	WT	G			↓	—		↓	↓	↓	↓							↓		↓	↓	↓	↓								012
3	↓ M-FB-1	WT	G			↓	1240		↓	↓	↓	↓							↓		↓	↓	↓	↓								013
4	↓ M-FB-2	WT	G			↓	1430		↓	↓	↓	↓							↓		↓	↓	↓	↓								014
5		WT	G																													
6		WT	G																													
7		WT	G																													
8		WT	G																													
9		WT	G																													
10		WT	G																													
11		WT	G																													
12		WT	G																													

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: Fe, Mg, Mn, K, Na	/ Golder	11/19/18	1810		11/20/18	0945	3.6	Y	Y	Y
**EPA 200.7: Be, Co, Pb **EPA 200.8: Sb, Cd, Se, Tl							3.0	Y	Y	Y
							2.7	Y	Y	Y

SAMPLE NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 11/19/18

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CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 1 of 2

Section A
Required Client Information:
Company: Golder Associates
Address: 13515 Barrett Parkway Drive, Ste 260
Ballwin, MO 63021
Email To: maddock@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: Standard

Section B
Required Project Information:
Report To: Mark Haddock (mhaddock@golder.com)
Copy To: Jeffrey Ingram
Purchase Order No.:
Project Name: Ameren Meramec Energy Center-MEC
Project Number: 153-1406.0004B (COC #21)

Section C
Invoice Information:
Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY
☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location **STATE:** MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / , -)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N ↓Analysis Test↓	Metals*	Chloride/Fluoride/Sulfate	TDS	Radium 226	Radium 228	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																			N	N	N	N	N		
1	M-MW-1	WT	G																						
2	M-MW-2	WT	G			11/19/18	1025		6	2	1	3							✓	✓	✓	✓	✓		
3	M-MW-3	WT	G				1245																		
4	M-MW-4	WT	G				1425																		
5	M-MW-5	WT	G				1530																		
6	M-MW-6	WT	G				1235																		
7	M-MW-7	WT	G				1325																		
8	M-MW-8	WT	G				1500																		
9	M-BMW-1	WT	G				1525																		
10	M-BMW-2	WT	G				1120																		
11	M-AMW-1	WT	G																						
12	M-AMW-2	WT	G			11/19/18	0955		18	6	3	9													MS/MSD @ AMW-2

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
*EPA 200.7: B, Ca, Ba, Li, Mo *EPA 200.8: As, Cr	Golder /	11/19/18	1810				

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 11/19/18

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 2 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260
	Ballwin, MO 63021
Email To:	maddock@golder.com
Phone:	636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center-MEC
Project Number:	153-1406 0004B (COC #21)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER ______

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Chloride/Fluoride/Sulfate	TDS	Radium 226	Radium 228		Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																			N	N	N	N	N	N		
1	M-DUP-1	WT	G			11/19/18	—		6	2	1	3							✓	✓	✓	✓	✓			
2	M-DUP-2	WT	G				—																			
3	M-FB-1	WT	G				1240																			
4	M-FB-2	WT	G				1430																			
5		WT	G																							
6		WT	G																							
7		WT	G																							
8		WT	G																							
9		WT	G																							
10		WT	G																							
11		WT	G																							
12		WT	G																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*EPA 200.7: B, Ca, Ba, Li, Mo *EPA 200.8: As, Cr	Golder /	11/19/18	1810							
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 11/19/18

WO# : 60287288

60287288

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Sample Condition Upon Receipt

Client Name: Golder Associates

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ____________ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Zplc

Thermometer Used: TJ00 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 0.8 **Corr. Factor** +0.2 **Corrected** 1.0

Date and initials of person examining contents: JLS 11-21-18 47

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	Fe+2
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ____________ Date/Time: ____________

Comments/ Resolution: ____________

Project Manager Review: Jamie Church Date: 11/21/18

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www.pacelabs.com

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Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center-MEC
Project Number:	153-1406.0004B (COC #21)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ________

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Chloride/Fluoride/Sulfate	TDS	Radium 226	Radium 228		Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60287288
																			N	N	N	N	N			
1	M-MW-1	WT	G			11/20/18	1505		6	2	1	3							✓	✓	✓	✓	✓	2BP1N, 2BP2U, BP3N, BP3S		001
2	M-MW-2	WT	G																							
3	M-MW-3	WT	G																							
4	M-MW-4	WT	G																							
5	M-MW-5	WT	G																							
6	M-MW-6	WT	G																							
7	M-MW-7	WT	G																							
8	M-MW-8	WT	G																							
9	M-BMW-1	WT	G																							
10	M-BMW-2	WT	G																							
11	M-AMW-1	WT	G			11/20/18	1210		6	2	1	3							✓	✓	✓	✓	✓	2BP1N, 2BP2U, BP3N, BP3S		002
12	M-AMW-2	WT	G																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*EPA 200.7: B, Ca, Ba, Li, Mo *EPA 200.8: As, Cr	/ Golder	11/20/18	1640	/ PACE	11/20/18	1640				
		11/20/18	1700	/ Pace	11-21-18	0530	1.0	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 11/20/18

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days

F-ALL-Q-020rev.08, 12-Oct-2007

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Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center-MEC N&E
Project Number:	153-1406.0004C (COC #22)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

Requested Analysis Filtered (Y/N): Metals* N; CCR App IV Metals**+Hg N; Alkalinity N; Total Phosphorus N; Ferrous Iron N; Ferric Iron N

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	CCR App IV Metals**+Hg	Alkalinity	Total Phosphorus	Ferrous Iron	Ferric Iron	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	M-MW-1	WT	G			11/20/18	1505		6	2	1	3							✓		✓	✓	✓	✓		
2	M-MW-2	WT	G																							
3	M-MW-3	WT	G																							
4	M-MW-4	WT	G																							
5	M-MW-5	WT	G																							
6	M-MW-6	WT	G																							
7	M-MW-7	WT	G																							
8	M-MW-8	WT	G																							
9	M-BMW-1	WT	G																							
10	M-BMW-2	WT	G																							
11	M-AMW-1	WT	G			11/20/18	~~1112~~ 1210 ES		6	2	1	3							✓	✓	✓	✓	✓	✓		
12	M-AMW-2	WT	G																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: Fe, Mg, Mn, K, Na	/ Golder	11/20/18	1640	/ PACE	11/20/18	1640				
**EPA 200.7: Be, Co, Pb **EPA 200.8: Sb, Cd, Se, Tl	/ PACE	11/20/18	1700	/ Pace	11-21-18	0330	1.0	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 11/20/18

GOLDER

MEMORANDUM

DATE January 8, 2019 **Project No.** 1531406

TO Project File
Golder Associates

CC

FROM Tommy Goodwin **EMAIL tgoodwin@golder.com**

DATA VALIDATION SUMMARY: AMEREN – MERAMEC ENERGY CENTER – NOVEMBER 2018 – CCR – DATA PACKAGE 60290697

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- Analysis of Ferrous Iron for all samples was initiated outside of the 15-minute EPA required holding time, the detections in samples were qualified as estimates (J) or non-detect and estimates (UJ).
- When analytes exceeded the recovery criteria for MS/MSD of a sample, the sample result was not qualified on MS/MSD data alone.
- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field, rinsate), and the sample results were greater than the MDL and less than the PQL the results were recorded at the PQL value and qualified as non-detects (U). When a compound was detected in a blank (i.e. method, field, rinsate), and the sample results were greater than the PQL and less than ten times the blank results the results were recorded at the result value and qualified as estimates (J).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren -MEC- Nov 2018-CCR
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 1531406
Validation Date: 1/8/19

Laboratory: Pace Analytical
SDG #: 60290697
Analytical Method (type and no.): Metals (200.7&200.8), Hg (7470), Alk (SM 2320B), TDS (SM 2540C), Fe (SM 3500-Fe B#4), Anions (300.0), P (365.4), Ra (903.1&904.0)
Matrix: ☐ Air ☐ Soil/Sed. ☒ Water ☐ Waste ☐
Sample Names M-AMW-1, M-AMW-2, M-AMW-2 MS, M-AMW-2 MSD

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	11/19 + 11/20/18
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated (grab/composite)?	☒	☐	☐	Grab
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Cond, Turb, Temp, DO, ORP, Q, DTW
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☐	☐	☒	
b) Were hold times met for sample analysis?	☐	☒	☐	Fe^{2+}
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☒	☐	☐	[010] Ca(54.6), Cl^-(0.33)
b) Were analytes detected in the field blank(s)?	☐	☐	☒	[018] Co(0.98), Ra-228(0.839)
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	☐	☒	☐	Dup-1@ N/A FB-1@ N/A
b) Were field dup. precision criteria met (note RPD)?	☐	☐	☒	
c) Were lab duplicates analyzed (note original and duplicate samples)?	☒	☐	☐	
d) Were lab dup. precision criteria met (note RPD)?	☒	☐	☐	

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☐	☒	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☒	☐	Ca, Na, F^-, P
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☒	☐	Ca
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☒	☐	☐	

Comments/Notes:

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-AMW-1	Radium-228 (Ra-228)	0.741	J	Detected in MB; MDC < Result < 10x Blank
⊥	Ferrous Iron (Fe^{2+})	4.7	J	Analyzed outside EPA hold time
M-AMW-1	⊥	2.4	J	⊥

Signature: Date: 1/8/19

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

February 05, 2019

Mark Haddock
Golder Associates
820 S. Main St
Suite 100
Saint Charles, MO 63301

RE: Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

Dear Mark Haddock:

Enclosed are the analytical results for sample(s) received by the laboratory on January 25, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Jeffrey Ingram, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60292767

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Arkansas Drinking Water
Missouri Certification Number: 10090
WY STR Certification #: 2456.01
Arkansas Certification #: 18-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116 / E10426
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070
Missouri Certification Number: 10090

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60292767001	**M-MW-5**	Water	01/24/19 14:35	01/25/19 04:25

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without the written consent of Pace Analytical Services, LLC.

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60292767001	**M-MW-5**	EPA 200.8	CTR	1	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

Sample: M-MW-5 **Lab ID: 60292767001** Collected: 01/24/19 14:35 Received: 01/25/19 04:25 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**19.7**	ug/L	1.0	0.065	1	01/28/19 11:44	02/05/19 10:53	7440-38-2	

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

QC Batch: 566437
QC Batch Method: EPA 200.8
Analysis Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60292767001

METHOD BLANK: 2323731
Matrix: Water
Associated Lab Samples: 60292767001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Arsenic	ug/L	<0.065	1.0	0.065	02/05/19 10:42	

LABORATORY CONTROL SAMPLE: 2323732

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	40	40.9	102	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2323733 2323734

Parameter	Units	60292531003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	1.7	40	40	37.3	36.9	89	88	70-130	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60292767

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60292767

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60292767001	**M-MW-5**	EPA 200.8	566437	EPA 200.8	566543

JLS

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Sample Condition Upon Receipt

WO#:60292767
60292767

Client Name: GOLDER ASSOC

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☑ Client ☐ Other ☐

Tracking #: NA Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☑ ZPLC

Thermometer Used: T-298 **Type of Ice:** [✓ Wet] Blue None

Date and initials of person examining contents: LR 012519

Cooler Temperature (°C): **As-read** 3.6 **Corr. Factor** 0.0 **Corrected** 3.6

Temperature should be above freezing to 6°C

Chain of Custody present:	☑Yes ☐No ☐N/A	
Chain of Custody relinquished:	☑Yes ☐No ☐N/A	
Samples arrived within holding time:	☑Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☑No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	
Sufficient volume:	☑Yes ☐No ☐N/A	
Correct containers used:	☑Yes ☐No ☐N/A	
Pace containers used:	☑Yes ☐No ☐N/A	
Containers intact:	☑Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☑N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☑No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☑Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☑N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: Date/Time:

Comments/ Resolution:

Project Manager Review: Jami Church Date: 1/25/19

F-KS-C-003-Rev.11, February 28, 2018

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www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page: 1 of 1

Section A
Required Client Information:

Company:	Golder Associates Inc.
Address:	13515 Barrett Parkway Dr., Ste 260 Ballwin, MO 63021
Email To:	mhaddock@golder.com
Phone:	314-984-8800
Fax:	
Requested Due Date/TAT:	

Section B
Required Project Information:

Report To:	Mark Haddock / Jeffrey Ingram
Copy To:	Eric Schneider / Ryan Feldmann
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center
Project Number:	

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ________

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N ↓Analysis Test↓	N 200.8 Arsenic												Residual Chlorine (Y/N)	6029 2767 Pace Project No./ Lab I.D.
1	M-MW-5	WT	G	1/24/19		1/24/19	1435		1			X							X			BP3 ~~S~~ N 012519										001
2																																
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																
11																																
12																																

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	/ Golder	1/24/19	1745	L Ratliff PACE	012519	0425	3.6	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Andrew Atkins

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 01/24/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

GOLDER

MEMORANDUM

DATE March 4, 2019 **Project No.** 1531406

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER– AMEREN GROUNDWATER – DATA PACKAGE 60292767

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- None.

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren-Meramec-
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 1531406.0004A
Validation Date: 3/4/19

Laboratory: Pace Analytical
SDG #: 60292767
Analytical Method (type and no.): Metals ~~200.7~~&200.8, ~~Hg 7470, TDS 2540C, pH 4500H+, Anions 300.0, Rads 903.1&904.0~~ TG TG
Matrix: ☐ Air ☐ Soil/Sed. ☒ Water ☐ Waste ☐
Sample Names ~~M-MW-1, M-MW-2, M-MW-3, M-MW-4,~~ M-MW-5, ~~M-MW-6, M-MW7, M-MW-8,~~ TG
~~M-BMW-1, M-BMW-2, M-DUP-1, M-FB-1~~ TG TG

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	1/28/19
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated (grab/composite)?	☒	☐	☐	Grab
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Cond, Turb, Temp, DO, ORP, Flow, DTW
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☑	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☐	☐	☒	
b) Were hold times met for sample analysis?	☑	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☐	☑	☐	
g) Were any matrix problems noted?	☐	☑	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☐	☑	☐	
b) Were analytes detected in the field blank(s)?	☐	☐	☑	
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☑	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	~~☒~~	☑	☐	Dup-1@ N/A FB-1@ N/A
b) Were field dup. precision criteria met (note RPD)?	☐	☐	☑	
c) Were lab duplicates analyzed (note original and duplicate samples)?	~~☒~~	☑	☐	
d) Were lab dup. precision criteria met (note RPD)?	☐	☐	☑	

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☐	☒	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☑	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☑	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☑	☐	☐	

Comments/Notes:

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
None				

Signature:

Date: 3/4/19

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

September 27, 2019

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory between August 14, 2019 and August 15, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

REV-1, 9/27/19: Missing 200.8 metals for MW-1 pulled in.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

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CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60311915001	**M-MW-2**	Water	08/12/19 11:15	08/14/19 02:55
60311915002	**M-MW-3**	Water	08/12/19 13:26	08/14/19 02:55
60311915003	**M-MW-4**	Water	08/12/19 15:59	08/14/19 02:55
60311915004	**M-MW-5**	Water	08/13/19 11:30	08/14/19 02:55
60311915005	**M-MW-6**	Water	08/13/19 15:55	08/14/19 02:55
60311915006	**M-MW-7**	Water	08/13/19 15:25	08/14/19 02:55
60311915007	**M-MW-8**	Water	08/13/19 14:00	08/14/19 02:55
60311915008	**M-BMW-1**	Water	08/13/19 10:50	08/14/19 02:55
60311915009	**M-BMW-2**	Water	08/13/19 09:55	08/14/19 02:55
60311915010	**M-DUP-1**	Water	08/12/19 08:00	08/14/19 02:55
60311915011	**M-FB-1**	Water	08/13/19 08:00	08/14/19 02:55
60312019001	**M-MW-1**	Water	08/14/19 11:37	08/15/19 02:55
60311915013	**M-MW-1 MS**	Water	08/14/19 11:37	08/15/19 02:55
60311915014	**M-MW-1 MSD**	Water	08/14/19 11:37	08/15/19 02:55

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60311915001	**M-MW-2**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	MGS	3	PASI-K
60311915002	**M-MW-3**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	MGS	3	PASI-K
60311915003	**M-MW-4**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	MGS	3	PASI-K
60311915004	**M-MW-5**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	MGS	3	PASI-K
60311915005	**M-MW-6**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	MGS	3	PASI-K
60311915006	**M-MW-7**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915007	**M-MW-8**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915008	**M-BMW-1**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915009	**M-BMW-2**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915010	**M-DUP-1**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915011	**M-FB-1**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312019001	**M-MW-1**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311915013	**M-MW-1 MS**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
60311915014	**M-MW-1 MSD**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-2 **Lab ID: 60311915001** Collected: 08/12/19 11:15 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**301**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:30	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:30	7440-41-7	
Boron	**4980**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:30	7440-42-8	
Calcium	**135000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:30	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:30	7440-48-4	
Iron	**45100**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:30	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:30	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:30	7439-93-2	
Magnesium	**40400**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:30	7439-95-4	
Manganese	**6110**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:30	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:30	7439-98-7	
Potassium	**2340**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:30	7440-09-7	
Sodium	**40300**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:30	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:00	7440-36-0	
Arsenic	**1.5**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:00	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:00	7440-43-9	
Chromium	**0.32J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:00	7440-47-3	
Selenium	**0.15J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:00	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:00	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:21	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**242**	mg/L	20.0	6.5	1		08/26/19 11:33		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**817**	mg/L	10.0	10.0	1		08/19/19 10:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**27.5**	mg/L	2.0	0.44	2		08/27/19 04:08	16887-00-6	
Fluoride	**0.15J**	mg/L	0.20	0.085	1		08/27/19 03:24	16984-48-8	
Sulfate	**324**	mg/L	50.0	11.5	50		08/27/19 04:53	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-3 **Lab ID: 60311915002** Collected: 08/12/19 13:26 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**196**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:38	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:38	7440-41-7	
Boron	**9420**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:38	7440-42-8	
Calcium	**175000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:38	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:38	7440-48-4	
Iron	**28500**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:38	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:38	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:38	7439-93-2	
Magnesium	**47400**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:38	7439-95-4	
Manganese	**2100**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:38	7439-96-5	
Molybdenum	**7.5J**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:38	7439-98-7	
Potassium	**2750**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:38	7440-09-7	
Sodium	**33700**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:38	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:02	7440-36-0	
Arsenic	**7.5**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:02	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:02	7440-43-9	
Chromium	**0.11J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:02	7440-47-3	
Selenium	**0.10J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:02	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:02	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:27	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**311**	mg/L	20.0	6.5	1		08/26/19 11:39		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**968**	mg/L	10.0	10.0	1		08/19/19 10:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**22.0**	mg/L	5.0	1.1	5		08/27/19 08:38	16887-00-6	
Fluoride	**0.13J**	mg/L	0.20	0.085	1		08/27/19 08:23	16984-48-8	
Sulfate	**363**	mg/L	50.0	11.5	50		08/27/19 08:52	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-4 **Lab ID: 60311915003** Collected: 08/12/19 15:59 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**168**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:41	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:41	7440-41-7	
Boron	**9120**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:41	7440-42-8	
Calcium	**181000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:41	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:41	7440-48-4	
Iron	**24500**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:41	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:41	7439-92-1	
Lithium	**14.0**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:41	7439-93-2	
Magnesium	**49600**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:41	7439-95-4	
Manganese	**731**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:41	7439-96-5	
Molybdenum	**51.5**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:41	7439-98-7	
Potassium	**6060**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:41	7440-09-7	
Sodium	**45600**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:41	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:04	7440-36-0	
Arsenic	**13.9**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:04	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:04	7440-43-9	
Chromium	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:04	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:04	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:04	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:30	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**242**	mg/L	20.0	6.5	1		08/26/19 11:52		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1090**	mg/L	10.0	10.0	1		08/19/19 10:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**48.9**	mg/L	5.0	1.1	5		08/27/19 09:22	16887-00-6	
Fluoride	**0.18J**	mg/L	0.20	0.085	1		08/27/19 09:07	16984-48-8	
Sulfate	**465**	mg/L	50.0	11.5	50		08/27/19 09:37	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-5 **Lab ID: 60311915004** Collected: 08/13/19 11:30 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**230**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:43	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:43	7440-41-7	
Boron	**6710**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:43	7440-42-8	
Calcium	**162000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:43	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:43	7440-48-4	
Iron	**16100**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:43	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:43	7439-92-1	
Lithium	**12.2**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:43	7439-93-2	
Magnesium	**51300**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:43	7439-95-4	
Manganese	**409**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:43	7439-96-5	
Molybdenum	**96.3**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:43	7439-98-7	
Potassium	**5280**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:43	7440-09-7	
Sodium	**44000**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:43	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**0.11J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:06	7440-36-0	
Arsenic	**23.0**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:06	7440-38-2	
Cadmium	**0.048J**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:06	7440-43-9	
Chromium	**0.18J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:06	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:06	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:06	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:37	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**113**	mg/L	20.0	6.5	1		08/26/19 12:26		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**957**	mg/L	10.0	10.0	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**41.3**	mg/L	5.0	1.1	5		08/27/19 10:07	16887-00-6	
Fluoride	**0.24**	mg/L	0.20	0.085	1		08/27/19 09:52	16984-48-8	
Sulfate	**339**	mg/L	50.0	11.5	50		08/27/19 10:51	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-6 **Lab ID: 60311915005** Collected: 08/13/19 15:55 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**44.1**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:46	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:46	7440-41-7	
Boron	**14500**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:46	7440-42-8	
Calcium	**320000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:46	7440-70-2	
Cobalt	**5.4**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:46	7440-48-4	
Iron	**3940**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:46	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:46	7439-92-1	
Lithium	**122**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:46	7439-93-2	
Magnesium	**23700**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:46	7439-95-4	
Manganese	**1030**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:46	7439-96-5	
Molybdenum	**123**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:46	7439-98-7	
Potassium	**13200**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:46	7440-09-7	
Sodium	**23400**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:46	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:08	7440-36-0	
Arsenic	**2.6**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:08	7440-38-2	
Cadmium	**0.31J**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:08	7440-43-9	
Chromium	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:08	7440-47-3	
Selenium	**0.087J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:08	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:08	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:39	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**331**	mg/L	20.0	6.5	1		08/26/19 12:30		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1310**	mg/L	13.3	13.3	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**8.3**	mg/L	2.0	0.44	2		08/27/19 11:21	16887-00-6	
Fluoride	**0.24**	mg/L	0.20	0.085	1		08/27/19 11:06	16984-48-8	
Sulfate	**516**	mg/L	50.0	11.5	50		08/27/19 11:36	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-7 **Lab ID: 60311915006** Collected: 08/13/19 15:25 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**37.0**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:48	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:48	7440-41-7	
Boron	**22700**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:48	7440-42-8	
Calcium	**354000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:48	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:48	7440-48-4	
Iron	**<14.0**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:48	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:48	7439-92-1	
Lithium	**36.2**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:48	7439-93-2	
Magnesium	**26900**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:48	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:48	7439-96-5	
Molybdenum	**463**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:48	7439-98-7	
Potassium	**18200**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:48	7440-09-7	
Sodium	**102000**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:48	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**0.39J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:15	7440-36-0	
Arsenic	**2.8**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:15	7440-38-2	
Cadmium	**0.36J**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:15	7440-43-9	
Chromium	**0.18J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:15	7440-47-3	
Selenium	**8.6**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:15	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:15	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:41	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**426**	mg/L	20.0	6.5	1		08/26/19 12:36		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1840**	mg/L	13.3	13.3	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**53.0**	mg/L	10.0	2.2	10		08/27/19 11:41	16887-00-6	
Fluoride	**0.82**	mg/L	0.20	0.085	1		08/27/19 11:25	16984-48-8	
Sulfate	**841**	mg/L	100	23.0	100		08/27/19 12:28	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-8 **Lab ID: 60311915007** Collected: 08/13/19 14:00 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**102**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:51	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:51	7440-41-7	
Boron	**8880**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:51	7440-42-8	
Calcium	**197000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:51	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:51	7440-48-4	
Iron	**8430**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:51	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:51	7439-92-1	
Lithium	**27.8**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:51	7439-93-2	
Magnesium	**41800**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:51	7439-95-4	
Manganese	**1550**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:51	7439-96-5	
Molybdenum	**186**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:51	7439-98-7	
Potassium	**7170**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:51	7440-09-7	
Sodium	**35600**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:51	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:19	7440-36-0	
Arsenic	**5.7**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:19	7440-38-2	
Cadmium	**0.099J**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:19	7440-43-9	
Chromium	**0.30J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:19	7440-47-3	
Selenium	**0.11J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:19	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:19	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:43	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**213**	mg/L	20.0	6.5	1		08/26/19 12:41		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1060**	mg/L	10.0	10.0	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**30.9**	mg/L	2.0	0.44	2		08/27/19 12:59	16887-00-6	
Fluoride	**0.37**	mg/L	0.20	0.085	1		08/27/19 12:44	16984-48-8	
Sulfate	**462**	mg/L	50.0	11.5	50		08/27/19 13:15	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-BMW-1 **Lab ID: 60311915008** Collected: 08/13/19 10:50 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**210**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:53	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:53	7440-41-7	
Boron	**354**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:53	7440-42-8	
Calcium	**102000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:53	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:53	7440-48-4	
Iron	**498**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:53	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:53	7439-92-1	
Lithium	**6.8J**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:53	7439-93-2	
Magnesium	**25600**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:53	7439-95-4	
Manganese	**994**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:53	7439-96-5	
Molybdenum	**3.7J**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:53	7439-98-7	
Potassium	**4890**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:53	7440-09-7	
Sodium	**60900**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:53	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**0.23J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:21	7440-36-0	
Arsenic	**2.1**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:21	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:21	7440-43-9	
Chromium	**0.086J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:21	7440-47-3	
Selenium	**0.12J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:21	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:21	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:48	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**298**	mg/L	20.0	6.5	1		08/26/19 12:56		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**620**	mg/L	10.0	10.0	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**96.2**	mg/L	10.0	2.2	10		08/27/19 13:47	16887-00-6	
Fluoride	**0.46**	mg/L	0.20	0.085	1		08/27/19 13:31	16984-48-8	
Sulfate	**53.0**	mg/L	10.0	2.3	10		08/27/19 13:47	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-BMW-2 **Lab ID: 60311915009** Collected: 08/13/19 09:55 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**502**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:56	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:56	7440-41-7	
Boron	**81.4J**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:56	7440-42-8	
Calcium	**104000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:56	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:56	7440-48-4	
Iron	**13600**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:56	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:56	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:56	7439-93-2	
Magnesium	**33600**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:56	7439-95-4	
Manganese	**3990**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:56	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:56	7439-98-7	
Potassium	**1420**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:56	7440-09-7	B
Sodium	**19800**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:56	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:22	7440-36-0	
Arsenic	**0.86J**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:22	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:22	7440-43-9	
Chromium	**0.16J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:22	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:22	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:22	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:50	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**405**	mg/L	20.0	6.5	1		08/26/19 13:01		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**483**	mg/L	10.0	10.0	1		08/19/19 10:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**13.0**	mg/L	1.0	0.22	1		08/27/19 14:19	16887-00-6	
Fluoride	**0.29**	mg/L	0.20	0.085	1		08/27/19 14:19	16984-48-8	
Sulfate	**25.9**	mg/L	2.0	0.46	2		08/27/19 14:35	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-DUP-1 **Lab ID: 60311915010** Collected: 08/12/19 08:00 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**188**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:58	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:58	7440-41-7	
Boron	**9030**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:58	7440-42-8	
Calcium	**168000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:58	7440-70-2	M1
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:58	7440-48-4	
Iron	**27200**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:58	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:58	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:58	7439-93-2	
Magnesium	**45200**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:58	7439-95-4	
Manganese	**1990**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:58	7439-96-5	
Molybdenum	**6.7J**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:58	7439-98-7	
Potassium	**2720**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:58	7440-09-7	
Sodium	**32200**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:58	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:24	7440-36-0	
Arsenic	**7.5**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:24	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:24	7440-43-9	
Chromium	**0.17J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:24	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:24	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:24	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:53	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**324**	mg/L	20.0	6.5	1		08/26/19 11:57		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**681**	mg/L	10.0	10.0	1		08/19/19 10:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**0.74J**	mg/L	1.0	0.22	1		08/27/19 15:54	16887-00-6	
Fluoride	**<0.085**	mg/L	0.20	0.085	1		08/27/19 15:54	16984-48-8	
Sulfate	**3.3**	mg/L	1.0	0.23	1		08/27/19 15:54	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-FB-1 **Lab ID: 60311915011** Collected: 08/13/19 08:00 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**<1.4**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 19:08	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 19:08	7440-41-7	
Boron	**13.0J**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 19:08	7440-42-8	
Calcium	**83.8J**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 19:08	7440-70-2	B
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 19:08	7440-48-4	
Iron	**<14.0**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 19:08	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 19:08	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 19:08	7439-93-2	
Magnesium	**<13.0**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 19:08	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 19:08	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 19:08	7439-98-7	
Potassium	**94.0J**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 19:08	7440-09-7	B
Sodium	**<144**	ug/L	500	144	1	08/16/19 14:00	08/19/19 19:08	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:13	7440-36-0	
Arsenic	**<0.065**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 16:13	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 16:13	7440-43-9	
Chromium	**0.090J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 16:13	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 16:13	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 16:13	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:55	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**<6.5**	mg/L	20.0	6.5	1		08/26/19 13:05		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**9.0**	mg/L	5.0	5.0	1		08/19/19 10:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**0.43J**	mg/L	1.0	0.22	1		08/27/19 16:10	16887-00-6	
Fluoride	**<0.085**	mg/L	0.20	0.085	1		08/27/19 16:10	16984-48-8	
Sulfate	**<0.23**	mg/L	1.0	0.23	1		08/27/19 16:10	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-1 **Lab ID: 60312019001** Collected: 08/14/19 11:37 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**341**	ug/L	5.0	1.4	1	08/16/19 14:00	08/19/19 18:23	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/16/19 14:00	08/19/19 18:23	7440-41-7	
Boron	**48.4J**	ug/L	100	10.7	1	08/16/19 14:00	08/19/19 18:23	7440-42-8	
Calcium	**131000**	ug/L	200	50.0	1	08/16/19 14:00	08/19/19 18:23	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/16/19 14:00	08/19/19 18:23	7440-48-4	
Iron	**14400**	ug/L	50.0	14.0	1	08/16/19 14:00	08/19/19 18:23	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/16/19 14:00	08/19/19 18:23	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/16/19 14:00	08/19/19 18:23	7439-93-2	
Magnesium	**42700**	ug/L	50.0	13.0	1	08/16/19 14:00	08/19/19 18:23	7439-95-4	
Manganese	**1840**	ug/L	5.0	2.1	1	08/16/19 14:00	08/19/19 18:23	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/16/19 14:00	08/19/19 18:23	7439-98-7	
Potassium	**1670**	ug/L	500	79.0	1	08/16/19 14:00	08/19/19 18:23	7440-09-7	
Sodium	**28400**	ug/L	500	144	1	08/16/19 14:00	08/19/19 18:23	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 15:55	7440-36-0	
Arsenic	**0.66J**	ug/L	1.0	0.065	1	08/16/19 14:15	08/19/19 15:55	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/16/19 14:15	08/19/19 15:55	7440-43-9	
Chromium	**0.22J**	ug/L	1.0	0.078	1	08/16/19 14:15	08/19/19 15:55	7440-47-3	
Selenium	**0.11J**	ug/L	1.0	0.085	1	08/16/19 14:15	08/19/19 15:55	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/16/19 14:15	08/19/19 15:55	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:05	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**390**	mg/L	20.0	6.5	1		08/19/19 11:50		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**696**	mg/L	10.0	10.0	1		08/20/19 09:55		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**44.2**	mg/L	10.0	2.2	10		08/20/19 23:16	16887-00-6	
Fluoride	**0.24**	mg/L	0.20	0.085	1		08/20/19 21:52	16984-48-8	
Sulfate	**106**	mg/L	10.0	2.3	10		08/20/19 23:16	14808-79-8	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 604020
QC Batch Method: EPA 245.1
Analysis Method: EPA 245.1
Analysis Description: 245.1 Mercury
Associated Lab Samples: 60312019001

METHOD BLANK: 2469857
Matrix: Water
Associated Lab Samples: 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.066	0.20	0.066	08/20/19 14:59	

LABORATORY CONTROL SAMPLE: 2469858

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	97	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2469859 2469860

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.066	5	5	4.7	4.5	93	91	70-130	3	20	

MATRIX SPIKE SAMPLE: 2469861

Parameter	Units	60311645005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	ND	5	4.9	98	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 604387
Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1
Analysis Description: 245.1 Mercury
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

METHOD BLANK: 2470996
Matrix: Water
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.066	0.20	0.066	08/21/19 11:09	

LABORATORY CONTROL SAMPLE: 2470997

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.0	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2470998 2470999

Parameter	Units	60311814005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.1	5.0	102	100	70-130	1	20	

MATRIX SPIKE SAMPLE: 2471000

Parameter	Units	60311920002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	<0.066	5	5.1	103	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 603700   Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7   Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011, 60312019001

METHOD BLANK: 2468488   Matrix: Water
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011, 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.4	5.0	1.4	08/19/19 18:21	
Beryllium	ug/L	<0.25	1.0	0.25	08/19/19 18:21	
Boron	ug/L	<10.7	100	10.7	08/19/19 18:21	
Calcium	ug/L	60.6J	200	50.0	08/19/19 18:21	
Cobalt	ug/L	<0.84	5.0	0.84	08/19/19 18:21	
Iron	ug/L	<14.0	50.0	14.0	08/19/19 18:21	
Lead	ug/L	<3.4	10.0	3.4	08/19/19 18:21	
Lithium	ug/L	<5.9	10.0	5.9	08/19/19 18:21	
Magnesium	ug/L	18.7J	50.0	13.0	08/19/19 18:21	
Manganese	ug/L	<2.1	5.0	2.1	08/19/19 18:21	
Molybdenum	ug/L	<2.6	20.0	2.6	08/19/19 18:21	
Potassium	ug/L	160J	500	79.0	08/19/19 18:21	
Sodium	ug/L	448J	500	144	08/19/19 18:21	

LABORATORY CONTROL SAMPLE: 2468489

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	978	98	85-115	
Beryllium	ug/L	1000	997	100	85-115	
Boron	ug/L	1000	945	95	85-115	
Calcium	ug/L	10000	9990	100	85-115	
Cobalt	ug/L	1000	1000	100	85-115	
Iron	ug/L	10000	9660	97	85-115	
Lead	ug/L	1000	1060	106	85-115	
Lithium	ug/L	1000	1010	101	85-115	
Magnesium	ug/L	10000	9590	96	85-115	
Manganese	ug/L	1000	975	98	85-115	
Molybdenum	ug/L	1000	983	98	85-115	
Potassium	ug/L	10000	10000	100	85-115	
Sodium	ug/L	10000	10400	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2468490   2468491

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	341	1000	1000	1290	1320	95	98	70-130	2	20	
Beryllium	ug/L	<0.25	1000	1000	992	1010	99	101	70-130	2	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2468490 2468491

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	48.4J	1000	1000	997	1010	95	96	70-130	1	20	
Calcium	ug/L	131000	10000	10000	139000	144000	81	129	70-130	3	20	
Cobalt	ug/L	<0.84	1000	1000	968	979	97	98	70-130	1	20	
Iron	ug/L	14400	10000	10000	23300	24000	89	96	70-130	3	20	
Lead	ug/L	<3.4	1000	1000	1020	1040	102	104	70-130	1	20	
Lithium	ug/L	<5.9	1000	1000	982	1000	98	100	70-130	2	20	
Magnesium	ug/L	42700	10000	10000	51200	53100	85	104	70-130	4	20	
Manganese	ug/L	1840	1000	1000	2760	2850	92	100	70-130	3	20	
Molybdenum	ug/L	<2.6	1000	1000	987	999	99	100	70-130	1	20	
Potassium	ug/L	1670	10000	10000	11300	11600	96	99	70-130	3	20	
Sodium	ug/L	28400	10000	10000	37500	38600	91	101	70-130	3	20	

MATRIX SPIKE SAMPLE: 2468492

Parameter	Units	60311915010 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	188	1000	1180	99	70-130	
Beryllium	ug/L	<0.25	1000	1020	101	70-130	
Boron	ug/L	9030	1000	10300	128	70-130	
Calcium	ug/L	168000	10000	183000	151	70-130	M1
Cobalt	ug/L	<0.84	1000	1010	101	70-130	
Iron	ug/L	27200	10000	37900	107	70-130	
Lead	ug/L	<3.4	1000	1060	106	70-130	
Lithium	ug/L	<5.9	1000	1020	102	70-130	
Magnesium	ug/L	45200	10000	56300	111	70-130	
Manganese	ug/L	1990	1000	3040	105	70-130	
Molybdenum	ug/L	6.7J	1000	1030	102	70-130	
Potassium	ug/L	2720	10000	12800	101	70-130	
Sodium	ug/L	32200	10000	43100	109	70-130	

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QUALITY CONTROL DATA

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

QC Batch:	603726	Analysis Method:	EPA 200.8
QC Batch Method:	EPA 200.8	Analysis Description:	200.8 MET

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011, 60312019001

METHOD BLANK: 2468551 Matrix: Water

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011, 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	08/19/19 15:51	
Arsenic	ug/L	<0.065	1.0	0.065	08/19/19 15:51	
Cadmium	ug/L	<0.033	0.50	0.033	08/19/19 15:51	
Chromium	ug/L	<0.078	1.0	0.078	08/19/19 15:51	
Selenium	ug/L	<0.085	1.0	0.085	08/19/19 15:51	
Thallium	ug/L	<0.099	1.0	0.099	08/19/19 15:51	

LABORATORY CONTROL SAMPLE: 2468552

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	41.4	103	85-115	
Arsenic	ug/L	40	40.0	100	85-115	
Cadmium	ug/L	40	41.2	103	85-115	
Chromium	ug/L	40	40.2	101	85-115	
Selenium	ug/L	40	41.0	102	85-115	
Thallium	ug/L	40	38.4	96	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2468553 2468554

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	<0.078	40	40	41.1	40.0	103	100	70-130	3	20	
Arsenic	ug/L	0.66J	40	40	40.5	39.7	100	98	70-130	2	20	
Cadmium	ug/L	<0.033	40	40	39.1	38.2	98	96	70-130	2	20	
Chromium	ug/L	0.22J	40	40	39.9	39.1	99	97	70-130	2	20	
Selenium	ug/L	0.11J	40	40	38.6	38.5	96	96	70-130	0	20	
Thallium	ug/L	<0.099	40	40	39.6	39.1	99	98	70-130	1	20	

MATRIX SPIKE SAMPLE: 2468555

Parameter	Units	60311915006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	0.39J	40	40.0	99	70-130	
Arsenic	ug/L	2.8	40	44.0	103	70-130	
Cadmium	ug/L	0.36J	40	37.1	92	70-130	
Chromium	ug/L	0.18J	40	41.3	103	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

MATRIX SPIKE SAMPLE: 2468555

Parameter	Units	60311915006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Selenium	ug/L	8.6	40	46.9	96	70-130	
Thallium	ug/L	<0.099	40	40.1	100	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 603916
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60312019001

METHOD BLANK: 2469612
Matrix: Water
Associated Lab Samples: 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	08/19/19 10:06	

LABORATORY CONTROL SAMPLE: 2469613

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	487	97	90-110	

SAMPLE DUPLICATE: 2469766

Parameter	Units	60311993004 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	386	387	0	10	

SAMPLE DUPLICATE: 2469767

Parameter	Units	60312019001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	390	412	6	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 605185
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

METHOD BLANK: 2473734
Matrix: Water
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	08/26/19 10:49	

LABORATORY CONTROL SAMPLE: 2473735

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	500	100	90-110	

SAMPLE DUPLICATE: 2473736

Parameter	Units	60311820012 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	378	393	4	10	

SAMPLE DUPLICATE: 2473737

Parameter	Units	60311736004 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	516	515	0	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 603928
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915010

METHOD BLANK: 2469645
Matrix: Water
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915010

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	08/19/19 10:17	

LABORATORY CONTROL SAMPLE: 2469646

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1020	102	80-120	

SAMPLE DUPLICATE: 2469647

Parameter	Units	60311915001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	817	798	2	10	

SAMPLE DUPLICATE: 2469648

Parameter	Units	60311879003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	499	523	5	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 603932 | Analysis Method: SM 2540C
QC Batch Method: SM 2540C | Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60311915006, 60311915007, 60311915008, 60311915009, 60311915011

METHOD BLANK: 2469663 | Matrix: Water
Associated Lab Samples: 60311915006, 60311915007, 60311915008, 60311915009, 60311915011

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	08/19/19 10:20	

LABORATORY CONTROL SAMPLE: 2469664

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1030	103	80-120	

SAMPLE DUPLICATE: 2469665

Parameter	Units	60311920002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1630	1620	1	10	

SAMPLE DUPLICATE: 2469666

Parameter	Units	60312087006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2950	3460	16	10	D6

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 604219
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60312019001

METHOD BLANK: 2470466
Matrix: Water
Associated Lab Samples: 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	08/20/19 09:55	

LABORATORY CONTROL SAMPLE: 2470467

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1030	103	80-120	

SAMPLE DUPLICATE: 2470468

Parameter	Units	60312019001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	696	698	0	10	

SAMPLE DUPLICATE: 2470469

Parameter	Units	60312020006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	<5.0	<5.0		10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 604358
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60312019001

METHOD BLANK: 2470936
Matrix: Water
Associated Lab Samples: 60312019001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	08/20/19 15:15	
Fluoride	mg/L	<0.085	0.20	0.085	08/20/19 15:15	
Sulfate	mg/L	<0.23	1.0	0.23	08/20/19 15:15	

LABORATORY CONTROL SAMPLE: 2470937

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	95	90-110	
Fluoride	mg/L	2.5	2.4	97	90-110	
Sulfate	mg/L	5	4.8	97	90-110	

MATRIX SPIKE SAMPLE: 2470938

Parameter	Units	60311700004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	1700	1000	2670	97	80-120	
Fluoride	mg/L	98.0	500	599	100	80-120	
Sulfate	mg/L	ND	1000	1000	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2470939 2470940

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	44.2	50	50	94.5	92.2	100	96	80-120	2	15	
Fluoride	mg/L	0.24	2.5	2.5	2.6	2.7	95	98	80-120	2	15	
Sulfate	mg/L	106	50	50	161	156	109	98	80-120	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 605614
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005

METHOD BLANK: 2475662
Matrix: Water
Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	08/27/19 02:54	
Fluoride	mg/L	<0.085	0.20	0.085	08/27/19 02:54	
Sulfate	mg/L	<0.23	1.0	0.23	08/27/19 02:54	

LABORATORY CONTROL SAMPLE: 2475663

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	95	90-110	
Fluoride	mg/L	2.5	2.5	100	90-110	
Sulfate	mg/L	5	5.2	104	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2475664 2475665

Parameter	Units	60311915001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	27.5	250	250	273	277	98	100	80-120	1	15	
Fluoride	mg/L	0.15J	2.5	2.5	2.7	2.7	104	104	80-120	0	15	
Sulfate	mg/L	324	250	250	564	568	96	98	80-120	1	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 605755
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

METHOD BLANK: 2476001
Matrix: Water
Associated Lab Samples: 60311915006, 60311915007, 60311915008, 60311915009, 60311915010, 60311915011

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	08/27/19 10:51	
Fluoride	mg/L	<0.085	0.20	0.085	08/27/19 10:51	
Sulfate	mg/L	<0.23	1.0	0.23	08/27/19 10:51	

LABORATORY CONTROL SAMPLE: 2476002

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.6	92	90-110	
Fluoride	mg/L	2.5	2.3	93	90-110	
Sulfate	mg/L	5	5.1	103	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2476003 2476004

Parameter	Units	60311920002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	271	250	250	508	507	95	94	80-120	0	15	
Fluoride	mg/L	0.47	2.5	2.5	2.9	2.9	99	98	80-120	1	15	
Sulfate	mg/L	456	250	250	703	701	99	98	80-120	0	15	

MATRIX SPIKE SAMPLE: 2476005

Parameter	Units	60312114001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	ND	50	49.6	86	80-120	
Fluoride	mg/L	ND	25	24.6	98	80-120	
Sulfate	mg/L	166	50	214	95	80-120	E

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

Sample: M-MW-2 **Lab ID: 60311915001** Collected: 08/12/19 11:15 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.627 ± 0.546 (0.828)** **C:NA T:89%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.0961 ± 0.405 (0.918)** **C:77% T:84%**	pCi/L	09/04/19 14:38	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-3 **Lab ID: 60311915002** Collected: 08/12/19 13:26 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.346 ± 0.260 (0.134)** **C:NA T:88%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.746 ± 0.411 (0.739)** **C:79% T:90%**	pCi/L	09/04/19 14:38	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-4 **Lab ID: 60311915003** Collected: 08/12/19 15:59 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.640 ± 0.425 (0.496)** **C:NA T:89%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.519 ± 0.422 (0.844)** **C:77% T:86%**	pCi/L	09/04/19 14:34	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-5 **Lab ID: 60311915004** Collected: 08/13/19 11:30 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.299 ± 0.403 (0.678)** **C:NA T:96%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**1.30 ± 0.551 (0.894)** **C:77% T:80%**	pCi/L	09/04/19 14:34	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-6 **Lab ID: 60311915005** Collected: 08/13/19 15:55 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.475 ± 0.315 (0.143)** **C:NA T:92%**	pCi/L	09/06/19 16:02	13982-63-3	
Radium-228	EPA 904.0	**-0.411 ± 0.348 (0.892)** **C:74% T:84%**	pCi/L	09/04/19 14:35	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-7 **Lab ID: 60311915006** Collected: 08/13/19 15:25 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.258 ± 0.337 (0.556)** **C:NA T:88%**	pCi/L	09/06/19 16:02	13982-63-3	
Radium-228	EPA 904.0	**0.366 ± 0.421 (0.885)** **C:72% T:88%**	pCi/L	09/04/19 14:36	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-8 **Lab ID: 60311915007** Collected: 08/13/19 14:00 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.373 ± 0.349 (0.495)** **C:NA T:84%**	pCi/L	09/06/19 16:02	13982-63-3	
Radium-228	EPA 904.0	**0.185 ± 0.321 (0.701)** **C:76% T:90%**	pCi/L	09/04/19 14:36	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-BMW-1	**Lab ID: 60311915008**	Collected: 08/13/19 10:50	Received: 08/14/19 02:55	Matrix: Water	
PWS:	Site ID:	Sample Type:			

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.838 ± 0.469 (0.487)** **C:NA T:88%**	pCi/L	09/06/19 16:02	13982-63-3	
Radium-228	EPA 904.0	**0.676 ± 0.426 (0.801)** **C:79% T:84%**	pCi/L	09/04/19 14:36	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-BMW-2 **Lab ID: 60311915009** Collected: 08/13/19 09:55 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.10 ± 0.603 (0.738)** **C:NA T:92%**	pCi/L	09/06/19 16:12	13982-63-3	
Radium-228	EPA 904.0	**0.173 ± 0.361 (0.797)** **C:79% T:85%**	pCi/L	09/04/19 14:37	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

Sample: M-DUP-1 **Lab ID: 60311915010** Collected: 08/12/19 08:00 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.307 ± 0.356 (0.574)** **C:NA T:97%**	pCi/L	09/06/19 14:47	13982-63-3	
Radium-228	EPA 904.0	**0.623 ± 0.466 (0.933)** **C:78% T:95%**	pCi/L	09/05/19 11:24	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-FB-1 **Lab ID: 60311915011** Collected: 08/13/19 08:00 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.586 ± 0.412 (0.526)** **C:NA T:94%**	pCi/L	09/06/19 14:47	13982-63-3	
Radium-228	EPA 904.0	**0.282 ± 0.402 (0.864)** **C:78% T:83%**	pCi/L	09/05/19 11:18	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-1 **Lab ID: 60312019001** Collected: 08/14/19 11:37 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.374 ± 0.318 (0.447)** **C:NA T:88%**	pCi/L	09/06/19 15:01	13982-63-3	
Radium-228	EPA 904.0	**0.344 ± 0.438 (0.934)** **C:78% T:85%**	pCi/L	09/05/19 11:19	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-1 MS **Lab ID: 60311915013** Collected: 08/14/19 11:37 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**71.24 %REC ± NA (NA) C:NA T:NA**	pCi/L	09/06/19 14:47	13982-63-3	
Radium-228	EPA 904.0	**90.20 %REC ± NA (NA) C:NA T:NA**	pCi/L	09/05/19 11:19	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Sample: M-MW-1 MSD **Lab ID: 60311915014** Collected: 08/14/19 11:37 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**93.85 %REC 27.39 RPD ± NA (NA) C:NA T:NA**	pCi/L	09/06/19 15:01	13982-63-3	
Radium-228	EPA 904.0	**87.50 %REC 3.04 RPD ± NA (NA) C:NA T:NA**	pCi/L	09/05/19 11:19	15262-20-1	

QUALITY CONTROL - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

QC Batch:	357798	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009

METHOD BLANK: 1737463 Matrix: Water

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.497 ± 0.316 (0.382) C:NA T:100%	pCi/L	09/06/19 15:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

QC Batch:	357805	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226

Associated Lab Samples: 60311915010, 60311915011, 60311915013, 60311915014, 60312019001

METHOD BLANK: 1737479 Matrix: Water

Associated Lab Samples: 60311915010, 60311915011, 60311915013, 60311915014, 60312019001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.445 ± 0.296 (0.345) C:NA T:100%	pCi/L	09/06/19 14:47	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 357804
Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Associated Lab Samples: 60311915010, 60311915011, 60311915013, 60311915014, 60312019001

METHOD BLANK: 1737478
Matrix: Water
Associated Lab Samples: 60311915010, 60311915011, 60311915013, 60311915014, 60312019001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.0593 ± 0.274 (0.666) C:80% T:77%	pCi/L	09/05/19 11:15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

QC Batch: 357797 | Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 | Analysis Description: 904.0 Radium 228

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009

METHOD BLANK: 1737457 Matrix: Water

Associated Lab Samples: 60311915001, 60311915002, 60311915003, 60311915004, 60311915005, 60311915006, 60311915007, 60311915008, 60311915009

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.550 ± 0.383 (0.736) C:76% T:81%	pCi/L	09/04/19 10:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311915

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60311915001	**M-MW-2**	EPA 200.7	603700	EPA 200.7	603765
60311915002	**M-MW-3**	EPA 200.7	603700	EPA 200.7	603765
60311915003	**M-MW-4**	EPA 200.7	603700	EPA 200.7	603765
60311915004	**M-MW-5**	EPA 200.7	603700	EPA 200.7	603765
60311915005	**M-MW-6**	EPA 200.7	603700	EPA 200.7	603765
60311915006	**M-MW-7**	EPA 200.7	603700	EPA 200.7	603765
60311915007	**M-MW-8**	EPA 200.7	603700	EPA 200.7	603765
60311915008	**M-BMW-1**	EPA 200.7	603700	EPA 200.7	603765
60311915009	**M-BMW-2**	EPA 200.7	603700	EPA 200.7	603765
60311915010	**M-DUP-1**	EPA 200.7	603700	EPA 200.7	603765
60311915011	**M-FB-1**	EPA 200.7	603700	EPA 200.7	603765
60312019001	**M-MW-1**	EPA 200.7	603700	EPA 200.7	603765
60311915001	**M-MW-2**	EPA 200.8	603726	EPA 200.8	603773
60311915002	**M-MW-3**	EPA 200.8	603726	EPA 200.8	603773
60311915003	**M-MW-4**	EPA 200.8	603726	EPA 200.8	603773
60311915004	**M-MW-5**	EPA 200.8	603726	EPA 200.8	603773
60311915005	**M-MW-6**	EPA 200.8	603726	EPA 200.8	603773
60311915006	**M-MW-7**	EPA 200.8	603726	EPA 200.8	603773
60311915007	**M-MW-8**	EPA 200.8	603726	EPA 200.8	603773
60311915008	**M-BMW-1**	EPA 200.8	603726	EPA 200.8	603773
60311915009	**M-BMW-2**	EPA 200.8	603726	EPA 200.8	603773
60311915010	**M-DUP-1**	EPA 200.8	603726	EPA 200.8	603773
60311915011	**M-FB-1**	EPA 200.8	603726	EPA 200.8	603773
60312019001	**M-MW-1**	EPA 200.8	603726	EPA 200.8	603773
60311915001	**M-MW-2**	EPA 245.1	604387	EPA 245.1	604433
60311915002	**M-MW-3**	EPA 245.1	604387	EPA 245.1	604433
60311915003	**M-MW-4**	EPA 245.1	604387	EPA 245.1	604433
60311915004	**M-MW-5**	EPA 245.1	604387	EPA 245.1	604433
60311915005	**M-MW-6**	EPA 245.1	604387	EPA 245.1	604433
60311915006	**M-MW-7**	EPA 245.1	604387	EPA 245.1	604433
60311915007	**M-MW-8**	EPA 245.1	604387	EPA 245.1	604433
60311915008	**M-BMW-1**	EPA 245.1	604387	EPA 245.1	604433
60311915009	**M-BMW-2**	EPA 245.1	604387	EPA 245.1	604433
60311915010	**M-DUP-1**	EPA 245.1	604387	EPA 245.1	604433
60311915011	**M-FB-1**	EPA 245.1	604387	EPA 245.1	604433
60312019001	**M-MW-1**	EPA 245.1	604020	EPA 245.1	604051
60311915001	**M-MW-2**	EPA 903.1	357798		
60311915002	**M-MW-3**	EPA 903.1	357798		
60311915003	**M-MW-4**	EPA 903.1	357798		
60311915004	**M-MW-5**	EPA 903.1	357798		
60311915005	**M-MW-6**	EPA 903.1	357798		
60311915006	**M-MW-7**	EPA 903.1	357798		
60311915007	**M-MW-8**	EPA 903.1	357798		
60311915008	**M-BMW-1**	EPA 903.1	357798		
60311915009	**M-BMW-2**	EPA 903.1	357798		
60311915010	**M-DUP-1**	EPA 903.1	357805		

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60311915011	**M-FB-1**	EPA 903.1	357805		
60312019001	**M-MW-1**	EPA 903.1	357805		
60311915013	**M-MW-1 MS**	EPA 903.1	357805		
60311915014	**M-MW-1 MSD**	EPA 903.1	357805		
60311915001	**M-MW-2**	EPA 904.0	357797		
60311915002	**M-MW-3**	EPA 904.0	357797		
60311915003	**M-MW-4**	EPA 904.0	357797		
60311915004	**M-MW-5**	EPA 904.0	357797		
60311915005	**M-MW-6**	EPA 904.0	357797		
60311915006	**M-MW-7**	EPA 904.0	357797		
60311915007	**M-MW-8**	EPA 904.0	357797		
60311915008	**M-BMW-1**	EPA 904.0	357797		
60311915009	**M-BMW-2**	EPA 904.0	357797		
60311915010	**M-DUP-1**	EPA 904.0	357804		
60311915011	**M-FB-1**	EPA 904.0	357804		
60312019001	**M-MW-1**	EPA 904.0	357804		
60311915013	**M-MW-1 MS**	EPA 904.0	357804		
60311915014	**M-MW-1 MSD**	EPA 904.0	357804		
60311915001	**M-MW-2**	SM 2320B	605185		
60311915002	**M-MW-3**	SM 2320B	605185		
60311915003	**M-MW-4**	SM 2320B	605185		
60311915004	**M-MW-5**	SM 2320B	605185		
60311915005	**M-MW-6**	SM 2320B	605185		
60311915006	**M-MW-7**	SM 2320B	605185		
60311915007	**M-MW-8**	SM 2320B	605185		
60311915008	**M-BMW-1**	SM 2320B	605185		
60311915009	**M-BMW-2**	SM 2320B	605185		
60311915010	**M-DUP-1**	SM 2320B	605185		
60311915011	**M-FB-1**	SM 2320B	605185		
60312019001	**M-MW-1**	SM 2320B	603916		
60311915001	**M-MW-2**	SM 2540C	603928		
60311915002	**M-MW-3**	SM 2540C	603928		
60311915003	**M-MW-4**	SM 2540C	603928		
60311915004	**M-MW-5**	SM 2540C	603928		
60311915005	**M-MW-6**	SM 2540C	603928		
60311915006	**M-MW-7**	SM 2540C	603932		
60311915007	**M-MW-8**	SM 2540C	603932		
60311915008	**M-BMW-1**	SM 2540C	603932		
60311915009	**M-BMW-2**	SM 2540C	603932		
60311915010	**M-DUP-1**	SM 2540C	603928		
60311915011	**M-FB-1**	SM 2540C	603932		
60312019001	**M-MW-1**	SM 2540C	604219		
60311915001	**M-MW-2**	EPA 300.0	605614		
60311915002	**M-MW-3**	EPA 300.0	605614		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311915

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60311915003	**M-MW-4**	EPA 300.0	605614		
60311915004	**M-MW-5**	EPA 300.0	605614		
60311915005	**M-MW-6**	EPA 300.0	605614		
60311915006	**M-MW-7**	EPA 300.0	605755		
60311915007	**M-MW-8**	EPA 300.0	605755		
60311915008	**M-BMW-1**	EPA 300.0	605755		
60311915009	**M-BMW-2**	EPA 300.0	605755		
60311915010	**M-DUP-1**	EPA 300.0	605755		
60311915011	**M-FB-1**	EPA 300.0	605755		
60312019001	**M-MW-1**	EPA 300.0	604358		

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Sample Condition Upon Receipt

WO# : 60311915
60311915

Client Name: Golder Assoc

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ____________ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Cp/C

Thermometer Used: T100 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): As-read 19.5 **Corr. Factor** 0.0 **Corrected** 19.5

Date and initials of person examining contents: 8-15-19 ik

Temperature should be above freezing to 6°C 2.7, 0.2, 18.8 2.7, 0.2, 18.8

Chain of Custody present:	☒Yes	☐No	☐N/A	
Chain of Custody relinquished:	☒Yes	☐No	☐N/A	
Samples arrived within holding time:	☒Yes	☐No	☐N/A	
Short Hold Time analyses (<72hr):	☐Yes	☒No	☐N/A	
Rush Turn Around Time requested:	☐Yes	☒No	☐N/A	
Sufficient volume:	☒Yes	☐No	☐N/A	
Correct containers used:	☒Yes	☐No	☐N/A	
Pace containers used:	☒Yes	☐No	☐N/A	
Containers intact:	☒Yes	☐No	☐N/A	All coolers without ICE
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes	☐No	☒N/A	have Radium samples
Filtered volume received for dissolved tests?	☐Yes	☐No	☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes	☐No	☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes	☒No	☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes	☐No	☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:				
Lead acetate strip turns dark? (Record only)	☐Yes	☐No		
Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes	☐No		
Trip Blank present:	☐Yes	☐No	☒N/A	
Headspace in VOA vials (>6mm):	☐Yes	☐No	☒N/A	
Samples from USDA Regulated Area: State:	☐Yes	☐No	☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes	☐No	☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ____________ Date/Time: ____________

Comments/ Resolution: ____________

Jami Church 8/16/19

Project Manager Review: ____________ Date: ____________

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	Jeffrey_Ingram@golder.com
Phone:	636-724-9191
Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Jeffrey Ingram
Copy To:	Ryan Feldmann / Eric Schneider
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center
Project Number:	153-1406-01.0004A (COC #9)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

60311915

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N ↓Analysis Test↓	Metals*	Mercury	Chloride/Fluoride/Sulfate	Alkalinity	Total Phosphorus	Radium 226	Radium 228					Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																			N	N	N	N	N	N	N						
1	~~M-MW-1~~	WT	G																												
2	M-MW-2	WT	G			8/12	1115		5	2		3							/	/	/	/		/	/	2BP1N, BP3N, BP3U, BP2U					00
3	M-MW-3	WT	G				1326																								002
4	M-MW-4	WT	G				1559																								003
5	M-MW-5	WT	G			8/13	1130																								004
6	M-MW-6	WT	G				1555																								005
7	M-MW-7	WT	G				1525																								006
8	M-MW-8	WT	G				1400																								007
9	M-BMW-1	WT	G				1050																								008
10	M-BMW-2	WT	G				0955																								009
11	M-DUP-1	WT	G			8/12	—																								010
12	~~M-DUP-2~~	WT	G																												

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	/ Golder	8/13/19	17:35	WEFT Pace	~~8-15-19~~ WS 8-15-19	0255	19.5	N	Y	Y
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl					8-14-19		18.8			
							0.9	Y		
							2.7			

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Ryan Feldmann

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 08/13/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days

F-ALL-Q-020rev.08, 12-Oct-2007

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 2 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	Jeffrey_Ingram@golder.com
Phone:	636-724-9191
Fax:	636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Jeffrey Ingram
Copy To:	Ryan Feldmann / Eric Schneider
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center
Project Number:	153-1406-01.0004A (COC #9)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

Requested Analysis Filtered (Y/N)

60311915

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N Analysis Test	Metals* N	Mercury N	Chloride/Fluoride/Sulfate N	Alkalinity N	Total Phosphorus N	Radium 226 N	Radium 228 N		Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	M-FB-1	WT	G			8/13			5	2		3							/	/	/	/		/	/	2BP1B,		BP3N, BP3U, BP2U 011
2	~~M-FB-2~~	~~WT~~	~~G~~																									
3		WT	G																									
4		WT	G																									
5		WT	G																									
6		WT	G																									
7		WT	G																									
8		WT	G																									
9		WT	G																									
10		WT	G																									
11		WT	G																									
12		WT	G																									

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	/ Golder	8/13/19	1735	WCxt Pace	8.14.19	0255	19.5	N	Y	Y
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl							18.8			
							0.2	Y		
							02.7			

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Ryan Feldmann

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 08/13/19

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Sample Condition Upon Receipt

WO# : 60312019

60312019

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☒ Other ☐

Thermometer Used: T-300 Type of Ice: [✓ Wet] Blue None

Cooler Temperature (°C): As-read 1.9/0.7 Corr. Factor 0.0 Corrected 1.9/0.7/11.9 14.6

Temperature should be above freezing to 6°C 11.9/14.6

Date and initials of person examining contents: PV 8/15/19

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☒No ☐N/A	No Volume for Total Phosphorus.
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	Receive a empty BP3S with project.
Sufficient volume	☒Yes ☐No ☐N/A	
Correct containers used	☒Yes ☐No ☐N/A	
Pace containers used	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO$_3$, H$_2$SO$_4$, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jami Church Date: 8/16/19

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company: Golder Associates
Address: 13515 Barrett Parkway Drive, Ste 260
Ballwin, MO 63021
Email To: Jeffrey_Ingram@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: Standard

Section B
Required Project Information:

Report To: Jeffrey Ingram
Copy To: Ryan Feldmann / Eric Schneider
Purchase Order No.:
Project Name: Ameren Meramec Energy Center
Project Number: 153-1406-01.0004A (COC #9)

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ______

Site Location MO
STATE:

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	Preservatives H_2SO_4	Preservatives HNO_3	Preservatives HCl	Preservatives NaOH	Preservatives $Na_2S_2O_3$	Preservatives Methanol	Preservatives Other	↓Analysis Test↓ Y/N	Metals*	Mercury	Chloride/Fluoride/Sulfate	Alkalinity	Total Phosphorus	Radium 226	Radium 228					Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60312019
																			N	N	N	N	N	N	N						
1	M-MW-1	WT	G			8/14	1137		15	6		9							/	/	/	/	/	/	/	3BP3U		3BP2U			3BP3N 6BP1N 001
2	M-MW-2	WT	G																												
3	M-MW-3	WT	G																												
4	M-MW-4	WT	G																												
5	M-MW-5	WT	G																												
6	M-MW-6	WT	G																												
7	M-MW-7	WT	G																												
8	M-MW-8	WT	G																												
9	M-BMW-1	WT	G																												
10	M-BMW-2	WT	G																												
11	M-DUP-1	WT	G																												
12	M-DUP-2	WT	G																												

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	Golder	8/14/19	1646		8/15	0255	1.9	X	X	Y
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl							0.7	↓		
							11.9	N		
							14.6	↓	↓	↓

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Ryan Feldmann
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 08/14/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

MEMORANDUM

DATE October 1, 2019 **Project No.** 1531406

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – CCR – DATA PACKAGE 60311915R1

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field) and the blank comparison criterion was not met, associated sample results were qualified as estimates (J) or non-detects (U).
- When a radionuclide was detected in a blank (i.e. method, field), and the sample results were greater than the MDC and less than ten times the blank results the results were recorded at the result value and qualified as estimates (J).
- When a field duplicate RPD exceeded 20%, associated samples were qualified as estimates (J).
- When MS/MSD recovery exceeded the QC limits, the associated sample result was qualified as an estimate (J).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren - MEC - DM/AM
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 1531406
Validation Date: 10/1/2019

Laboratory: Pace Analytical - KS

SDG #: 60311915R1

Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 245.1 (Hg); EPA 903.1/904.0 (Rads); SM 2320B (Alk); SM 2540C (TDS); EPA 300.0 (Anions)

Matrix: ☐ Air ☐ Soil/Sed. ■ Water ☐ Waste ☐

Sample Names M-MW-1, M-MW-2, M-MW-3, M-MW-4, M-MW-5, M-MW-6, M-MW-7, M-MW-8, M-BMW-1, M-BMW-2, M-DUP-1, M-FB-1, M-MW-1 MS, M-MW-1 MSD

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	8/12-8/14/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☒	☐	☐	See Notes
b) Were analytes detected in the field blank(s)?	☒	☐	☐	See Notes
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?				DUP-1@M-MW-3
	☒	☐	☐	FB-1@M-MW-8
b) Were field dup. precision criteria met (note RPD)?	☐	☒	☐	See Notes
c) Were lab duplicates analyzed (note original and duplicate samples)?				
	☒	☐	☐	-19001 (Alk, TDS); -15001 (TDS)
d) Were lab dup. precision criteria met (note RPD)?	☒	☐	☐	See Notes

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☒	☐	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☒	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☒	☐	☐	

Comments/Notes:

MB: -915001-11, -019001: Ca (60.6), Mg (18.7), K (160), Na (448); -915001-09: Ra-226 (0.497); -10-14, -19001: Ra-226 (0.445)

FB-1: B (13.0), Ca (83.8), K (94.0), Cr (0.090), TDS (9.0), Cl (0.43), Ra-226 (0.586)

DUP-1: Cr (43), Se (200), Cl (187), F (200), SO4 (196), TDS (35), Ra-226 (200), Ra-228 (200)

Max Lab Duplicate RPD: 6% (Limit 10%)

MS/MSD: -915010: Ca (MS-H)

Dilution: Chloride and Sulfate diluted in several samples; no qualification is necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-FB-1	Calcium (Ca)	200	U	Analyte Detected in Method Blank (MB); PQL>Result>MDL
"	Potassium (K)	500	U	"
M-MW-8	Chromium (Cr)	1.0	U	Analyte Detected in Field Blank (FB); PQL>Result>MDL
M-MW-3	Chloride (Cl)	-	J	Field Duplicate (FD) Exceeded RPD Limit; Result > MDL
"	Sulfate (SO4)	-	J	"
"	Total Dissolved Solids (TDS)	-	J	"
M-DUP-1	SO4	-	J	"
"	TDS	-	J	"
"	Cl	-	J	"
"	Ca	-	J	MS/MSD Exceeded Calibration Range
M-MW-3	Radium-226 (Ra-226)	-	J	Analyte Detected in MB; 10xMB>Result>MDC
M-MW-4	"	-	J	"
M-MW-6	"	-	J	"
M-BMW-1	"	-	J	"
M-BMW-2	"	-	J	"
M-FB-1	"	-	J	"
M-MW-3	Radium-228 (Ra-228)	-	J	FD Exceeded RPD Limit; Result > MDC

Signature: ______________________ Date: 10/1/2019

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

September 09, 2019

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory between August 14, 2019 and August 15, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

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CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60311920001	**M-MW-9**	Water	08/13/19 13:14	08/14/19 02:55
60311920002	**M-TP-2**	Water	08/13/19 13:48	08/14/19 02:55
60311920003	**M-NE-DUP-1**	Water	08/13/19 08:00	08/14/19 02:55
60312020001	**M-TP-1**	Water	08/14/19 14:30	08/15/19 02:55
60312020002	**MW-10**	Water	08/14/19 09:32	08/15/19 02:55
60312020003	**M-BMW-3**	Water	08/14/19 11:05	08/15/19 02:55
60312020004	**M-BMW-4**	Water	08/14/19 10:02	08/15/19 02:55
60312020005	**M-BMW-5**	Water	08/14/19 09:00	08/15/19 02:55
60312020006	**M-NE-FB-1**	Water	08/14/19 10:06	08/15/19 02:55
60311920010	**M-TP-2 MS**	Water	08/13/19 13:48	08/14/19 02:55
60311920011	**M-TP-2 MSD**	Water	08/13/19 13:48	08/14/19 02:55

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60311920001	**M-MW-9**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311920002	**M-TP-2**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	MJK	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311920003	**M-NE-DUP-1**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	MJK	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020001	**M-TP-1**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020002	**MW-10**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020003	**M-BMW-3**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020004	**M-BMW-4**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020005	**M-BMW-5**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60312020006	**M-NE-FB-1**	EPA 200.7	EMR	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 300.0	JDS	3	PASI-K
60311920010	**M-TP-2 MS**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60311920011	**M-TP-2 MSD**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-MW-9 **Lab ID: 60311920001** Collected: 08/13/19 13:14 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**247**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:37	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:37	7440-41-7	
Boron	**5420**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:37	7440-42-8	
Calcium	**135000**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:37	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:37	7440-48-4	
Iron	**14800**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:37	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:37	7439-92-1	
Lithium	**13.8**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:37	7439-93-2	
Magnesium	**47400**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:37	7439-95-4	
Manganese	**376**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:37	7439-96-5	
Molybdenum	**37.8**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:37	7439-98-7	
Potassium	**4820**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:37	7440-09-7	
Sodium	**41400**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:37	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:21	7440-36-0	
Arsenic	**15.8**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:21	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:21	7440-43-9	
Chromium	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:21	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:21	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:21	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 11:57	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**344**	mg/L	20.0	6.5	1		08/26/19 13:10		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**830**	mg/L	10.0	10.0	1		08/19/19 10:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**35.2**	mg/L	5.0	1.1	5		08/27/19 16:41	16887-00-6	
Fluoride	**0.20**	mg/L	0.20	0.085	1		08/27/19 16:26	16984-48-8	
Sulfate	**222**	mg/L	50.0	11.5	50		08/27/19 16:57	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-2 **Lab ID: 60311920002** Collected: 08/13/19 13:48 Received: 08/14/19 02:55 Matrix: Water

Comments: • Upon receipt at the laboratory, 5 mls of nitric acid were added to the sample to meet the sample preservation requirement of pH <2 for radiochemistry analysis. The samples were not preserved <2 within the required 5 days of collection.

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**64.6**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:40	7440-39-3	
Beryllium	**0.45J**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:40	7440-41-7	B
Boron	**2410**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:40	7440-42-8	
Calcium	**221000**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:40	7440-70-2	M1
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:40	7440-48-4	
Iron	**15900**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:40	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:40	7439-92-1	
Lithium	**43.3**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:40	7439-93-2	
Magnesium	**62400**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:40	7439-95-4	
Manganese	**584**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:40	7439-96-5	
Molybdenum	**107**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:40	7439-98-7	
Potassium	**8230**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:40	7440-09-7	
Sodium	**196000**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:40	7440-23-5	M1
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:23	7440-36-0	
Arsenic	**4.0**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:23	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:23	7440-43-9	
Chromium	**0.084J**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:23	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:23	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:23	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 12:04	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**392**	mg/L	20.0	6.5	1		08/27/19 08:30		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1630**	mg/L	13.3	13.3	1		08/19/19 10:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**271**	mg/L	50.0	11.0	50		08/27/19 18:01	16887-00-6	
Fluoride	**0.47**	mg/L	0.20	0.085	1		08/27/19 17:13	16984-48-8	
Sulfate	**456**	mg/L	50.0	11.5	50		08/27/19 18:01	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-NE-DUP-1 **Lab ID: 60311920003** Collected: 08/13/19 08:00 Received: 08/14/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**246**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:51	7440-39-3	
Beryllium	**0.40J**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:51	7440-41-7	B
Boron	**5370**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:51	7440-42-8	
Calcium	**135000**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:51	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:51	7440-48-4	
Iron	**14700**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:51	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:51	7439-92-1	
Lithium	**13.7**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:51	7439-93-2	
Magnesium	**47200**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:51	7439-95-4	
Manganese	**372**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:51	7439-96-5	
Molybdenum	**39.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:51	7439-98-7	
Potassium	**4830**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:51	7440-09-7	
Sodium	**41300**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:51	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:28	7440-36-0	
Arsenic	**16.7**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:28	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:28	7440-43-9	
Chromium	**0.12J**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:28	7440-47-3	
Selenium	**0.11J**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:28	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:28	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/20/19 15:57	08/21/19 12:06	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**371**	mg/L	20.0	6.5	1		08/27/19 08:42		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**881**	mg/L	10.0	10.0	1		08/19/19 10:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**35.2**	mg/L	5.0	1.1	5		08/27/19 19:36	16887-00-6	
Fluoride	**0.28**	mg/L	0.20	0.085	1		08/27/19 19:20	16984-48-8	
Sulfate	**208**	mg/L	20.0	4.6	20		08/28/19 12:01	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-1 **Lab ID: 60312020001** Collected: 08/14/19 14:30 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**346**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:13	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:13	7440-41-7	
Boron	**558**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:13	7440-42-8	
Calcium	**69800**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:13	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:13	7440-48-4	
Iron	**4930**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:13	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:13	7439-92-1	
Lithium	**10.5**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:13	7439-93-2	
Magnesium	**30400**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:13	7439-95-4	
Manganese	**71.8**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:13	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:13	7439-98-7	
Potassium	**2940**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:13	7440-09-7	
Sodium	**40000**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:13	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:01	7440-36-0	
Arsenic	**14.3**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:01	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:01	7440-43-9	
Chromium	**4.2**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:01	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:01	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:01	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:17	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**386**	mg/L	20.0	6.5	1		08/19/19 00:00		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**440**	mg/L	10.0	10.0	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**20.2**	mg/L	2.0	0.44	2		08/21/19 00:24	16887-00-6	
Fluoride	**0.25**	mg/L	0.20	0.085	1		08/21/19 00:07	16984-48-8	
Sulfate	**<0.23**	mg/L	1.0	0.23	1		08/21/19 00:07	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: MW-10 **Lab ID: 60312020002** Collected: 08/14/19 09:32 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**162**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:20	7440-39-3	
Beryllium	**0.50J**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:20	7440-41-7	B
Boron	**1740**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:20	7440-42-8	
Calcium	**197000**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:20	7440-70-2	
Cobalt	**1.6J**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:20	7440-48-4	
Iron	**18200**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:20	7439-89-6	
Lead	**4.0J**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:20	7439-92-1	
Lithium	**37.4**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:20	7439-93-2	
Magnesium	**50800**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:20	7439-95-4	
Manganese	**788**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:20	7439-96-5	
Molybdenum	**4.5J**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:20	7439-98-7	
Potassium	**8180**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:20	7440-09-7	
Sodium	**61700**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:20	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:02	7440-36-0	
Arsenic	**11.8**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:02	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:02	7440-43-9	
Chromium	**0.11J**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:02	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:02	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:02	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:19	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**509**	mg/L	20.0	6.5	1		08/19/19 12:24		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1110**	mg/L	13.3	13.3	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**82.7**	mg/L	20.0	4.4	20		08/21/19 01:14	16887-00-6	
Fluoride	**0.21**	mg/L	0.20	0.085	1		08/21/19 00:41	16984-48-8	
Sulfate	**211**	mg/L	20.0	4.6	20		08/21/19 01:14	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-BMW-3 **Lab ID: 60312020003** Collected: 08/14/19 11:05 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**558**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:22	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:22	7440-41-7	
Boron	**381**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:22	7440-42-8	
Calcium	**75100**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:22	7440-70-2	M1
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:22	7440-48-4	
Iron	**38400**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:22	7439-89-6	M1
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:22	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:22	7439-93-2	
Magnesium	**30900**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:22	7439-95-4	
Manganese	**4440**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:22	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:22	7439-98-7	
Potassium	**1170**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:22	7440-09-7	
Sodium	**37100**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:22	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:04	7440-36-0	
Arsenic	**4.3**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:04	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:04	7440-43-9	
Chromium	**0.097J**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:04	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:04	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:04	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:21	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**265**	mg/L	20.0	6.5	1		08/19/19 12:34		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**600**	mg/L	10.0	10.0	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**19.2**	mg/L	2.0	0.44	2		08/21/19 02:22	16887-00-6	
Fluoride	**0.10J**	mg/L	0.20	0.085	1		08/21/19 01:31	16984-48-8	
Sulfate	**127**	mg/L	20.0	4.6	20		08/21/19 02:39	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-BMW-4 **Lab ID: 60312020004** Collected: 08/14/19 10:02 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**300**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:26	7440-39-3	
Beryllium	**0.39J**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:26	7440-41-7	B
Boron	**40.1J**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:26	7440-42-8	
Calcium	**42600**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:26	7440-70-2	
Cobalt	**7.0**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:26	7440-48-4	
Iron	**28400**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:26	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:26	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:26	7439-93-2	
Magnesium	**19800**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:26	7439-95-4	
Manganese	**3340**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:26	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:26	7439-98-7	
Potassium	**602**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:26	7440-09-7	
Sodium	**28500**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:26	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:08	7440-36-0	
Arsenic	**7.4**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:08	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:08	7440-43-9	
Chromium	**0.14J**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:08	7440-47-3	
Selenium	**0.11J**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:08	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:08	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:24	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**176**	mg/L	20.0	6.5	1		08/19/19 12:39		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**357**	mg/L	5.0	5.0	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**19.8**	mg/L	1.0	0.22	1		08/21/19 02:56	16887-00-6	
Fluoride	**<0.085**	mg/L	0.20	0.085	1		08/21/19 02:56	16984-48-8	
Sulfate	**86.5**	mg/L	10.0	2.3	10		08/21/19 03:12	14808-79-8	

ANALYTICAL RESULTS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

Sample: M-BMW-5 **Lab ID: 60312020005** Collected: 08/14/19 09:00 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**212**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:28	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:28	7440-41-7	
Boron	**81.9J**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:28	7440-42-8	
Calcium	**56800**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:28	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:28	7440-48-4	
Iron	**191**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:28	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:28	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:28	7439-93-2	
Magnesium	**23500**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:28	7439-95-4	
Manganese	**407**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:28	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:28	7439-98-7	
Potassium	**1110**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:28	7440-09-7	
Sodium	**36100**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:28	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:10	7440-36-0	
Arsenic	**0.30J**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:10	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:10	7440-43-9	
Chromium	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:10	7440-47-3	
Selenium	**0.61J**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:10	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:10	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:26	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**170**	mg/L	20.0	6.5	1		08/19/19 12:43		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**429**	mg/L	5.0	5.0	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**42.9**	mg/L	10.0	2.2	10		08/21/19 03:46	16887-00-6	
Fluoride	**<0.085**	mg/L	0.20	0.085	1		08/21/19 03:29	16984-48-8	
Sulfate	**85.0**	mg/L	10.0	2.3	10		08/21/19 03:46	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-NE-FB-1 **Lab ID: 60312020006** Collected: 08/14/19 10:06 Received: 08/15/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**<1.4**	ug/L	5.0	1.4	1	08/19/19 09:27	08/20/19 19:31	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	08/19/19 09:27	08/20/19 19:31	7440-41-7	
Boron	**<10.7**	ug/L	100	10.7	1	08/19/19 09:27	08/20/19 19:31	7440-42-8	
Calcium	**<50.0**	ug/L	200	50.0	1	08/19/19 09:27	08/20/19 19:31	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	08/19/19 09:27	08/20/19 19:31	7440-48-4	
Iron	**<14.0**	ug/L	50.0	14.0	1	08/19/19 09:27	08/20/19 19:31	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	08/19/19 09:27	08/20/19 19:31	7439-92-1	
Lithium	**<5.9**	ug/L	10.0	5.9	1	08/19/19 09:27	08/20/19 19:31	7439-93-2	
Magnesium	**14.0J**	ug/L	50.0	13.0	1	08/19/19 09:27	08/20/19 19:31	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	08/19/19 09:27	08/20/19 19:31	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	08/19/19 09:27	08/20/19 19:31	7439-98-7	
Potassium	**<79.0**	ug/L	500	79.0	1	08/19/19 09:27	08/20/19 19:31	7440-09-7	
Sodium	**<144**	ug/L	500	144	1	08/19/19 09:27	08/20/19 19:31	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:15	7440-36-0	
Arsenic	**<0.065**	ug/L	1.0	0.065	1	08/19/19 10:11	08/20/19 12:15	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	08/19/19 10:11	08/20/19 12:15	7440-43-9	
Chromium	**<0.078**	ug/L	1.0	0.078	1	08/19/19 10:11	08/20/19 12:15	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	08/19/19 10:11	08/20/19 12:15	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	08/19/19 10:11	08/20/19 12:15	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.066**	ug/L	0.20	0.066	1	08/19/19 11:47	08/20/19 15:28	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**<6.5**	mg/L	20.0	6.5	1		08/19/19 12:46		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<5.0**	mg/L	5.0	5.0	1		08/20/19 09:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**<0.22**	mg/L	1.0	0.22	1		08/21/19 04:03	16887-00-6	
Fluoride	**<0.085**	mg/L	0.20	0.085	1		08/21/19 04:03	16984-48-8	
Sulfate	**<0.23**	mg/L	1.0	0.23	1		08/21/19 04:03	14808-79-8	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 604020
Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1
Analysis Description: 245.1 Mercury
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2469857
Matrix: Water
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.066	0.20	0.066	08/20/19 14:59	

LABORATORY CONTROL SAMPLE: 2469858

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	97	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2469859 2469860

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.066	5	5	4.7	4.5	93	91	70-130	3	20	

MATRIX SPIKE SAMPLE: 2469861

Parameter	Units	60311645005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	ND	5	4.9	98	70-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 604387
Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1
Analysis Description: 245.1 Mercury
Associated Lab Samples: 60311920001, 60311920002, 60311920003

METHOD BLANK: 2470996
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.066	0.20	0.066	08/21/19 11:09	

LABORATORY CONTROL SAMPLE: 2470997

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.0	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2470998 2470999

Parameter	Units	60311814005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.1	5.0	102	100	70-130	1	20	

MATRIX SPIKE SAMPLE: 2471000

Parameter	Units	60311920002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	<0.066	5	5.1	103	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 603943
Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2469675
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.4	5.0	1.4	08/20/19 19:11	
Beryllium	ug/L	0.30J	1.0	0.25	08/20/19 19:11	
Boron	ug/L	<10.7	100	10.7	08/20/19 19:11	
Calcium	ug/L	<50.0	200	50.0	08/20/19 19:11	
Cobalt	ug/L	<0.84	5.0	0.84	08/20/19 19:11	
Iron	ug/L	<14.0	50.0	14.0	08/20/19 19:11	
Lead	ug/L	<3.4	10.0	3.4	08/20/19 19:11	
Lithium	ug/L	<5.9	10.0	5.9	08/20/19 19:11	
Magnesium	ug/L	<13.0	50.0	13.0	08/20/19 19:11	
Manganese	ug/L	<2.1	5.0	2.1	08/20/19 19:11	
Molybdenum	ug/L	<2.6	20.0	2.6	08/20/19 19:11	
Potassium	ug/L	<79.0	500	79.0	08/20/19 19:11	
Sodium	ug/L	<144	500	144	08/20/19 19:11	

LABORATORY CONTROL SAMPLE: 2469676

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	957	96	85-115	
Beryllium	ug/L	1000	959	96	85-115	
Boron	ug/L	1000	930	93	85-115	
Calcium	ug/L	10000	9390	94	85-115	
Cobalt	ug/L	1000	988	99	85-115	
Iron	ug/L	10000	9480	95	85-115	
Lead	ug/L	1000	1040	104	85-115	
Lithium	ug/L	1000	991	99	85-115	
Magnesium	ug/L	10000	9680	97	85-115	
Manganese	ug/L	1000	976	98	85-115	
Molybdenum	ug/L	1000	991	99	85-115	
Potassium	ug/L	10000	9520	95	85-115	
Sodium	ug/L	10000	9850	98	85-115	

MATRIX SPIKE SAMPLE: 2469677

Parameter	Units	60312020003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	558	1000	1480	92	70-130	
Beryllium	ug/L	<0.25	1000	940	94	70-130	
Boron	ug/L	381	1000	1310	93	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

MATRIX SPIKE SAMPLE: 2469677

Parameter	Units	60312020003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Calcium	ug/L	75100	10000	79700	45	70-130	M1
Cobalt	ug/L	<0.84	1000	963	96	70-130	
Iron	ug/L	38400	10000	45200	68	70-130	M1
Lead	ug/L	<3.4	1000	1000	100	70-130	
Lithium	ug/L	<5.9	1000	992	99	70-130	
Magnesium	ug/L	30900	10000	38400	76	70-130	
Manganese	ug/L	4440	1000	5150	70	70-130	
Molybdenum	ug/L	<2.6	1000	994	99	70-130	
Potassium	ug/L	1170	10000	10600	94	70-130	
Sodium	ug/L	37100	10000	45000	79	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2469678 2469679

Parameter	Units	60311920002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	64.6	1000	1000	1040	1050	98	99	70-130	1	20	
Beryllium	ug/L	0.45J	1000	1000	954	967	95	97	70-130	1	20	
Boron	ug/L	2410	1000	1000	3370	3440	95	103	70-130	2	20	
Calcium	ug/L	221000	10000	10000	229000	234000	79	136	70-130	2	20	M1
Cobalt	ug/L	<0.84	1000	1000	963	968	96	97	70-130	1	20	
Iron	ug/L	15900	10000	10000	25100	25500	93	96	70-130	1	20	
Lead	ug/L	<3.4	1000	1000	1000	1000	100	100	70-130	0	20	
Lithium	ug/L	43.3	1000	1000	1060	1070	102	103	70-130	0	20	
Magnesium	ug/L	62400	10000	10000	71800	73200	94	108	70-130	2	20	
Manganese	ug/L	584	1000	1000	1540	1570	96	98	70-130	2	20	
Molybdenum	ug/L	107	1000	1000	1020	1020	91	92	70-130	0	20	
Potassium	ug/L	8230	10000	10000	18100	18400	99	102	70-130	2	20	
Sodium	ug/L	196000	10000	10000	205000	213000	93	171	70-130	4	20	M1

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 603985
Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2469777
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.078	1.0	0.078	08/20/19 11:55	
Arsenic	ug/L	<0.065	1.0	0.065	08/20/19 11:55	
Cadmium	ug/L	<0.033	0.50	0.033	08/20/19 11:55	
Chromium	ug/L	<0.078	1.0	0.078	08/20/19 11:55	
Selenium	ug/L	<0.085	1.0	0.085	08/20/19 11:55	
Thallium	ug/L	<0.099	1.0	0.099	08/20/19 11:55	

LABORATORY CONTROL SAMPLE: 2469778

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.5	96	85-115	
Arsenic	ug/L	40	37.8	94	85-115	
Cadmium	ug/L	40	38.6	97	85-115	
Chromium	ug/L	40	40.2	101	85-115	
Selenium	ug/L	40	39.0	97	85-115	
Thallium	ug/L	40	36.6	91	85-115	

MATRIX SPIKE SAMPLE: 2469779

Parameter	Units	60312020003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	40.4	101	70-130	
Arsenic	ug/L	4.3	40	43.0	97	70-130	
Cadmium	ug/L	<0.033	40	38.6	96	70-130	
Chromium	ug/L	0.097J	40	41.9	104	70-130	
Selenium	ug/L	<0.085	40	38.6	96	70-130	
Thallium	ug/L	<0.099	40	38.3	96	70-130	

MATRIX SPIKE SAMPLE: 2469780

Parameter	Units	60311920002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	<0.078	40	38.9	97	70-130	
Arsenic	ug/L	4.0	40	43.0	98	70-130	
Cadmium	ug/L	<0.033	40	36.4	91	70-130	
Chromium	ug/L	0.084J	40	39.5	98	70-130	
Selenium	ug/L	<0.085	40	37.3	93	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

MATRIX SPIKE SAMPLE: 2469780

Parameter	Units	60311920002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Thallium	ug/L	<0.099	40	39.7	99	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 603916
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2469612
Matrix: Water
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	08/19/19 10:06	

LABORATORY CONTROL SAMPLE: 2469613

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	487	97	90-110	

SAMPLE DUPLICATE: 2469766

Parameter	Units	60311993004 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	386	387	0	10	

SAMPLE DUPLICATE: 2469767

Parameter	Units	60312019001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	390	412	6	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

QC Batch:	605185	Analysis Method:	SM 2320B
QC Batch Method:	SM 2320B	Analysis Description:	2320B Alkalinity
Associated Lab Samples:	60311920001		

METHOD BLANK: 2473734 Matrix: Water

Associated Lab Samples: 60311920001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	08/26/19 10:49	

LABORATORY CONTROL SAMPLE: 2473735

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	500	100	90-110	

SAMPLE DUPLICATE: 2473736

Parameter	Units	60311820012 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	378	393	4	10	

SAMPLE DUPLICATE: 2473737

Parameter	Units	60311736004 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	516	515	0	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 605686
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60311920002, 60311920003

METHOD BLANK: 2475836
Matrix: Water
Associated Lab Samples: 60311920002, 60311920003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	08/27/19 08:19	

LABORATORY CONTROL SAMPLE: 2475837

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	492	98	90-110	

SAMPLE DUPLICATE: 2475838

Parameter	Units	60311920002 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	392	406	4	10	

SAMPLE DUPLICATE: 2475839

Parameter	Units	60312418001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	434	441	2	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 603932
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60311920001, 60311920002, 60311920003

METHOD BLANK: 2469663
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	08/19/19 10:20	

LABORATORY CONTROL SAMPLE: 2469664

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1030	103	80-120	

SAMPLE DUPLICATE: 2469665

Parameter	Units	60311920002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1630	1620	1	10	

SAMPLE DUPLICATE: 2469666

Parameter	Units	60312087006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2950	3460	16	10	D6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 604219   Analysis Method: SM 2540C
QC Batch Method: SM 2540C   Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2470466   Matrix: Water
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	08/20/19 09:55	

LABORATORY CONTROL SAMPLE: 2470467

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1030	103	80-120	

SAMPLE DUPLICATE: 2470468

Parameter	Units	60312019001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	696	698	0	10	

SAMPLE DUPLICATE: 2470469

Parameter	Units	60312020006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	<5.0	<5.0		10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 604358
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 2470936
Matrix: Water
Associated Lab Samples: 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	08/20/19 15:15	
Fluoride	mg/L	<0.085	0.20	0.085	08/20/19 15:15	
Sulfate	mg/L	<0.23	1.0	0.23	08/20/19 15:15	

LABORATORY CONTROL SAMPLE: 2470937

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	95	90-110	
Fluoride	mg/L	2.5	2.4	97	90-110	
Sulfate	mg/L	5	4.8	97	90-110	

MATRIX SPIKE SAMPLE: 2470938

Parameter	Units	60311700004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	1700	1000	2670	97	80-120	
Fluoride	mg/L	98.0	500	599	100	80-120	
Sulfate	mg/L	ND	1000	1000	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2470939 2470940

Parameter	Units	60312019001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	44.2	50	50	94.5	92.2	100	96	80-120	2	15	
Fluoride	mg/L	0.24	2.5	2.5	2.6	2.7	95	98	80-120	2	15	
Sulfate	mg/L	106	50	50	161	156	109	98	80-120	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 605755
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60311920001, 60311920002, 60311920003

METHOD BLANK: 2476001
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	08/27/19 10:51	
Fluoride	mg/L	<0.085	0.20	0.085	08/27/19 10:51	
Sulfate	mg/L	<0.23	1.0	0.23	08/27/19 10:51	

LABORATORY CONTROL SAMPLE: 2476002

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.6	92	90-110	
Fluoride	mg/L	2.5	2.3	93	90-110	
Sulfate	mg/L	5	5.1	103	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2476003 2476004

Parameter	Units	60311920002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	271	250	250	508	507	95	94	80-120	0	15	
Fluoride	mg/L	0.47	2.5	2.5	2.9	2.9	99	98	80-120	1	15	
Sulfate	mg/L	456	250	250	703	701	99	98	80-120	0	15	

MATRIX SPIKE SAMPLE: 2476005

Parameter	Units	60312114001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	ND	50	49.6	86	80-120	
Fluoride	mg/L	ND	25	24.6	98	80-120	
Sulfate	mg/L	166	50	214	95	80-120	E

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

QC Batch:	606064	Analysis Method:	EPA 300.0
QC Batch Method:	EPA 300.0	Analysis Description:	300.0 IC Anions
Associated Lab Samples:	60311920003		

METHOD BLANK: 2477152 Matrix: Water

Associated Lab Samples: 60311920003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Sulfate	mg/L	<0.23	1.0	0.23	08/28/19 10:20	

LABORATORY CONTROL SAMPLE: 2477153

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.7	93	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2477154 2477155

Parameter	Units	60310792030 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	29.4	25	25	54.5	54.4	100	100	80-120	0	15	

MATRIX SPIKE SAMPLE: 2477156

Parameter	Units	60310792033 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	67.5	25	93.3	103	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-MW-9 **Lab ID: 60311920001** Collected: 08/13/19 13:14 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.686 ± 0.356 (0.124)** **C:NA T:91%**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**1.02 ± 0.452 (0.753)** **C:80% T:82%**	pCi/L	09/04/19 10:34	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-2 **Lab ID: 60311920002** Collected: 08/13/19 13:48 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Comments: • Upon receipt at the laboratory, 5 mls of nitric acid were added to the sample to meet the sample preservation requirement of pH <2 for radiochemistry analysis. The samples were not preserved <2 within the required 5 days of collection.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.478 ± 0.523 (0.842)** **C:NA T:91%**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**0.138 ± 0.341 (0.758)** **C:77% T:88%**	pCi/L	09/04/19 10:35	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-NE-DUP-1 **Lab ID: 60311920003** Collected: 08/13/19 08:00 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.723 ± 0.420 (0.447)** **C:NA T:94%**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**0.637 ± 0.392 (0.735)** **C:79% T:83%**	pCi/L	09/04/19 10:35	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-1 **Lab ID: 60312020001** Collected: 08/14/19 14:30 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.193 ± 0.363 (0.642)** **C:NA T:96%**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**0.984 ± 0.478 (0.821)** **C:75% T:81%**	pCi/L	09/04/19 11:13	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: MW-10 **Lab ID: 60312020002** Collected: 08/14/19 09:32 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.785 ± 0.543 (0.769)** **C:NA T:92%**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**1.08 ± 0.505 (0.867)** **C:77% T:83%**	pCi/L	09/04/19 11:13	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-BMW-3 **Lab ID: 60312020003** Collected: 08/14/19 11:05 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.19 ± 0.515 (0.365)** **C:NA T:96%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.518 ± 0.443 (0.893)** **C:79% T:82%**	pCi/L	09/04/19 11:13	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-BMW-4 **Lab ID: 60312020004** Collected: 08/14/19 10:02 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.416 ± 0.480 (0.780)** **C:NA T:87%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.484 ± 0.418 (0.841)** **C:75% T:79%**	pCi/L	09/04/19 11:13	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

Sample: M-BMW-5 **Lab ID: 60312020005** Collected: 08/14/19 09:00 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.331 ± 0.384 (0.619)** **C:NA T:92%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.133 ± 0.377 (0.845)** **C:74% T:84%**	pCi/L	09/04/19 14:38	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

Sample: M-NE-FB-1 **Lab ID: 60312020006** Collected: 08/14/19 10:06 Received: 08/15/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.653 ± 0.435 (0.540)** **C:NA T:89%**	pCi/L	09/06/19 15:49	13982-63-3	
Radium-228	EPA 904.0	**0.155 ± 0.454 (1.02)** **C:80% T:72%**	pCi/L	09/04/19 14:38	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-2 MS **Lab ID: 60311920010** Collected: 08/13/19 13:48 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Comments: • Sample collection time on containers does not match COC; client was notified and confirmed correct time is 13:48.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**87.91 %REC ± NA (NA) C:NA T:NA**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**123.73 %REC ± NA (NA) C:NA T:NA**	pCi/L	09/04/19 10:35	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Sample: M-TP-2 MSD **Lab ID: 60311920011** Collected: 08/13/19 13:48 Received: 08/14/19 02:55 Matrix: Water
PWS: Site ID: Sample Type:

Comments: • Sample collection time on containers does not match COC; client was notified and confirmed correct time is 13:48.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**85.57 %REC 2.70 RPD ± NA (NA) C:NA T:NA**	pCi/L	09/06/19 15:35	13982-63-3	
Radium-228	EPA 904.0	**126.02 %REC 1.83 RPD ± NA (NA) C:NA T:NA**	pCi/L	09/04/19 10:35	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

QC Batch: 357798
Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60311920010, 60311920011, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 1737463
Matrix: Water
Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60311920010, 60311920011, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.497 ± 0.316 (0.382) C:NA T:100%	pCi/L	09/06/19 15:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

QC Batch:	357797	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228

Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60311920010, 60311920011, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

METHOD BLANK: 1737457 Matrix: Water

Associated Lab Samples: 60311920001, 60311920002, 60311920003, 60311920010, 60311920011, 60312020001, 60312020002, 60312020003, 60312020004, 60312020005, 60312020006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.550 ± 0.383 (0.736) C:76% T:81%	pCi/L	09/04/19 10:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60311920

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60311920001	**M-MW-9**	EPA 200.7	603943	EPA 200.7	604004
60311920002	**M-TP-2**	EPA 200.7	603943	EPA 200.7	604004
60311920003	**M-NE-DUP-1**	EPA 200.7	603943	EPA 200.7	604004
60312020001	**M-TP-1**	EPA 200.7	603943	EPA 200.7	604004
60312020002	**MW-10**	EPA 200.7	603943	EPA 200.7	604004
60312020003	**M-BMW-3**	EPA 200.7	603943	EPA 200.7	604004
60312020004	**M-BMW-4**	EPA 200.7	603943	EPA 200.7	604004
60312020005	**M-BMW-5**	EPA 200.7	603943	EPA 200.7	604004
60312020006	**M-NE-FB-1**	EPA 200.7	603943	EPA 200.7	604004
60311920001	**M-MW-9**	EPA 200.8	603985	EPA 200.8	604011
60311920002	**M-TP-2**	EPA 200.8	603985	EPA 200.8	604011
60311920003	**M-NE-DUP-1**	EPA 200.8	603985	EPA 200.8	604011
60312020001	**M-TP-1**	EPA 200.8	603985	EPA 200.8	604011
60312020002	**MW-10**	EPA 200.8	603985	EPA 200.8	604011
60312020003	**M-BMW-3**	EPA 200.8	603985	EPA 200.8	604011
60312020004	**M-BMW-4**	EPA 200.8	603985	EPA 200.8	604011
60312020005	**M-BMW-5**	EPA 200.8	603985	EPA 200.8	604011
60312020006	**M-NE-FB-1**	EPA 200.8	603985	EPA 200.8	604011
60311920001	**M-MW-9**	EPA 245.1	604387	EPA 245.1	604433
60311920002	**M-TP-2**	EPA 245.1	604387	EPA 245.1	604433
60311920003	**M-NE-DUP-1**	EPA 245.1	604387	EPA 245.1	604433
60312020001	**M-TP-1**	EPA 245.1	604020	EPA 245.1	604051
60312020002	**MW-10**	EPA 245.1	604020	EPA 245.1	604051
60312020003	**M-BMW-3**	EPA 245.1	604020	EPA 245.1	604051
60312020004	**M-BMW-4**	EPA 245.1	604020	EPA 245.1	604051
60312020005	**M-BMW-5**	EPA 245.1	604020	EPA 245.1	604051
60312020006	**M-NE-FB-1**	EPA 245.1	604020	EPA 245.1	604051
60311920001	**M-MW-9**	EPA 903.1	357798		
60311920002	**M-TP-2**	EPA 903.1	357798		
60311920003	**M-NE-DUP-1**	EPA 903.1	357798		
60312020001	**M-TP-1**	EPA 903.1	357798		
60312020002	**MW-10**	EPA 903.1	357798		
60312020003	**M-BMW-3**	EPA 903.1	357798		
60312020004	**M-BMW-4**	EPA 903.1	357798		
60312020005	**M-BMW-5**	EPA 903.1	357798		
60312020006	**M-NE-FB-1**	EPA 903.1	357798		
60311920010	**M-TP-2 MS**	EPA 903.1	357798		
60311920011	**M-TP-2 MSD**	EPA 903.1	357798		
60311920001	**M-MW-9**	EPA 904.0	357797		
60311920002	**M-TP-2**	EPA 904.0	357797		
60311920003	**M-NE-DUP-1**	EPA 904.0	357797		
60312020001	**M-TP-1**	EPA 904.0	357797		
60312020002	**MW-10**	EPA 904.0	357797		
60312020003	**M-BMW-3**	EPA 904.0	357797		
60312020004	**M-BMW-4**	EPA 904.0	357797		
60312020005	**M-BMW-5**	EPA 904.0	357797		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60311920

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60312020006	**M-NE-FB-1**	EPA 904.0	357797		
60311920010	**M-TP-2 MS**	EPA 904.0	357797		
60311920011	**M-TP-2 MSD**	EPA 904.0	357797		
60311920001	**M-MW-9**	SM 2320B	605185		
60311920002	**M-TP-2**	SM 2320B	605686		
60311920003	**M-NE-DUP-1**	SM 2320B	605686		
60312020001	**M-TP-1**	SM 2320B	603916		
60312020002	**MW-10**	SM 2320B	603916		
60312020003	**M-BMW-3**	SM 2320B	603916		
60312020004	**M-BMW-4**	SM 2320B	603916		
60312020005	**M-BMW-5**	SM 2320B	603916		
60312020006	**M-NE-FB-1**	SM 2320B	603916		
60311920001	**M-MW-9**	SM 2540C	603932		
60311920002	**M-TP-2**	SM 2540C	603932		
60311920003	**M-NE-DUP-1**	SM 2540C	603932		
60312020001	**M-TP-1**	SM 2540C	604219		
60312020002	**MW-10**	SM 2540C	604219		
60312020003	**M-BMW-3**	SM 2540C	604219		
60312020004	**M-BMW-4**	SM 2540C	604219		
60312020005	**M-BMW-5**	SM 2540C	604219		
60312020006	**M-NE-FB-1**	SM 2540C	604219		
60311920001	**M-MW-9**	EPA 300.0	605755		
60311920002	**M-TP-2**	EPA 300.0	605755		
60311920003	**M-NE-DUP-1**	EPA 300.0	605755		
60311920003	**M-NE-DUP-1**	EPA 300.0	606064		
60312020001	**M-TP-1**	EPA 300.0	604358		
60312020002	**MW-10**	EPA 300.0	604358		
60312020003	**M-BMW-3**	EPA 300.0	604358		
60312020004	**M-BMW-4**	EPA 300.0	604358		
60312020005	**M-BMW-5**	EPA 300.0	604358		
60312020006	**M-NE-FB-1**	EPA 300.0	604358		

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Sample Condition Upon Receipt

WO#: 60311920

60311920

Client Name: Golder Assoc

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Cpic

Thermometer Used: TJ00 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 19.5 **Corr. Factor** 0.0 **Corrected** 19.5

Date and initials of person examining contents: 8.15.19 lk

Temperature should be above freezing to 6°C 2.7, 0.2, 18.8 2.7, 0.2, 18.8

Chain of Custody present:	☒Yes	☐No	☐N/A	
Chain of Custody relinquished:	☒Yes	☐No	☐N/A	
Samples arrived within holding time:	☒Yes	☐No	☐N/A	
Short Hold Time analyses (<72hr):	☐Yes	☒No	☐N/A	
Rush Turn Around Time requested:	☐Yes	☒No	☐N/A	
Sufficient volume:	☒Yes	☐No	☐N/A	
Correct containers used:	☒Yes	☐No	☐N/A	
Pace containers used:	☒Yes	☐No	☐N/A	
Containers intact:	☒Yes	☐No	☐N/A	All coolers without ICE
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes	☐No	☒N/A	have Radium samples
Filtered volume received for dissolved tests?	☐Yes	☐No	☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes	☐No	☐N/A	NO time on COC for M-TP-2
Samples contain multiple phases? Matrix: WT	☐Yes	☒No	☐N/A	container 13:48
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes	☐No	☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:				
Lead acetate strip turns dark? (Record only)	☐Yes	☐No		
Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes	☐No		
Trip Blank present:	☐Yes	☐No	☒N/A	
Headspace in VOA vials (>6mm):	☐Yes	☐No	☒N/A	
Samples from USDA Regulated Area: State:	☐Yes	☐No	☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes	☐No	☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

8/16/19

Project Manager Review: Jami Church Date: ______

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page: 1 of 1

2013251

Section A
Required Client Information:

Company: Golder Associates
Address: 13515 Barrett Parkway Drive, Ste 260
Email To: Jeffrey_Ingram@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: standard

Section B
Required Project Information:

Report To: Jeffrey Ingram
Copy To: Ryan Feldmann
Eric Schneider
Purchase Order No :
Project Name: Ameren Meramec E.C.-NE
Project Number: 153-1406-01.0004B

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

60311920

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Mercury	Chloride, Fluoride, Sulfate	Alkalinity	Rad 226+228							Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	M-MW-9	WT	G			8/13	1314		5	2		3							/	/	/	/	/	2BP1N, BP2U							BP3N, BP3U 001
2	M-TP-2	WT	G			↓			15	6		9							↓	↓	↓	↓	↓	6BP1N, 4BP2U							2BP3U, 3BP3N
3	M-NE-DUP-1	WT	G			↓	—		5	2		3							↓	↓	↓	↓	↓	2BP1N, BP2U							BP3N, BP3U
4																															
5																															
6																															
7																															
8																															
9																															
10																															
11																															
12																															

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	/ Golder	8/13/19	1735	MZYT / PGS	8-14-19	0255	19.5	N	Y	Y
							18.8	↓	↓	↓
							0.2	Y		
							2.7	↓		

ORIGINAL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Ryan Feldmann
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 08/13/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days

F-ALL-Q-020rev 07, 15-May-2007

WO#: 60312020

60312020

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Sample Condition Upon Receipt

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☑ Other ☐

Thermometer Used: T-300 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 1.9/0.7 **Corr. Factor** 0.0 **Corrected** 1.9/0.7/11.9 14.6

Temperature should be above freezing to 6°C 11.9/14.6

Date and initials of person examining contents: PV 8/15/19

Chain of Custody present:	☑Yes ☐No ☐N/A	
Chain of Custody relinquished:	☑Yes ☐No ☐N/A	
Samples arrived within holding time:	☑Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☑No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	
Sufficient volume:	☑Yes ☐No ☐N/A	
Correct containers used	☑Yes ☐No ☐N/A	
Pace containers used:	☑Yes ☐No ☐N/A	
Containers intact:	☑Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☑N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☑No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☑Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☑N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	
Samples from USDA Regulated Area: State	☐Yes ☐No ☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jamie Church 8/16/19 Dat

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT All relevant fields must be completed accurately

Page: of

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260
	Ballwin, MO 63021
Email To:	jeffrey ingram@golder.com
Phone:	636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Jeffrey Ingram
Copy To:	Ryan Feldmann/Eric Schneider
Purchase Order No.:	
Project Name:	Ameren Meramec Energy Center
Project Number:	153-1406-01.0004 (COC #13)

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER ______

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)	Metals* (N)	Mercury (N)	Chloride/Fluoride/Sulfate (N)	TDS (N)	Alkalinity (N)	Radium 226 (N)	Radium 228 (N)	Residual Chlorine (Y/N)	603/2020 Pace Project No./ Lab I.D.
1	M-TP-1	WT	G			8/14	1430		5	2		3							/	/	/	/	/	/	/		BP3U BP3N BP2U 2BP1N 001
2	M-TP-2	WT	G																								
3	M-UMW-9 (AMW-1)	WT	G																								
4	MW-10 ~~M-UMW-10 (AMW-2)~~ RF	WT	G			8/14	0932		5	2		3							/	/	/	/	/	/	/		002
5	M-BMW-3	WT	G				1105																				003
6	M-BMW-4	WT	G				1002																				004
7	M-BMW-5	WT	G				0900																				005
8	M-NE-FB-1	WT	G				1006																				006
9		WT	G																								
10		WT	G																								
11		WT	G																								
12		WT	G																								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na *EPA 200.8: Sb, As, Cd, Cr, Se, Tl	/ Golder	8/14/19	1646	PASC	~~8/15~~ 8/15	0255	1.9	Y	Y	Y
							0.7	Y		
							11.9	N		
							14.6	N		

SAMPLE NAME AND SIGNATURE

PRINT Name of SAMPLER: Ryan Feldmann

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 08/14/19

SAMPLE CONDITIONS

MEMORANDUM

DATE October 1, 2019 **Project No.** 1531406

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – NATURE & EXTENT – DATA PACKAGE 60311920

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field) and the blank comparison criterion was not met, associated sample results were qualified as estimates (J) non-detects (U).
- When a duplicate comparison criterion was not met, associated sample detections were qualified as estimates (J).
- When MS/MSD recovery exceeded the QC limits, the associated sample result was qualified as an estimate (J).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Manager: J Ingram
Project Name: Ameren - MEC - DM/AM
Project Number: 1531406
Reviewer: T Goodwin
Validation Date: 10/1/2019

Laboratory: Pace Analytical - KS
SDG #: 60311920
Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 245.1 (Hg); EPA 903.1/904.0 (Rads); SM 2320B (Alk); SM 2540C (TDS); EPA 300.0 (Anions)
Matrix: ☐ Air ☐ Soil/Sed. ■ Water ☐ Waste ☐
Sample Names M-MW-9, M-TP-2, M-NE-DUP-1, M-TP-1, MW-10, M-BMW-3, M-BMW-4, M-BMW-5, M-NE-FB-1, M-TP-2 MS, M-TP-2 MSD

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	8/13-8/14/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☐	☒	☐	See Notes
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☒	☐	☐	See Notes
b) Were analytes detected in the field blank(s)?	☒	☐	☐	See Notes
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?				DUP-1@M-MW-9
	☒	☐	☐	FB-1@ MW-10
b) Were field dup. precision criteria met (note RPD)?	☐	☒	☐	See Notes
c) Were lab duplicates analyzed (note original and duplicate samples)?				
	☒	☐	☐	-920002 (Alk, TDS); -020006 (TDS)
d) Were lab dup. precision criteria met (note RPD)?	☒	☐	☐	See Notes

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☒	☐	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☒	☐	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☒	☐	☐	

Comments/Notes:

MB: -920001-03,-020001-06: Be (0.30); All: Ra-226 (0.497),
FB: FB-1: Mg (14.0), Ra-226 (0.653)
FD: DUP-1: Be (200), Cr (200), Se (200), F (33), Ra-228 (200)
Max Lab RPD: 4% (Limit 10%)
MS/MSD: -020003: Ca (MS-L), Fe (MS-L); -920002: Ca (MSD-H), Na (MSD-H)
Dilution: Chloride and Sulfate diluted in several samples; no qualification is necessary.
Preservation: M-TP-2 was not preserved to <2 within the required 5 days of collection. Preservative added upon arrival at lab for radiochemistry analysis.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-TP-2	Beryllium (Be)	1.0	U	Analyte Detected in Method Blank (MB); PQL>Result>MDL
"	Calcium (Ca)	-	J	MS/MSD Exceeded Calibration Range; MSD %Rec High
"	Sodium (Na)	-	J	"
M-NE-DUP-1	Be	1.0	U	Analyte Detected in MB; PQL>Result>MDL
M-MW-10	Be	1.0	U	Analyte Detected in MB; PQL>Result>MDL
M-BMW-3	Ca	-	J	MS/MSD Exceeded Calibration Range; MS %Rec Low
"	Iron (Fe)	-	J	"
M-BMW-4	Be	1.0	U	Analyte Detected in MB; PQL>Result>MDL
M-MW-9	Radium-226 (Ra-226)	-	J	Analyte Detected in MB; 10x Blank>Result>MDC
M-NE-DUP-1	"	-	J	"
M-MW-10	"	-	J	"
M-BMW-3	"	-	J	"
M-NE-FB-1	"	-	J	"
M-MW-9	Radium-228 (Ra-228)	-	J	FD Exceeded RPD Limit; Result > MDC

Signature:

Date: 10/1/2019

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

October 17, 2019

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory on October 04, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60317032

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60317032001	**M-MW-7**	Water	10/03/19 08:55	10/04/19 02:55
60317032002	**M-MW-5**	Water	10/03/19 10:27	10/04/19 02:55
60317032003	**M-MW-DUP-1**	Water	10/03/19 10:27	10/04/19 02:55
60317032004	**M-MW-FB-1**	Water	10/03/19 10:34	10/04/19 02:55

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60317032001	**M-MW-7**	EPA 300.0	MGS	1	PASI-K
60317032002	**M-MW-5**	SM 2540C	MAP	1	PASI-K
60317032003	**M-MW-DUP-1**	EPA 300.0	MGS	1	PASI-K
60317032004	**M-MW-FB-1**	SM 2540C	MAP	1	PASI-K
		EPA 300.0	MGS	1	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Sample: M-MW-7 **Lab ID: 60317032001** Collected: 10/03/19 08:55 Received: 10/04/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Fluoride	**0.54**	mg/L	0.20	0.085	1		10/15/19 22:15	16984-48-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Sample: M-MW-5 **Lab ID: 60317032002** Collected: 10/03/19 10:27 Received: 10/04/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**898**	mg/L	10.0	10.0	1		10/08/19 15:23		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Sample: M-MW-DUP-1 **Lab ID: 60317032003** Collected: 10/03/19 10:27 Received: 10/04/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Fluoride	**0.52**	mg/L	0.20	0.085	1		10/15/19 22:32	16984-48-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Sample: M-MW-FB-1 **Lab ID: 60317032004** Collected: 10/03/19 10:34 Received: 10/04/19 02:55 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**6.0**	mg/L	5.0	5.0	1		10/08/19 15:23		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Fluoride	**<0.085**	mg/L	0.20	0.085	1		10/15/19 22:49	16984-48-8	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

QC Batch: 614091
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60317032002, 60317032004

METHOD BLANK: 2507725
Matrix: Water
Associated Lab Samples: 60317032002, 60317032004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	10/08/19 15:18	

LABORATORY CONTROL SAMPLE: 2507726

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	982	98	80-120	

SAMPLE DUPLICATE: 2507728

Parameter	Units	60317050012 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	47100	45400	4	10	

SAMPLE DUPLICATE: 2507743

Parameter	Units	60317050008 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	947	957	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60317032

QC Batch:	614196	Analysis Method:	EPA 300.0
QC Batch Method:	EPA 300.0	Analysis Description:	300.0 IC Anions

Associated Lab Samples: 60317032001, 60317032003, 60317032004

METHOD BLANK: 2508100 Matrix: Water

Associated Lab Samples: 60317032001, 60317032003, 60317032004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Fluoride	mg/L	<0.085	0.20	0.085	10/15/19 15:08	

LABORATORY CONTROL SAMPLE: 2508101

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Fluoride	mg/L	2.5	2.4	97	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2508102 2508103

Parameter	Units	60317026001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Fluoride	mg/L	0.26	2.5	2.5	2.8	2.9	103	106	80-120	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60317032

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60317032

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60317032002	**M-MW-5**	SM 2540C	614091		
60317032004	**M-MW-FB-1**	SM 2540C	614091		
60317032001	**M-MW-7**	EPA 300.0	614196		
60317032003	**M-MW-DUP-1**	EPA 300.0	614196		
60317032004	**M-MW-FB-1**	EPA 300.0	614196		

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Sample Condition Upon Receipt

WO#: 60317032
60317032

Client Name: Golder Associates

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☑ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☑ Ziplc

Thermometer Used: T-301 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 0.6 **Corr. Factor** +0.0 **Corrected** 0.6

Date and initials of person examining contents:

Temperature should be above freezing to 6°C

Chain of Custody present:	☑Yes	☐No	☐N/A	
Chain of Custody relinquished:	☑Yes	☐No	☐N/A	
Samples arrived within holding time:	☑Yes	☐No	☐N/A	
Short Hold Time analyses (<72hr):	☐Yes	☑No	☐N/A	
Rush Turn Around Time requested:	☐Yes	☑No	☐N/A	
Sufficient volume:	☑Yes	☐No	☐N/A	
Correct containers used:	☑Yes	☐No	☐N/A	
Pace containers used:	☑Yes	☐No	☐N/A	
Containers intact:	☑Yes	☐No	☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes	☐No	☑N/A	
Filtered volume received for dissolved tests?	☐Yes	☐No	☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes	☐No	☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes	☑No	☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☐Yes	☐No	☑N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐Yes	 ☐No ☐No		
Trip Blank present:	☐Yes	☑No	☐N/A	
Headspace in VOA vials (>6mm):	☐Yes	☐No	☑N/A	
Samples from USDA Regulated Area: State:	☐Yes	☐No	☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes	☐No	☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jamie Church 10/8/19 Date: ______

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Ste 260 Ballwin, MO 63021
Email To:	jeffrey_ingram@golder.com
Phone: 636-724-9191	Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Jeffrey Ingram
Copy To:	Ryan Feldmann/Eric Schneider
Purchase Order No.:	
Project Name:	Ameren MEC
Project Number:	153146 01.0004A

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER ______

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	200.7 Boron N	200.7 Calcium N	Chloride N	Fluoride N	Sulfate N	TDS N	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60317032
1	M-MW-7	WT	G			10/3/19	0855		1	/																001
2	M-MW-5	WT	G				1027		1	/												/		/		002
3	MS-MW-DUP-1	WT	G				—		1	/												/		/		003
4	M-MW-FB-1	WT	G				1034		1	/												/		/		004
5		WT	G																							
6		WT	G																							
7		WT	G																							
8		WT	G																							
9		WT	G																							
10		WT	G																							
11		WT	G																							
12		WT	G																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Annie Muehlfarth	10/3/19	1333	Angelo McManus	10/3/19	13:31		HS 10.4		
	Angelo McManus	10/3/19	1335	E Brockett Pace	10/4/19	0255	~~0.4~~ 0.6	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Annie Muehlfarth
SIGNATURE of SAMPLER: Annie Muehlfarth
DATE Signed (MM/DD/YY): 10/3/19

MEMORANDUM

DATE January 29, 2020 **Project No.** 153140601

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – DATA PACKAGE 60317032

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- None.

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren - Meramec - MEC
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 153140601
Validation Date: 1/29/2020

Laboratory: Pace Analytical - KS
SDG #: 60317032
Analytical Method (type and no.): SM 2540C (TDS); EPA 300.0 (Anions)
Matrix: ☐ Air ☐ Soil/Sed. ■ Water ☐ Waste ☐
Sample Names M-MW-7, M-MW-5, M-MW-DUP-1, M-MW-FB-1

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	YES	NO	NA	COMMENTS
a) Sampling dates noted?	☒	☐	☐	10/3/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	YES	NO	NA	COMMENTS
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	YES	NO	NA	COMMENTS
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☐	☒	☐	
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☐	☒	☐	
b) Were analytes detected in the field blank(s)?	☒	☐	☐	See Notes
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	☒	☐	☐	DUP-1 @ M-MW-7 FB-1 @ M-MW-5
b) Were field dup. precision criteria met (note RPD)?	☐	☒	☐	See Notes
c) Were lab duplicates analyzed (note original and duplicate samples)?	☐	☒	☐	
d) Were lab dup. precision criteria met (note RPD)?	☐	☐	☒	

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☐	☒	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☐	☒	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☐	☐	☒	

Comments/Notes:

FB-1: TDS (6.0)

Max Field DUP RPD: 4% (Limit 20%)

MS/MSD was for unrelated samples; no qualification is necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
None				

Signature: Tommy McGood Jr

Date: 1/29/2020

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

November 13, 2019

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory on October 19, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Tommy Goodwin, Golder Associates
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212020-2
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-19-12
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60318734001	**M-MW-10**	Water	10/17/19 14:38	10/19/19 03:50

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SAMPLE ANALYTE COUNT

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60318734

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60318734001	**M-MW-10**	EPA 200.7	EMR	6	PASI-K
		EPA 200.8	EMR	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MAP	1	PASI-K
		EPA 300.0	MJK	3	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

Sample: M-MW-10 **Lab ID: 60318734001** Collected: 10/17/19 14:38 Received: 10/19/19 03:50 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**181**	ug/L	5.0	1.4	1	10/23/19 08:55	10/24/19 15:03	7440-39-3	
Boron	**1780**	ug/L	100	10.7	1	10/23/19 08:55	10/24/19 15:03	7440-42-8	
Calcium	**208000**	ug/L	200	50.0	1	10/23/19 08:55	10/24/19 15:03	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	10/23/19 08:55	10/24/19 15:03	7440-48-4	
Lithium	**35.0**	ug/L	10.0	5.9	1	10/23/19 08:55	10/24/19 15:03	7439-93-2	
Molybdenum	**6.6J**	ug/L	20.0	2.6	1	10/23/19 08:55	10/24/19 15:03	7439-98-7	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**12.5**	ug/L	1.0	0.065	1	10/21/19 17:01	10/23/19 16:21	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	10/21/19 17:01	10/23/19 16:21	7782-49-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**961**	mg/L	13.3	13.3	1		10/24/19 09:37		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**76.3**	mg/L	20.0	4.4	20		11/11/19 21:40	16887-00-6	
Fluoride	**0.29**	mg/L	0.20	0.085	1		11/11/19 20:50	16984-48-8	
Sulfate	**198**	mg/L	20.0	4.6	20		11/11/19 21:40	14808-79-8	M1

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

QC Batch: 617629
Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60318734001

METHOD BLANK: 2520187
Matrix: Water
Associated Lab Samples: 60318734001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.4	5.0	1.4	10/24/19 14:50	
Boron	ug/L	<10.7	100	10.7	10/24/19 14:50	
Calcium	ug/L	<50.0	200	50.0	10/24/19 14:50	
Cobalt	ug/L	<0.84	5.0	0.84	10/24/19 14:50	
Lithium	ug/L	<5.9	10.0	5.9	10/24/19 14:50	
Molybdenum	ug/L	<2.6	20.0	2.6	10/24/19 14:50	

LABORATORY CONTROL SAMPLE: 2520188

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	990	99	85-115	
Boron	ug/L	1000	962	96	85-115	
Calcium	ug/L	10000	10200	102	85-115	
Cobalt	ug/L	1000	993	99	85-115	
Lithium	ug/L	1000	979	98	85-115	
Molybdenum	ug/L	1000	1020	102	85-115	

MATRIX SPIKE SAMPLE: 2520189

Parameter	Units	60318736001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	155	1000	1130	97	70-130	
Boron	ug/L	9440	1000	10200	81	70-130	
Calcium	ug/L	87100	10000	96300	92	70-130	
Cobalt	ug/L	1.3J	1000	959	96	70-130	
Lithium	ug/L	28.8	1000	994	97	70-130	
Molybdenum	ug/L	292	1000	1290	100	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2520190 2520191

Parameter	Units	60318735001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	14.2	1000	1000	998	996	98	98	70-130	0	20	
Boron	ug/L	5260	1000	1000	6480	6410	122	114	70-130	1	20	
Calcium	ug/L	7340	10000	10000	17700	17700	103	103	70-130	0	20	
Cobalt	ug/L	<0.84	1000	1000	964	970	96	97	70-130	1	20	
Lithium	ug/L	12.3	1000	1000	989	985	98	97	70-130	0	20	
Molybdenum	ug/L	302	1000	1000	1320	1320	101	102	70-130	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

QC Batch: 617202
Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60318734001

METHOD BLANK: 2518943
Matrix: Water
Associated Lab Samples: 60318734001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Arsenic	ug/L	<0.065	1.0	0.065	10/23/19 15:53	
Selenium	ug/L	<0.085	1.0	0.085	10/23/19 15:53	

LABORATORY CONTROL SAMPLE: 2518944

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	40	39.9	100	85-115	
Selenium	ug/L	40	40.9	102	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2518945 2518946

Parameter	Units	60318764002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	ND	40	40	41.7	42.0	102	103	70-130	1	20	
Selenium	ug/L	ND	40	40	39.4	40.1	97	99	70-130	2	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

QC Batch: 617744
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60318734001

METHOD BLANK: 2520622
Matrix: Water
Associated Lab Samples: 60318734001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	10/24/19 09:35	

LABORATORY CONTROL SAMPLE: 2520623

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	977	98	80-120	

SAMPLE DUPLICATE: 2520624

Parameter	Units	60318634006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	640	636	1	10	

SAMPLE DUPLICATE: 2520625

Parameter	Units	60318741004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	625	618	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60318734

QC Batch:	621676	Analysis Method:	EPA 300.0
QC Batch Method:	EPA 300.0	Analysis Description:	300.0 IC Anions

Associated Lab Samples: 60318734001

METHOD BLANK: 2535170 Matrix: Water

Associated Lab Samples: 60318734001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	11/11/19 19:42	
Fluoride	mg/L	<0.085	0.20	0.085	11/11/19 19:42	
Sulfate	mg/L	<0.23	1.0	0.23	11/11/19 19:42	

METHOD BLANK: 2535876 Matrix: Water

Associated Lab Samples: 60318734001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	11/12/19 21:35	
Fluoride	mg/L	<0.085	0.20	0.085	11/12/19 21:35	
Sulfate	mg/L	<0.23	1.0	0.23	11/12/19 21:35	

LABORATORY CONTROL SAMPLE: 2535171

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	93	90-110	
Fluoride	mg/L	2.5	2.5	99	90-110	
Sulfate	mg/L	5	5.1	102	90-110	

LABORATORY CONTROL SAMPLE: 2535877

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	90-110	
Fluoride	mg/L	2.5	2.6	106	90-110	
Sulfate	mg/L	5	5.3	105	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2535172 2535173

Parameter	Units	60318734001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	76.3	100	100	176	168	100	92	80-120	5	15	
Fluoride	mg/L	0.29	2.5	2.5	2.7	2.6	96	94	80-120	2	15	
Sulfate	mg/L	198	100	100	319	290	121	92	80-120	9	15	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

MATRIX SPIKE SAMPLE: 2535174

Parameter	Units	60319962005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	4.3	5	9.3	99	80-120	
Fluoride	mg/L	ND	2.5	2.9	116	80-120	
Sulfate	mg/L	17.9	5	23.5	111	80-120	E

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60318734

Sample: M-MW-10 **Lab ID: 60318734001** Collected: 10/17/19 14:38 Received: 10/19/19 03:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.121 ± 0.290 (0.560)** **C:NA T:89%**	pCi/L	11/11/19 13:58	13982-63-3	
Radium-228	EPA 904.0	**1.18 ± 0.525 (0.890)** **C:83% T:87%**	pCi/L	11/08/19 17:07	15262-20-1	

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

QC Batch: 368390
Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60318734001

METHOD BLANK: 1787310
Matrix: Water
Associated Lab Samples: 60318734001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.000 ± 0.306 (0.647) C:NA T:87%	pCi/L	11/11/19 13:45	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60318734

QC Batch:	368389	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228

Associated Lab Samples: 60318734001

METHOD BLANK: 1787305 Matrix: Water

Associated Lab Samples: 60318734001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.274 ± 0.426 (0.922) C:70% T:83%	pCi/L	11/08/19 12:59	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60318734

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60318734

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60318734001	**M-MW-10**	EPA 200.7	617629	EPA 200.7	617750
60318734001	**M-MW-10**	EPA 200.8	617202	EPA 200.8	617258
60318734001	**M-MW-10**	EPA 903.1	368390		
60318734001	**M-MW-10**	EPA 904.0	368389		
60318734001	**M-MW-10**	SM 2540C	617744		
60318734001	**M-MW-10**	EPA 300.0	621676		

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Pace Analytical®
www.pacelabs.com

Sample Condition Upon Receipt

WO#:60318734
60318734

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☑ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☑ Foam ☐ None ☐ Other ☐

Thermometer Used: T-296 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 2.1, 1.0 **Corr. Factor** 0.4 **Corrected** 2.5, 1.4

Temperature should be above freezing to 6°C

Date and initials of person examining contents: 10/19/19 AF

Chain of Custody present:	☑Yes ☐No ☐N/A	
Chain of Custody relinquished:	☑Yes ☐No ☐N/A	
Samples arrived within holding time:	☑Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☑No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	
Sufficient volume:	☑Yes ☐No ☐N/A	
Correct containers used:	☑Yes ☐No ☐N/A	
Pace containers used:	☑Yes ☐No ☐N/A	
Containers intact:	☑Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☑N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☑No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☑Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☑N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jami Church Date: 10/21/19

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Drive, Suite 26
	Ballwin, MO 63021
Email To:	maddock@golder.com
Phone: 314-984-8800	Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Mark Haddock (mhaddock@golder.com)
Copy To:	Jeffrey Ingram
Purchase Order No.:	
Project Name:	Ameren Groundwater Sampling - MCC
Project Number:	153-1406

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals* (N)	Chloride/Fluoride/Sulfate (N)	TDS (N)	Radium 226 & 228 (N)									Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60318733?
1	M-MW-10	WT	G			10/7/19	1438		4	1		3							1	1	1	1										001
2		WT	G																													
3		WT	G																													
4		WT	G																													
5		WT	G																													
6		WT	G																													
7		WT	G																													
8		WT	G																													
9		WT	G																													
10		WT	G																													
11		WT	G																													
12		WT	G																													

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*EPA 200.7: Ba, B, Co, Ca, Li, Mo EPA 200.8: As, Se	Katherine Bartels/Golder	10/18/19	11:35	A. McManus	10/18	11:36				
				[illegible]	10/19/19	0550	2.5 2.4	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Katherine Bartels
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 10/18/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

GOLDER

MEMORANDUM

DATE January 6, 2020 **Project No.** 153140601

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – DATA PACKAGE 60318734

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When MS/MSD recovery exceeded the QC limits, the associated sample result was qualified as an estimate (J).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Manager: J Ingram
Project Name: Ameren - Meramec - MEC
Project Number: 153140601
Reviewer: T Goodwin
Validation Date: 1/6/2020

Laboratory: Pace Analytical - KS
SDG #: 60318734
Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 903.1/904.0 (Rads); SM 2540C (TDS); EPA 300.0 (Anions)
Matrix: ☐ Air ☐ Soil/Sed. ■ Water ☐ Waste ☐
Sample Names M-MW-10

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	10/17/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☐	☒	☐	
b) Were analytes detected in the field blank(s)?	☐	☐	☒	
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	☐	☒	☐	
b) Were field dup. precision criteria met (note RPD)?	☐	☐	☒	
c) Were lab duplicates analyzed (note original and duplicate samples)?	☐	☒	☐	
d) Were lab dup. precision criteria met (note RPD)?	☐	☐	☒	

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☒	☐	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☒	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☒	☐	☐	

Comments/Notes:

MS/MSD: -734001: SO4 (MS/MSD-H); results qualified as necessary

Dilution: Chloride and Sulfate were diluted in several samples; no qualification is necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-MW-10	Sulfate (SO4)	198	J	MS Recovered High; Result > MDL

Signature:

Date: 1/6/2020

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

December 16, 2019

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory on November 20, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Tommy Goodwin, Golder Associates
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Pace Analytical Services Kansas

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Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212020-2
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-19-12
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60321788001	**M-MW-1**	Water	11/18/19 15:20	11/20/19 03:30
60321788002	**M-MW-2**	Water	11/19/19 09:15	11/20/19 03:30
60321788003	**M-MW-3**	Water	11/19/19 10:30	11/20/19 03:30
60321788004	**M-MW-4**	Water	11/18/19 10:42	11/20/19 03:30
60321788005	**M-MW-5**	Water	11/18/19 12:17	11/20/19 03:30
60321788006	**M-MW-6**	Water	11/18/19 14:55	11/20/19 03:30
60321788007	**M-MW-7**	Water	11/18/19 16:18	11/20/19 03:30
60321788008	**M-MW-8**	Water	11/18/19 16:37	11/20/19 03:30
60321788009	**M-BMW-1**	Water	11/18/19 13:12	11/20/19 03:30
60321788010	**M-BMW-2**	Water	11/18/19 10:38	11/20/19 03:30
60321788011	**M-MW-10**	Water	11/18/19 14:33	11/20/19 03:30
60321788012	**M-DUP-1**	Water	11/18/19 14:33	11/20/19 03:30
60321788013	**M-FB-1**	Water	11/18/19 14:57	11/20/19 03:30
60321788014	**M-DUP-2**	Water	11/18/19 14:57	11/20/19 03:30
60321788015	**M-FB-2**	Water	11/18/19 14:57	11/20/19 03:30
60321788016	**M-MW-6 MS**	Water	11/18/19 14:55	11/20/19 03:30
60321788017	**M-MW-6 MSD**	Water	11/18/19 14:55	11/20/19 03:30

SAMPLE ANALYTE COUNT

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60321788

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60321788001	**M-MW-1**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788002	**M-MW-2**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788003	**M-MW-3**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788004	**M-MW-4**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788005	**M-MW-5**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788006	**M-MW-6**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788007	**M-MW-7**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788008	**M-MW-8**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788009	**M-BMW-1**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788010	**M-BMW-2**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MGS, MJK	3	PASI-K
60321788011	**M-MW-10**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788012	**M-DUP-1**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788013	**M-FB-1**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788014	**M-DUP-2**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788015	**M-FB-2**	EPA 200.7	HKC	11	PASI-K
		EPA 200.8	JGP	2	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K
60321788016	**M-MW-6 MS**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
60321788017	**M-MW-6 MSD**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-1 **Lab ID: 60321788001** Collected: 11/18/19 15:20 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**368**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:04	7440-39-3	
Boron	**45.6J**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:04	7440-42-8	
Calcium	**137000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:04	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:04	7440-48-4	
Iron	**15700**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:04	7439-89-6	
Lithium	**<5.9**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:04	7439-93-2	
Magnesium	**44800**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:04	7439-95-4	
Manganese	**1950**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:04	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:04	7439-98-7	
Potassium	**1820**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:04	7440-09-7	B
Sodium	**29700**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:04	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**0.69J**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:15	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:15	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**401**	mg/L	20.0	6.5	1		11/26/19 10:27		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**655**	mg/L	10.0	10.0	1		11/25/19 11:05		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**46.1**	mg/L	10.0	2.2	10		12/04/19 22:11	16887-00-6	
Fluoride	**0.30**	mg/L	0.20	0.085	1		12/04/19 21:54	16984-48-8	
Sulfate	**110**	mg/L	10.0	2.3	10		12/04/19 22:11	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-2 **Lab ID: 60321788002** Collected: 11/19/19 09:15 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**309**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:07	7440-39-3	
Boron	**5000**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:07	7440-42-8	
Calcium	**134000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:07	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:07	7440-48-4	
Iron	**46800**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:07	7439-89-6	
Lithium	**7.7J**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:07	7439-93-2	
Magnesium	**41000**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:07	7439-95-4	
Manganese	**6110**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:07	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:07	7439-98-7	
Potassium	**2400**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:07	7440-09-7	B
Sodium	**39000**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:07	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**1.8**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:18	7440-38-2	
Selenium	**0.12J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:18	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**275**	mg/L	20.0	6.5	1		11/26/19 10:32		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**770**	mg/L	10.0	10.0	1		11/26/19 06:43		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**27.8**	mg/L	2.0	0.44	2		12/04/19 23:35	16887-00-6	
Fluoride	**0.17J**	mg/L	0.20	0.085	1		12/04/19 22:28	16984-48-8	
Sulfate	**305**	mg/L	50.0	11.5	50		12/04/19 22:45	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-3 **Lab ID: 60321788003** Collected: 11/19/19 10:30 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**200**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:09	7440-39-3	
Boron	**9110**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:09	7440-42-8	
Calcium	**171000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:09	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:09	7440-48-4	
Iron	**27400**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:09	7439-89-6	
Lithium	**7.4J**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:09	7439-93-2	
Magnesium	**46200**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:09	7439-95-4	
Manganese	**1990**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:09	7439-96-5	
Molybdenum	**7.7J**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:09	7439-98-7	
Potassium	**2780**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:09	7440-09-7	
Sodium	**34900**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:09	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**7.4**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:19	7440-38-2	
Selenium	**0.089J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:19	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**342**	mg/L	20.0	6.5	1		11/26/19 10:47		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**848**	mg/L	10.0	10.0	1		11/26/19 06:43		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**23.9**	mg/L	5.0	1.1	5		12/05/19 00:09	16887-00-6	
Fluoride	**0.13J**	mg/L	0.20	0.085	1		12/04/19 23:52	16984-48-8	
Sulfate	**315**	mg/L	50.0	11.5	50		12/05/19 00:26	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-4 **Lab ID: 60321788004** Collected: 11/18/19 10:42 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**199**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:12	7440-39-3	
Boron	**9740**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:12	7440-42-8	
Calcium	**190000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:12	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:12	7440-48-4	
Iron	**28600**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:12	7439-89-6	
Lithium	**18.6**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:12	7439-93-2	
Magnesium	**53800**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:12	7439-95-4	
Manganese	**798**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:12	7439-96-5	
Molybdenum	**52.4**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:12	7439-98-7	
Potassium	**6420**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:12	7440-09-7	
Sodium	**47800**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:12	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**16.1**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:21	7440-38-2	
Selenium	**0.093J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:21	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**270**	mg/L	20.0	6.5	1		11/26/19 10:51		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1000**	mg/L	13.3	13.3	1		11/25/19 11:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**50.3**	mg/L	5.0	1.1	5		12/05/19 00:59	16887-00-6	
Fluoride	**0.16J**	mg/L	0.20	0.085	1		12/05/19 00:43	16984-48-8	
Sulfate	**472**	mg/L	50.0	11.5	50		12/05/19 01:16	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-5 **Lab ID: 60321788005** Collected: 11/18/19 12:17 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**240**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:14	7440-39-3	
Boron	**7670**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:14	7440-42-8	
Calcium	**170000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:14	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:14	7440-48-4	
Iron	**17400**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:14	7439-89-6	
Lithium	**17.9**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:14	7439-93-2	
Magnesium	**54700**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:14	7439-95-4	
Manganese	**446**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:14	7439-96-5	
Molybdenum	**98.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:14	7439-98-7	
Potassium	**5590**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:14	7440-09-7	
Sodium	**44700**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:14	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**21.8**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:22	7440-38-2	
Selenium	**0.093J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:22	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**343**	mg/L	20.0	6.5	1		11/26/19 10:58		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**932**	mg/L	10.0	10.0	1		11/25/19 11:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**42.3**	mg/L	5.0	1.1	5		12/05/19 01:50	16887-00-6	
Fluoride	**0.23**	mg/L	0.20	0.085	1		12/05/19 01:33	16984-48-8	
Sulfate	**352**	mg/L	50.0	11.5	50		12/05/19 02:07	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-6 **Lab ID: 60321788006** Collected: 11/18/19 14:55 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**51.0**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:17	7440-39-3	
Boron	**14000**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:17	7440-42-8	
Calcium	**333000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:17	7440-70-2	
Cobalt	**4.2J**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:17	7440-48-4	
Iron	**8230**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:17	7439-89-6	
Lithium	**127**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:17	7439-93-2	
Magnesium	**24800**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:17	7439-95-4	
Manganese	**1270**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:17	7439-96-5	
Molybdenum	**132**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:17	7439-98-7	
Potassium	**13600**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:17	7440-09-7	
Sodium	**21900**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:17	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**3.9**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:24	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:24	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**444**	mg/L	20.0	6.5	1		11/26/19 11:03		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1270**	mg/L	13.3	13.3	1		11/25/19 11:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**20.2**	mg/L	2.0	0.44	2		12/05/19 10:32	16887-00-6	
Fluoride	**0.11J**	mg/L	0.20	0.085	1		12/05/19 02:57	16984-48-8	
Sulfate	**557**	mg/L	50.0	11.5	50		12/05/19 03:48	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-7 **Lab ID: 60321788007** Collected: 11/18/19 16:18 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**42.6**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:29	7440-39-3	
Boron	**27500**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:29	7440-42-8	
Calcium	**431000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:29	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:29	7440-48-4	
Iron	**14.9J**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:29	7439-89-6	B
Lithium	**52.2**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:29	7439-93-2	
Magnesium	**34700**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:29	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:29	7439-96-5	
Molybdenum	**373**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:29	7439-98-7	
Potassium	**18900**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:29	7440-09-7	
Sodium	**85200**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:29	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**2.6**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:33	7440-38-2	
Selenium	**8.2**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:33	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**319**	mg/L	20.0	6.5	1		11/26/19 11:15		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1870**	mg/L	20.0	20.0	1		11/25/19 11:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**67.5**	mg/L	10.0	2.2	10		12/05/19 04:55	16887-00-6	
Fluoride	**0.55**	mg/L	0.20	0.085	1		12/05/19 04:39	16984-48-8	
Sulfate	**960**	mg/L	100	23.0	100		12/05/19 05:12	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-8 **Lab ID: 60321788008** Collected: 11/18/19 16:37 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**142**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:31	7440-39-3	
Boron	**9880**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:31	7440-42-8	
Calcium	**186000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:31	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:31	7440-48-4	
Iron	**10800**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:31	7439-89-6	
Lithium	**36.5**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:31	7439-93-2	
Magnesium	**38400**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:31	7439-95-4	
Manganese	**2080**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:31	7439-96-5	
Molybdenum	**221**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:31	7439-98-7	
Potassium	**7070**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:31	7440-09-7	
Sodium	**35200**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:31	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**6.4**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:34	7440-38-2	
Selenium	**0.088J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:34	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**206**	mg/L	20.0	6.5	1		11/26/19 11:19		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**937**	mg/L	10.0	10.0	1		11/25/19 11:07		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**26.1**	mg/L	2.0	0.44	2		12/05/19 06:20	16887-00-6	
Fluoride	**0.28**	mg/L	0.20	0.085	1		12/05/19 06:37	16984-48-8	
Sulfate	**497**	mg/L	50.0	11.5	50		12/05/19 05:29	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-BMW-1 **Lab ID: 60321788009** Collected: 11/18/19 13:12 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**292**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:34	7440-39-3	
Boron	**485**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:34	7440-42-8	
Calcium	**122000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:34	7440-70-2	
Cobalt	**3.2J**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:34	7440-48-4	
Iron	**2710**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:34	7439-89-6	
Lithium	**14.4**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:34	7439-93-2	
Magnesium	**28300**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:34	7439-95-4	
Manganese	**2060**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:34	7439-96-5	
Molybdenum	**5.9J**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:34	7439-98-7	
Potassium	**10500**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:34	7440-09-7	
Sodium	**55000**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:34	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**4.7**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:35	7440-38-2	
Selenium	**0.15J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:35	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**365**	mg/L	20.0	6.5	1		11/26/19 11:26		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**599**	mg/L	10.0	10.0	1		11/25/19 12:03		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**94.4**	mg/L	10.0	2.2	10		12/04/19 16:51	16887-00-6	
Fluoride	**0.62**	mg/L	0.20	0.085	1		12/04/19 16:35	16984-48-8	
Sulfate	**32.9**	mg/L	10.0	2.3	10		12/04/19 16:51	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-BMW-2 **Lab ID: 60321788010** Collected: 11/18/19 10:38 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**558**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:36	7440-39-3	
Boron	**118**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:36	7440-42-8	
Calcium	**107000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:36	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:36	7440-48-4	
Iron	**15600**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:36	7439-89-6	
Lithium	**6.5J**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:36	7439-93-2	
Magnesium	**35800**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:36	7439-95-4	
Manganese	**4590**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:36	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:36	7439-98-7	
Potassium	**1490**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:36	7440-09-7	B
Sodium	**20200**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:36	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**1.3**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:37	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:37	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**402**	mg/L	20.0	6.5	1		11/26/19 11:31		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**468**	mg/L	10.0	10.0	1		11/25/19 12:03		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**13.3**	mg/L	1.0	0.22	1		12/04/19 17:07	16887-00-6	
Fluoride	**0.31**	mg/L	0.20	0.085	1		12/04/19 17:07	16984-48-8	
Sulfate	**26.4**	mg/L	2.0	0.46	2		12/05/19 10:47	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-10 **Lab ID: 60321788011** Collected: 11/18/19 14:33 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**180**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:39	7440-39-3	
Boron	**1720**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:39	7440-42-8	
Calcium	**226000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:39	7440-70-2	
Cobalt	**2.8J**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:39	7440-48-4	
Iron	**18900**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:39	7439-89-6	
Lithium	**36.6**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:39	7439-93-2	
Magnesium	**58600**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:39	7439-95-4	
Manganese	**857**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:39	7439-96-5	
Molybdenum	**2.7J**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:39	7439-98-7	
Potassium	**8550**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:39	7440-09-7	
Sodium	**53000**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:39	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**10.7**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:38	7440-38-2	
Selenium	**0.093J**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:38	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**588**	mg/L	20.0	6.5	1		11/26/19 11:39		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1030**	mg/L	13.3	13.3	1		11/25/19 12:04		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**65.1**	mg/L	20.0	4.4	20		12/04/19 17:39	16887-00-6	
Fluoride	**0.15J**	mg/L	0.20	0.085	1		12/04/19 17:23	16984-48-8	
Sulfate	**197**	mg/L	20.0	4.6	20		12/04/19 17:39	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-DUP-1 **Lab ID: 60321788012** Collected: 11/18/19 14:33 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**204**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:41	7440-39-3	
Boron	**9920**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:41	7440-42-8	
Calcium	**193000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:41	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:41	7440-48-4	
Iron	**29100**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:41	7439-89-6	
Lithium	**21.2**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:41	7439-93-2	
Magnesium	**54400**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:41	7439-95-4	
Manganese	**808**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:41	7439-96-5	
Molybdenum	**54.7**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:41	7439-98-7	
Potassium	**6540**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:41	7440-09-7	
Sodium	**48400**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:41	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**15.8**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:40	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:40	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**273**	mg/L	20.0	6.5	1		11/26/19 11:54		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1010**	mg/L	13.3	13.3	1		11/25/19 12:04		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**47.8**	mg/L	5.0	1.1	5		12/04/19 18:43	16887-00-6	
Fluoride	**0.18J**	mg/L	0.20	0.085	1		12/04/19 18:27	16984-48-8	
Sulfate	**435**	mg/L	50.0	11.5	50		12/04/19 19:00	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-FB-1 **Lab ID: 60321788013** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**<1.4**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:44	7440-39-3	
Boron	**51.5J**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:44	7440-42-8	
Calcium	**<50.0**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:44	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:44	7440-48-4	
Iron	**<14.0**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:44	7439-89-6	
Lithium	**<5.9**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:44	7439-93-2	
Magnesium	**<13.0**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:44	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:44	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:44	7439-98-7	
Potassium	**136J**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:44	7440-09-7	B
Sodium	**448J**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:44	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**<0.065**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:41	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:41	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**<6.5**	mg/L	20.0	6.5	1		11/26/19 11:58		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<5.0**	mg/L	5.0	5.0	1		11/25/19 12:04		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**0.28J**	mg/L	1.0	0.22	1		12/04/19 19:16	16887-00-6	B
Fluoride	**<0.085**	mg/L	0.20	0.085	1		12/04/19 19:16	16984-48-8	M1
Sulfate	**<0.23**	mg/L	1.0	0.23	1		12/04/19 19:16	14808-79-8	M1

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-DUP-2 **Lab ID: 60321788014** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**367**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:47	7440-39-3	
Boron	**87.0J**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:47	7440-42-8	
Calcium	**136000**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:47	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:47	7440-48-4	
Iron	**15600**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:47	7439-89-6	
Lithium	**7.9J**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:47	7439-93-2	
Magnesium	**45200**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:47	7439-95-4	
Manganese	**1960**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:47	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:47	7439-98-7	
Potassium	**1720**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:47	7440-09-7	B
Sodium	**28800**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:47	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**0.68J**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:43	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:43	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**386**	mg/L	20.0	6.5	1		11/26/19 12:04		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**647**	mg/L	10.0	10.0	1		11/25/19 12:04		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**42.9**	mg/L	10.0	2.2	10		12/04/19 20:04	16887-00-6	
Fluoride	**0.30**	mg/L	0.20	0.085	1		12/04/19 19:48	16984-48-8	
Sulfate	**105**	mg/L	10.0	2.3	10		12/04/19 20:04	14808-79-8	

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ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-FB-2 **Lab ID: 60321788015** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**<1.4**	ug/L	5.0	1.4	1	12/04/19 10:20	12/04/19 21:49	7440-39-3	
Boron	**27.1J**	ug/L	100	10.7	1	12/04/19 10:20	12/04/19 21:49	7440-42-8	
Calcium	**<50.0**	ug/L	200	50.0	1	12/04/19 10:20	12/04/19 21:49	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/04/19 10:20	12/04/19 21:49	7440-48-4	
Iron	**<14.0**	ug/L	50.0	14.0	1	12/04/19 10:20	12/04/19 21:49	7439-89-6	
Lithium	**<5.9**	ug/L	10.0	5.9	1	12/04/19 10:20	12/04/19 21:49	7439-93-2	
Magnesium	**<13.0**	ug/L	50.0	13.0	1	12/04/19 10:20	12/04/19 21:49	7439-95-4	
Manganese	**<2.1**	ug/L	5.0	2.1	1	12/04/19 10:20	12/04/19 21:49	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/04/19 10:20	12/04/19 21:49	7439-98-7	
Potassium	**<79.0**	ug/L	500	79.0	1	12/04/19 10:20	12/04/19 21:49	7440-09-7	
Sodium	**396J**	ug/L	500	144	1	12/04/19 10:20	12/04/19 21:49	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Arsenic	**<0.065**	ug/L	1.0	0.065	1	12/02/19 12:18	12/03/19 11:30	7440-38-2	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/02/19 12:18	12/03/19 11:30	7782-49-2	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**<6.5**	mg/L	20.0	6.5	1		11/26/19 12:08		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<5.0**	mg/L	5.0	5.0	1		11/25/19 12:04		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**0.34J**	mg/L	1.0	0.22	1		12/04/19 20:36	16887-00-6	B
Fluoride	**<0.085**	mg/L	0.20	0.085	1		12/04/19 20:36	16984-48-8	
Sulfate	**<0.23**	mg/L	1.0	0.23	1		12/04/19 20:36	14808-79-8	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 626041 Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

METHOD BLANK: 2551873 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.4	5.0	1.4	12/04/19 21:01	
Boron	ug/L	<10.7	100	10.7	12/04/19 21:01	
Calcium	ug/L	<50.0	200	50.0	12/04/19 21:01	
Cobalt	ug/L	<0.84	5.0	0.84	12/04/19 21:01	
Iron	ug/L	25.9J	50.0	14.0	12/04/19 21:01	
Lithium	ug/L	<5.9	10.0	5.9	12/04/19 21:01	
Magnesium	ug/L	<13.0	50.0	13.0	12/04/19 21:01	
Manganese	ug/L	<2.1	5.0	2.1	12/04/19 21:01	
Molybdenum	ug/L	<2.6	20.0	2.6	12/04/19 21:01	
Potassium	ug/L	260J	500	79.0	12/04/19 21:01	
Sodium	ug/L	<144	500	144	12/05/19 12:09	

LABORATORY CONTROL SAMPLE: 2551874

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	1020	102	85-115	
Boron	ug/L	1000	992	99	85-115	
Calcium	ug/L	10000	10100	101	85-115	
Cobalt	ug/L	1000	1040	104	85-115	
Iron	ug/L	10000	10200	102	85-115	
Lithium	ug/L	1000	957	96	85-115	
Magnesium	ug/L	10000	10000	100	85-115	
Manganese	ug/L	1000	1020	102	85-115	
Molybdenum	ug/L	1000	1040	104	85-115	
Potassium	ug/L	10000	9980	100	85-115	
Sodium	ug/L	10000	10900	109	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2551875 2551876

Parameter	Units	60321788006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	51.0	1000	1000	1070	1060	102	101	70-130	1	20	
Boron	ug/L	14000	1000	1000	15000	14800	100	80	70-130	1	20	
Calcium	ug/L	333000	10000	10000	342000	340000	93	72	70-130	1	20	
Cobalt	ug/L	4.2J	1000	1000	1020	1000	101	100	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2551875 2551876

Parameter	Units	60321788006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Iron	ug/L	8230	10000	10000	18400	18200	101	100	70-130	1	20	
Lithium	ug/L	127	1000	1000	1110	1100	98	97	70-130	1	20	
Magnesium	ug/L	24800	10000	10000	34400	34300	96	95	70-130	0	20	
Manganese	ug/L	1270	1000	1000	2290	2260	102	99	70-130	1	20	
Molybdenum	ug/L	132	1000	1000	1200	1180	107	105	70-130	1	20	
Potassium	ug/L	13600	10000	10000	23600	23500	100	99	70-130	1	20	
Sodium	ug/L	21900	10000	10000	31800	31500	99	96	70-130	1	20	

MATRIX SPIKE SAMPLE: 2551877

Parameter	Units	60322250002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	9.5	1000	1030	102	70-130	
Boron	ug/L	ND	1000	1110	101	70-130	
Calcium	ug/L	57100	10000	68200	111	70-130	
Cobalt	ug/L	ND	1000	1040	104	70-130	
Iron	ug/L	584	10000	10800	103	70-130	
Lithium	ug/L	43.3	1000	1010	96	70-130	
Magnesium	ug/L	5680	10000	15600	100	70-130	
Manganese	ug/L	11.3	1000	1020	101	70-130	
Molybdenum	ug/L	ND	1000	1060	106	70-130	
Potassium	ug/L	6570	10000	16700	101	70-130	
Sodium	ug/L	64800	10000	75500	107	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 625419 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

METHOD BLANK: 2550309 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Arsenic	ug/L	<0.065	1.0	0.065	12/03/19 11:12	
Selenium	ug/L	<0.085	1.0	0.085	12/03/19 11:12	

LABORATORY CONTROL SAMPLE: 2550310

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	40	37.6	94	85-115	
Selenium	ug/L	40	38.0	95	85-115	

MATRIX SPIKE SAMPLE: 2550311

Parameter	Units	60321788001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	0.69J	40	39.3	97	70-130	
Selenium	ug/L	<0.085	40	37.5	94	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2550312 2550313

Parameter	Units	60321788006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	3.9	40	40	43.8	44.0	100	100	70-130	1	20	
Selenium	ug/L	<0.085	40	40	37.6	37.5	94	94	70-130	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 624825
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

METHOD BLANK: 2547622
Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<6.5	20.0	6.5	11/26/19 09:43	

LABORATORY CONTROL SAMPLE: 2547623

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	487	97	90-110	

SAMPLE DUPLICATE: 2547624

Parameter	Units	60321687015 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	331	337	2	10	

SAMPLE DUPLICATE: 2547625

Parameter	Units	60321788006 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	444	446	0	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 624428
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60321788001, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008

METHOD BLANK: 2546269
Matrix: Water
Associated Lab Samples: 60321788001, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/25/19 11:03	

LABORATORY CONTROL SAMPLE: 2546270

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	994	99	80-120	

SAMPLE DUPLICATE: 2546271

Parameter	Units	60321687012 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	923	908	2	10	

SAMPLE DUPLICATE: 2546272

Parameter	Units	60321788006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1270	1210	5	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 624429
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

METHOD BLANK: 2546273
Matrix: Water
Associated Lab Samples: 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/25/19 12:03	

LABORATORY CONTROL SAMPLE: 2546274

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	978	98	80-120	

SAMPLE DUPLICATE: 2546275

Parameter	Units	60321788009 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	599	617	3	10	

SAMPLE DUPLICATE: 2546276

Parameter	Units	60321808004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	907	945	4	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 624637
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60321788002, 60321788003

METHOD BLANK: 2547071
Matrix: Water
Associated Lab Samples: 60321788002, 60321788003

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	11/26/19 06:41	

LABORATORY CONTROL SAMPLE: 2547072

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	983	98	80-120	

SAMPLE DUPLICATE: 2547073

Parameter	Units	60321719001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	964	880	9	10	

SAMPLE DUPLICATE: 2547074

Parameter	Units	60322107003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	15600	15600	0	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 625953
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008

METHOD BLANK: 2551524 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/04/19 09:17	
Fluoride	mg/L	<0.085	0.20	0.085	12/04/19 09:17	
Sulfate	mg/L	<0.23	1.0	0.23	12/04/19 09:17	

METHOD BLANK: 2552886 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/05/19 09:21	
Fluoride	mg/L	<0.085	0.20	0.085	12/05/19 09:21	
Sulfate	mg/L	<0.23	1.0	0.23	12/05/19 09:21	

LABORATORY CONTROL SAMPLE: 2551525

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	5.0	100	90-110	
Fluoride	mg/L	2.5	2.5	102	90-110	
Sulfate	mg/L	5	5.0	100	90-110	

LABORATORY CONTROL SAMPLE: 2552887

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	5.0	99	90-110	
Fluoride	mg/L	2.5	2.6	102	90-110	
Sulfate	mg/L	5	5.1	101	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2551526 2551527

Parameter	Units	60320950001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	21.5	10	10	32.4	32.0	109	105	80-120	1	15	
Fluoride	mg/L	0.74	2.5	2.5	3.5	3.4	108	106	80-120	2	15	
Sulfate	mg/L	125	100	100	246	189	121	64	80-120	26	15	M1,R1

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2551528 2551529

Parameter	Units	60321788006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	20.2	10	10	30.6	31.1	105	109	80-120	1	15	
Fluoride	mg/L	0.11J	2.5	2.5	2.9	2.8	112	108	80-120	4	15	
Sulfate	mg/L	557	250	250	795	777	95	88	80-120	2	15	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 625956 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

METHOD BLANK: 2551535 Matrix: Water
Associated Lab Samples: 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/04/19 13:38	
Fluoride	mg/L	<0.085	0.20	0.085	12/04/19 13:38	
Sulfate	mg/L	<0.23	1.0	0.23	12/04/19 13:38	

METHOD BLANK: 2552784 Matrix: Water
Associated Lab Samples: 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	0.27J	1.0	0.22	12/05/19 09:18	
Fluoride	mg/L	<0.085	0.20	0.085	12/05/19 09:18	
Sulfate	mg/L	<0.23	1.0	0.23	12/05/19 09:18	

LABORATORY CONTROL SAMPLE: 2551536

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	100	95.8	96	90-110	
Fluoride	mg/L	50	53.4	107	90-110	
Sulfate	mg/L	100	93.2	93	90-110	

LABORATORY CONTROL SAMPLE: 2552787

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	93	90-110	
Fluoride	mg/L	2.5	2.6	102	90-110	
Sulfate	mg/L	5	4.8	95	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2551537 2551538

Parameter	Units	60322173001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	273	250	250	509	514	95	97	80-120	1	15	
Fluoride	mg/L	ND	125	125	129	131	103	105	80-120	1	15	
Sulfate	mg/L	23.7J	250	250	273	274	100	100	80-120	0	15	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

MATRIX SPIKE SAMPLE: 2551539

Parameter	Units	60321788013 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	0.28J	5	4.7	88	80-120	
Fluoride	mg/L	<0.085	2.5	3.1	123	80-120	M1
Sulfate	mg/L	<0.23	5	7.2	145	80-120	M1

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-1 **Lab ID: 60321788001** Collected: 11/18/19 15:20 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0144 ± 0.462 (0.927)** **C:NA T:92%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.613 ± 0.345 (0.603)** **C:70% T:83%**	pCi/L	12/12/19 11:46	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-2 **Lab ID: 60321788002** Collected: 11/19/19 09:15 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0282 ± 0.398 (0.812)** **C:NA T:88%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.263 ± 0.309 (0.647)** **C:73% T:86%**	pCi/L	12/12/19 11:46	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-3 **Lab ID: 60321788003** Collected: 11/19/19 10:30 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.643 ± 0.610 (0.882)** **C:NA T:80%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.425 ± 0.333 (0.653)** **C:71% T:89%**	pCi/L	12/12/19 11:46	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-4 **Lab ID: 60321788004** Collected: 11/18/19 10:42 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.238 ± 0.380 (0.215)** **C:NA T:86%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.779 ± 0.509 (0.951)** **C:75% T:82%**	pCi/L	12/12/19 15:11	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CTR
Pace Project No.:	60321788

Sample: M-MW-5 **Lab ID: 60321788005** Collected: 11/18/19 12:17 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.221 ± 0.429 (0.748) C:NA T:95%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**1.54 ± 0.562 (0.758) C:73% T:92%**	pCi/L	12/12/19 15:11	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-6 **Lab ID: 60321788006** Collected: 11/18/19 14:55 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0880 ± 0.283 (0.545)** **C:NA T:81%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.349 ± 0.446 (0.946)** **C:76% T:86%**	pCi/L	12/12/19 15:11	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-7 **Lab ID: 60321788007** Collected: 11/18/19 16:18 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.307 ± 0.489 (1.11)** **C:NA T:87%**	pCi/L	12/13/19 13:04	13982-63-3	
Radium-228	EPA 904.0	**0.658 ± 0.406 (0.764)** **C:78% T:85%**	pCi/L	12/12/19 14:53	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-8 **Lab ID: 60321788008** Collected: 11/18/19 16:37 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.598 ± 0.558 (0.780)** **C:NA T:81%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.176 ± 0.338 (0.742)** **C:74% T:92%**	pCi/L	12/12/19 14:53	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-BMW-1 **Lab ID: 60321788009** Collected: 11/18/19 13:12 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.389 ± 0.314 (0.176)** **C:NA T:93%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**1.45 ± 0.507 (0.711)** **C:74% T:88%**	pCi/L	12/12/19 14:53	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-BMW-2 **Lab ID: 60321788010** Collected: 11/18/19 10:38 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.719 ± 0.433 (0.177)** **C:NA T:91%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.667 ± 0.472 (0.926)** **C:75% T:79%**	pCi/L	12/12/19 14:53	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-10 **Lab ID: 60321788011** Collected: 11/18/19 14:33 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.490 ± 0.437 (0.562)** **C:NA T:85%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.697 ± 0.412 (0.768)** **C:77% T:85%**	pCi/L	12/12/19 14:54	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-DUP-1 **Lab ID: 60321788012** Collected: 11/18/19 14:33 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0950 ± 0.406 (0.783)** **C:NA T:86%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**1.12 ± 0.511 (0.864)** **C:75% T:76%**	pCi/L	12/12/19 14:54	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-FB-1 **Lab ID: 60321788013** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.443 ± 0.396 (0.509)** **C:NA T:92%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.182 ± 0.423 (0.942)** **C:74% T:82%**	pCi/L	12/12/19 17:59	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-DUP-2 **Lab ID: 60321788014** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.258 ± 0.340 (0.531)** **C:NA T:92%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.642 ± 0.506 (0.991)** **C:75% T:78%**	pCi/L	12/12/19 17:59	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-FB-2 **Lab ID: 60321788015** Collected: 11/18/19 14:57 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.128 ± 0.583 (1.08)** **C:NA T:90%**	pCi/L	12/13/19 13:19	13982-63-3	
Radium-228	EPA 904.0	**0.419 ± 0.330 (0.651)** **C:76% T:91%**	pCi/L	12/12/19 14:55	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-6 MS **Lab ID: 60321788016** Collected: 11/18/19 14:55 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**92.95 %REC ± NA (NA) C:NA T:NA**	pCi/L	12/13/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**98.59 %REC ± NA (NA) C:NA T:NA**	pCi/L	12/12/19 14:55	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Sample: M-MW-6 MSD **Lab ID: 60321788017** Collected: 11/18/19 14:55 Received: 11/20/19 03:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**77.73 %REC 17.83 RPD ± NA (NA) C:NA T:NA**	pCi/L	12/13/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**103.81 %REC 5.16 RPD ± NA (NA) C:NA T:NA**	pCi/L	12/12/19 14:55	15262-20-1	

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 373619 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015, 60321788016, 60321788017

METHOD BLANK: 1812928 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015, 60321788016, 60321788017

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	-0.223 ± 0.332 (0.785) C:NA T:89%	pCi/L	12/13/19 13:04	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

QC Batch: 373620 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015, 60321788016, 60321788017

METHOD BLANK: 1812929 Matrix: Water
Associated Lab Samples: 60321788001, 60321788002, 60321788003, 60321788004, 60321788005, 60321788006, 60321788007, 60321788008, 60321788009, 60321788010, 60321788011, 60321788012, 60321788013, 60321788014, 60321788015, 60321788016, 60321788017

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.0391 ± 0.291 (0.692) C:74% T:83%	pCi/L	12/12/19 11:45	

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QUALIFIERS

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

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TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60321788001	**M-MW-1**	EPA 200.7	626041	EPA 200.7	626085
60321788002	**M-MW-2**	EPA 200.7	626041	EPA 200.7	626085
60321788003	**M-MW-3**	EPA 200.7	626041	EPA 200.7	626085
60321788004	**M-MW-4**	EPA 200.7	626041	EPA 200.7	626085
60321788005	**M-MW-5**	EPA 200.7	626041	EPA 200.7	626085
60321788006	**M-MW-6**	EPA 200.7	626041	EPA 200.7	626085
60321788007	**M-MW-7**	EPA 200.7	626041	EPA 200.7	626085
60321788008	**M-MW-8**	EPA 200.7	626041	EPA 200.7	626085
60321788009	**M-BMW-1**	EPA 200.7	626041	EPA 200.7	626085
60321788010	**M-BMW-2**	EPA 200.7	626041	EPA 200.7	626085
60321788011	**M-MW-10**	EPA 200.7	626041	EPA 200.7	626085
60321788012	**M-DUP-1**	EPA 200.7	626041	EPA 200.7	626085
60321788013	**M-FB-1**	EPA 200.7	626041	EPA 200.7	626085
60321788014	**M-DUP-2**	EPA 200.7	626041	EPA 200.7	626085
60321788015	**M-FB-2**	EPA 200.7	626041	EPA 200.7	626085
60321788001	**M-MW-1**	EPA 200.8	625419	EPA 200.8	625603
60321788002	**M-MW-2**	EPA 200.8	625419	EPA 200.8	625603
60321788003	**M-MW-3**	EPA 200.8	625419	EPA 200.8	625603
60321788004	**M-MW-4**	EPA 200.8	625419	EPA 200.8	625603
60321788005	**M-MW-5**	EPA 200.8	625419	EPA 200.8	625603
60321788006	**M-MW-6**	EPA 200.8	625419	EPA 200.8	625603
60321788007	**M-MW-7**	EPA 200.8	625419	EPA 200.8	625603
60321788008	**M-MW-8**	EPA 200.8	625419	EPA 200.8	625603
60321788009	**M-BMW-1**	EPA 200.8	625419	EPA 200.8	625603
60321788010	**M-BMW-2**	EPA 200.8	625419	EPA 200.8	625603
60321788011	**M-MW-10**	EPA 200.8	625419	EPA 200.8	625603
60321788012	**M-DUP-1**	EPA 200.8	625419	EPA 200.8	625603
60321788013	**M-FB-1**	EPA 200.8	625419	EPA 200.8	625603
60321788014	**M-DUP-2**	EPA 200.8	625419	EPA 200.8	625603
60321788015	**M-FB-2**	EPA 200.8	625419	EPA 200.8	625603
60321788001	**M-MW-1**	EPA 903.1	373619		
60321788002	**M-MW-2**	EPA 903.1	373619		
60321788003	**M-MW-3**	EPA 903.1	373619		
60321788004	**M-MW-4**	EPA 903.1	373619		
60321788005	**M-MW-5**	EPA 903.1	373619		
60321788006	**M-MW-6**	EPA 903.1	373619		
60321788007	**M-MW-7**	EPA 903.1	373619		
60321788008	**M-MW-8**	EPA 903.1	373619		
60321788009	**M-BMW-1**	EPA 903.1	373619		
60321788010	**M-BMW-2**	EPA 903.1	373619		
60321788011	**M-MW-10**	EPA 903.1	373619		
60321788012	**M-DUP-1**	EPA 903.1	373619		
60321788013	**M-FB-1**	EPA 903.1	373619		
60321788014	**M-DUP-2**	EPA 903.1	373619		
60321788015	**M-FB-2**	EPA 903.1	373619		
60321788016	**M-MW-6 MS**	EPA 903.1	373619		
60321788017	**M-MW-6 MSD**	EPA 903.1	373619		

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60321788001	**M-MW-1**	EPA 904.0	373620		
60321788002	**M-MW-2**	EPA 904.0	373620		
60321788003	**M-MW-3**	EPA 904.0	373620		
60321788004	**M-MW-4**	EPA 904.0	373620		
60321788005	**M-MW-5**	EPA 904.0	373620		
60321788006	**M-MW-6**	EPA 904.0	373620		
60321788007	**M-MW-7**	EPA 904.0	373620		
60321788008	**M-MW-8**	EPA 904.0	373620		
60321788009	**M-BMW-1**	EPA 904.0	373620		
60321788010	**M-BMW-2**	EPA 904.0	373620		
60321788011	**M-MW-10**	EPA 904.0	373620		
60321788012	**M-DUP-1**	EPA 904.0	373620		
60321788013	**M-FB-1**	EPA 904.0	373620		
60321788014	**M-DUP-2**	EPA 904.0	373620		
60321788015	**M-FB-2**	EPA 904.0	373620		
60321788016	**M-MW-6 MS**	EPA 904.0	373620		
60321788017	**M-MW-6 MSD**	EPA 904.0	373620		
60321788001	**M-MW-1**	SM 2320B	624825		
60321788002	**M-MW-2**	SM 2320B	624825		
60321788003	**M-MW-3**	SM 2320B	624825		
60321788004	**M-MW-4**	SM 2320B	624825		
60321788005	**M-MW-5**	SM 2320B	624825		
60321788006	**M-MW-6**	SM 2320B	624825		
60321788007	**M-MW-7**	SM 2320B	624825		
60321788008	**M-MW-8**	SM 2320B	624825		
60321788009	**M-BMW-1**	SM 2320B	624825		
60321788010	**M-BMW-2**	SM 2320B	624825		
60321788011	**M-MW-10**	SM 2320B	624825		
60321788012	**M-DUP-1**	SM 2320B	624825		
60321788013	**M-FB-1**	SM 2320B	624825		
60321788014	**M-DUP-2**	SM 2320B	624825		
60321788015	**M-FB-2**	SM 2320B	624825		
60321788001	**M-MW-1**	SM 2540C	624428		
60321788002	**M-MW-2**	SM 2540C	624637		
60321788003	**M-MW-3**	SM 2540C	624637		
60321788004	**M-MW-4**	SM 2540C	624428		
60321788005	**M-MW-5**	SM 2540C	624428		
60321788006	**M-MW-6**	SM 2540C	624428		
60321788007	**M-MW-7**	SM 2540C	624428		
60321788008	**M-MW-8**	SM 2540C	624428		
60321788009	**M-BMW-1**	SM 2540C	624429		
60321788010	**M-BMW-2**	SM 2540C	624429		
60321788011	**M-MW-10**	SM 2540C	624429		
60321788012	**M-DUP-1**	SM 2540C	624429		
60321788013	**M-FB-1**	SM 2540C	624429		
60321788014	**M-DUP-2**	SM 2540C	624429		

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CTR
Pace Project No.: 60321788

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60321788015	**M-FB-2**	SM 2540C	624429		
60321788001	**M-MW-1**	EPA 300.0	625953		
60321788002	**M-MW-2**	EPA 300.0	625953		
60321788003	**M-MW-3**	EPA 300.0	625953		
60321788004	**M-MW-4**	EPA 300.0	625953		
60321788005	**M-MW-5**	EPA 300.0	625953		
60321788006	**M-MW-6**	EPA 300.0	625953		
60321788007	**M-MW-7**	EPA 300.0	625953		
60321788008	**M-MW-8**	EPA 300.0	625953		
60321788009	**M-BMW-1**	EPA 300.0	625956		
60321788010	**M-BMW-2**	EPA 300.0	625956		
60321788011	**M-MW-10**	EPA 300.0	625956		
60321788012	**M-DUP-1**	EPA 300.0	625956		
60321788013	**M-FB-1**	EPA 300.0	625956		
60321788014	**M-DUP-2**	EPA 300.0	625956		
60321788015	**M-FB-2**	EPA 300.0	625956		

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www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60321788
60321788

Client Name: Golder Associates

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☑ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☑ No ☐

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☑ Other ☑ 2PLC

Thermometer Used: T296 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 0.6, 0.8, 17.5, 17.3 **Corr. Factor** +0.0 **Corrected** 0.6, 0.8, 17.5, 17.3

Temperature should be above freezing to 6°C

Date and initials of person examining contents: VB 11/20/19

Chain of Custody present:	☑Yes ☐No ☐N/A	
Chain of Custody relinquished:	☑Yes ☐No ☐N/A	
Samples arrived within holding time:	☑Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☑No ☐N/A	Coolers at 17.5 and 17.3
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	only contained BPIN
Sufficient volume:	☑Yes ☑No ☐N/A	containers
Correct containers used:	☑Yes ☐No ☐N/A	1 M-MW-4 BPIN has low
Pace containers used:	☑Yes ☐No ☐N/A	volume
Containers intact:	☑Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☑N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☑No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☑Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☑N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jamie Church Date: 11/20/19

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page: 1 of 2

Section A
Required Client Information:

Company:	Golder Associates
Address:	13515 Barrett Parkway Dr., Ste 260 Ballwin, MO 63021
Email To:	jeffrey_ingram@golder.com
Phone: 636-724-9191	Fax: 636-724-9323
Requested Due Date/TAT:	Standard

Section B
Required Project Information:

Report To:	Jeffrey Ingram
Copy To:	
Purchase Order No.:	
Project Name:	Ameren Labadie Energy Center MEC
Project Number:	

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote Reference:	
Pace Project Manager:	Jamie Church
Pace Profile #:	9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N): Metals* N, Metals** N, Chloride/Fluoride/Sulfate N, TDS N

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Metals**	Chloride/Fluoride/Sulfate	TDS	Alkalinity	Radium 226/228	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60321788
1	M-MW-1	WT	G			11/18/19	1520		4	1		3							✓	✓	✓	✓	✓	✓		001
2	M-MW-2	WT	G			11/19/19	0915																			002
3	M-MW-3	WT	G				1030																			003
4	M-MW-4	WT	G			11/18/19	1042																			004
5	M-MW-5	WT	G				1217																			005
6	M-MW-6 ras	WT	G				1455																			006
7	M-MW-7	WT	G				1618																			007
8	M-MW-8	WT	G				1637																			008
9	M-BMW-1	WT	G				1312																			009
10	M-BMW-2	WT	G				1038																			010
11	M-MW-9	WT	G																							
12	M-MW-10	WT	G			11/18/19	1433		4	1		3							✓	✓	✓	✓	✓	✓		011

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Fe, Mn, Mg, K, Na, Ba, Co, Li, Mo	Eric Schneider / Golder	11/19/19	1600	Victor B / Pace	11/20/19	0330	0.6 0.8 17.5 17.3	Y	Y	Y
**EPA 200.8: As, Se										

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 11/19/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

Pace Analytical
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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT All relevant fields must be completed accurately

Page: 2 of 2

Section A
Required Client Information:

Company: Golder Associates
Address: 13515 Barrett Parkway Dr., Ste 260
Ballwin, MO 63021
Email To: jeffrey_ingram@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: Standard

Section B
Required Project Information:

Report To: Jeffrey Ingram
Copy To:
Purchase Order No.:
Project Name: Ameren Labadie Energy Center MEC
Project Number:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY

NPDES [✓ GROUND WATER] DRINKING WATER
UST RCRA OTHER

Site Location STATE: MO

Section D
Required Client Information

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

60321788

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Metals**	Chloride/Fluoride/Sulfate	TDS	Alkalinity	Radium 226/228	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																			N	N	N	N				
1	M-DUP-1	WT	G			11/18/19	—		4	1		3							/	/	/	/	/	/		012
2	M-FB-1	WT	G			↓	1457		↓	↓		↓							↓	↓	↓	↓	↓	↓		013
3	M-DUP-2	WT	G			↓	—		↓	↓		↓							↓	↓	↓	↓	↓	↓		014
4	M-FB-2	WT	G			↓	1620		↓	↓		↓							↓	↓	↓	↓	↓	↓		015
5	M-MW-6-MS	WT	G			↓	1455		↓	↓		↓							↓	↓	↓	↓	↓	↓		006
6	M-MW-6-MSD	WT	G			↓	1455		↓	↓		↓							↓	↓	↓	↓	↓	↓		
7		WT	G																							
8		WT	G																							
9		WT	G																							
10		WT	G																							
11		WT	G																							
12		WT	G																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Fe, Mn, Mg, K, Na, Ba, Co, Li, Mo	Eric Schneider / Golder	11/19/19	1600	Victor B / Pace	11/20/19	0330	0.6	Y	Y	Y
**EPA 200.8: As, Se							0.8	↓	↓	↓
							17.5	↓	↓	↓
							17.3	↓	↓	↓

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER: (MM/DD/YY): 11/19/19

MEMORANDUM

DATE January 14, 2020 **Project No.** 153140601

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – DATA PACKAGE 60321788

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field), and the blank comparison criterion was not met, associated sample results were qualified as estimates (J) or non-detects (U).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Manager: J Ingram
Project Name: Ameren - Meramec - MEC
Project Number: 153140601
Reviewer: T Goodwin
Validation Date: 1/14/2020

Laboratory: Pace Analytical - KS
SDG #: 60321788
Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 903.1/904.0 (Rads); SM 2320B (Alk); SM 2540C (TDS); EPA 300.0 (Anions)
Matrix: ☐ Air ☐ Soil/Sed. ■ Water ☐ Waste ☐
Sample Names M-MW-1, M-MW-2, M-MW-3, M-MW-4, M-MW-5, M-MW-6, M-MW-7, M-MW-8, M-BMW-1, M-BMW-2, M-MW-10, M-DUP-1, M-FB-1, M-DUP-2, M-FB-2, M-MW-6 MS, M-MW-6 MSD

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	11/18-19/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	**YES**	**NO**	**NA**	**COMMENTS**
a) Were analytes detected in the method blank(s)?	☒	☐	☐	See Notes
b) Were analytes detected in the field blank(s)?	☒	☐	☐	See Notes
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	**YES**	**NO**	**NA**	**COMMENTS**
a) Were field duplicates collected (note original and duplicate sample names)?	☒	☐	☐	DUP-1 @ M-MW-4; DUP-2 @ M-MW-1 FB-1 @ M-MW-10; FB-2 @ M-MW-7
b) Were field dup. precision criteria met (note RPD)?	☐	☒	☐	See Notes
c) Were lab duplicates analyzed (note original and duplicate samples)?	☒	☐	☐	-88006: Alk, TDS; -88009: TDS
d) Were lab dup. precision criteria met (note RPD)?	☒	☐	☐	See Notes

Blind Standards	**YES**	**NO**	**NA**	**COMMENTS**
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was MS accuracy criteria met?	☐	☒	☐	See Notes
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☒	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☒	☐	☐	

Comments/Notes:

FB-1: B (51.5), K (136), Na (448), Cl (0.28); FB-2: B (27.1), Na (396), Cl (0.34)

MB: -88001-15: Fe (25.9), K (260); -88009-15 {12/05/19 09:18} Cl (0.27)

MS/MSD: -88013: F MS-H(123% of 80-120%), SO4 MS-H(145% of 80-120%); Results are non-detect

DUP-1: Se (200); DUP-2: B (62), Li (200); no qualification is necessary for DUP-1 or DUP-2 samples

Dilution: Chloride and Sulfate were diluted in several samples; no qualification is necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-MW-7	Iron (Fe)	50.0	U	Detected in Method Blank (MB); PQL > Result > MDL
M-FB-1	Potassium (K)	500	U	"
"	Chloride (Cl)	1.0	U	"
M-FB-2	Cl	1.0	U	"

Signature: ____________ Date: 1/14/2020

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

January 02, 2020

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory on December 11, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Tommy Goodwin, Golder Associates
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Pace Analytical Services Kansas

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212020-2
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-19-12
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60323864001	**M-MW-9**	Water	12/10/19 12:15	12/11/19 03:00
60323864002	**M-TP-1**	Water	12/10/19 13:55	12/11/19 03:00

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SAMPLE ANALYTE COUNT

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60323864001	**M-MW-9**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	LRS	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	LDF	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	CNB, MJK	3	PASI-K
60323864002	**M-TP-1**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	LRS	6	PASI-K
		EPA 245.1	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	LDF	1	PASI-K
		SM 2540C	BLA	1	PASI-K
		EPA 300.0	MJK	3	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Sample: M-MW-9 **Lab ID: 60323864001** Collected: 12/10/19 12:15 Received: 12/11/19 03:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**207**	ug/L	5.0	1.4	1	12/17/19 12:45	12/18/19 14:17	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	12/17/19 12:45	12/18/19 14:17	7440-41-7	
Boron	**3860**	ug/L	100	10.7	1	12/17/19 12:45	12/18/19 14:17	7440-42-8	
Calcium	**118000**	ug/L	200	50.0	1	12/17/19 12:45	12/18/19 14:17	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/17/19 12:45	12/18/19 14:17	7440-48-4	
Iron	**12300**	ug/L	50.0	14.0	1	12/17/19 12:45	12/18/19 14:17	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	12/17/19 12:45	12/18/19 14:17	7439-92-1	
Lithium	**9.8J**	ug/L	10.0	5.9	1	12/17/19 12:45	12/18/19 14:17	7439-93-2	
Magnesium	**39700**	ug/L	50.0	13.0	1	12/17/19 12:45	12/18/19 14:17	7439-95-4	
Manganese	**302**	ug/L	5.0	2.1	1	12/17/19 12:45	12/18/19 14:17	7439-96-5	
Molybdenum	**37.6**	ug/L	20.0	2.6	1	12/17/19 12:45	12/18/19 14:17	7439-98-7	
Potassium	**4550**	ug/L	500	79.0	1	12/17/19 12:45	12/18/19 14:17	7440-09-7	
Sodium	**40000**	ug/L	500	144	1	12/17/19 12:45	12/18/19 14:17	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/13/19 08:30	12/19/19 11:47	7440-36-0	
Arsenic	**17.1**	ug/L	1.0	0.065	1	12/13/19 08:30	12/19/19 11:47	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/13/19 08:30	12/19/19 11:47	7440-43-9	
Chromium	**0.10J**	ug/L	1.0	0.078	1	12/13/19 08:30	12/19/19 11:47	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/13/19 08:30	12/19/19 11:47	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/13/19 08:30	12/19/19 11:47	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.052**	ug/L	0.20	0.052	1	12/13/19 10:20	12/16/19 14:15	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**367**	mg/L	20.0	6.5	1		12/17/19 18:32		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**620**	mg/L	10.0	10.0	1		12/16/19 07:33		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**32.1**	mg/L	5.0	1.1	5		12/17/19 23:22	16887-00-6	
Fluoride	**0.25**	mg/L	0.20	0.085	1		12/17/19 23:06	16984-48-8	
Sulfate	**133**	mg/L	10.0	2.3	10		12/18/19 20:21	14808-79-8	

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Sample: M-TP-1 **Lab ID: 60323864002** Collected: 12/10/19 13:55 Received: 12/11/19 03:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**357**	ug/L	5.0	1.4	1	12/17/19 12:45	12/18/19 14:20	7440-39-3	
Beryllium	**0.28J**	ug/L	1.0	0.25	1	12/17/19 12:45	12/18/19 14:20	7440-41-7	B
Boron	**592**	ug/L	100	10.7	1	12/17/19 12:45	12/18/19 14:20	7440-42-8	
Calcium	**75000**	ug/L	200	50.0	1	12/17/19 12:45	12/18/19 14:20	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/17/19 12:45	12/18/19 14:20	7440-48-4	
Iron	**7470**	ug/L	50.0	14.0	1	12/17/19 12:45	12/18/19 14:20	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	12/17/19 12:45	12/18/19 14:20	7439-92-1	
Lithium	**15.7**	ug/L	10.0	5.9	1	12/17/19 12:45	12/18/19 14:20	7439-93-2	
Magnesium	**30700**	ug/L	50.0	13.0	1	12/17/19 12:45	12/18/19 14:20	7439-95-4	
Manganese	**87.9**	ug/L	5.0	2.1	1	12/17/19 12:45	12/18/19 14:20	7439-96-5	
Molybdenum	**<2.6**	ug/L	20.0	2.6	1	12/17/19 12:45	12/18/19 14:20	7439-98-7	
Potassium	**2950**	ug/L	500	79.0	1	12/17/19 12:45	12/18/19 14:20	7440-09-7	
Sodium	**43400**	ug/L	500	144	1	12/17/19 12:45	12/18/19 14:20	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.078**	ug/L	1.0	0.078	1	12/13/19 08:30	12/19/19 11:49	7440-36-0	
Arsenic	**6.6**	ug/L	1.0	0.065	1	12/13/19 08:30	12/19/19 11:49	7440-38-2	
Cadmium	**<0.033**	ug/L	0.50	0.033	1	12/13/19 08:30	12/19/19 11:49	7440-43-9	
Chromium	**0.11J**	ug/L	1.0	0.078	1	12/13/19 08:30	12/19/19 11:49	7440-47-3	
Selenium	**<0.085**	ug/L	1.0	0.085	1	12/13/19 08:30	12/19/19 11:49	7782-49-2	
Thallium	**<0.099**	ug/L	1.0	0.099	1	12/13/19 08:30	12/19/19 11:49	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**<0.052**	ug/L	0.20	0.052	1	12/13/19 10:20	12/16/19 14:20	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**387**	mg/L	20.0	6.5	1		12/17/19 18:37		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**410**	mg/L	10.0	10.0	1		12/16/19 07:33		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**23.3**	mg/L	2.0	0.44	2		12/18/19 00:43	16887-00-6	
Fluoride	**0.32**	mg/L	0.20	0.085	1		12/18/19 00:27	16984-48-8	
Sulfate	**<0.23**	mg/L	1.0	0.23	1		12/18/19 00:27	14808-79-8	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628095
Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1
Analysis Description: 245.1 Mercury
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2560016
Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.052	0.20	0.052	12/16/19 13:42	

LABORATORY CONTROL SAMPLE: 2560017

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.1	101	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2560018 2560019

Parameter	Units	60323977001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	4.9	4.9	99	99	70-130	0	20	

MATRIX SPIKE SAMPLE: 2560020

Parameter	Units	60323864001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	<0.052	5	4.6	92	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628789 Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2562752 Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.8	5.0	1.8	12/18/19 13:32	
Beryllium	ug/L	0.49J	1.0		12/18/19 13:32	
Boron	ug/L	<11.7	100	11.7	12/18/19 13:32	
Calcium	ug/L	36.1J	200	32.4	12/18/19 13:32	
Cobalt	ug/L	<1.5	5.0	1.5	12/18/19 13:32	
Iron	ug/L	<26.8	50.0	26.8	12/18/19 13:32	
Lead	ug/L	<4.6	10.0	4.6	12/18/19 13:32	
Lithium	ug/L	<4.6	10.0	4.6	12/18/19 13:32	
Magnesium	ug/L	<19.7	50.0	19.7	12/18/19 13:32	
Manganese	ug/L	<0.97	5.0	0.97	12/18/19 13:32	
Molybdenum	ug/L	<1.7	20.0	1.7	12/18/19 13:32	
Potassium	ug/L	<189	500	189	12/18/19 13:32	
Sodium	ug/L	126J	500	107	12/18/19 13:32	

LABORATORY CONTROL SAMPLE: 2562753

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	972	97	85-115	
Beryllium	ug/L	1000	974	97	85-115	
Boron	ug/L	1000	939	94	85-115	
Calcium	ug/L	10000	9840	98	85-115	
Cobalt	ug/L	1000	1020	102	85-115	
Iron	ug/L	10000	9820	98	85-115	
Lead	ug/L	1000	1010	101	85-115	
Lithium	ug/L	1000	955	95	85-115	
Magnesium	ug/L	10000	9810	98	85-115	
Manganese	ug/L	1000	997	100	85-115	
Molybdenum	ug/L	1000	1020	102	85-115	
Potassium	ug/L	10000	9760	98	85-115	
Sodium	ug/L	10000	10200	102	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2562754 2562755

Parameter	Units	60324131001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	141	1000	1000	1130	1120	99	98	70-130	1	20	
Beryllium	ug/L	ND	1000	1000	1010	1000	101	100	70-130	1	20	
Boron	ug/L	447	1000	1000	1420	1420	97	97	70-130	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2562754 2562755

Parameter	Units	60324131001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	212000	10000	10000	225000	224000	131	120	70-130	0	20	M1
Cobalt	ug/L	ND	1000	1000	994	982	99	98	70-130	1	20	
Iron	ug/L	173	10000	10000	10200	10100	100	100	70-130	1	20	
Lead	ug/L	ND	1000	1000	970	959	97	96	70-130	1	20	
Lithium	ug/L	230	1000	1000	1190	1190	96	96	70-130	0	20	
Magnesium	ug/L	94000	10000	10000	105000	104000	106	98	70-130	1	20	
Manganese	ug/L	27.1	1000	1000	992	985	96	96	70-130	1	20	
Molybdenum	ug/L	ND	1000	1000	1040	1040	104	103	70-130	1	20	
Potassium	ug/L	16200	10000	10000	26400	26400	102	102	70-130	0	20	
Sodium	ug/L	255000	10000	10000	268000	267000	130	117	70-130	0	20	

MATRIX SPIKE SAMPLE: 2562756

Parameter	Units	60324192003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	126	1000	1130	101	70-130	
Beryllium	ug/L	ND	1000	1000	100	70-130	
Boron	ug/L	ND	1000	952J	95	70-130	
Calcium	ug/L	53900	10000	65300	114	70-130	
Cobalt	ug/L	ND	1000	1060	105	70-130	
Iron	ug/L	ND	10000	10700	104	70-130	
Lead	ug/L	ND	1000	1010	100	70-130	
Lithium	ug/L	ND	1000	982	98	70-130	
Magnesium	ug/L	8610	10000	18600	99	70-130	
Manganese	ug/L	ND	1000	1020	101	70-130	
Molybdenum	ug/L	ND	1000	1020	102	70-130	
Potassium	ug/L	5250	10000	15200	100	70-130	
Sodium	ug/L	28100	10000	37900	98	70-130	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628102 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2560041 Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.097	1.0	0.097	12/19/19 10:45	
Arsenic	ug/L	<0.086	1.0	0.086	12/19/19 10:45	
Cadmium	ug/L	<0.056	0.50	0.056	12/19/19 10:45	
Chromium	ug/L	<0.22	1.0	0.22	12/19/19 10:45	
Selenium	ug/L	<0.18	1.0	0.18	12/19/19 10:45	
Thallium	ug/L	<0.093	1.0	0.093	12/19/19 10:45	

LABORATORY CONTROL SAMPLE: 2560042

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	40.3	101	85-115	
Arsenic	ug/L	40	41.2	103	85-115	
Cadmium	ug/L	40	40.2	100	85-115	
Chromium	ug/L	40	39.6	99	85-115	
Selenium	ug/L	40	41.6	104	85-115	
Thallium	ug/L	40	39.9	100	85-115	

MATRIX SPIKE SAMPLE: 2560043

Parameter	Units	60323935004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	0.12J	40	38.8	97	70-130	
Arsenic	ug/L	1.2	40	42.0	102	70-130	
Cadmium	ug/L	0.055J	40	36.3	91	70-130	
Chromium	ug/L	0.60J	40	41.2	102	70-130	
Selenium	ug/L	0.091J	40	38.0	95	70-130	
Thallium	ug/L	<0.099	40	37.1	93	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2560044 2560045

Parameter	Units	60323886001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	38.6	38.6	95	95	70-130	0	20	
Arsenic	ug/L	ND	40	40	41.4	41.6	102	102	70-130	0	20	
Cadmium	ug/L	ND	40	40	36.4	36.2	91	90	70-130	1	20	
Chromium	ug/L	2.4	40	40	42.6	42.5	100	100	70-130	0	20	
Selenium	ug/L	4.7	40	40	42.0	41.7	93	92	70-130	1	20	
Thallium	ug/L	ND	40	40	36.3	36.5	91	91	70-130	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628835
Analysis Method: SM 2320B
QC Batch Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2562954
Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<8.4	20.0	8.4	12/17/19 16:38	

LABORATORY CONTROL SAMPLE: 2562955

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	472	94	90-110	

SAMPLE DUPLICATE: 2562956

Parameter	Units	60323570001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	602	603	0	10	

SAMPLE DUPLICATE: 2562957

Parameter	Units	60323800002 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	1480	1580	6	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628400
Analysis Method: SM 2540C
QC Batch Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2561610
Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	12/16/19 07:33	

LABORATORY CONTROL SAMPLE: 2561611

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	985	98	80-120	

SAMPLE DUPLICATE: 2561612

Parameter	Units	60324058001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	141000	139000	2	10	

SAMPLE DUPLICATE: 2561613

Parameter	Units	60324174001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	318	324	2	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 628838 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 2562965 Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/17/19 09:27	
Fluoride	mg/L	<0.085	0.20	0.085	12/17/19 09:27	
Sulfate	mg/L	<0.23	1.0	0.23	12/17/19 09:27	

METHOD BLANK: 2563581 Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/18/19 16:55	
Fluoride	mg/L	<0.085	0.20	0.085	12/18/19 16:55	
Sulfate	mg/L	<0.23	1.0	0.23	12/18/19 16:55	

LABORATORY CONTROL SAMPLE: 2562966

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	95	90-110	
Fluoride	mg/L	2.5	2.6	104	90-110	
Sulfate	mg/L	5	4.8	97	90-110	

LABORATORY CONTROL SAMPLE: 2563582

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	95	90-110	
Fluoride	mg/L	2.5	2.4	95	90-110	
Sulfate	mg/L	5	5.0	99	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2562967 2562968

Parameter	Units	60324384001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	190	50	50	251	244	122	108	80-120	3	15	E,M1
Fluoride	mg/L	ND	25	25	26.9	26.6	108	106	80-120	1	15	
Sulfate	mg/L	387	250	250	649	647	105	104	80-120	0	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

MATRIX SPIKE SAMPLE: 2562969

Parameter	Units	60324321004 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	13600	5000	19300	114	80-120	
Fluoride	mg/L	ND	2500	2680	107	80-120	
Sulfate	mg/L	ND	5000	5170	103	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Sample: M-MW-9 **Lab ID: 60323864001** Collected: 12/10/19 12:15 Received: 12/11/19 03:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.317 ± 0.361 (0.570)** **C:NA T:91%**	pCi/L	01/02/20 12:25	13982-63-3	
Radium-228	EPA 904.0	**0.404 ± 0.381 (0.782)** **C:68% T:90%**	pCi/L	12/31/19 12:15	15262-20-1	

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Sample: M-TP-1 **Lab ID: 60323864002** Collected: 12/10/19 13:55 Received: 12/11/19 03:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.135 ± 0.384 (0.713)** **C:NA T:101%**	pCi/L	01/02/20 12:25	13982-63-3	
Radium-228	EPA 904.0	**0.719 ± 0.386 (0.687)** **C:68% T:96%**	pCi/L	12/31/19 12:15	15262-20-1	

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch:	376355	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226

Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 1825595 Matrix: Water

Associated Lab Samples: 60323864001, 60323864002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	-0.0798 ± 0.182 (0.430) C:NA T:88%	pCi/L	01/02/20 11:46	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

QC Batch: 376354
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Associated Lab Samples: 60323864001, 60323864002

METHOD BLANK: 1825593
Matrix: Water
Associated Lab Samples: 60323864001, 60323864002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.748 ± 0.359 (0.613) C:75% T:98%	pCi/L	12/31/19 12:15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60323864

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60323864

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60323864001	**M-MW-9**	EPA 200.7	628789	EPA 200.7	628865
60323864002	**M-TP-1**	EPA 200.7	628789	EPA 200.7	628865
60323864001	**M-MW-9**	EPA 200.8	628102	EPA 200.8	628208
60323864002	**M-TP-1**	EPA 200.8	628102	EPA 200.8	628208
60323864001	**M-MW-9**	EPA 245.1	628095	EPA 245.1	628185
60323864002	**M-TP-1**	EPA 245.1	628095	EPA 245.1	628185
60323864001	**M-MW-9**	EPA 903.1	376355		
60323864002	**M-TP-1**	EPA 903.1	376355		
60323864001	**M-MW-9**	EPA 904.0	376354		
60323864002	**M-TP-1**	EPA 904.0	376354		
60323864001	**M-MW-9**	SM 2320B	628835		
60323864002	**M-TP-1**	SM 2320B	628835		
60323864001	**M-MW-9**	SM 2540C	628400		
60323864002	**M-TP-1**	SM 2540C	628400		
60323864001	**M-MW-9**	EPA 300.0	628838		
60323864002	**M-TP-1**	EPA 300.0	628838		

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Sample Condition Upon Receipt

WO# : 60323864

60323864

Client Name: Golder

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ______ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☒ Foam ☐ None ☐ Other ☐

Thermometer Used: T-299 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 3.0 **Corr. Factor** 0.2 **Corrected** 3.2

Date and initials of person examining contents: 12/11/19

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☒No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: Jami Church Date: 12/(11/19

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company: Golder Associates
Address: 13515 Barrett Parkway Drive, Ste 260
Ballwin, MO 63021
Email To: Jeffrey.Ingram@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: **Standard**

Section B
Required Project Information:

Report To: Jeffrey Ingram
Copy To: Ryan Feldmann / Eric Schneider
Purchase Order No.:
Project Name: Ameren Meramec Energy Center
Project Number: 153-1406-01.0004A (COC #9)

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location **STATE:** MO

Section D
Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N): Metals* N, Mercury N, Chloride/Fluoride/Sulfate N, Alkalinity N, ~~Total Phosphorus~~ N, Radium 226 N, Radium 228 N

Pace Project No./ Lab I.D.: 60323824

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Metals*	Mercury	Chloride/Fluoride/Sulfate	Alkalinity	~~Total Phosphorus~~	Radium 226	Radium 228					Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	M-MW-9	WT	G	12-10-19		12-10-19	1215		2	1		3							✓	✓	✓	✓		✓	✓						001
2	M-TP-1						1355		1	1		3							✓	✓	✓	✓		✓	✓						002
3																															
4																															
5																															
6																															
7																															
8																															
9																															
10																															
11																															
12																															

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*EPA 200.7: B, Ca, Ba, Be, Co, Pb, Li, Mo, Fe, Mg, Mn, K, Na	A. Muehlfarth / Golder	12-10-19	1620	Angela McManus	12-10-19	16:25				
*EPA 200.8: Sb, As, Cd, Cr, Se, Tl	Angela Mc	12-10-19	1625		12/11/19	0330	3.2	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Annie Muehlfarth
SIGNATURE of SAMPLER: Annie Muehlfarth
DATE Signed (MM/DD/YY): 12-10-19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days

F-ALL-Q-020rev.08, 12-Oct-2007

MEMORANDUM

DATE January 6, 2020 **Project No.** 153140601

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – DATA PACKAGE 60323864

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- When a compound was detected in a sample result between the MDL and the PQL the results were recorded at the detection value and qualified as estimates (J).
- When a compound was detected in a blank (i.e. method, field) and the blank comparison criterion was not met, associated sample results were qualified as estimates (J) or non-detects (U).

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren - Meramec - MEC
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 153140601
Validation Date: 1/6/2020

Laboratory: Pace Analytical - KS

SDG #: 60323864

Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 903.1/904.0 (Rads); EPA 245.1 (Hg); SM 2320B (Alk); SM 2540C (TDS); EPA 300.0 (Anions)

Matrix: ☐ Air ☐ Soil/Sed. ☒ Water ☐ Waste ☐

Sample Names M-MW-9, M-TP-1

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	12/10/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	YES	NO	NA	COMMENTS
a) Were analytes detected in the method blank(s)?	☒	☐	☐	See Notes
b) Were analytes detected in the field blank(s)?	☐	☐	☒	
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	YES	NO	NA	COMMENTS
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	YES	NO	NA	COMMENTS
a) Were field duplicates collected (note original and duplicate sample names)?	☐	☒	☐	
b) Were field dup. precision criteria met (note RPD)?	☐	☐	☒	
c) Were lab duplicates analyzed (note original and duplicate samples)?	☐	☒	☐	
d) Were lab dup. precision criteria met (note RPD)?	☐	☐	☒	

Blind Standards	YES	NO	NA	COMMENTS
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	YES	NO	NA	COMMENTS
a) Was MS accuracy criteria met?	☒	☐	☐	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☐	☒	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☐	☐	☒	

Comments/Notes:

MB: 01-02: Be (0.49), Ca (36.1), Na (126), Ra-228 (0.748)

Dilution: Chloride and Sulfate were diluted in several samples; no qualification is necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
M-TP-1	Beryllium (Be)	1.0	U	Detected in Method Blank (MB); PQL > Result > MDL
"	Radium-228 (Ra-228)	0.719	J	Detected in MB; 10x MB > Result > MDC

Signature: Tommy J Goodf Date: 4/6/2020

Revised May 2004

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

January 13, 2020

Jeffrey Ingram
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

RE: Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

Dear Jeffrey Ingram:

Enclosed are the analytical results for sample(s) received by the laboratory on December 21, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church

Jamie Church
jamie.church@pacelabs.com
314-838-7223
Project Manager

Enclosures

cc: Ryan Feldmann, Golder
Tommy Goodwin, Golder Associates
Mark Haddock, Golder Associates
Eric Schneider, Golder Associates

CERTIFICATIONS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Florida: Cert E871149 SEKS WET
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Pace Analytical Services Kansas

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 19-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212020-2
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-19-12
Utah Certification #: KS000212018-8
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60324976001	**M-MW-9**	Water	12/20/19 09:50	12/21/19 03:25

SAMPLE ANALYTE COUNT

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60324976

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60324976001	**M-MW-9**	EPA 200.7	HKC	13	PASI-K
		EPA 200.8	JGP	6	PASI-K
		EPA 7470	JLH	1	PASI-K
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2320B	AJS2	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 300.0	CNB	3	PASI-K

ANALYTICAL RESULTS

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

Sample: M-MW-9 **Lab ID: 60324976001** Collected: 12/20/19 09:50 Received: 12/21/19 03:25 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Barium	**192**	ug/L	5.0	1.4	1	12/23/19 15:15	12/24/19 11:46	7440-39-3	
Beryllium	**<0.25**	ug/L	1.0	0.25	1	12/23/19 15:15	12/24/19 11:46	7440-41-7	
Boron	**3440**	ug/L	100	10.7	1	12/23/19 15:15	12/24/19 11:46	7440-42-8	
Calcium	**106000**	ug/L	200	50.0	1	12/23/19 15:15	12/24/19 11:46	7440-70-2	
Cobalt	**<0.84**	ug/L	5.0	0.84	1	12/23/19 15:15	12/24/19 11:46	7440-48-4	
Iron	**11000**	ug/L	50.0	14.0	1	12/23/19 15:15	12/24/19 11:46	7439-89-6	
Lead	**<3.4**	ug/L	10.0	3.4	1	12/23/19 15:15	12/24/19 11:46	7439-92-1	
Lithium	**16.1**	ug/L	10.0	5.9	1	12/23/19 15:15	12/24/19 11:46	7439-93-2	
Magnesium	**37300**	ug/L	50.0	13.0	1	12/23/19 15:15	12/24/19 11:46	7439-95-4	
Manganese	**277**	ug/L	5.0	2.1	1	12/23/19 15:15	12/24/19 11:46	7439-96-5	
Molybdenum	**34.2**	ug/L	20.0	2.6	1	12/23/19 15:15	12/24/19 11:46	7439-98-7	
Potassium	**4270**	ug/L	500	79.0	1	12/23/19 15:15	12/24/19 11:46	7440-09-7	
Sodium	**37600**	ug/L	500	144	1	12/23/19 15:15	12/24/19 11:46	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**<0.097**	ug/L	1.0	0.097	1	12/26/19 12:42	12/30/19 16:38	7440-36-0	
Arsenic	**18.6**	ug/L	1.0	0.086	1	12/26/19 12:42	12/30/19 16:38	7440-38-2	
Cadmium	**<0.056**	ug/L	0.50	0.056	1	12/26/19 12:42	12/30/19 16:38	7440-43-9	
Chromium	**<0.22**	ug/L	1.0	0.22	1	12/26/19 12:42	12/30/19 16:38	7440-47-3	
Selenium	**<0.18**	ug/L	1.0	0.18	1	12/26/19 12:42	12/30/19 16:38	7782-49-2	
Thallium	**<0.093**	ug/L	1.0	0.093	1	12/26/19 12:42	12/30/19 16:38	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**<0.085**	ug/L	0.20	0.085	1	12/30/19 10:23	12/31/19 10:51	7439-97-6	
2320B Alkalinity	Analytical Method: SM 2320B								
Alkalinity, Total as CaCO3	**358**	mg/L	20.0	8.4	1		12/27/19 10:57		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**634**	mg/L	10.0	10.0	1		12/23/19 14:15		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**33.1**	mg/L	10.0	2.2	10		12/26/19 23:16	16887-00-6	
Fluoride	**0.21**	mg/L	0.20	0.085	1		12/26/19 23:00	16984-48-8	
Sulfate	**127**	mg/L	10.0	2.3	10		12/26/19 23:16	14808-79-8	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630876
QC Batch Method: EPA 7470
Analysis Method: EPA 7470
Analysis Description: 7470 Mercury
Associated Lab Samples: 60324976001

METHOD BLANK: 2570066
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	<0.085	0.20	0.085	12/31/19 10:40	

LABORATORY CONTROL SAMPLE: 2570067

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2570068 2570069

Parameter	Units	60325171001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	<0.085	5	5	5.0	5.0	100	100	75-125	0	20	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630016
Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60324976001

METHOD BLANK: 2567679
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Barium	ug/L	<1.8	5.0	1.8	12/24/19 11:19	
Beryllium	ug/L	<0.49	1.0	0.49	12/24/19 11:19	
Boron	ug/L	<11.7	100	11.7	12/24/19 11:19	
Calcium	ug/L	<32.4	200	32.4	12/24/19 11:19	
Cobalt	ug/L	<1.5	5.0	1.5	12/24/19 11:19	
Iron	ug/L	<26.8	50.0	26.8	12/24/19 11:19	
Lead	ug/L	<4.6	10.0	4.6	12/24/19 11:19	
Lithium	ug/L	<4.6	10.0	4.6	12/24/19 11:19	
Magnesium	ug/L	<19.7	50.0	19.7	12/24/19 11:19	
Manganese	ug/L	<0.97	5.0	0.97	12/24/19 11:19	
Molybdenum	ug/L	<1.7	20.0	1.7	12/24/19 11:19	
Potassium	ug/L	<189	500	189	12/24/19 11:19	
Sodium	ug/L	<107	500	107	12/24/19 11:19	

LABORATORY CONTROL SAMPLE: 2567680

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Barium	ug/L	1000	883	88	85-115	
Beryllium	ug/L	1000	886	89	85-115	
Boron	ug/L	1000	875	88	85-115	
Calcium	ug/L	10000	8800	88	85-115	
Cobalt	ug/L	1000	891	89	85-115	
Iron	ug/L	10000	8830	88	85-115	
Lead	ug/L	1000	924	92	85-115	
Lithium	ug/L	1000	867	87	85-115	
Magnesium	ug/L	10000	8960	90	85-115	
Manganese	ug/L	1000	881	88	85-115	
Molybdenum	ug/L	1000	896	90	85-115	
Potassium	ug/L	10000	8690	87	85-115	
Sodium	ug/L	10000	8900	89	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2567681 2567682

Parameter	Units	2627103003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Barium	ug/L	ND	1000	1000	941	933	94	93	70-130	1	20	
Beryllium	ug/L	ND	1000	1000	942	934	94	93	70-130	1	20	
Boron	ug/L	ND	1000	1000	902	902	90	90	70-130	0	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2567681 2567682

Parameter	Units	2627103003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	ug/L	ND	10000	10000	9330	9300	91	91	70-130	0	20	
Cobalt	ug/L	ND	1000	1000	940	934	94	93	70-130	1	20	
Iron	ug/L	ND	10000	10000	9210	9120	92	91	70-130	1	20	
Lead	ug/L	ND	1000	1000	975	971	97	97	70-130	0	20	
Lithium	ug/L	ND	1000	1000	914	908	91	91	70-130	1	20	
Magnesium	ug/L	102	10000	10000	9530	9510	94	94	70-130	0	20	
Manganese	ug/L	ND	1000	1000	952	953	95	95	70-130	0	20	
Molybdenum	ug/L	ND	1000	1000	951	948	95	95	70-130	0	20	
Potassium	ug/L	ND	10000	10000	9270	9140	90	89	70-130	1	20	
Sodium	ug/L	1900	10000	10000	11100	11000	92	91	70-130	1	20	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630507
QC Batch Method: EPA 200.8
Analysis Method: EPA 200.8
Analysis Description: 200.8 MET
Associated Lab Samples: 60324976001

METHOD BLANK: 2569008
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	<0.097	1.0	0.097	12/30/19 16:08	
Arsenic	ug/L	<0.086	1.0	0.086	12/30/19 16:08	
Cadmium	ug/L	<0.056	0.50	0.056	12/30/19 16:08	
Chromium	ug/L	<0.22	1.0	0.22	12/30/19 16:08	
Selenium	ug/L	<0.18	1.0	0.18	12/30/19 16:08	
Thallium	ug/L	<0.093	1.0	0.093	12/30/19 16:08	

LABORATORY CONTROL SAMPLE: 2569009

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.7	97	85-115	
Arsenic	ug/L	40	40.9	102	85-115	
Cadmium	ug/L	40	40.1	100	85-115	
Chromium	ug/L	40	41.1	103	85-115	
Selenium	ug/L	40	41.0	102	85-115	
Thallium	ug/L	40	38.0	95	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2569010 2569011

Parameter	Units	60325167001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	<0.097	40	40	36.0	39.5	90	99	70-130	9	20	
Arsenic	ug/L	0.50J	40	40	41.6	45.5	103	113	70-130	9	20	
Cadmium	ug/L	0.37J	40	40	36.5	40.0	90	99	70-130	9	20	
Chromium	ug/L	0.75J	40	40	51.5	57.3	127	141	70-130	11	20	M1
Selenium	ug/L	<0.18	40	40	41.0	45.2	102	113	70-130	10	20	
Thallium	ug/L	3.5	40	40	43.3	48.7	100	113	70-130	12	20	

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630622
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60324976001

METHOD BLANK: 2569347
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	<8.4	20.0	8.4	12/27/19 10:17	

LABORATORY CONTROL SAMPLE: 2569348

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	470	94	90-110	

SAMPLE DUPLICATE: 2569349

Parameter	Units	60325105001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	267	270	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630031
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60324976001

METHOD BLANK: 2567691
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	12/23/19 14:13	

LABORATORY CONTROL SAMPLE: 2567692

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1040	104	80-120	

SAMPLE DUPLICATE: 2567693

Parameter	Units	60324810002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	430	426	1	10	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 630399
Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60324976001

METHOD BLANK: 2568812 Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/26/19 14:48	
Fluoride	mg/L	<0.085	0.20	0.085	12/26/19 14:48	
Sulfate	mg/L	<0.23	1.0	0.23	12/26/19 14:48	

METHOD BLANK: 2569447 Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/27/19 15:13	
Fluoride	mg/L	<0.085	0.20	0.085	12/27/19 15:13	
Sulfate	mg/L	<0.23	1.0	0.23	12/27/19 15:13	

METHOD BLANK: 2570116 Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.22	1.0	0.22	12/31/19 14:59	
Fluoride	mg/L	<0.085	0.20	0.085	12/31/19 14:59	
Sulfate	mg/L	<0.23	1.0	0.23	12/31/19 14:59	

LABORATORY CONTROL SAMPLE: 2568813

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.9	97	90-110	
Fluoride	mg/L	2.5	2.6	104	90-110	
Sulfate	mg/L	5	5.1	101	90-110	

LABORATORY CONTROL SAMPLE: 2569448

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	90-110	
Fluoride	mg/L	2.5	2.4	96	90-110	
Sulfate	mg/L	5	5.0	99	90-110	

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QUALITY CONTROL DATA

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

LABORATORY CONTROL SAMPLE: 2570117

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	95	90-110	
Fluoride	mg/L	2.5	2.3	92	90-110	
Sulfate	mg/L	5	4.5	90	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2568814 2568815

Parameter	Units	60325171001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	124	50	50	179	183	110	119	80-120	2	15	
Fluoride	mg/L	<0.85	25	25	29.9	29.6	116	115	80-120	1	15	
Sulfate	mg/L	154	50	50	209	213	110	118	80-120	2	15	E

MATRIX SPIKE SAMPLE: 2568816

Parameter	Units	60325161001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	124	250	385	104	80-120	
Fluoride	mg/L	ND	125	139	112	80-120	
Sulfate	mg/L	104	250	382	111	80-120	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60324976

Sample: M-MW-9	**Lab ID: 60324976001**	Collected: 12/20/19 09:50	Received: 12/21/19 03:25	Matrix: Water
PWS:	Site ID:	Sample Type:		

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.322 ± 0.632 (1.14)** **C:NA T:76%**	pCi/L	01/09/20 12:35	13982-63-3	
Radium-228	EPA 904.0	**0.263 ± 0.274 (0.564)** **C:82% T:85%**	pCi/L	01/10/20 10:52	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 377186
Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Associated Lab Samples: 60324976001

METHOD BLANK: 1829503
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.121 ± 0.335 (0.651) C:NA T:75%	pCi/L	01/09/20 12:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL - RADIOCHEMISTRY

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

QC Batch: 377187
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Associated Lab Samples: 60324976001

METHOD BLANK: 1829504
Matrix: Water
Associated Lab Samples: 60324976001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.474 ± 0.327 (0.619) C:85% T:71%	pCi/L	01/10/20 10:51	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	AMEREN MERAMEC ENERGY CENTER
Pace Project No.:	60324976

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: AMEREN MERAMEC ENERGY CENTER
Pace Project No.: 60324976

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60324976001	**M-MW-9**	EPA 200.7	630016	EPA 200.7	630089
60324976001	**M-MW-9**	EPA 200.8	630507	EPA 200.8	630549
60324976001	**M-MW-9**	EPA 7470	630876	EPA 7470	630900
60324976001	**M-MW-9**	EPA 903.1	377186		
60324976001	**M-MW-9**	EPA 904.0	377187		
60324976001	**M-MW-9**	SM 2320B	630622		
60324976001	**M-MW-9**	SM 2540C	630031		
60324976001	**M-MW-9**	EPA 300.0	630399		

Pace Analytical®
www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60324976
60324976

Client Name: Golder Associates

Courier: FedEx ☐ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☒ Client ☐ Other ☐

Tracking #: ____________ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☒ Other ☐

Thermometer Used: 1298 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 0.1 **Corr. Factor** ~~+0.1~~ +0.0 VB 12/21/19 **Corrected** 0.1

Date and initials of person examining contents: VB 12/21/19

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☒No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: Wt	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	 ☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ____________ Date/Time: ____________

Comments/ Resolution: ____________

12/23/19

Jami Church

Project Manager Review: ____________ Date: ____________

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company: Golder Associates
Address: 13515 Barrett Parkway Drive, Ste 260
Ballwin, MO 63021
Email To: Jeffrey_Ingram@golder.com
Phone: 636-724-9191 Fax: 636-724-9323
Requested Due Date/TAT: Standard

Section B
Required Project Information:

Report To: Jeffrey Ingram
Copy To: Ryan Feldmann / Eric Schneider
Purchase Order No.:
Project Name: Ameren Meramec Energy Center
Project Number: 153-1406-01.0004A

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: Jamie Church
Pace Profile #: 9285

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ______

Site Location STATE: MO

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test	Metals*	Metals*	Chloride/Fluoride/Sulfate	Alkalinity	TDS	Radium 226	Radium 228						Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																		Y/N	N	N	N	N	N	N	N							6032497
1	M-MW-9	WT	G			12/20/19	0950		4	1		3							X	X	X	X	X	X	X							001
2		WT	G																													
3		WT	G																													
4		WT	G																													
5		WT	G																													
6		WT	G																													
7		WT	G																													
8		WT	G																													
9		WT	G																													
10		WT	G																													
11		WT	G																													
12		WT	G																													

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*EPA 200.7: B, Ca, Fe, Mn, Mg, K, Na, Ba, Co, Li, Mo	Eric Schneider / Golder	12/20/19	1130	[illegible]	12/20	1311				
*EPA 200.8: As, Se	[illegible]	12/20	1311	[illegible] / Pace	12/21/19	0325	0.1	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Eric Schneider
SIGNATURE of SAMPLER:
DATE Signed (MM/DD/YY): 12/20/19

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

GOLDER

MEMORANDUM

DATE January 13, 2020 **Project No.** 153140601

TO Project File
Golder Associates

CC Amanda Derhake, Jeff Ingram

FROM Tommy Goodwin **EMAIL Tommy_Goodwin@golder.com**

DATA VALIDATION SUMMARY, MERAMEC ENERGY CENTER – DATA PACKAGE 60324976

The following is a summary of instances where quality control criteria in the functional guidelines were not met and data qualification was required:

- None.

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QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Company Name: Golder Associates
Project Name: Ameren - Meramec - MEC
Reviewer: T Goodwin

Project Manager: J Ingram
Project Number: 153140601
Validation Date: 1/13/2020

Laboratory: Pace Analytical - KS
SDG #: 60324976
Analytical Method (type and no.): EPA 200.7/200.8 (Metals); EPA 903.1/904.0 (Rads); EPA 7470 (Hg); SM 2320B (Alk); SM 2540C (TDS); EPA 300.0 (Anions)
Matrix: ☐ Air ☐ Soil/Sed. ☒ Water ☐ Waste ☐
Sample Names M-MW-9

NOTE: Please provide calculation in Comment areas or on the back (if on the back please indicate in comment areas).

Field Information	**YES**	**NO**	**NA**	**COMMENTS**
a) Sampling dates noted?	☒	☐	☐	12/20/2019
b) Sampling team indicated?	☒	☐	☐	
c) Sample location noted?	☒	☐	☐	
d) Sample depth indicated (Soils)?	☐	☐	☒	
e) Sample type indicated ([✓ grab]/composite)?	☒	☐	☐	
f) Field QC noted?	☒	☐	☐	
g) Field parameters collected (note types)?	☒	☐	☐	pH, Sp.Cond, ORP, Temp, DO, Turb
h) Field Calibration within control limits?	☒	☐	☐	
i) Notations of unacceptable field conditions/performances from field logs or field notes?	☐	☒	☐	
j) Does the laboratory narrative indicate deficiencies?	☐	☐	☒	

Note Deficiencies:

Chain-of-Custody (COC)	**YES**	**NO**	**NA**	**COMMENTS**
a) Was the COC properly completed?	☒	☐	☐	
b) Was the COC signed by both field and laboratory personnel?	☒	☐	☐	
c) Were samples received in good condition?	☒	☐	☐	

General (reference QAPP or Method)	**YES**	**NO**	**NA**	**COMMENTS**
a) Were hold times met for sample pretreatment?	☒	☐	☐	
b) Were hold times met for sample analysis?	☒	☐	☐	
c) Were the correct preservatives used?	☒	☐	☐	
d) Was the correct method used?	☒	☐	☐	
e) Were appropriate reporting limits achieved?	☒	☐	☐	
f) Were any sample dilutions noted?	☒	☐	☐	See Notes
g) Were any matrix problems noted?	☐	☒	☐	

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Blanks	YES	NO	NA	COMMENTS
a) Were analytes detected in the method blank(s)?	☐	☒	☐	
b) Were analytes detected in the field blank(s)?	☐	☐	☒	
c) Were analytes detected in the equipment blank(s)?	☐	☐	☒	
d) Were analytes detected in the trip blank(s)?	☐	☐	☒	

Laboratory Control Sample (LCS)	YES	NO	NA	COMMENTS
a) Was a LCS analyzed once per SDG?	☒	☐	☐	
b) Were the proper analytes included in the LCS?	☒	☐	☐	
c) Was the LCS accuracy criteria met?	☒	☐	☐	

Duplicates	YES	NO	NA	COMMENTS
a) Were field duplicates collected (note original and duplicate sample names)?	☐	☒	☐	
b) Were field dup. precision criteria met (note RPD)?	☐	☐	☒	
c) Were lab duplicates analyzed (note original and duplicate samples)?	☐	☒	☐	
d) Were lab dup. precision criteria met (note RPD)?	☐	☐	☒	

Blind Standards	YES	NO	NA	COMMENTS
a) Was a blind standard used (indicate name, analytes included and concentrations)?	☐	☒	☐	
b) Was the %D within control limits?	☐	☐	☒	

Matrix Spike/Matrix Spike Duplicate (MS/MSD)	YES	NO	NA	COMMENTS
a) Was MS accuracy criteria met?	☐	☐	☒	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
b) Was MSD accuracy criteria met?	☐	☐	☒	
Recovery could not be calculated since sample contained high concentration of analyte?	☐	☐	☒	
c) Were MS/MSD precision criteria met?	☐	☐	☒	

Comments/Notes:

Dilution: Chloride and Sulfate were diluted in several samples; no qualification necessary.

QA LEVEL II - INORGANIC DATA EVALUATION CHECKLIST

Data Qualification:

Sample Name	Constituent(s)	Result	Qualifier	Reason
None				

Signature: ______________________ Date: 01/13/2020

APPENDIX C

November 2018 Assessment Monitoring Statistical Evaluation

TECHNICAL MEMORANDUM

DATE February 28, 2019 **Project No.** 153-1406

TO Bill Kutosky
Ameren Missouri

CC Susan Knowles, Craig Giesmann, Paul Pike, Charlie Henderson

FROM Mark Haddock - Golder Associates **EMAIL mhaddock@golder.com**

ASSESSMENT MONITORING STATISTICAL EVALUATION FOR THE MULTI-UNIT SURFACE IMPOUNDMENT NETWORK, MERAMEC ENERGY CENTER, ST LOUIS COUNTY MISSOURI

This Technical Memorandum provides the results of the Assessment Monitoring Statistical Evaluation for the Multi-unit Surface Impoundment Network November 2018 sampling event at the Meramec Energy Center located in St. Louis County Missouri. Included in this memorandum is a brief summary of constituents that are present at a Statistically Significant Level (SSL), a list of site-specific Groundwater Protection Standards (**Table 1**), and the Sanitas Technologies™ (Sanitas) statistical software output for each of the Appendix IV parameters (**Appendix A** and **Appendix B**).

SSLs were calculated using the methods and procedures outlined in the Groundwater Monitoring Plan's (GMP) Statistical Analysis Plan (SAP). In addition to the outliers that were noted in previous statistical analysis, the following outliers were removed prior to the calculation of confidence limits:

- Arsenic at MW-5 on 11/19/2018: result was statistically lower than other values at the same well

One new SSL was noted for lithium in MW-7 during the November 2018 sampling event. A summary of SSLs at corresponding wells is as follows:

- Arsenic at MW-4 and MW-5
- Lithium at MW-6 and MW-7
- Molybdenum at MW-6, MW-7 and MW-8

Golder appreciates this opportunity to provide hydrogeological and engineering support services to Ameren. If you have any questions or comments regarding the information provided, please call our office at (314) 984-8800.

Sincerely,

Jeffrey S. Ingram

Jeffrey Ingram, R.G.
Project Geologist

Mark Haddock, P.E., R.G.
Principal, Practice Leader

Golder Associates Inc.
13515 Barrett Parkway Drive, Suite 260, Ballwin, Missouri, USA 63021 T: +1 314 984-8800 F: +1 314 984-8770

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Enclosures:

Table 1 – MEC Groundwater Protection Standards

Appendix A – Sanitas Confidence Interval Statistical Output
Appendix B – Sanitas Trending Confidence Bands Statistical Output

JSI/SCP/MNH

Table 1
Meramec Groundwater Protection Standards
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Parameter	Units	MCL or Health Based GWPS	Site GWPS	Value to Return to Detection Monitoring[7]
Antimony	µg/L	6	6	DQR
Arsenic	µg/L	10	10	2.344
Barium	µg/L	2000	2000	566
Beryllium	µg/L	4	4	DQR
Cadmium	µg/L	5	5	DQR
Chromium	µg/L	100	100	1.8
Cobalt	µg/L	6	6	DQR
Fluoride	mg/l	4	4	0.5215
Lead	µg/L	15	15	DQR
Lithium	µg/L	40	40	16
Mercury	µg/L	2	2	DQR
Molybdenum	µg/L	100	100	DQR
Radium 226 + 228	pCi/L	5	5	1.888
Selenium	µg/L	50	50	DQR
Thallium	µg/L	2	2	DQR

Prepared by: JSI 10/3/2018
Checked by: TJG 10/5/2018
Reviewed by:MNH 10/11/2018

Notes:

1. µg/L - micrograms per liter
2. mg/L - milligrams per liter
3. pCi/L - picocuries per liter
4. MCL - Maximum Contaminant Level. MCLs from United States Environmental Protection Agency (USEPA) 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm.
5. Health Based Groundwater Protection Standards (GWPS) were adoped for Appendix IV parameters without an MCL (i.e. cobalt, lithium, molybdenum, and lead). Information available at https://www.epa.gov/coalash/coal-ash-rule.
6. Values were calculated using statistical methods outlined for Detection Monitoring and are used for returning to Detection Monitoring based on available data to date.
7. DQR - Double Quantification Rule. If all baseline data are less than the Practical Quantitation Limit (PQL), then the DQR will be used. More information on the DQR is provided in the Statistical Analysis Plan.
8. Site GWPS is either the MCL/Health Based GWPS or based on background levels (calculated as described in the Statistical Analysis Plan for Assessment Monitoring), whichever is higher.
9. GWPS and background values calculated using baseline sampling results from monitoring wells BMW-1 and BMW-2.

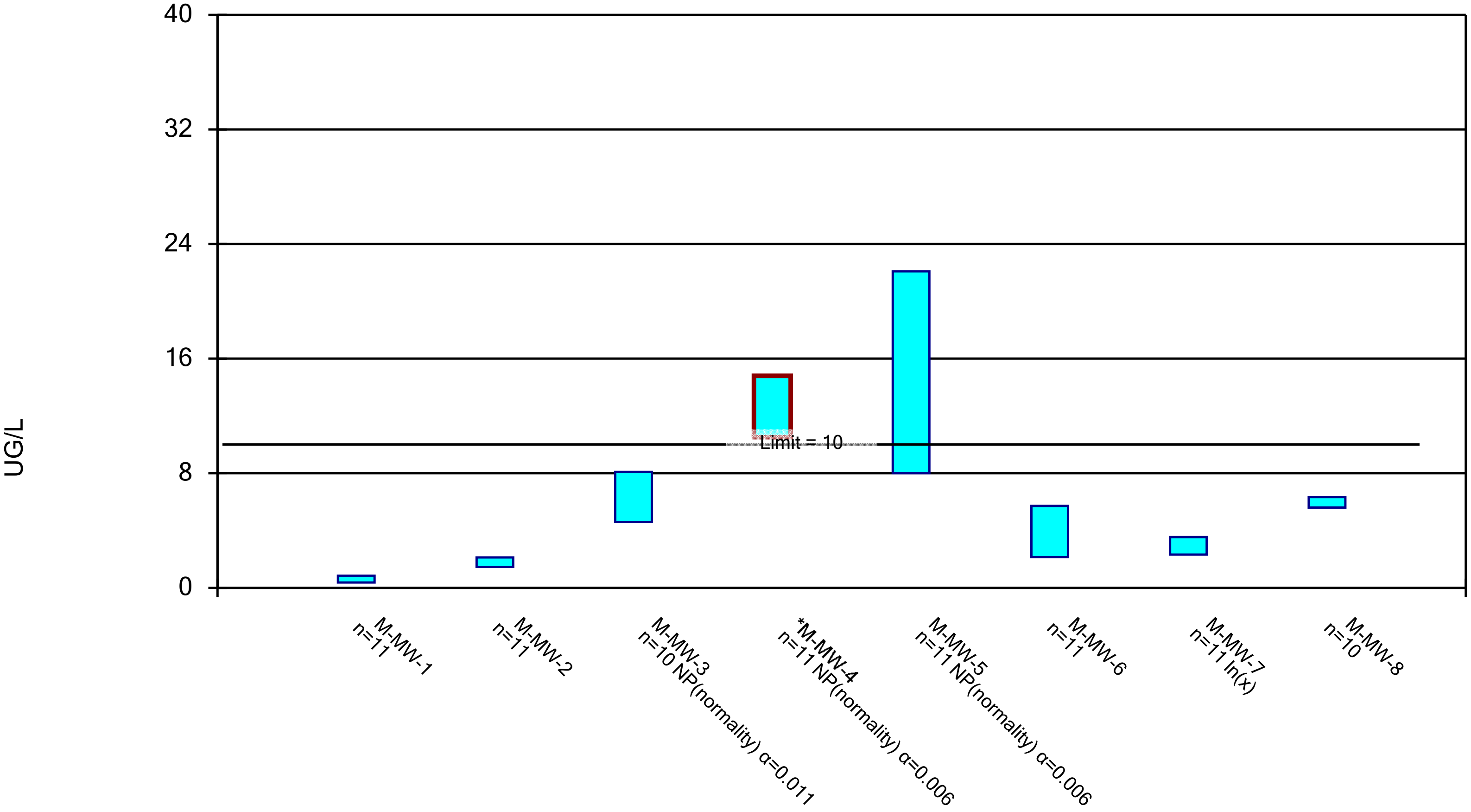
APPENDIX A

Sanitas Confidence Interval Statistical Output

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

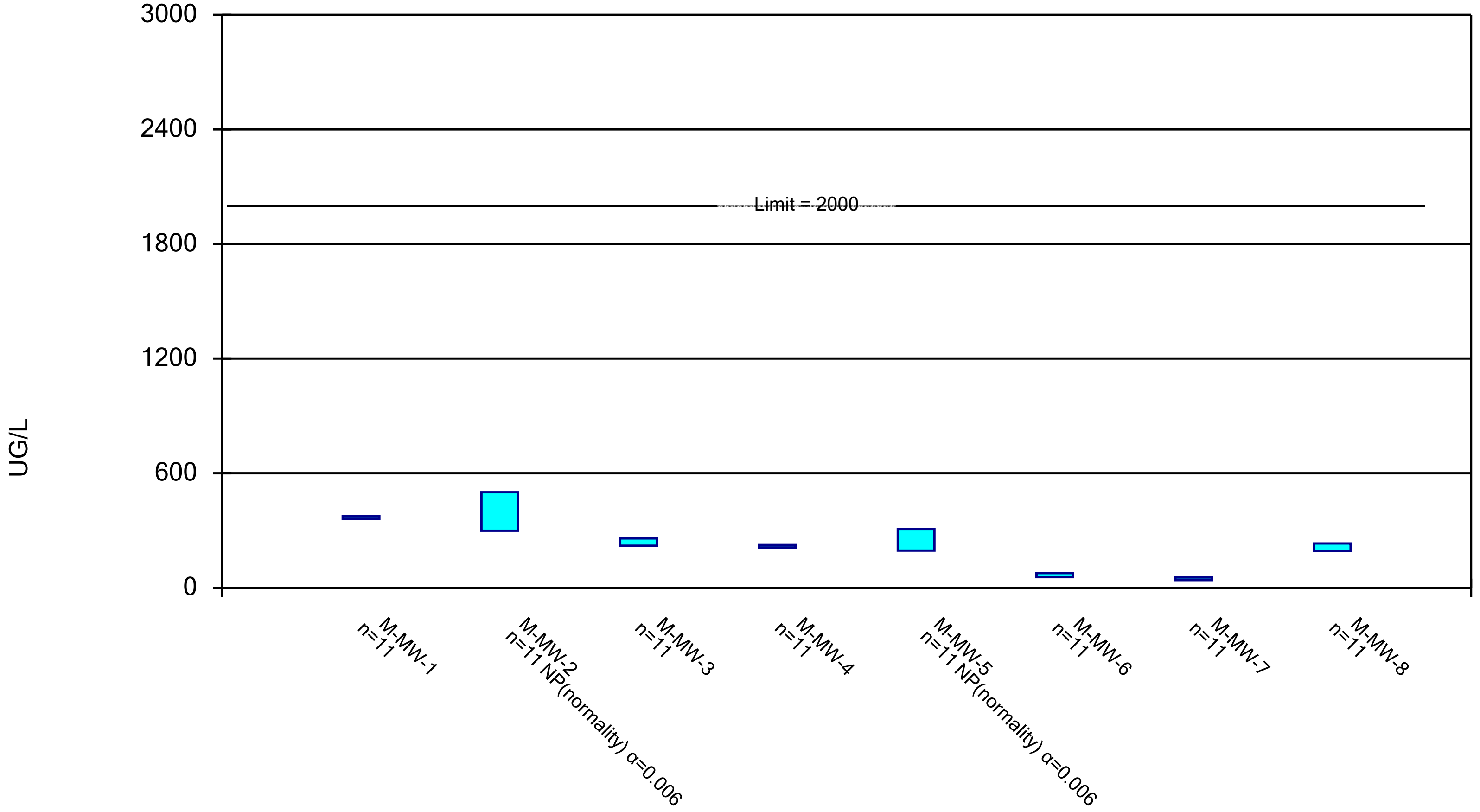


Constituent: ARSENIC, TOTAL Analysis Run 2/20/2019 10:39 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

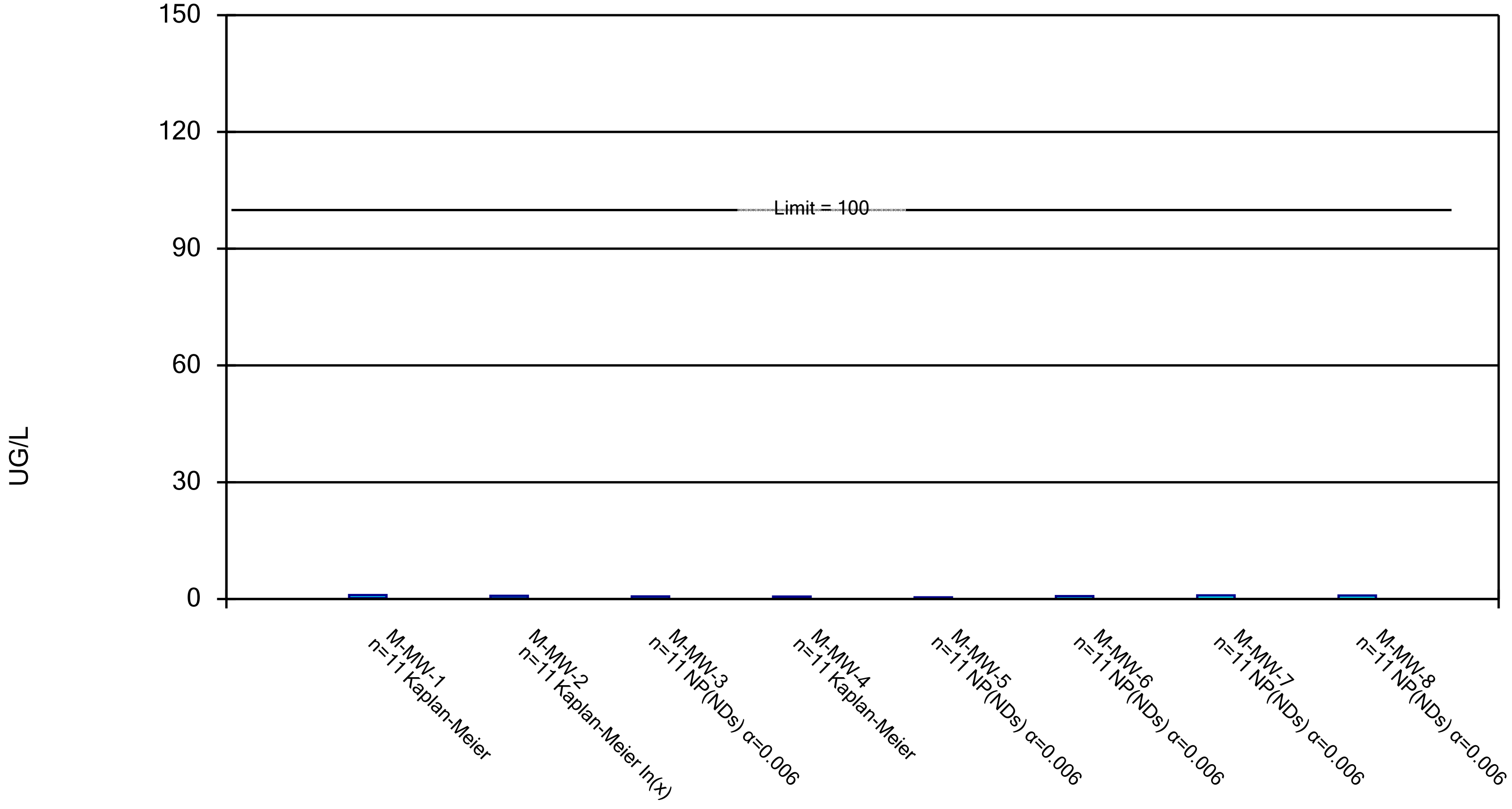


Constituent: BARIUM, TOTAL   Analysis Run 2/20/2019 10:39 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

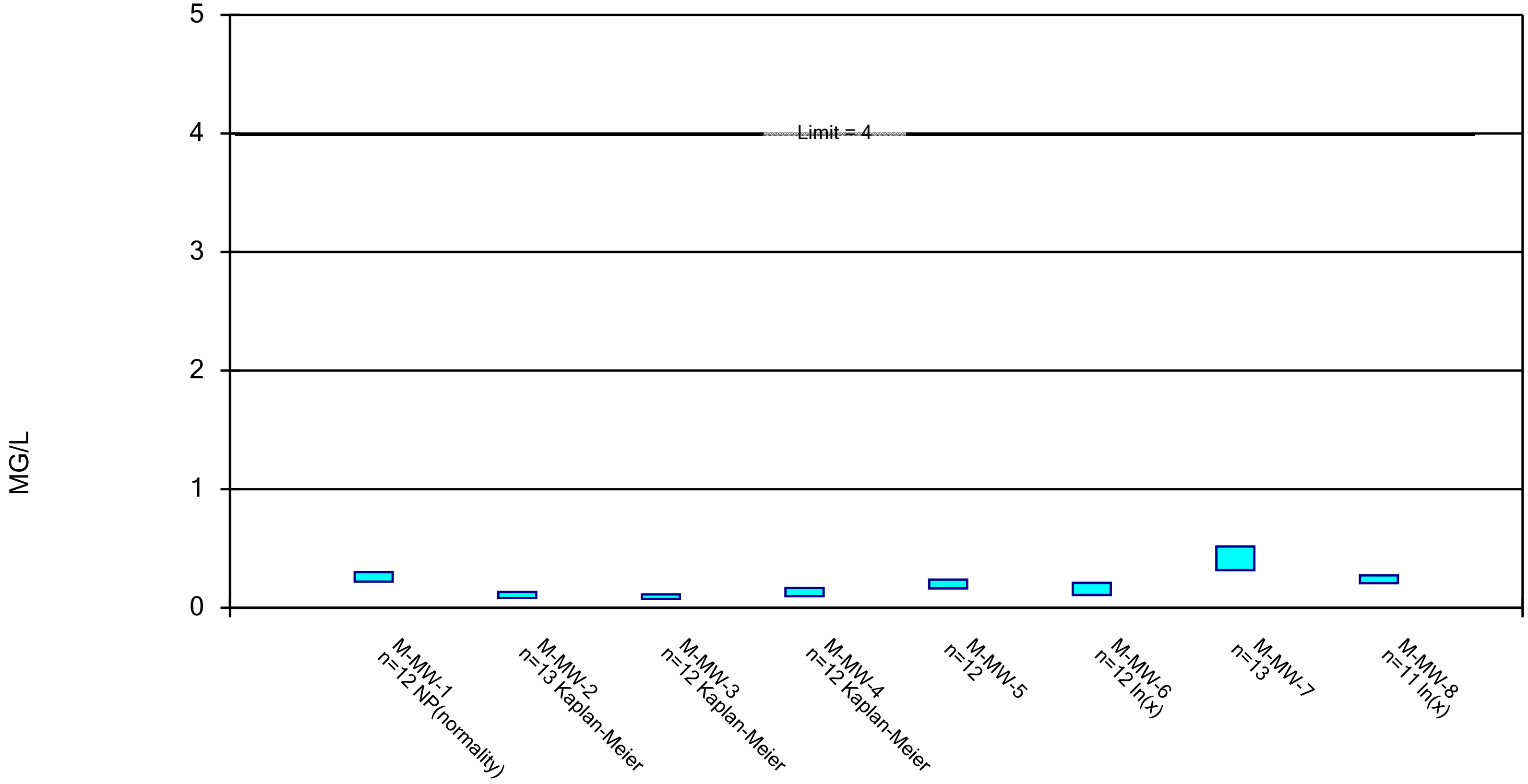


Constituent: CHROMIUM, TOTAL Analysis Run 2/20/2019 10:39 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



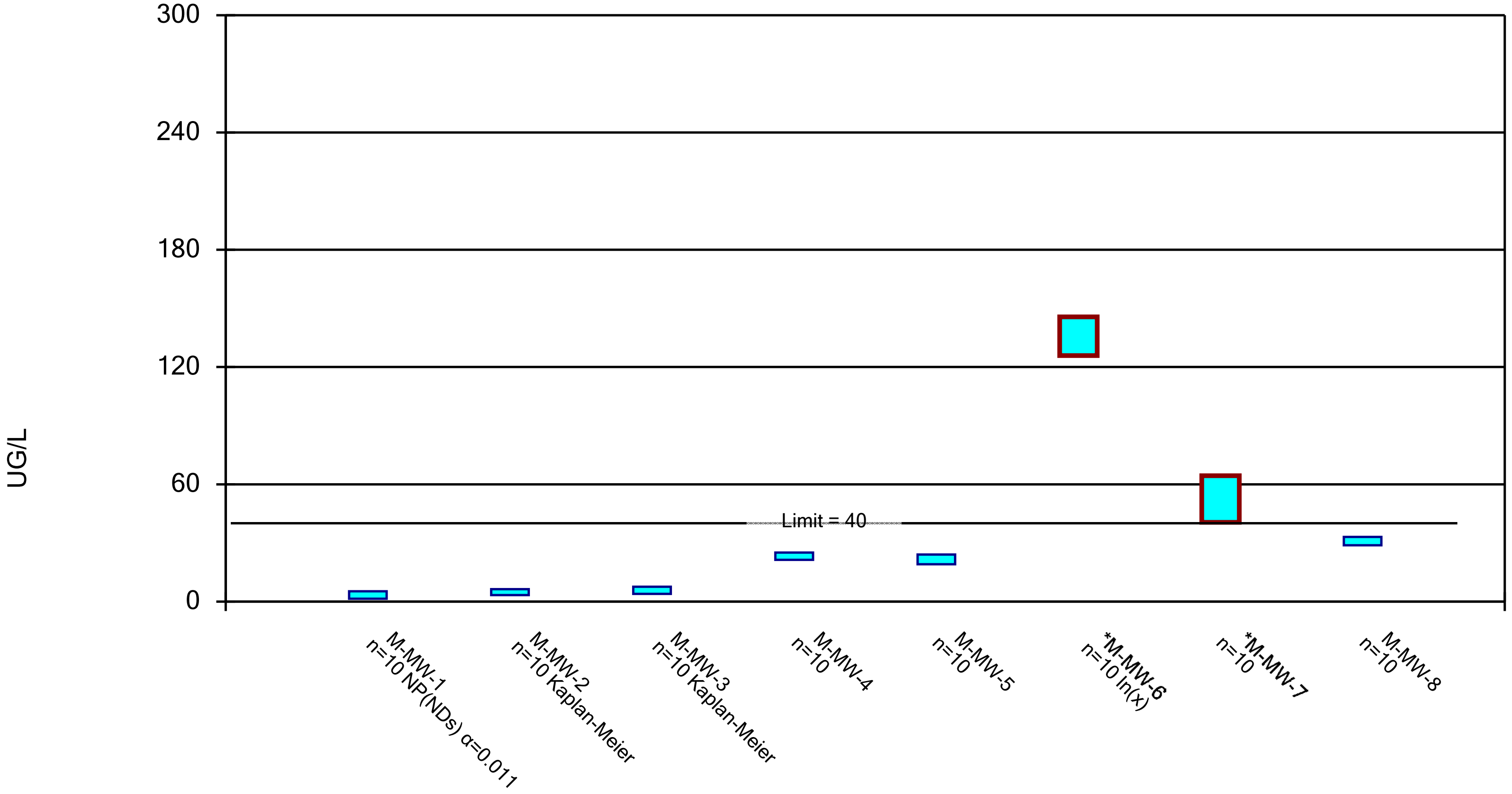
Constituent: FLUORIDE, TOTAL Analysis Run 2/20/2019 10:39 AM

Meramec E.C. Client: Ameren Data: MEC Data

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



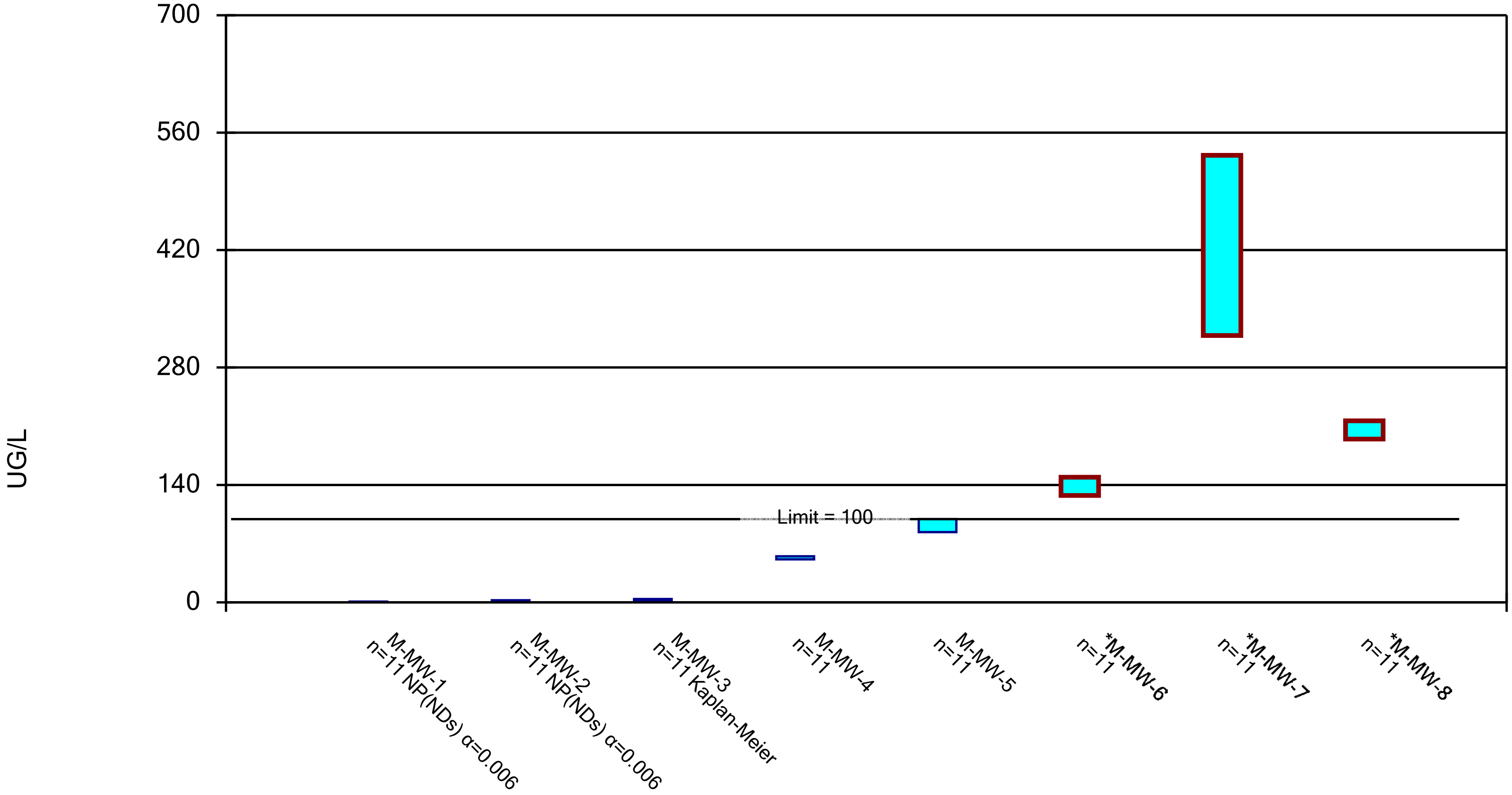
Constituent: LITHIUM, TOTAL Analysis Run 2/20/2019 10:39 AM

Meramec E.C. Client: Ameren Data: MEC Data

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



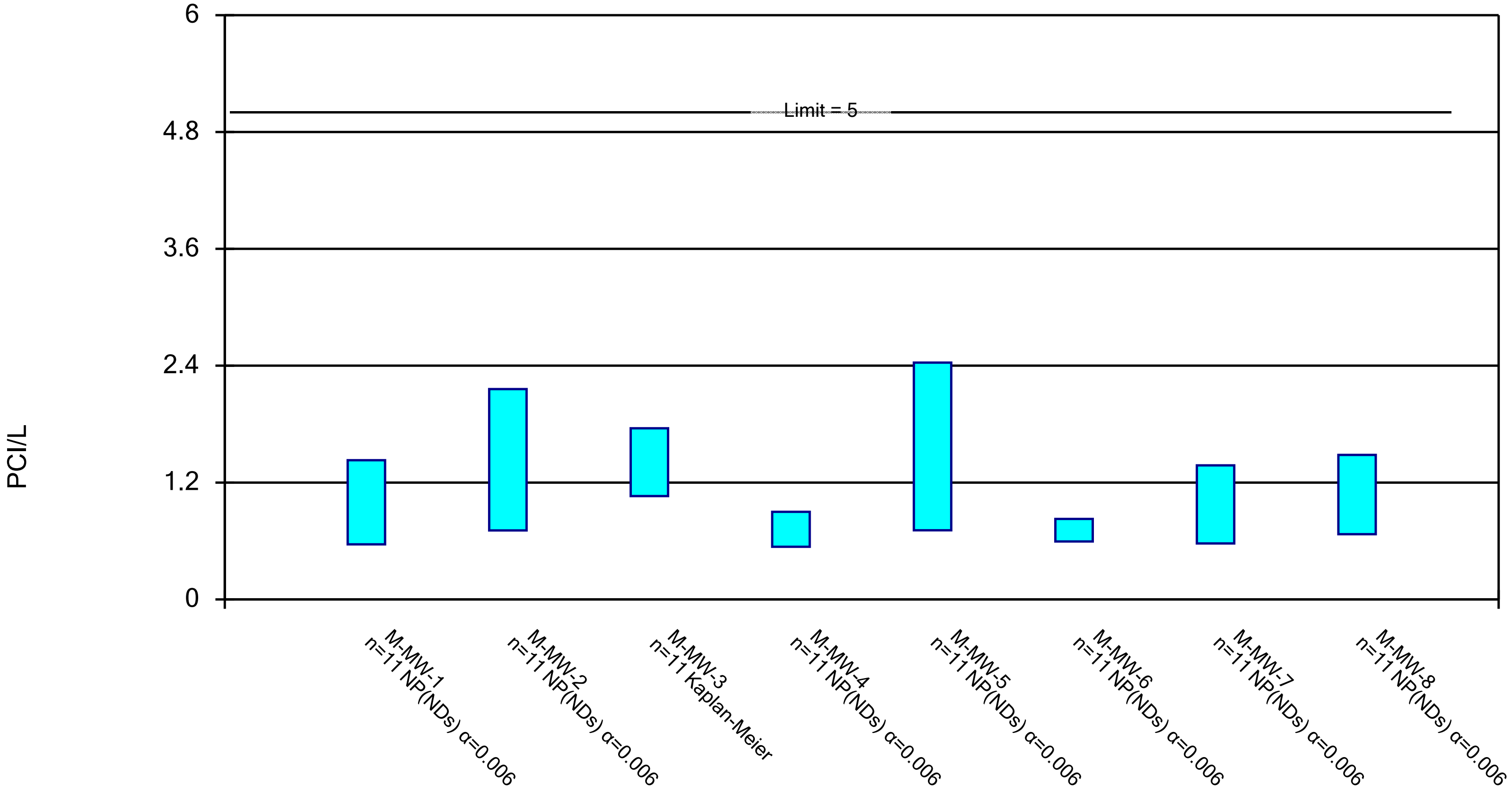
Constituent: MOLYBDENUM, TOTAL   Analysis Run 2/20/2019 10:39 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Radium [226 + 228]   Analysis Run 2/20/2019 10:39 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Confidence Interval

Meramec E.C.   Client: Ameren   Data: MEC Data   Printed 2/20/2019, 10:39 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
ARSENIC, TOTAL (UG/L)	M-MW-1	0.8512	0.3663	10	No	11	9.091	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-2	2.125	1.457	10	No	11	0	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-3	8.1	4.6	10	No	10	0	No	0.011	NP (normality)
ARSENIC, TOTAL (UG/L)	**M-MW-4**	**14.8**	**10.5**	**10**	**Yes**	**11**	**0**	**No**	**0.006**	**NP (normality)**
ARSENIC, TOTAL (UG/L)	M-MW-5	22.1	8	10	No	11	0	No	0.006	NP (normality)
ARSENIC, TOTAL (UG/L)	M-MW-6	5.721	2.143	10	No	11	9.091	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-7	3.542	2.314	10	No	11	0	ln(x)	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-8	6.339	5.601	10	No	10	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-1	374.1	359.2	2000	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-2	500	299	2000	No	11	0	No	0.006	NP (normality)
BARIUM, TOTAL (UG/L)	M-MW-3	258.6	220.1	2000	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-4	224.4	211.1	2000	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-5	308	195	2000	No	11	0	No	0.006	NP (normality)
BARIUM, TOTAL (UG/L)	M-MW-6	76.6	55.95	2000	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-7	53.86	40.3	2000	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-8	232.2	192.2	2000	No	11	0	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-1	0.9947	0.2402	100	No	11	27.27	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-2	0.8113	0.1301	100	No	11	36.36	ln(x)	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-3	0.64	0.027	100	No	11	54.55	No	0.006	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-4	0.6153	0.1218	100	No	11	45.45	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-5	0.42	0.027	100	No	11	54.55	No	0.006	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-6	0.71	0.027	100	No	11	54.55	No	0.006	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-7	0.91	0.027	100	No	11	54.55	No	0.006	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-8	0.88	0.027	100	No	11	72.73	No	0.006	NP (NDs)
FLUORIDE, TOTAL (MG/L)	M-MW-1	0.3	0.22	4	No	12	0	No	0.01	NP (normality)
FLUORIDE, TOTAL (MG/L)	M-MW-2	0.1337	0.08117	4	No	13	23.08	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-3	0.1129	0.07364	4	No	12	33.33	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-4	0.1671	0.09686	4	No	12	16.67	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-5	0.2368	0.1632	4	No	12	0	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-6	0.21	0.1072	4	No	12	8.333	ln(x)	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-7	0.5169	0.317	4	No	13	0	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-8	0.2735	0.2065	4	No	11	0	ln(x)	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-1	5.3	1.45	40	No	10	80	No	0.011	NP (NDs)
LITHIUM, TOTAL (UG/L)	M-MW-2	6.368	3.292	40	No	10	30	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-3	7.559	3.981	40	No	10	30	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-4	25.07	21.33	40	No	10	0	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-5	24.04	19.12	40	No	10	0	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	**M-MW-6**	**145.6**	**125.8**	**40**	**Yes**	**10**	**0**	**ln(x)**	**0.01**	**Param.**
LITHIUM, TOTAL (UG/L)	**M-MW-7**	**64.42**	**40.56**	**40**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
LITHIUM, TOTAL (UG/L)	M-MW-8	33.1	28.82	40	No	10	0	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	M-MW-1	0.84	0.26	100	No	11	90.91	No	0.006	NP (NDs)
MOLYBDENUM, TOTAL (UG/L)	M-MW-2	2.5	0.26	100	No	11	72.73	No	0.006	NP (NDs)
MOLYBDENUM, TOTAL (UG/L)	M-MW-3	4.028	1.537	100	No	11	27.27	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	M-MW-4	54.9	51.31	100	No	11	0	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	M-MW-5	99.32	83.7	100	No	11	0	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	**M-MW-6**	**149.2**	**127.4**	**100**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
MOLYBDENUM, TOTAL (UG/L)	**M-MW-7**	**533**	**318.1**	**100**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
MOLYBDENUM, TOTAL (UG/L)	**M-MW-8**	**216.4**	**194.7**	**100**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Radium [226 + 228] (PCI/L)	M-MW-1	1.43	0.565	5	No	11	81.82	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-2	2.16	0.7075	5	No	11	63.64	No	0.006	NP (NDs)

Confidence Interval

Meramec E.C.   Client: Ameren   Data: MEC Data   Printed 2/20/2019, 10:39 AM

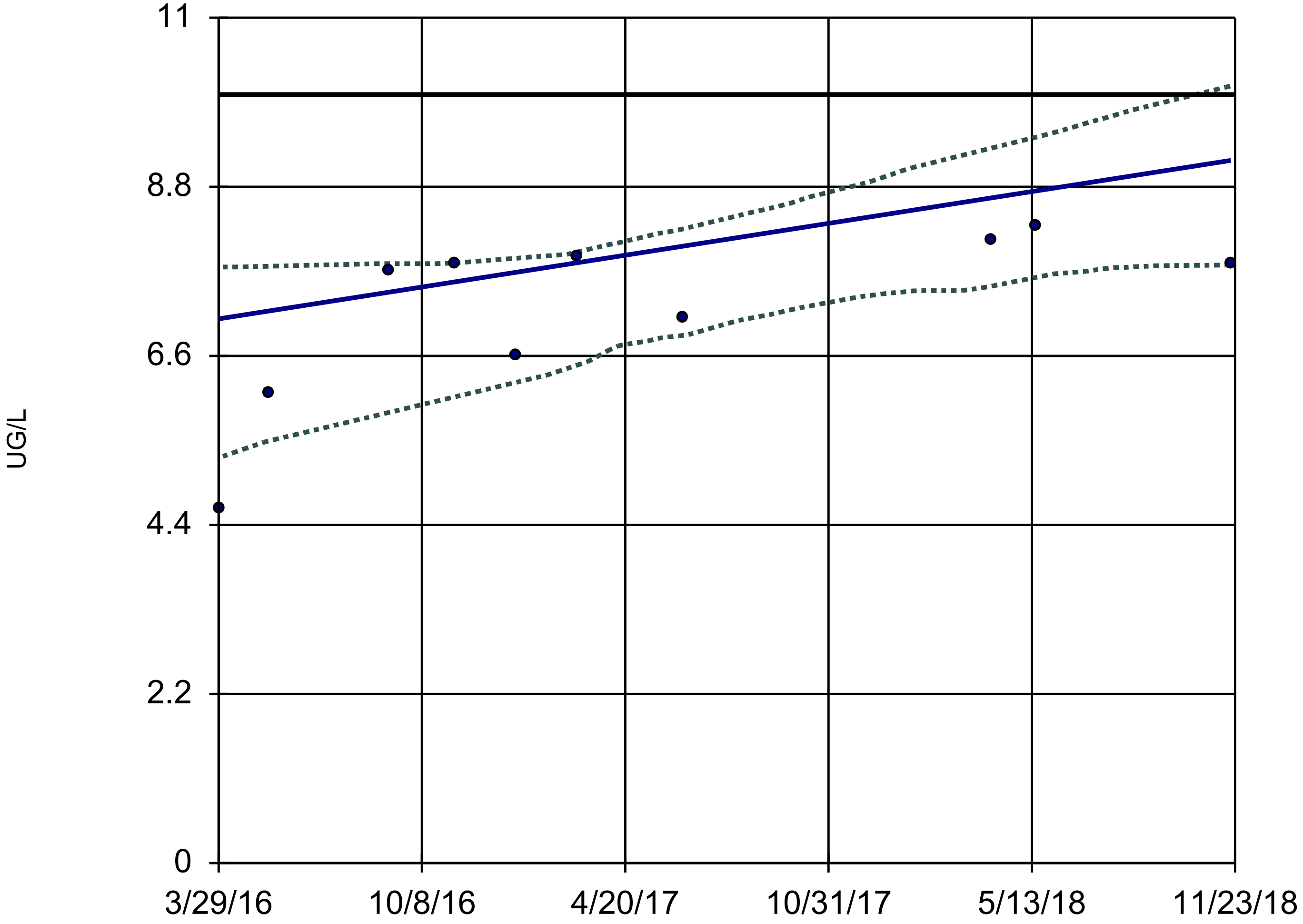
Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Radium [226 + 228] (PCI/L)	M-MW-3	1.756	1.06	5	No	11	36.36	No	0.01	Param.
Radium [226 + 228] (PCI/L)	M-MW-4	0.9	0.541	5	No	11	90.91	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-5	2.432	0.71	5	No	11	54.55	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-6	0.827	0.5945	5	No	11	100	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-7	1.376	0.575	5	No	11	81.82	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-8	1.483	0.669	5	No	11	72.73	No	0.006	NP (NDs)

APPENDIX B

Sanitas Trending Confidence Bands Statistical Output

Sen's Slope and 95% Confidence Band

M-MW-3



n = 10

Slope = 0.7799
units per year.

Mann-Kendall
statistic = 28
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 10.

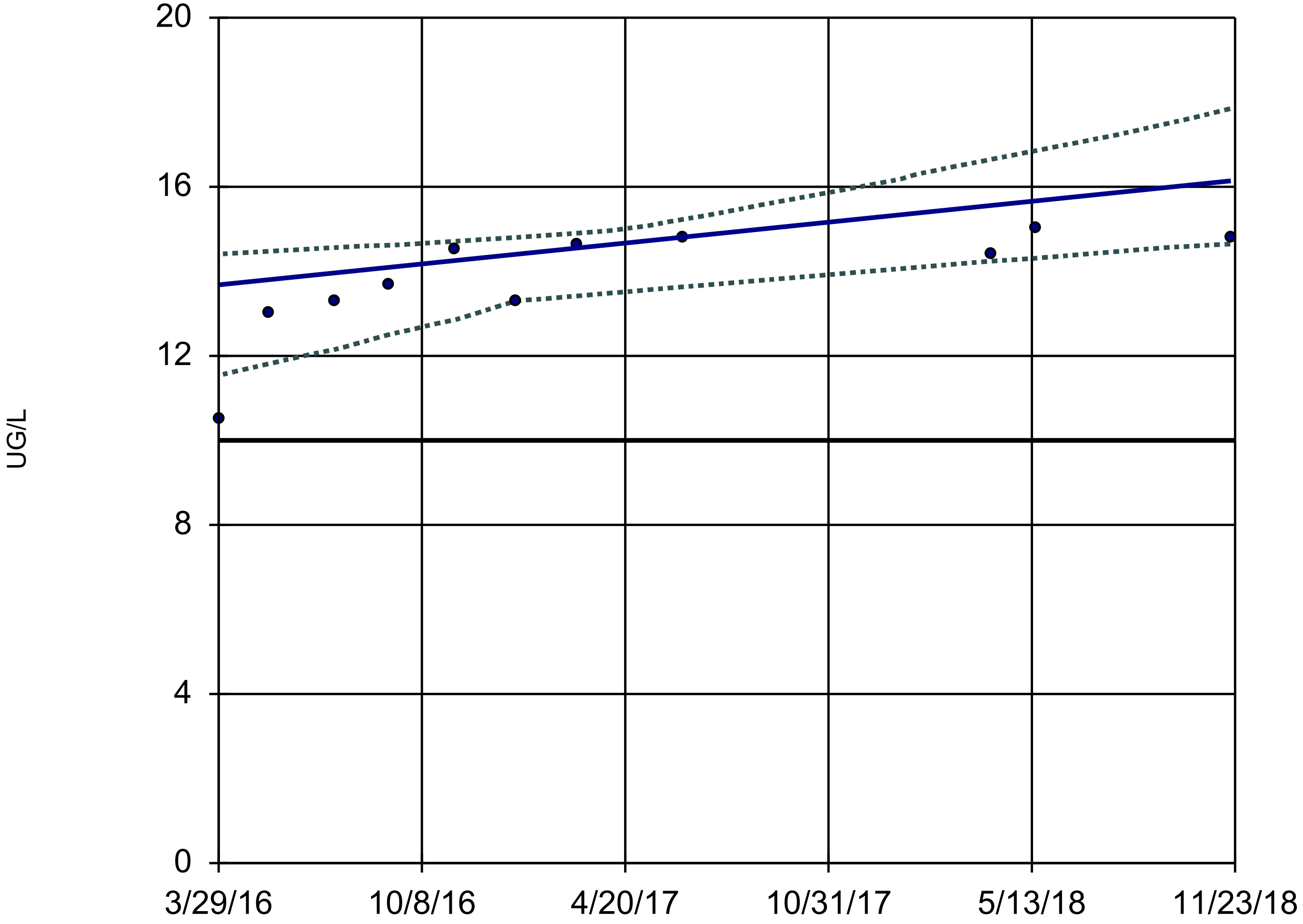
Constituent: ARSENIC, TOTAL   Analysis Run 2/20/2019 10:43 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG

Sen's Slope and 95% Confidence Band

M-MW-4



n = 11

Slope = 0.9303
units per year.

Mann-Kendall
statistic = 41
critical = 31

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

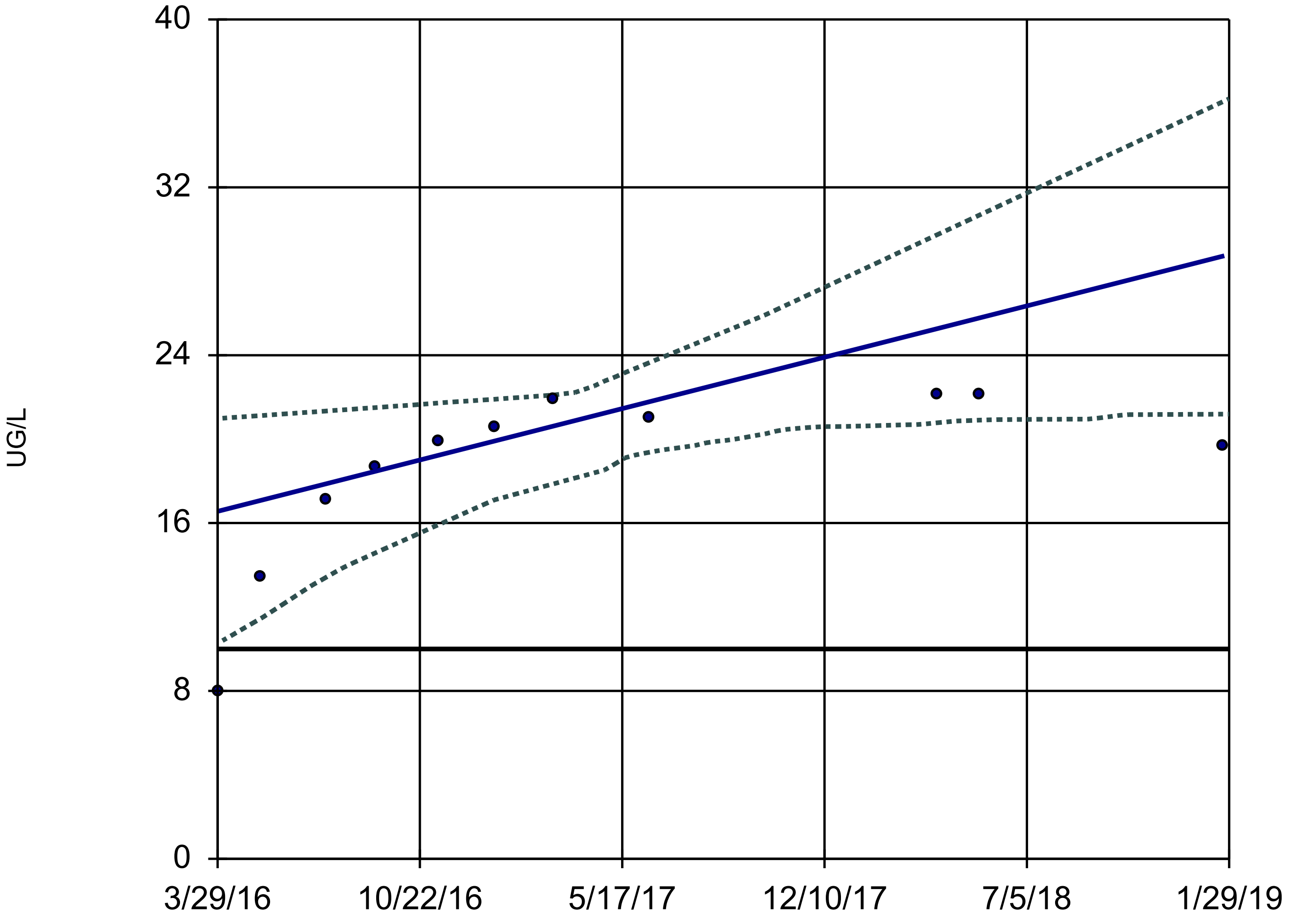
GWPS = 10.

Constituent: ARSENIC, TOTAL   Analysis Run 2/20/2019 10:43 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-5



n = 11

Slope = 4.314
units per year.

Mann-Kendall
statistic = 40
critical = 31

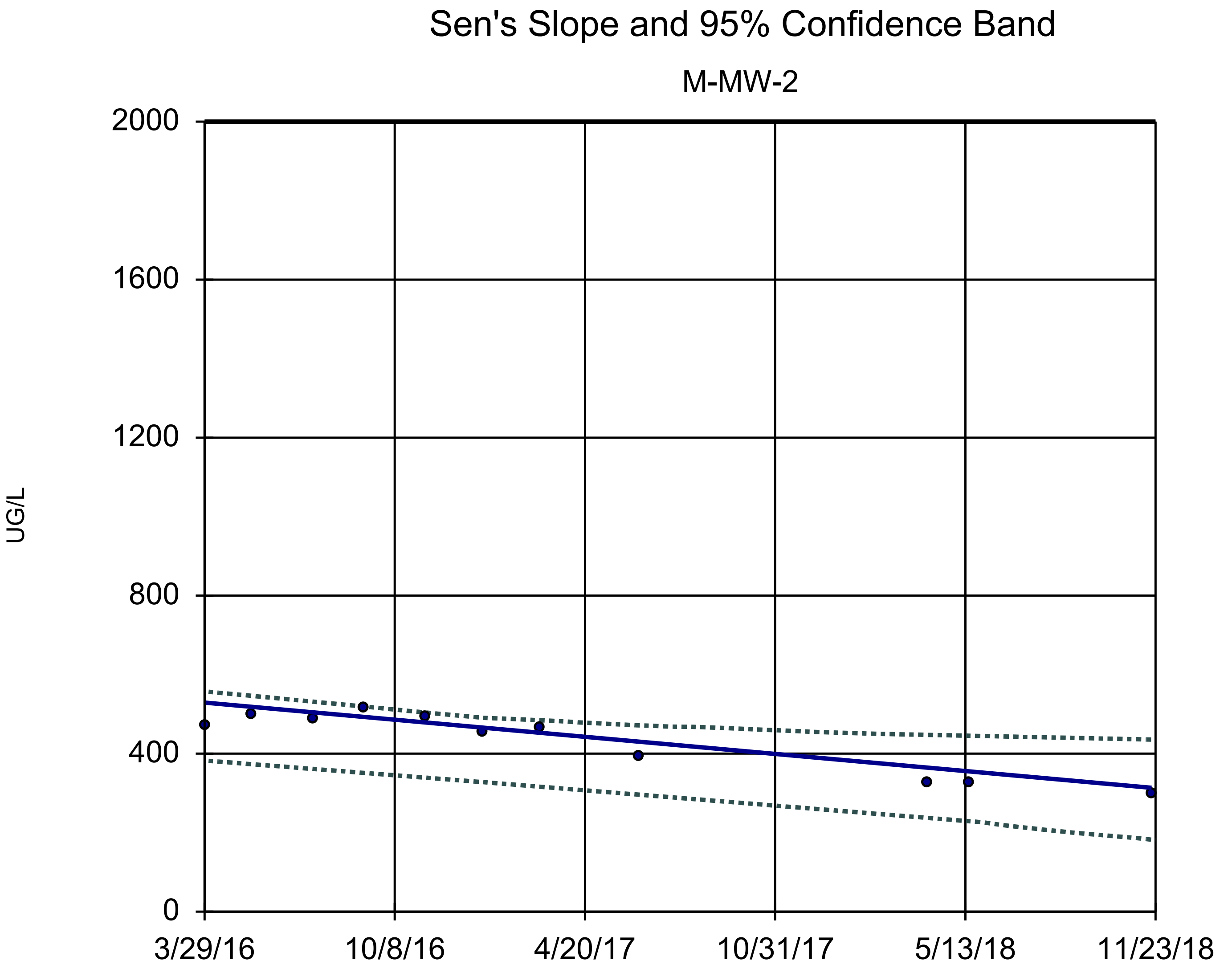
Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 10.

Constituent: ARSENIC, TOTAL   Analysis Run 2/20/2019 10:43 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.12 For the statistical analyses of ground water by Golder Associates only. UG



n = 11

Slope = -81.63
units per year.

Mann-Kendall
statistic = -37
critical = -31

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

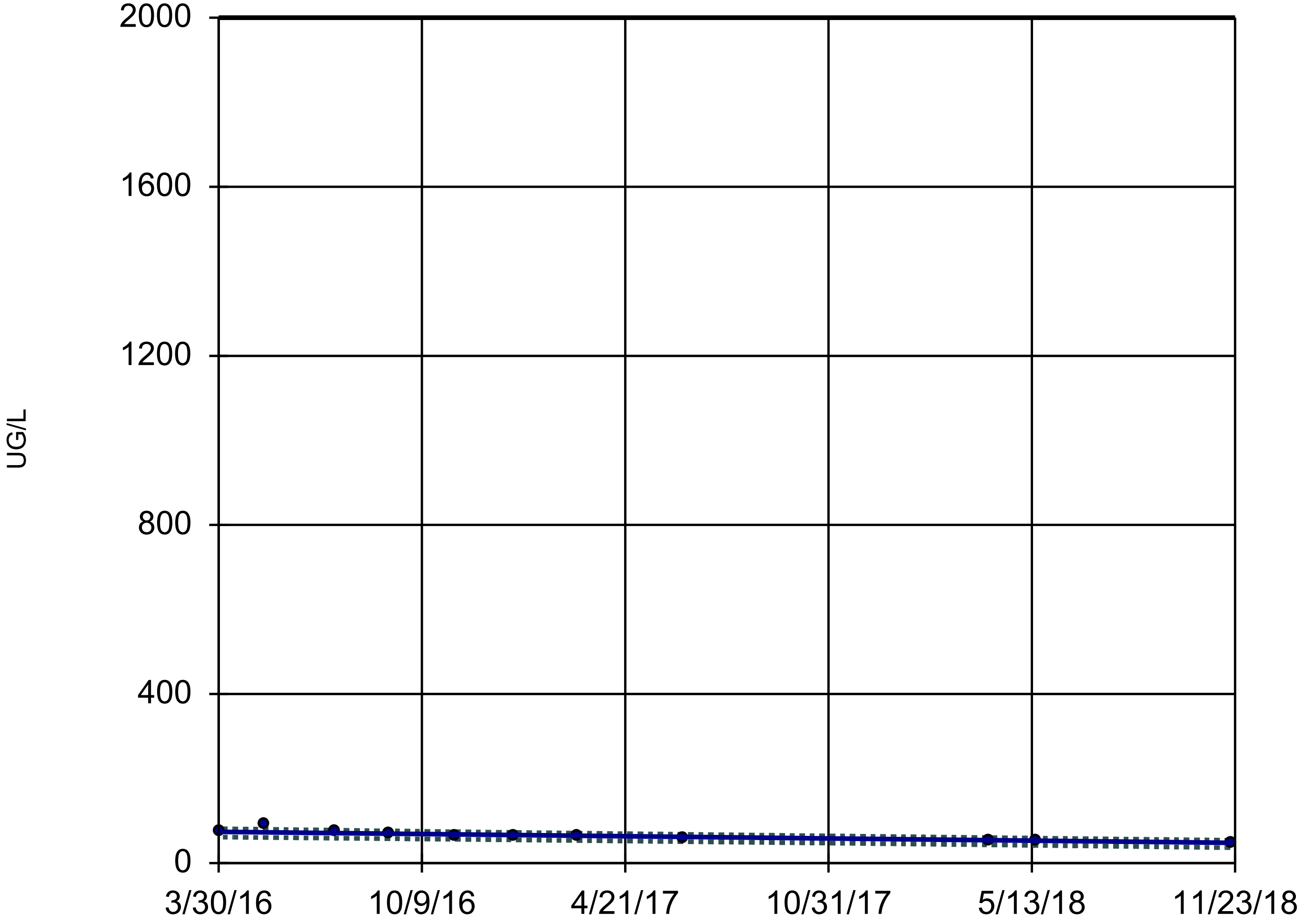
GWPS = 2000.

Constituent: BARIUM, TOTAL   Analysis Run 2/20/2019 10:43 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-6



n = 11

Slope = -9.917
units per year.

Mann-Kendall
statistic = -51
critical = -31

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

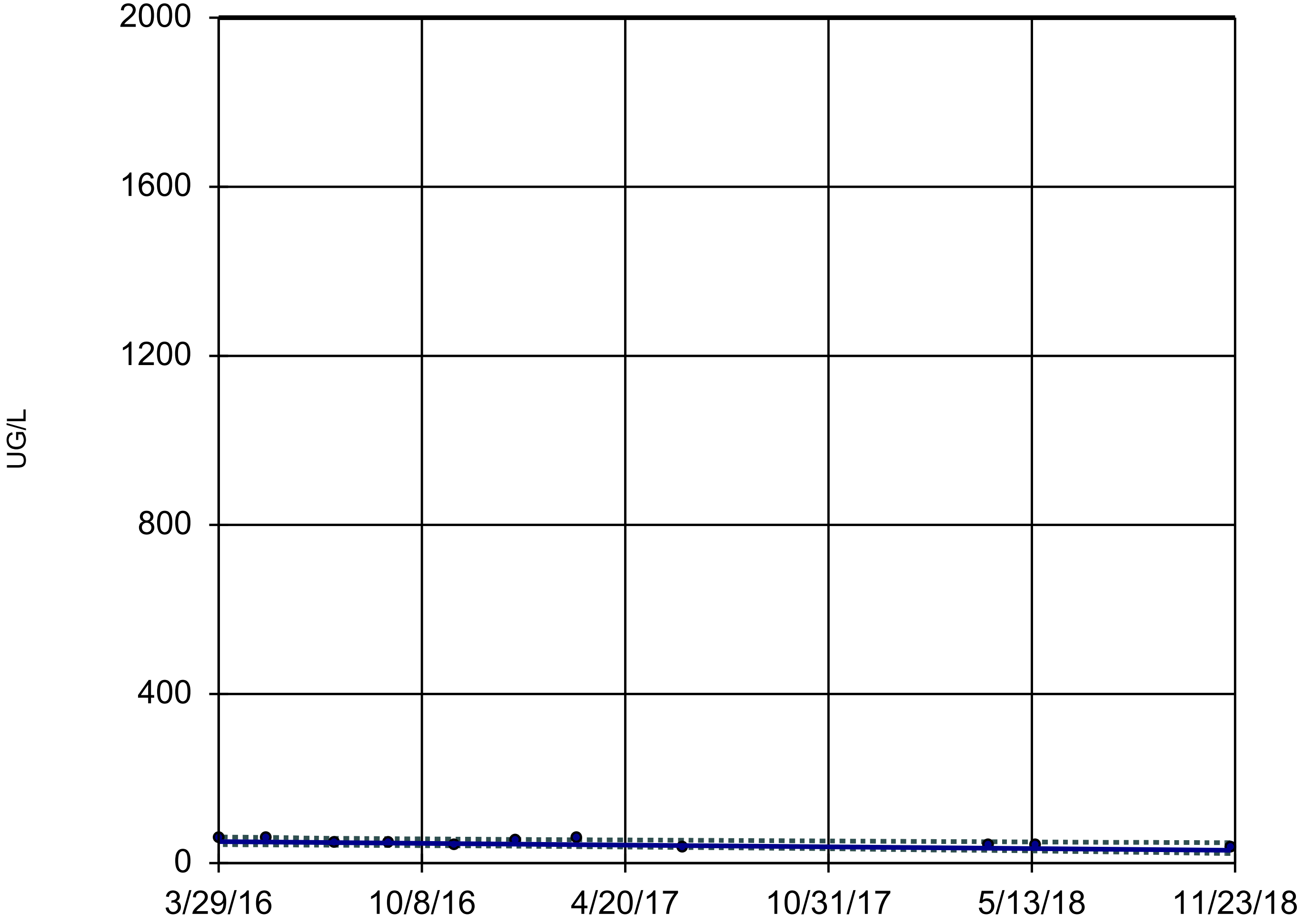
GWPS = 2000.

Constituent: BARIUM, TOTAL Analysis Run 2/20/2019 10:43 AM

Meramec E.C. Client: Ameren Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-7



n = 11

Slope = -7.747
units per year.

Mann-Kendall
statistic = -33
critical = -31

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

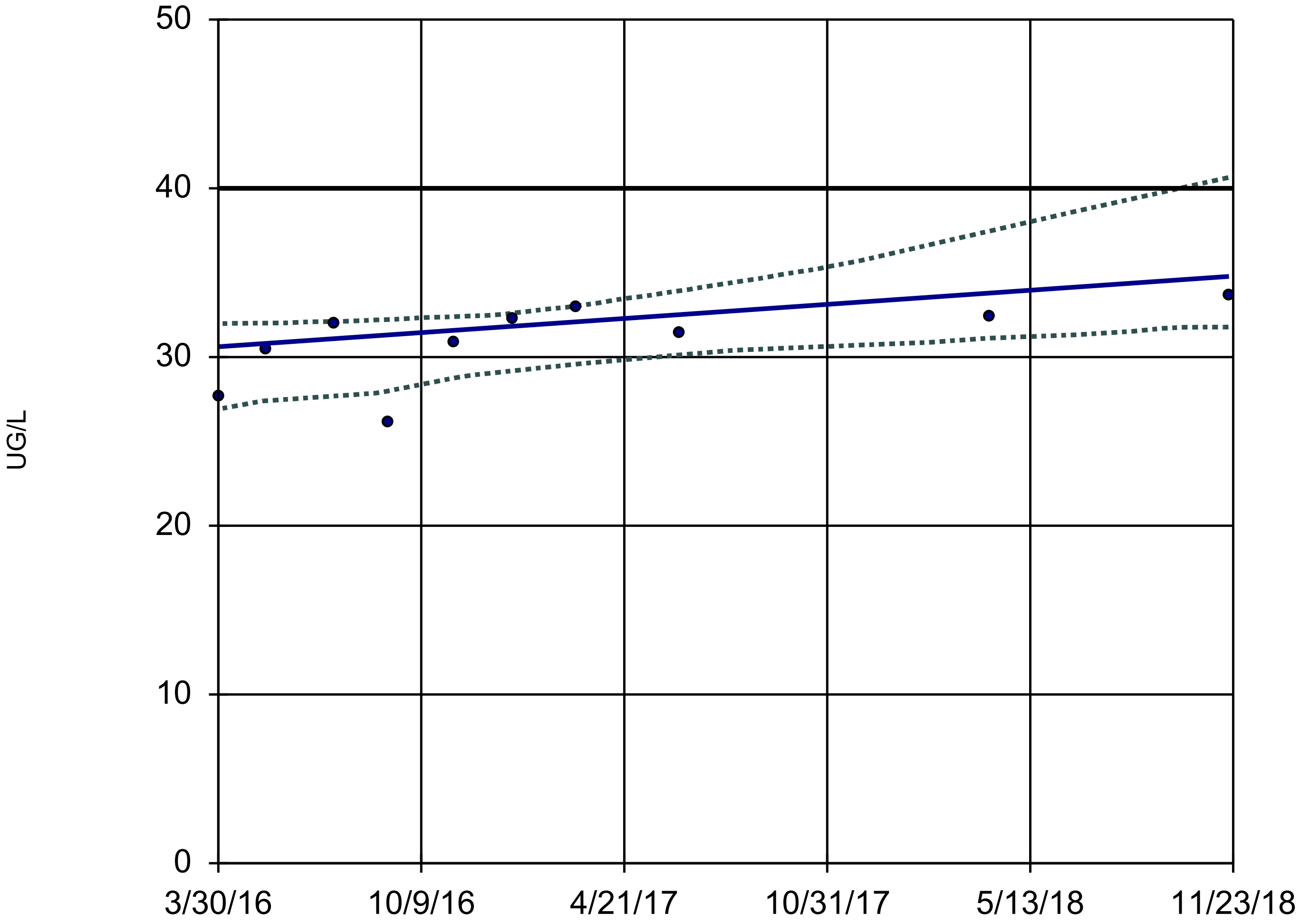
GWPS = 2000.

Constituent: BARIUM, TOTAL   Analysis Run 2/20/2019 10:43 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-8



n = 10

Slope = 1.58
units per year.

Mann-Kendall
statistic = 29
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 40.

Constituent: LITHIUM, TOTAL   Analysis Run 2/20/2019 10:44 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

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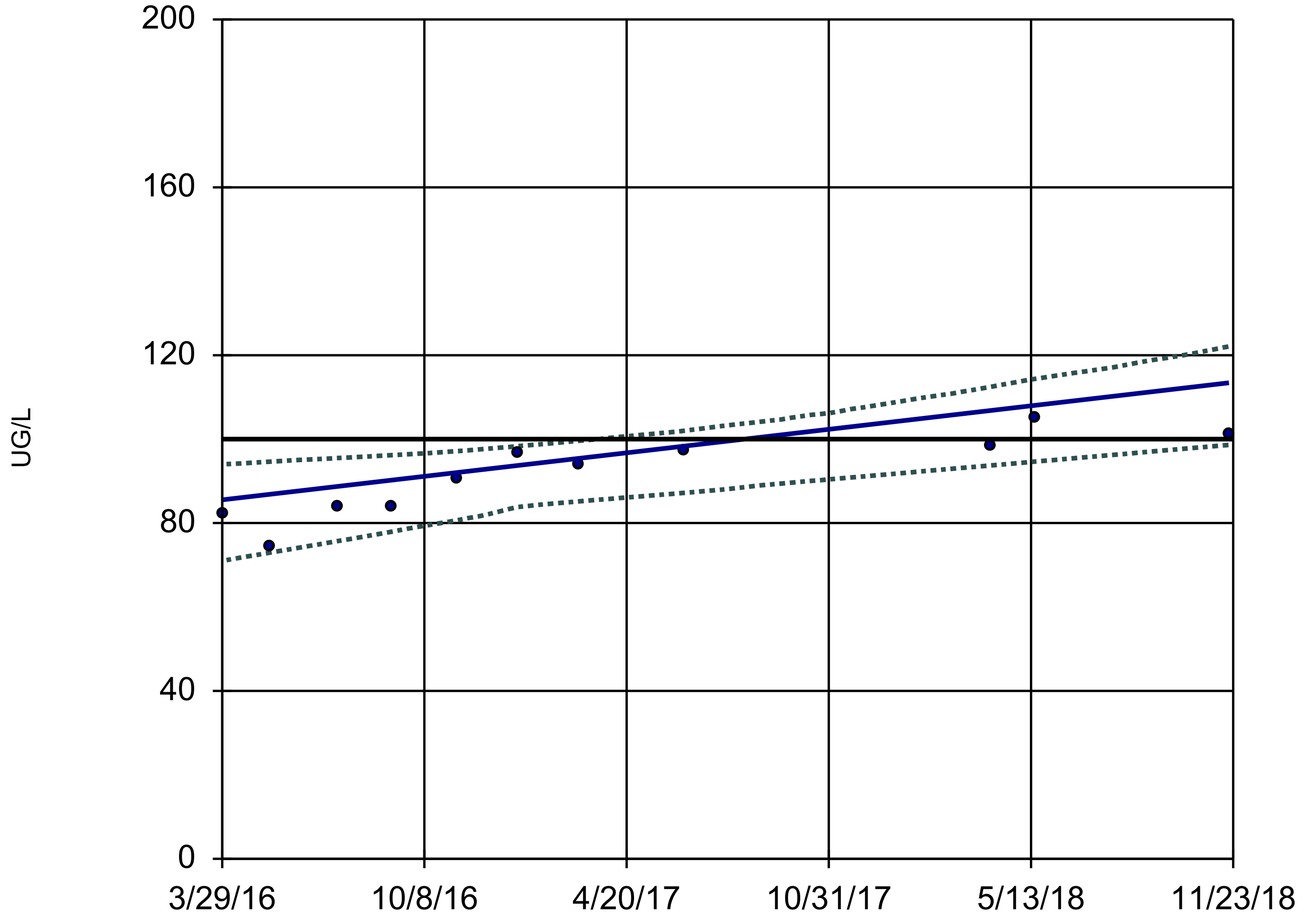
Sen's Slope and 95% Confidence Band

M-MW-5



n = 11

Slope = 10.55
units per year.

Mann-Kendall
statistic = 47
critical = 31

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 100.

Constituent: MOLYBDENUM, TOTAL Analysis Run 2/20/2019 10:44 AM

Meramec E.C. Client: Ameren Data: MEC Data

APPENDIX D

August 2019 Assessment Monitoring Statistical Evaluation

TECHNICAL MEMORANDUM

DATE November 22, 2019 **Project No.** 153-140601

TO Bill Kutosky
Ameren Missouri

CC Susan Knowles, Craig Giesmann, Paul Pike, Charlie Henderson

FROM Jeffrey Ingram - Golder Associates **EMAIL JIngram@Golder.com**

ASSESSMENT MONITORING STATISTICAL EVALUATION FOR THE MULTI-UNIT SURFACE IMPOUNDMENT NETWORK, MERAMEC ENERGY CENTER, ST LOUIS COUNTY MISSOURI

This Technical Memorandum provides the results of the Assessment Monitoring Statistical Evaluation for the Multi-unit Surface Impoundment Network August 2018 sampling event at the Meramec Energy Center located in St. Louis County Missouri. Included in this memorandum is a brief summary of constituents that are present at a Statistically Significant Level (SSL), a list of site-specific Groundwater Protection Standards (**Table 1**), and the Sanitas Technologies™ (Sanitas) statistical software output for each of the Appendix IV parameters (**Appendix A** and **Appendix B**).

SSLs were calculated using the methods and procedures outlined in the Groundwater Monitoring Plan's (GMP) Statistical Analysis Plan (SAP). In addition to the outliers that were noted in previous statistical analysis, the following outliers were removed prior to the calculation of confidence limits:

- Antimony
  - MW-1 on 3/29/2016 at 0.063 µg/L and on 3/7/2017 at Non-detect: Values were statistically higher and lower than other values at the same well.
  - MW-7 on 7/19/2016 at 0.065 J µg/L and on 1/6/2017 at Non-detect: Values were statistically lower than other values at the same well.
- Arsenic
  - MW-1 on 6/14/2017 at Non-detect: Value was statistically lower than other values at the same well.
  - MW-4 on 3/29/2016 at 10.5 µg/L: Value was statistically lower than other values at the same well.
  - MW-5 on 3/29/2016 at 8.0 µg/L and on 5/13/2016 at 13.4 µg/L: Values were statistically lower than other values at the same well.
  - MW-6 on 7/19/2016 at Non-detect: Value was statistically lower than other values at the same well.
- Beryllium
  - MW-6 on 4/3/2018 at 0.36 J µg/L: Value was statically higher than the other values at the same well.

  - MW-7 on 4/3/2018 at 0.35 J µg/L: Value was statically higher than the other values at the same well.
- Cadmium
  - MW-3 on 4/4/2018 at 0.11 J µg/L: Value was statically higher than the other values at the same well.
  - MW-4 on 4/4/2018 at 0.16 J µg/L: Value was statically higher than the other values at the same well.
- Cobalt
  - MW-1 on 3/29/2016 at 1.5 J µg/L: Value was statically higher than the other values at the same well.
  - MW-7 on 5/13/2016 at 1.2 J µg/L: Value was statically higher than the other values at the same well.
- Fluoride
  - MW-1 on 4/4/2018 at 0.069 J mg/L: Value was statistically lower than other values at the same well.
- Lithium
  - MW-6 on 5/12/2016 at 164 µg/L: Value was statically higher than the other values at the same well.
- Radium 226 + 228
  - MW-1 on 11/20/2018 at 1.663 J pCi/L: Value was statically higher than the other values at the same well.
  - MW-7 on 7/19/2016 at 1.917 pCi/L and on 11/19/2018 at 1.376 pCi/L: Values were statistically higher than other values at the same well.

Lithium at MW-7, which was added as an SSL in the November 2018 sampling event, is no longer an SSL, as the lower confidence limit is at 39.67 µg/L, and no statistically significant trend is observed; however, it is noteworthy that there is an obvious downward trend in the concentration of lithium in MW-7 over the past two years. The other SSLs at Meramec have not changed. A summary of SSLs at corresponding wells is as follows:

- Arsenic at MW-4 and MW-5
- Lithium at MW-6
- Molybdenum at MW-6, MW-7 and MW-8

Golder appreciates this opportunity to provide hydrogeological and engineering support services to Ameren. If you have any questions or comments regarding the information provided, please call our office at (314) 984-8800.

Sincerely,

Jeffrey S. Ingram

Sean C Paulsen

Jeffrey Ingram, R.G.
Project Geologist

Sean Paulsen, P.G.
Associate, Senior Consultant

JSI/SCP

Enclosures:
Table 1 – MEC Groundwater Protection Standards
Appendix A – Sanitas Confidence Interval Statistical Output
Appendix B – Sanitas Trending Confidence Bands Statistical Output

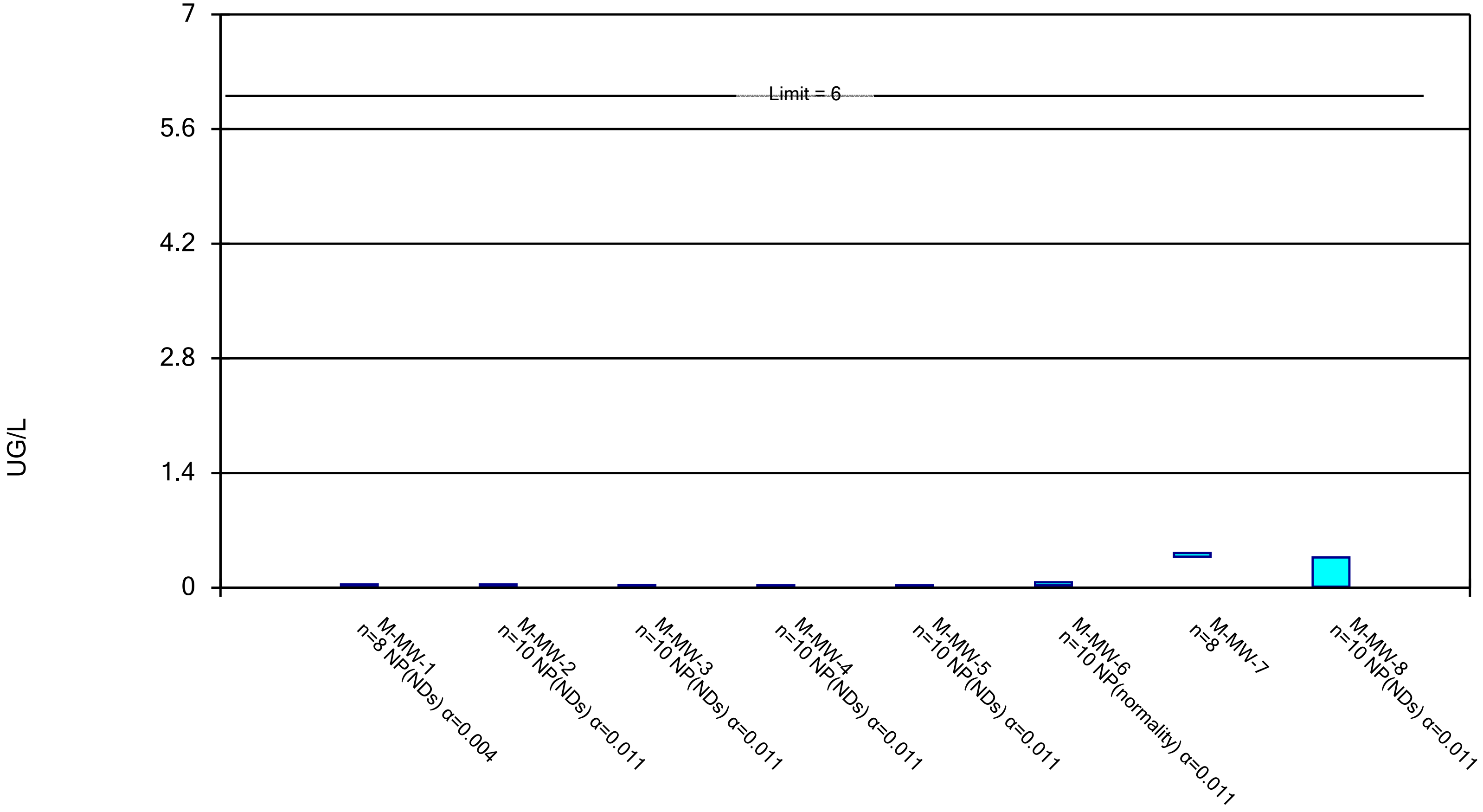
APPENDIX A

Sanitas Confidence Interval Statistical Output

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

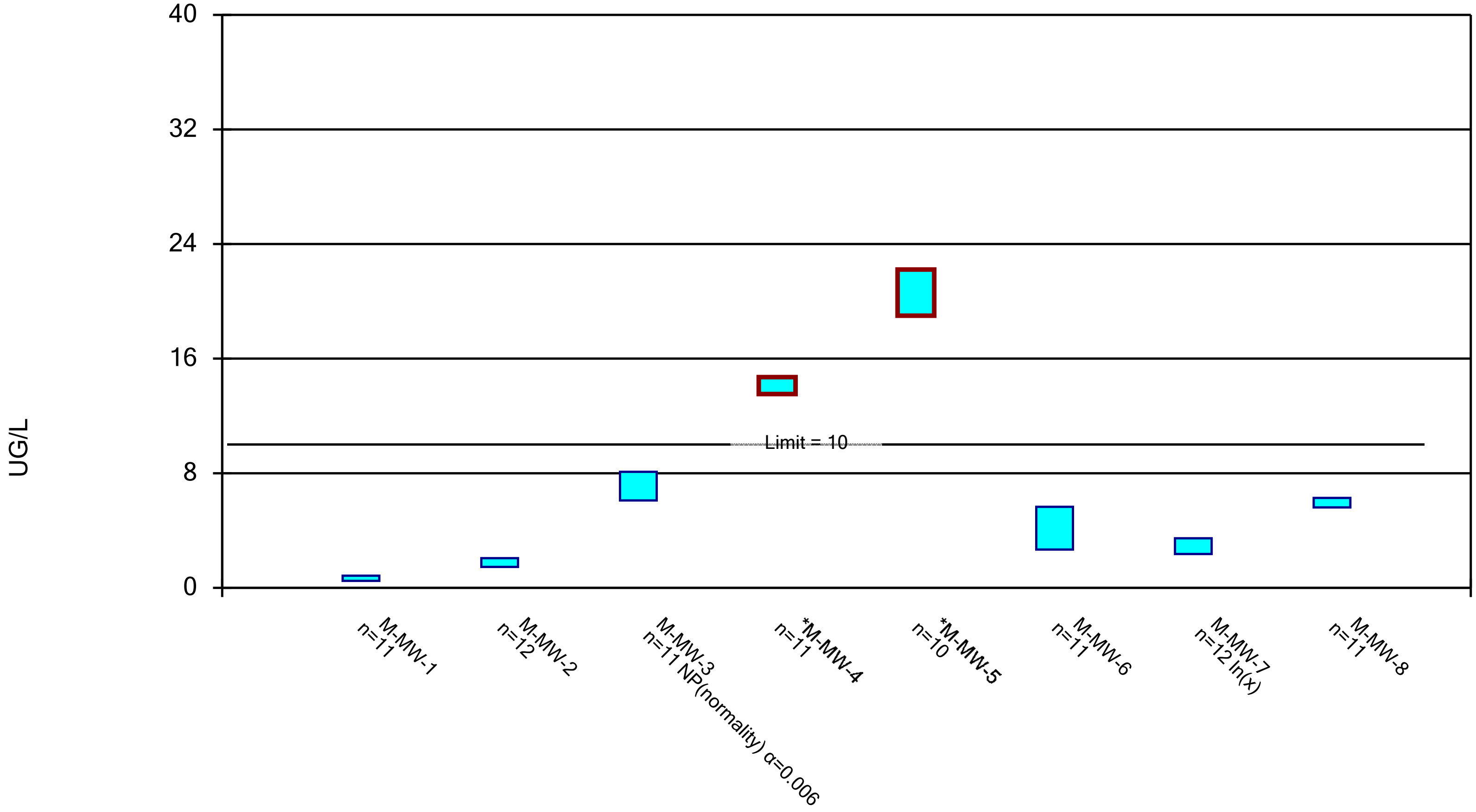


Constituent: ANTIMONY, TOTAL   Analysis Run 11/22/2019 8:08 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



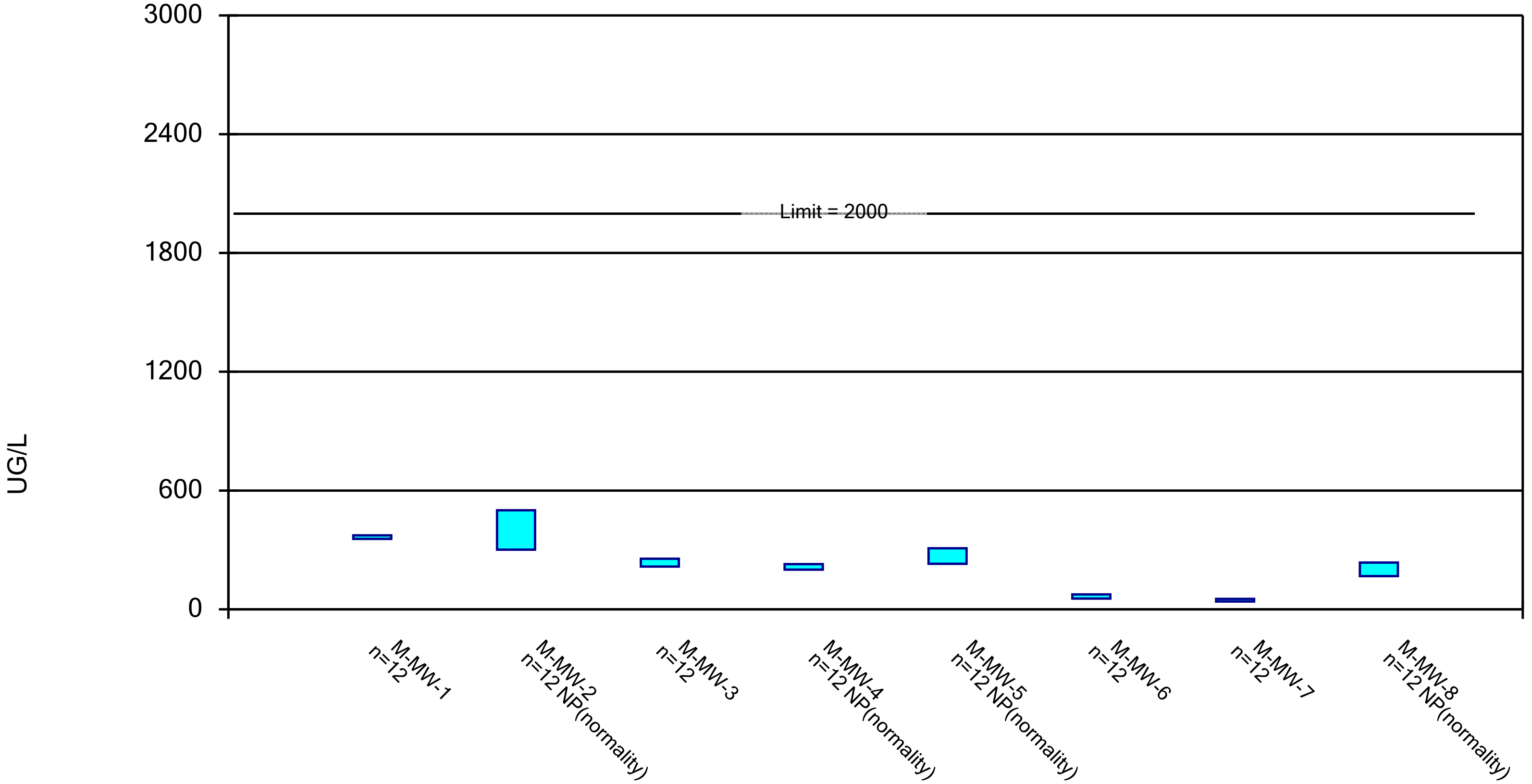
Constituent: ARSENIC, TOTAL Analysis Run 11/22/2019 8:08 AM

Meramec E.C. Client: Ameren Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

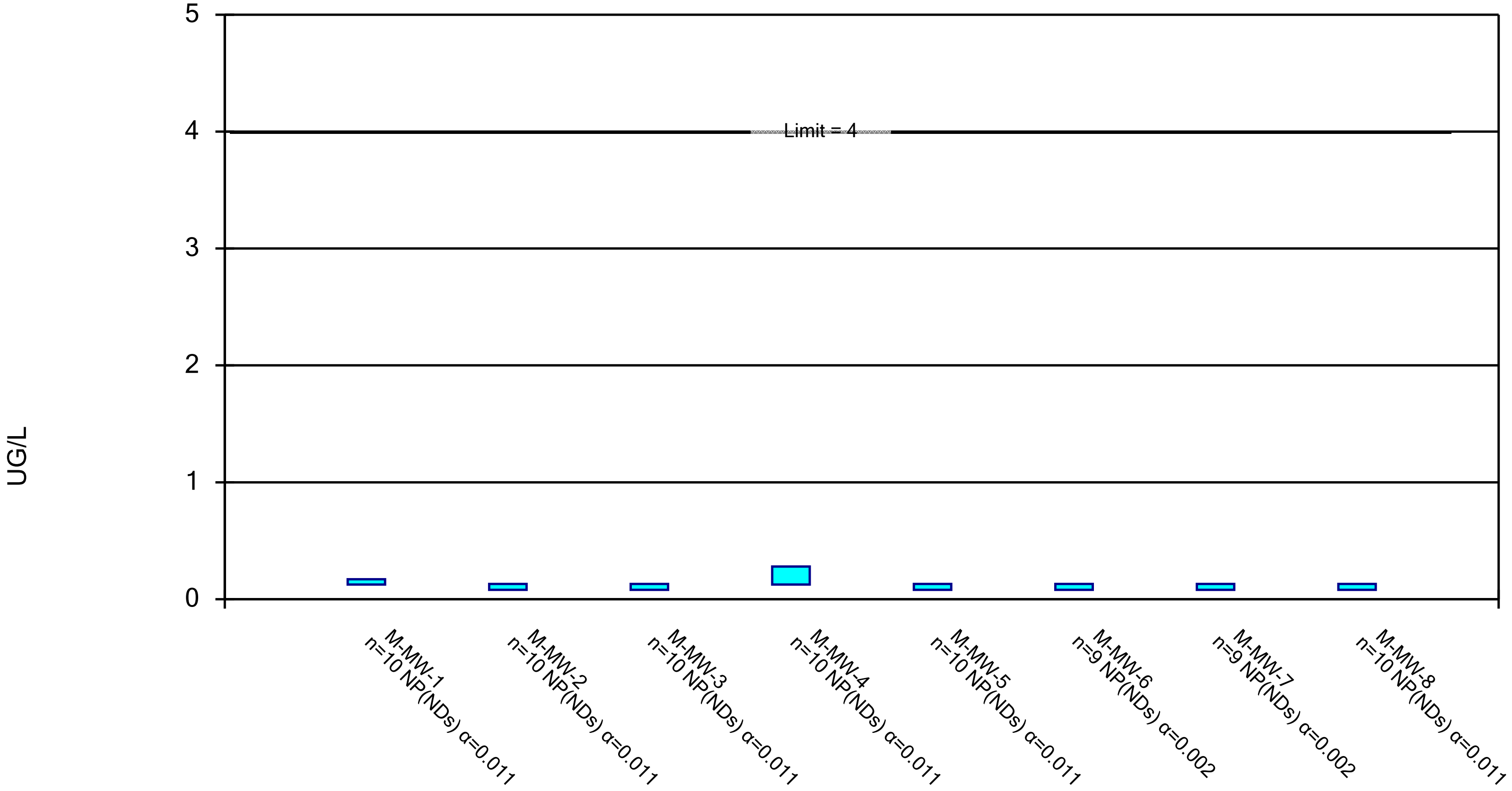


Constituent: BARIUM, TOTAL   Analysis Run 11/22/2019 8:08 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

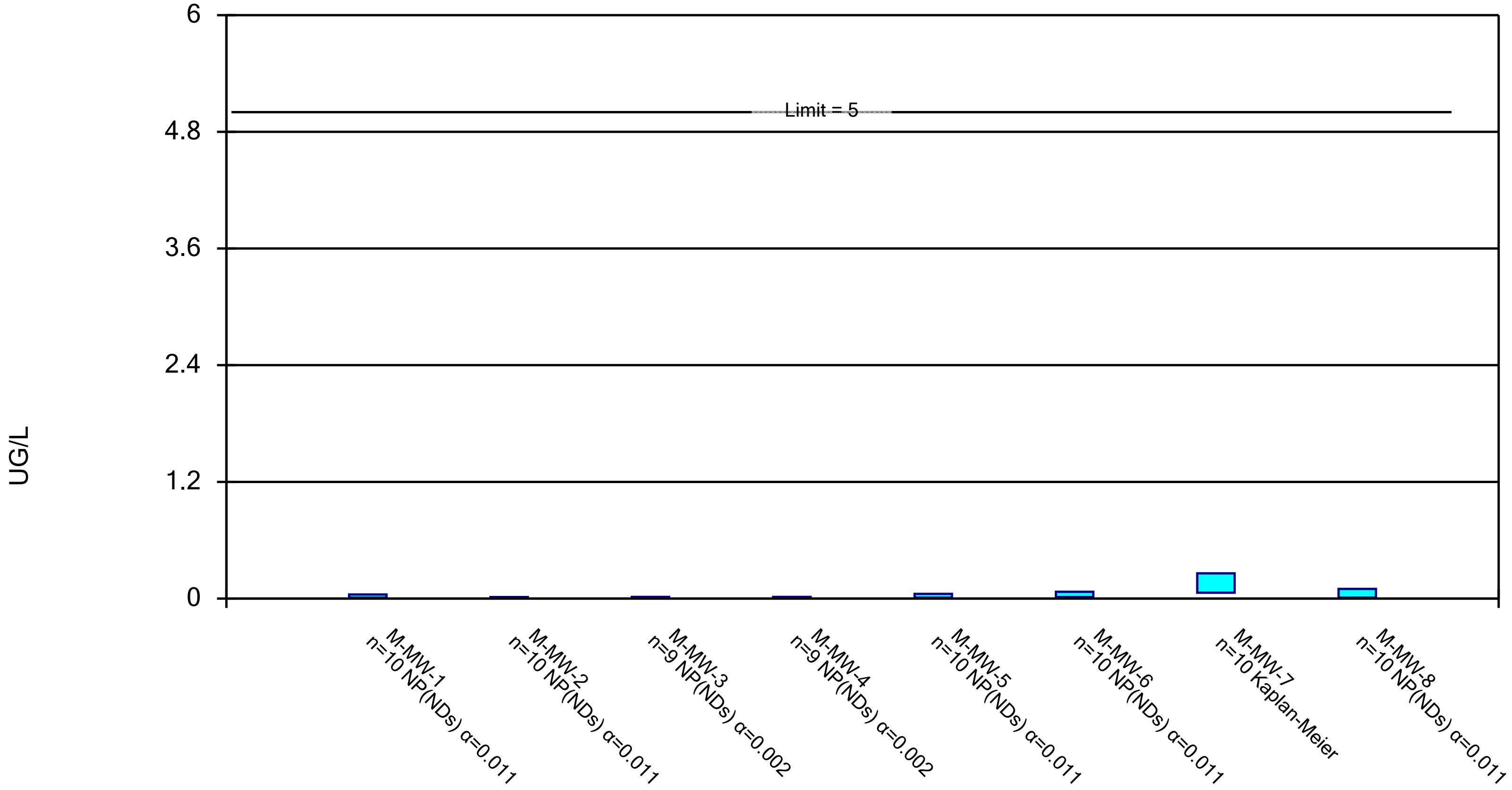


Constituent: BERYLLIUM, TOTAL Analysis Run 11/22/2019 8:08 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

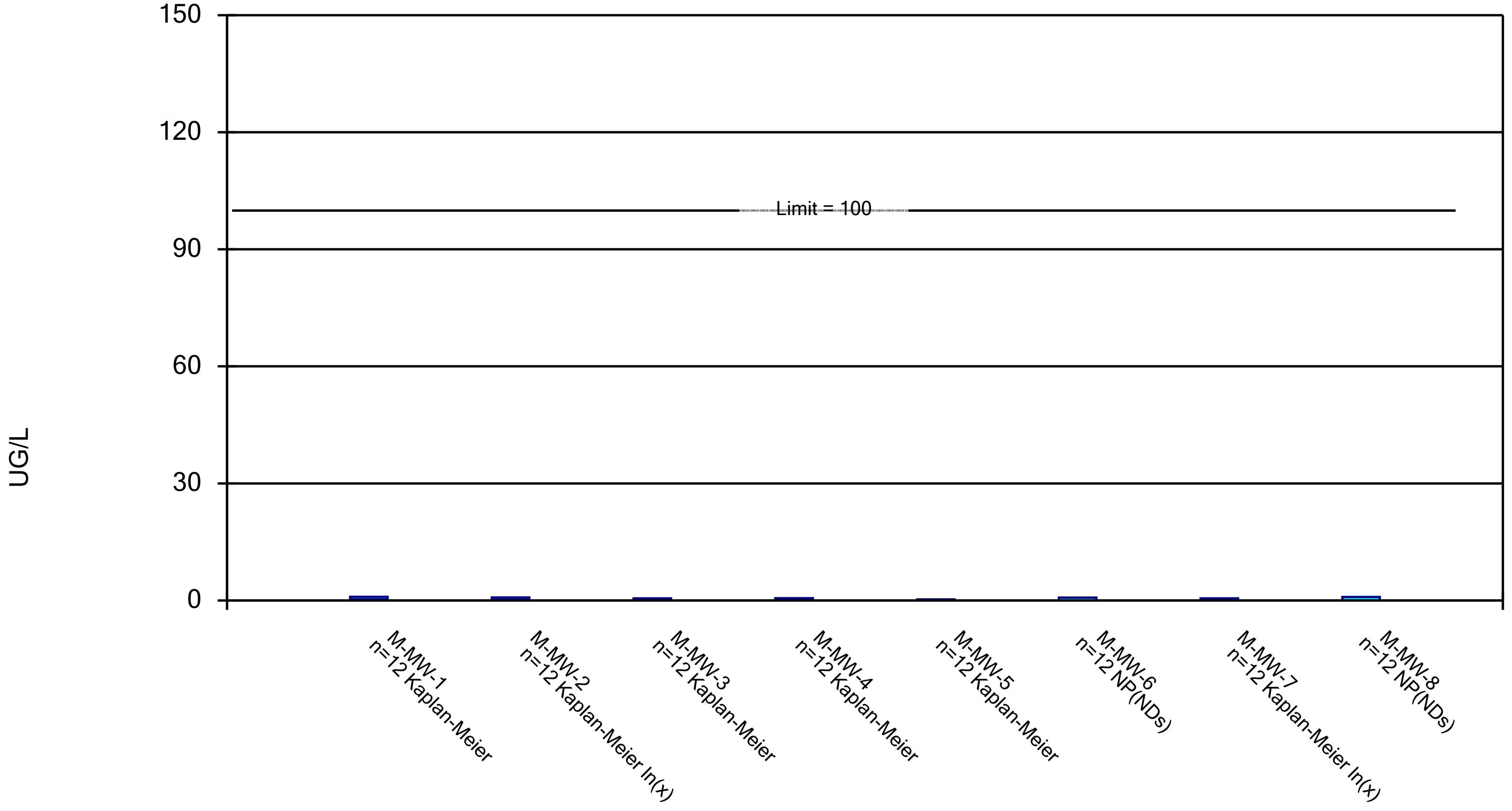


Constituent: CADMIUM, TOTAL   Analysis Run 11/22/2019 8:08 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

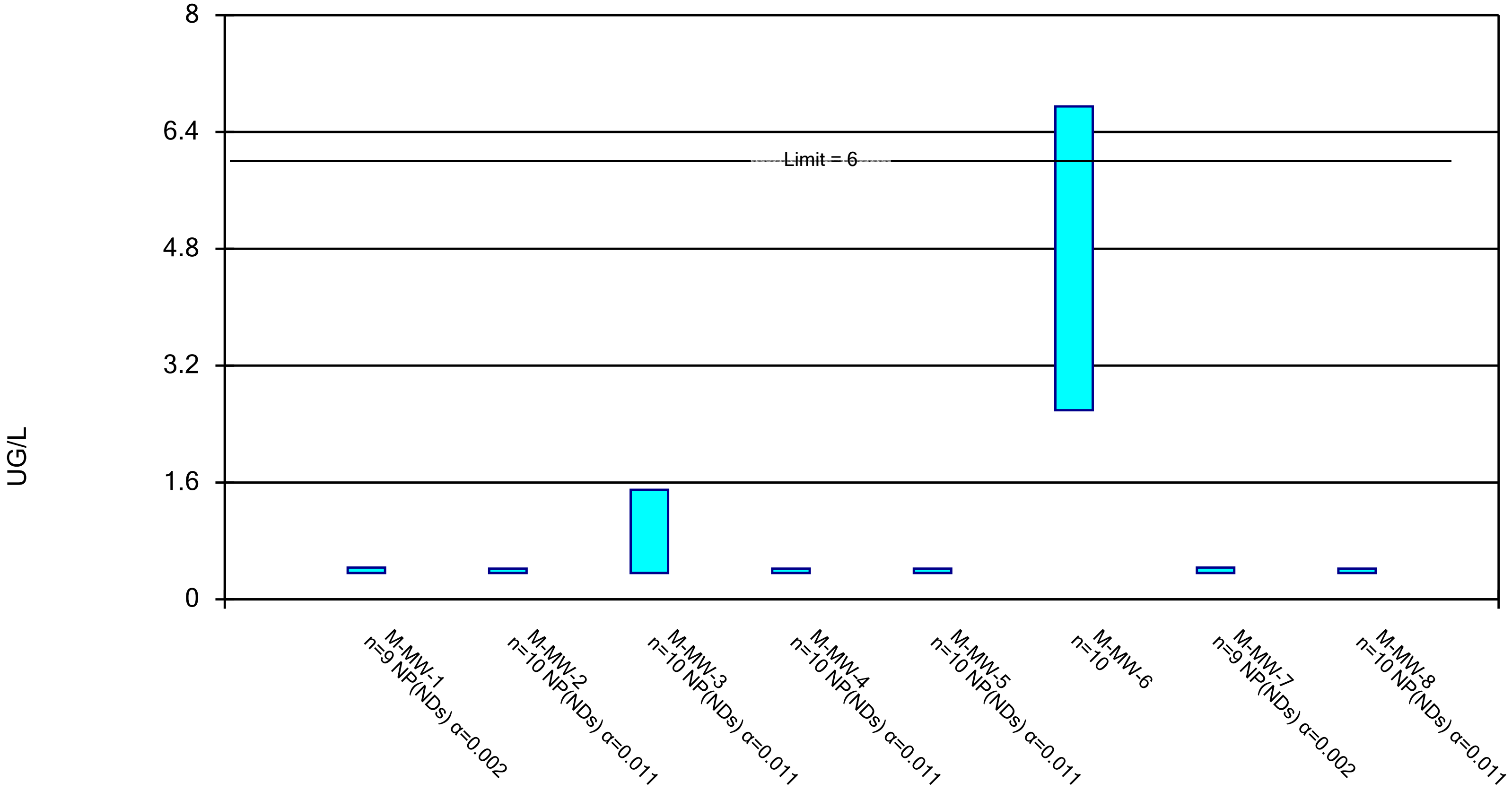


Constituent: CHROMIUM, TOTAL Analysis Run 11/22/2019 8:08 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

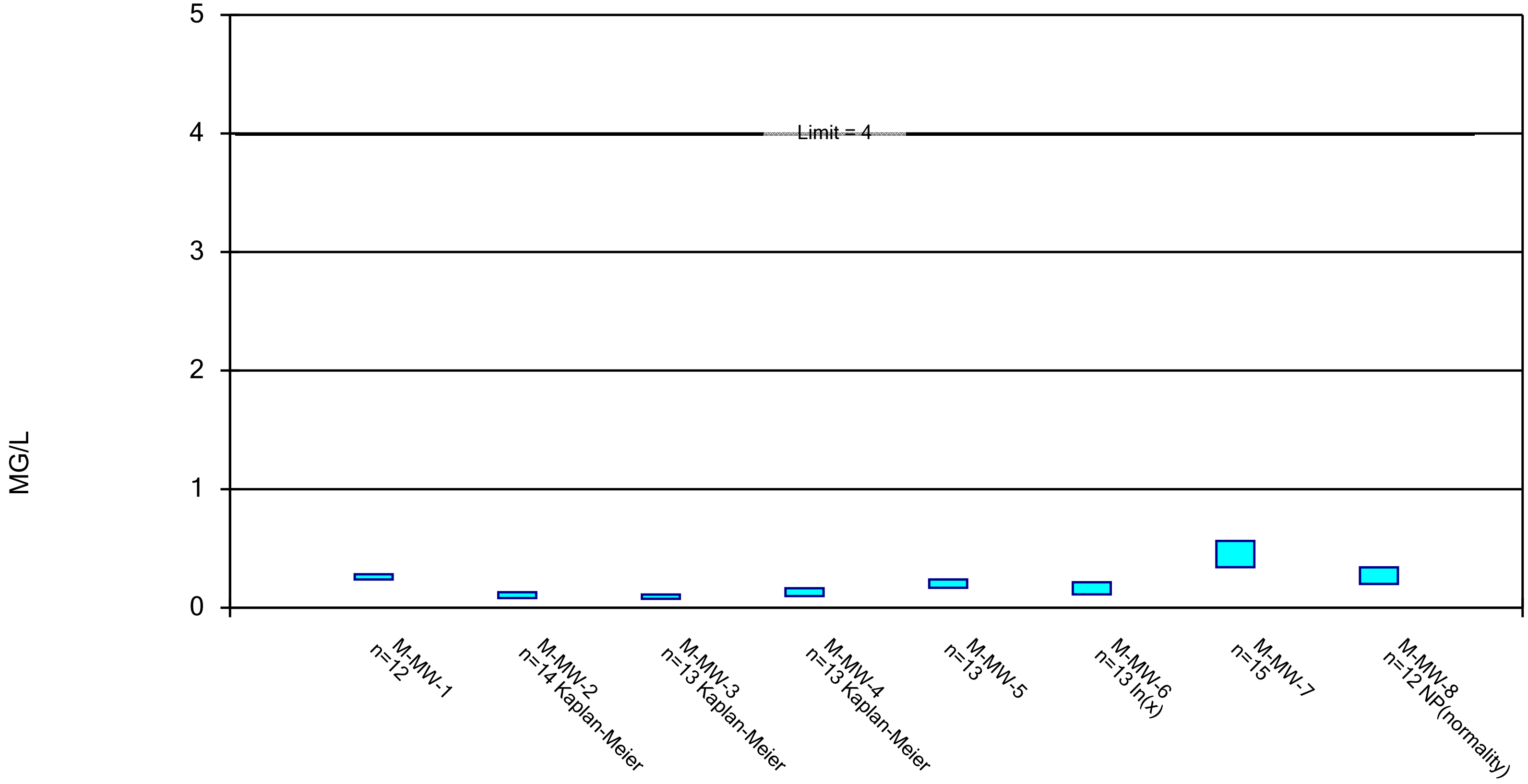


Constituent: COBALT, TOTAL   Analysis Run 11/22/2019 8:08 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



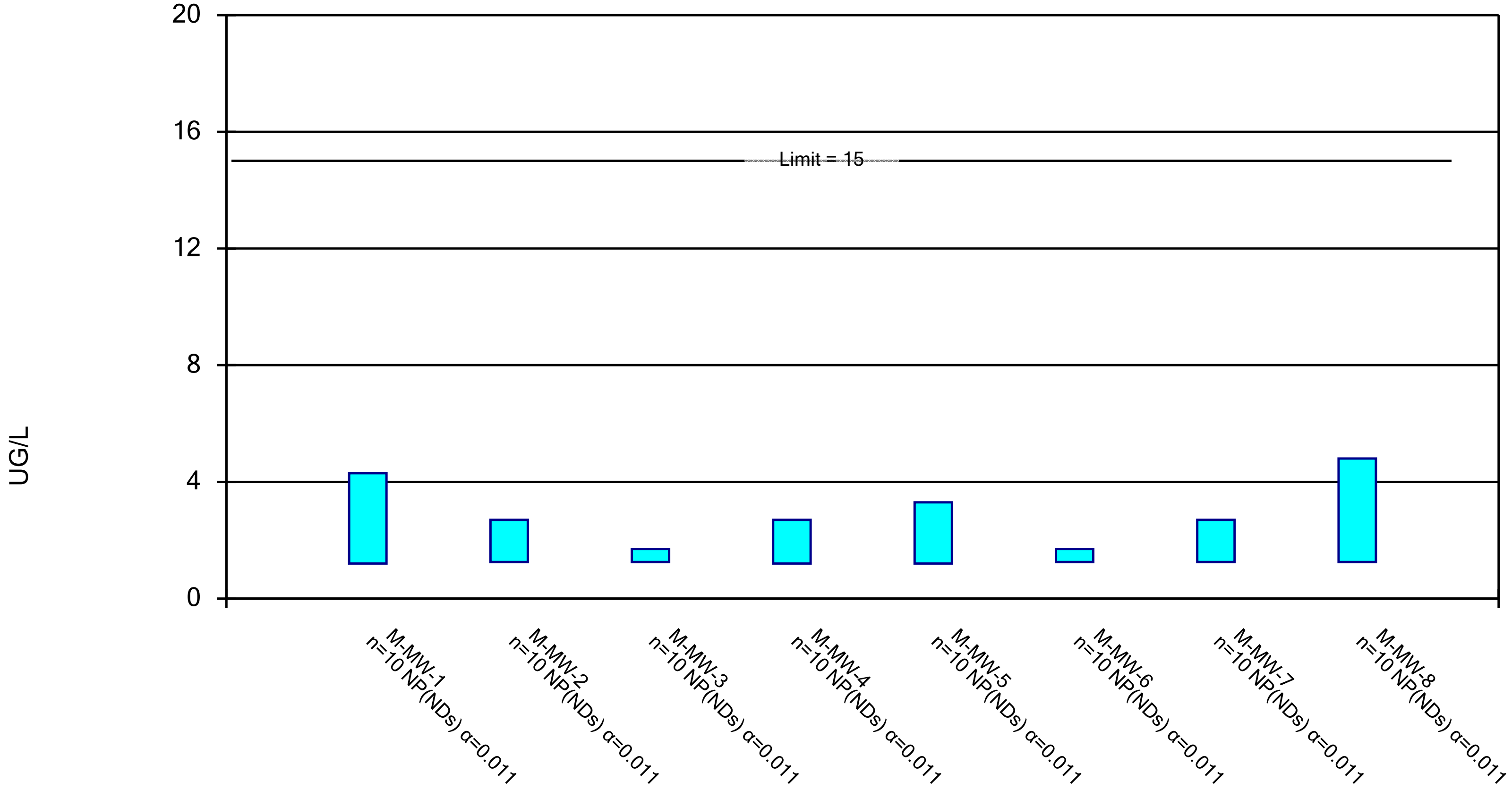
Constituent: FLUORIDE, TOTAL   Analysis Run 11/22/2019 8:08 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

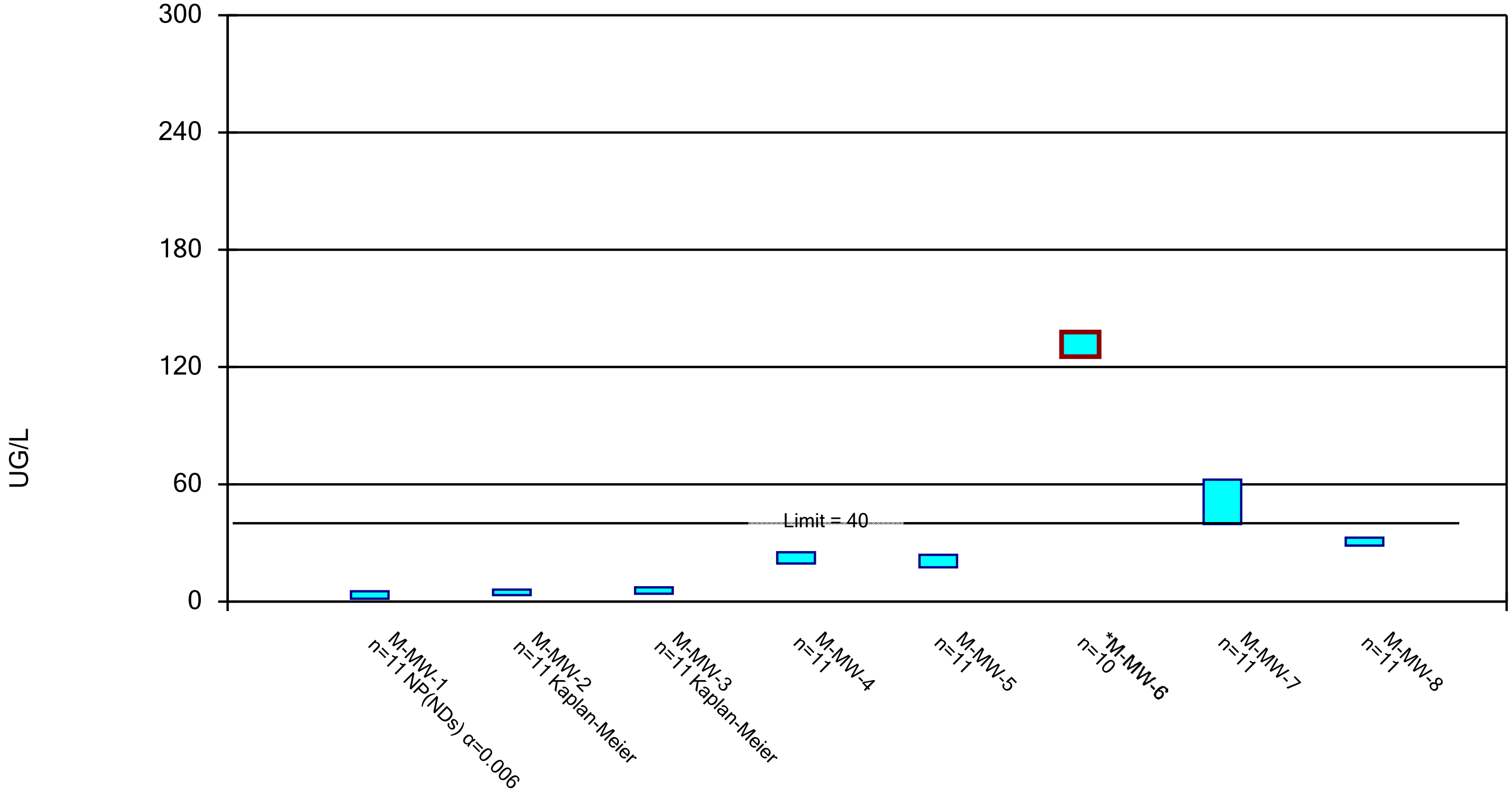


Constituent: LEAD, TOTAL Analysis Run 11/22/2019 8:08 AM

Meramec E.C. Client: Ameren Data: MEC Data

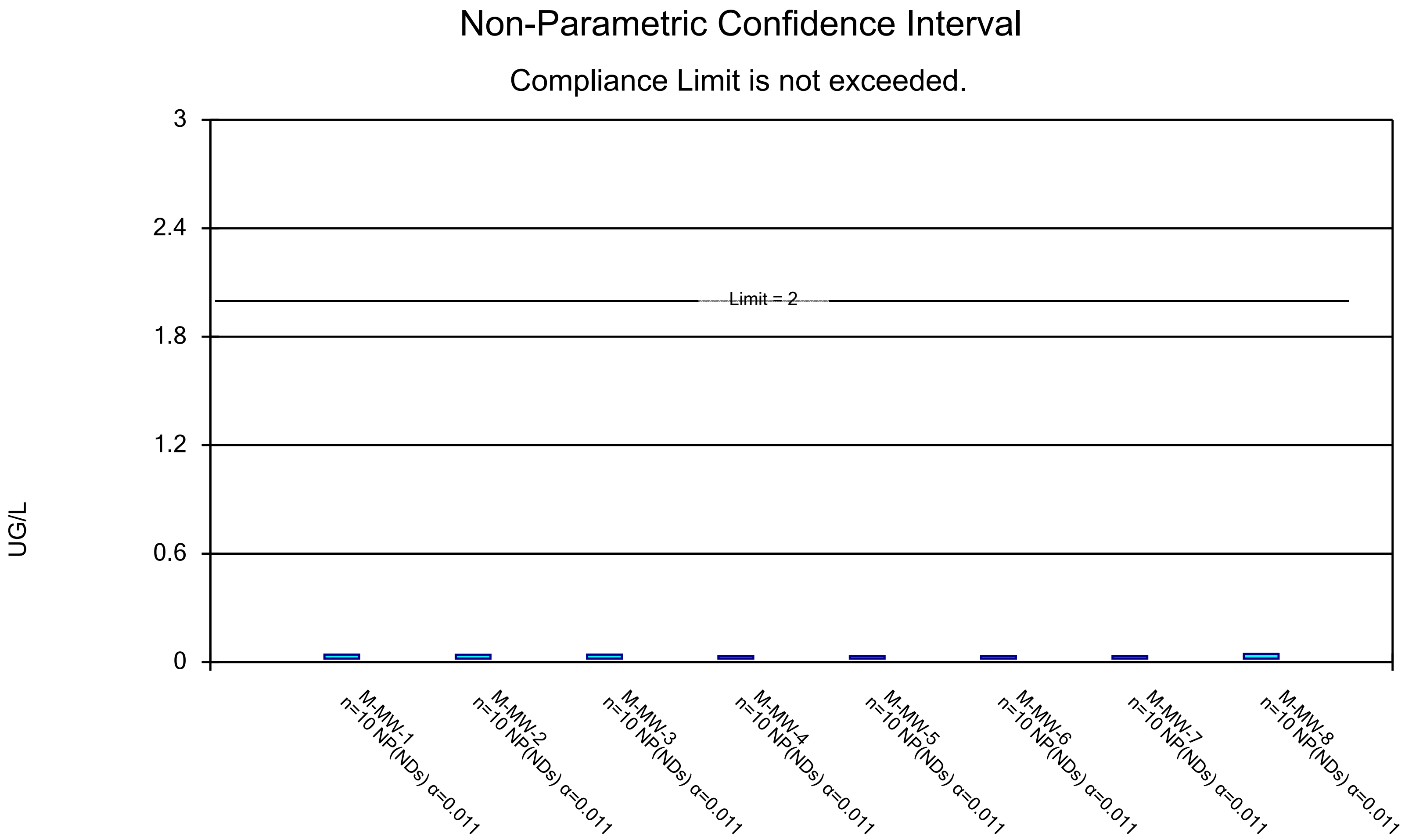
Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: LITHIUM, TOTAL Analysis Run 11/22/2019 8:09 AM

Meramec E.C. Client: Ameren Data: MEC Data

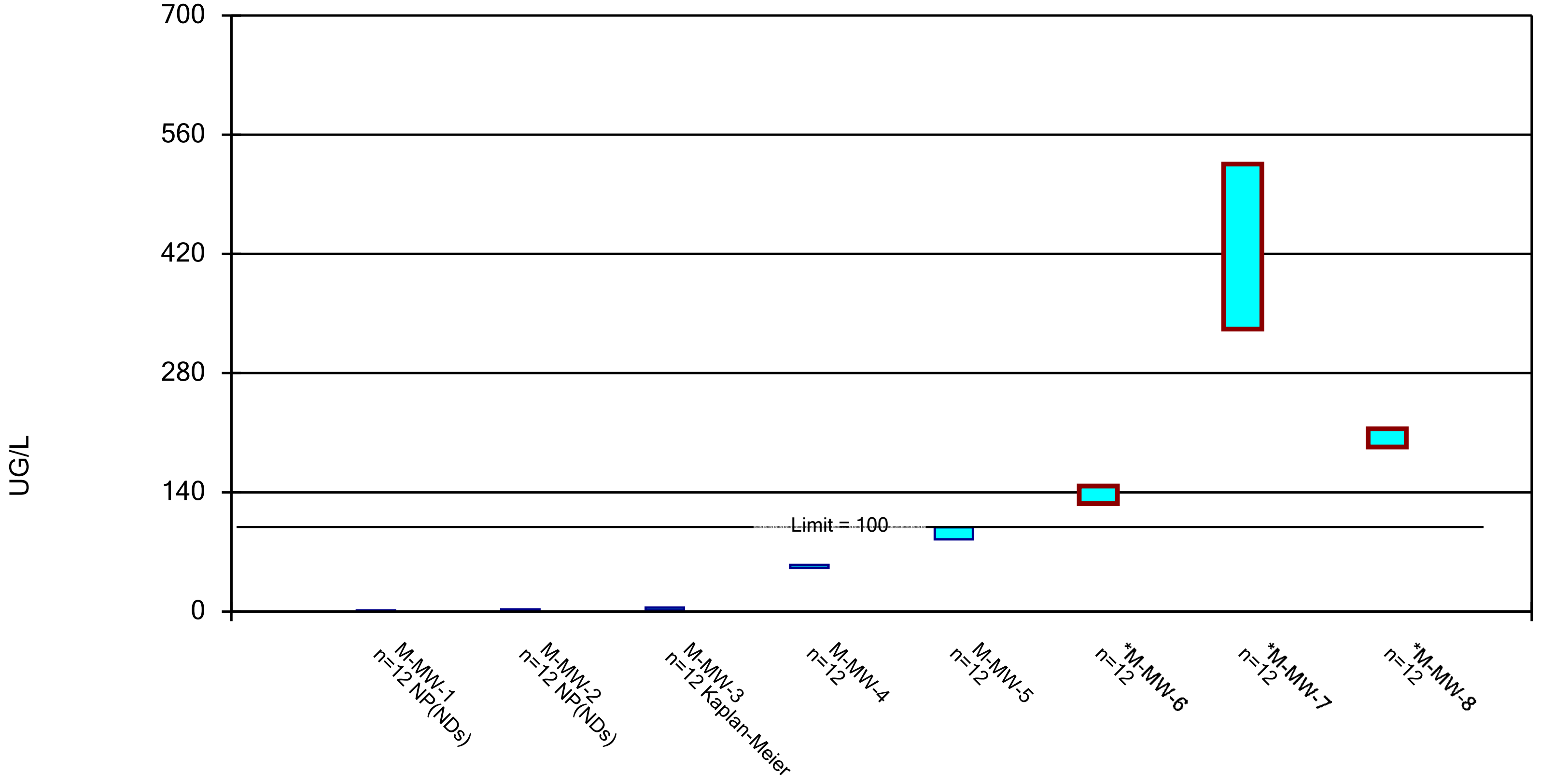


Constituent: MERCURY, TOTAL Analysis Run 11/22/2019 8:09 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

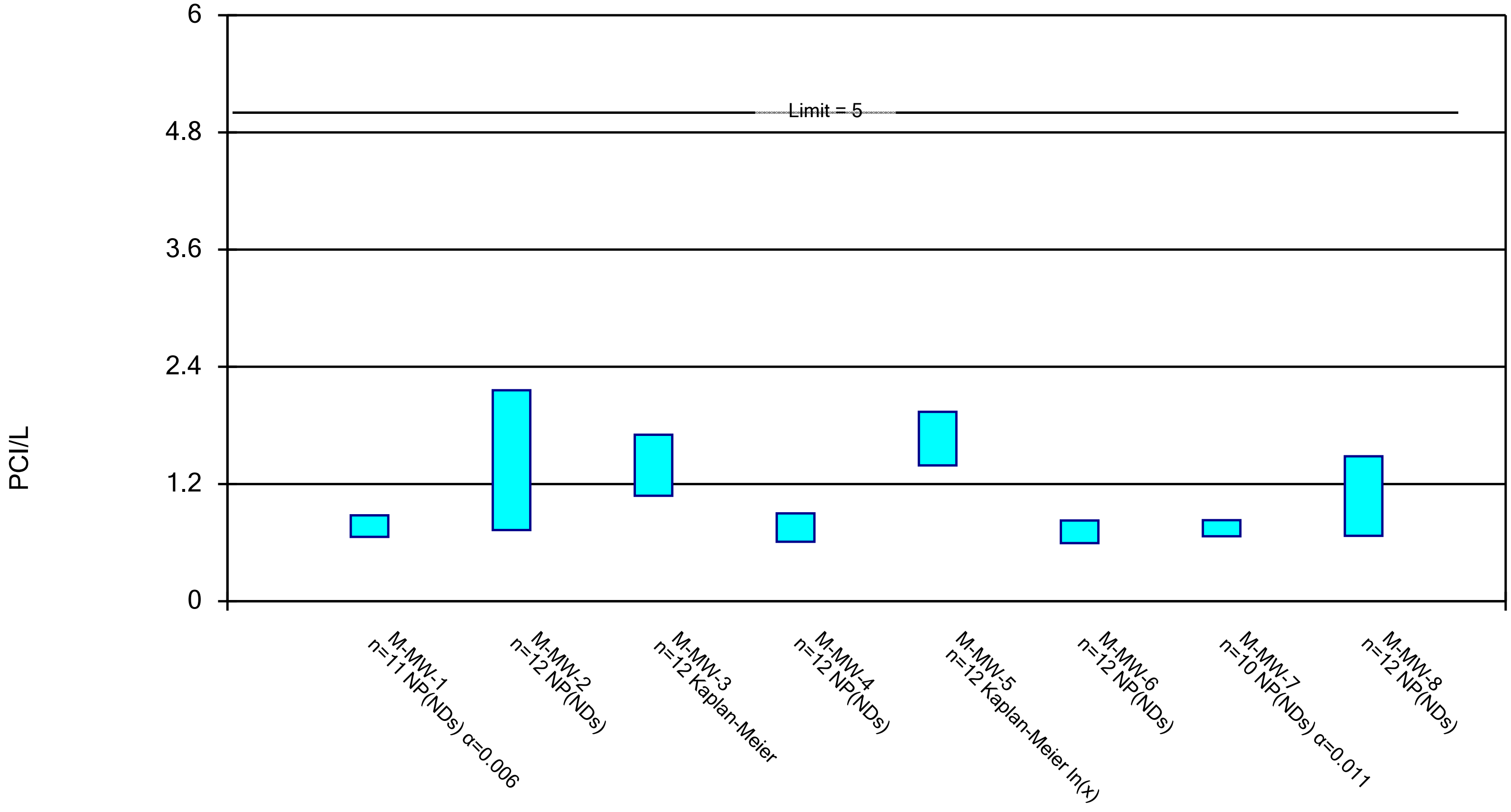


Constituent: MOLYBDENUM, TOTAL Analysis Run 11/22/2019 8:09 AM

Meramec E.C. Client: Ameren Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

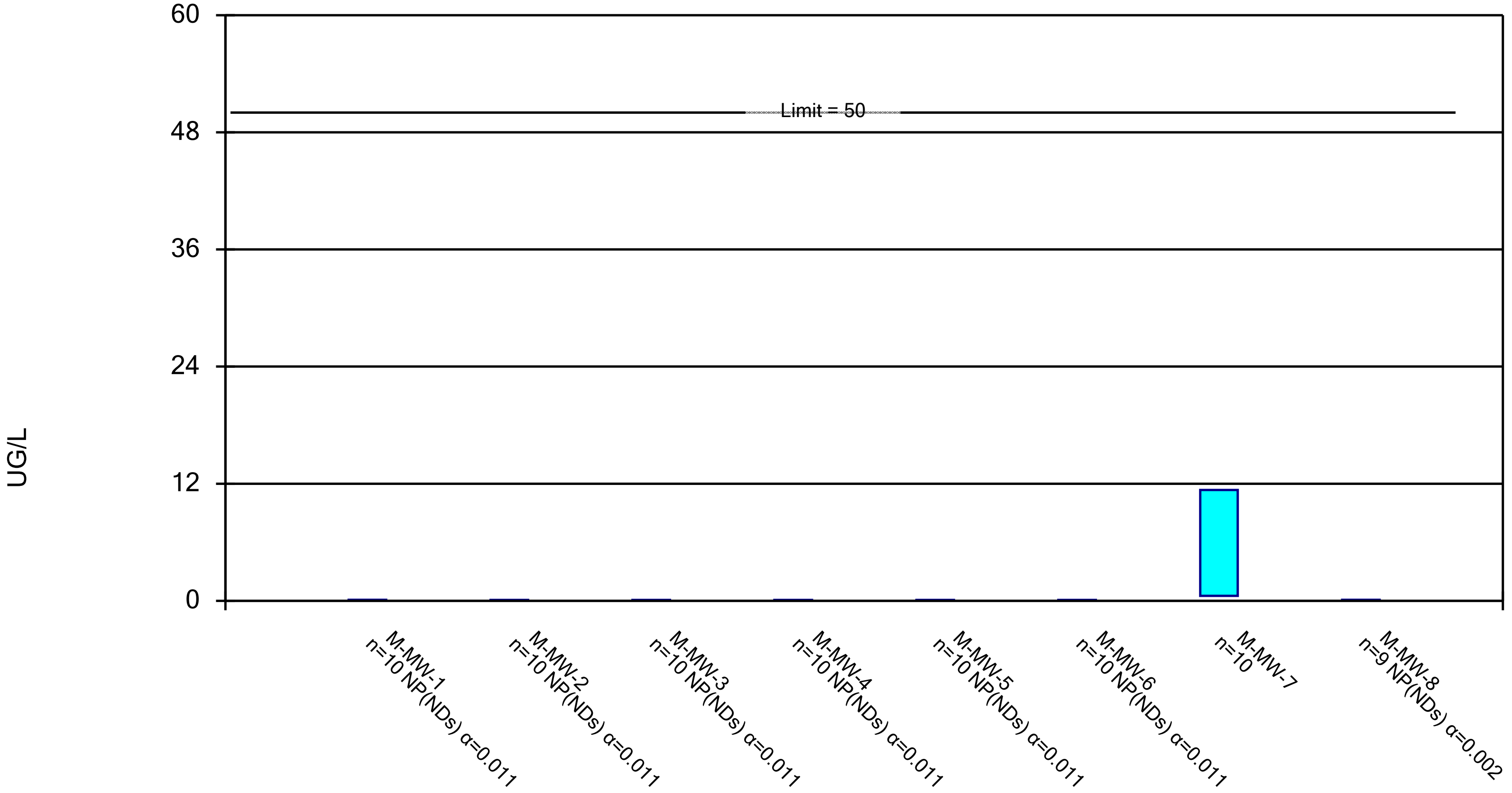


Constituent: Radium [226 + 228]   Analysis Run 11/22/2019 8:09 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

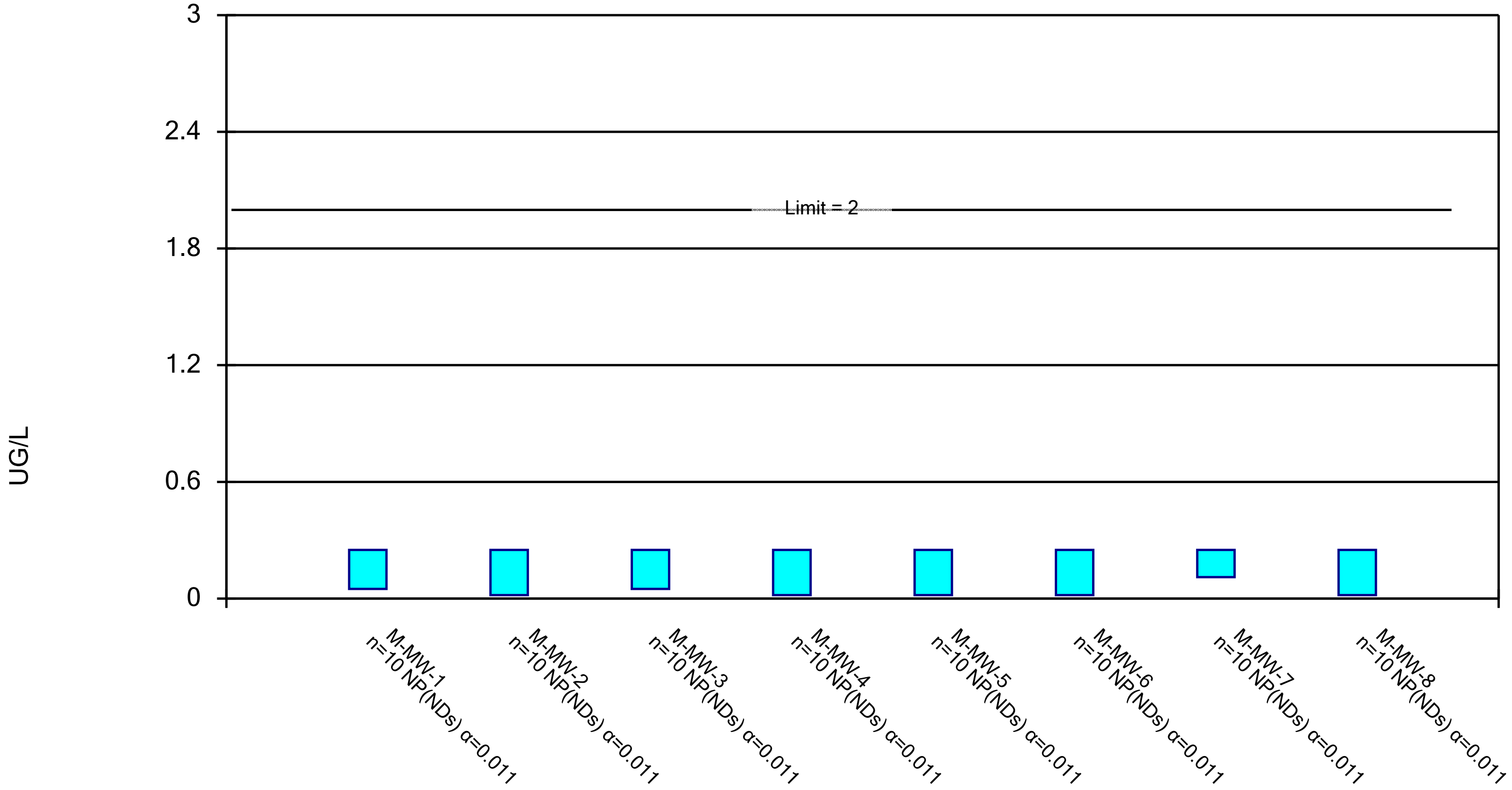


Constituent: SELENIUM, TOTAL Analysis Run 11/22/2019 8:09 AM

Meramec E.C. Client: Ameren Data: MEC Data

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: THALLIUM, TOTAL   Analysis Run 11/22/2019 8:09 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Confidence Interval

Meramec E.C. Client: Ameren Data: MEC Data Printed 11/22/2019, 8:09 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
ANTIMONY, TOTAL (UG/L)	M-MW-1	0.039	0.028	6	No	8	75	No	0.004	NP (NDs)
ANTIMONY, TOTAL (UG/L)	M-MW-2	0.039	0.013	6	No	10	90	No	0.011	NP (NDs)
ANTIMONY, TOTAL (UG/L)	M-MW-3	0.031	0.013	6	No	10	90	No	0.011	NP (NDs)
ANTIMONY, TOTAL (UG/L)	M-MW-4	0.029	0.013	6	No	10	90	No	0.011	NP (NDs)
ANTIMONY, TOTAL (UG/L)	M-MW-5	0.029	0.013	6	No	10	90	No	0.011	NP (NDs)
ANTIMONY, TOTAL (UG/L)	M-MW-6	0.066	0.029	6	No	10	50	No	0.011	NP (normality)
ANTIMONY, TOTAL (UG/L)	M-MW-7	0.4242	0.3783	6	No	8	0	No	0.01	Param.
ANTIMONY, TOTAL (UG/L)	M-MW-8	0.37	0.013	6	No	10	70	No	0.011	NP (NDs)
ARSENIC, TOTAL (UG/L)	M-MW-1	0.8476	0.4852	10	No	11	0	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-2	2.074	1.459	10	No	12	0	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-3	8.1	6.1	10	No	11	0	No	0.006	NP (normality)
ARSENIC, TOTAL (UG/L)	**M-MW-4**	**14.71**	**13.53**	**10**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
ARSENIC, TOTAL (UG/L)	**M-MW-5**	**22.22**	**19**	**10**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
ARSENIC, TOTAL (UG/L)	M-MW-6	5.659	2.668	10	No	11	0	No	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-7	3.459	2.361	10	No	12	0	ln(x)	0.01	Param.
ARSENIC, TOTAL (UG/L)	M-MW-8	6.28	5.611	10	No	11	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-1	373.3	355.7	2000	No	12	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-2	500	301	2000	No	12	0	No	0.01	NP (normality)
BARIUM, TOTAL (UG/L)	M-MW-3	255.6	215.9	2000	No	12	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-4	228	200	2000	No	12	0	No	0.01	NP (normality)
BARIUM, TOTAL (UG/L)	M-MW-5	308	230	2000	No	12	0	No	0.01	NP (normality)
BARIUM, TOTAL (UG/L)	M-MW-6	74.97	53.88	2000	No	12	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-7	52.74	39.74	2000	No	12	0	No	0.01	Param.
BARIUM, TOTAL (UG/L)	M-MW-8	236	168	2000	No	12	0	No	0.01	NP (normality)
BERYLLIUM, TOTAL (UG/L)	M-MW-1	0.17	0.125	4	No	10	80	No	0.011	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-2	0.13	0.08	4	No	10	100	No	0.011	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-3	0.13	0.08	4	No	10	100	No	0.011	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-4	0.28	0.125	4	No	10	70	No	0.011	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-5	0.13	0.08	4	No	10	100	No	0.011	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-6	0.13	0.08	4	No	9	100	No	0.002	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-7	0.13	0.08	4	No	9	100	No	0.002	NP (NDs)
BERYLLIUM, TOTAL (UG/L)	M-MW-8	0.13	0.08	4	No	10	100	No	0.011	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-1	0.042	0.009	5	No	10	80	No	0.011	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-2	0.0145	0.009	5	No	10	100	No	0.011	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-3	0.0165	0.009	5	No	9	100	No	0.002	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-4	0.0165	0.009	5	No	9	100	No	0.002	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-5	0.048	0.009	5	No	10	80	No	0.011	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-6	0.069	0.0145	5	No	10	60	No	0.011	NP (NDs)
CADMIUM, TOTAL (UG/L)	M-MW-7	0.2595	0.05993	5	No	10	20	No	0.01	Param.
CADMIUM, TOTAL (UG/L)	M-MW-8	0.099	0.009	5	No	10	60	No	0.011	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-1	0.9378	0.2585	100	No	12	25	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-2	0.755	0.1534	100	No	12	33.33	ln(x)	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-3	0.5184	0.07647	100	No	12	50	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-4	0.5716	0.1012	100	No	12	50	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-5	0.2749	0.0857	100	No	12	50	No	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-6	0.71	0.027	100	No	12	58.33	No	0.01	NP (NDs)
CHROMIUM, TOTAL (UG/L)	M-MW-7	0.5339	0.08681	100	No	12	50	ln(x)	0.01	Param.
CHROMIUM, TOTAL (UG/L)	M-MW-8	0.88	0.039	100	No	12	75	No	0.01	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-1	0.435	0.36	6	No	9	100	No	0.002	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-2	0.42	0.36	6	No	10	100	No	0.011	NP (NDs)

Confidence Interval

Meramec E.C. Client: Ameren Data: MEC Data Printed 11/22/2019, 8:09 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
COBALT, TOTAL (UG/L)	M-MW-3	1.5	0.36	6	No	10	60	No	0.011	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-4	0.42	0.36	6	No	10	100	No	0.011	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-5	0.42	0.36	6	No	10	100	No	0.011	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-6	6.749	2.591	6	No	10	0	No	0.01	Param.
COBALT, TOTAL (UG/L)	M-MW-7	0.435	0.36	6	No	9	100	No	0.002	NP (NDs)
COBALT, TOTAL (UG/L)	M-MW-8	0.42	0.36	6	No	10	100	No	0.011	NP (NDs)
FLUORIDE, TOTAL (MG/L)	M-MW-1	0.2822	0.2378	4	No	12	0	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-2	0.1307	0.0815	4	No	14	21.43	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-3	0.1107	0.07416	4	No	13	30.77	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-4	0.1638	0.09783	4	No	13	15.38	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-5	0.2375	0.1687	4	No	13	0	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-6	0.2142	0.113	4	No	13	7.692	ln(x)	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-7	0.5631	0.3409	4	No	15	0	No	0.01	Param.
FLUORIDE, TOTAL (MG/L)	M-MW-8	0.34	0.2	4	No	12	0	No	0.01	NP (normality)
LEAD, TOTAL (UG/L)	M-MW-1	4.3	1.2	15	No	10	80	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-2	2.7	1.25	15	No	10	60	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-3	1.7	1.25	15	No	10	90	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-4	2.7	1.2	15	No	10	80	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-5	3.3	1.2	15	No	10	70	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-6	1.7	1.25	15	No	10	90	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-7	2.7	1.25	15	No	10	80	No	0.011	NP (NDs)
LEAD, TOTAL (UG/L)	M-MW-8	4.8	1.25	15	No	10	70	No	0.011	NP (NDs)
LITHIUM, TOTAL (UG/L)	M-MW-1	5.3	1.45	40	No	11	81.82	No	0.006	NP (NDs)
LITHIUM, TOTAL (UG/L)	M-MW-2	6.134	3.303	40	No	11	36.36	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-3	7.278	3.985	40	No	11	36.36	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-4	25.21	19.52	40	No	11	0	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-5	23.94	17.52	40	No	11	0	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	**M-MW-6**	**137.9**	**125.3**	**40**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
LITHIUM, TOTAL (UG/L)	M-MW-7	62.35	39.67	40	No	11	0	No	0.01	Param.
LITHIUM, TOTAL (UG/L)	M-MW-8	32.73	28.62	40	No	11	0	No	0.01	Param.
MERCURY, TOTAL (UG/L)	M-MW-1	0.041	0.0195	2	No	10	90	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-2	0.04	0.0195	2	No	10	90	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-3	0.041	0.0195	2	No	10	90	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-4	0.033	0.0195	2	No	10	100	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-5	0.033	0.0195	2	No	10	100	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-6	0.033	0.0195	2	No	10	100	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-7	0.033	0.0195	2	No	10	100	No	0.011	NP (NDs)
MERCURY, TOTAL (UG/L)	M-MW-8	0.045	0.0195	2	No	10	90	No	0.011	NP (NDs)
MOLYBDENUM, TOTAL (UG/L)	M-MW-1	1.3	0.26	100	No	12	91.67	No	0.01	NP (NDs)
MOLYBDENUM, TOTAL (UG/L)	M-MW-2	2.5	0.26	100	No	12	75	No	0.01	NP (NDs)
MOLYBDENUM, TOTAL (UG/L)	M-MW-3	4.695	1.657	100	No	12	25	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	M-MW-4	54.63	51.32	100	No	12	0	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	M-MW-5	99	84.82	100	No	12	0	No	0.01	Param.
MOLYBDENUM, TOTAL (UG/L)	**M-MW-6**	**147.4**	**126.6**	**100**	**Yes**	**12**	**0**	**No**	**0.01**	**Param.**
MOLYBDENUM, TOTAL (UG/L)	**M-MW-7**	**525.5**	**331.8**	**100**	**Yes**	**12**	**0**	**No**	**0.01**	**Param.**
MOLYBDENUM, TOTAL (UG/L)	**M-MW-8**	**214.6**	**193.2**	**100**	**Yes**	**12**	**0**	**No**	**0.01**	**Param.**
Radium [226 + 228] (PCI/L)	M-MW-1	0.8785	0.6585	5	No	11	90.91	No	0.006	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-2	2.16	0.728	5	No	12	66.67	No	0.01	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-3	1.704	1.079	5	No	12	33.33	No	0.01	Param.
Radium [226 + 228] (PCI/L)	M-MW-4	0.9	0.6095	5	No	12	91.67	No	0.01	NP (NDs)

Confidence Interval

Meramec E.C.   Client: Ameren   Data: MEC Data   Printed 11/22/2019, 8:09 AM

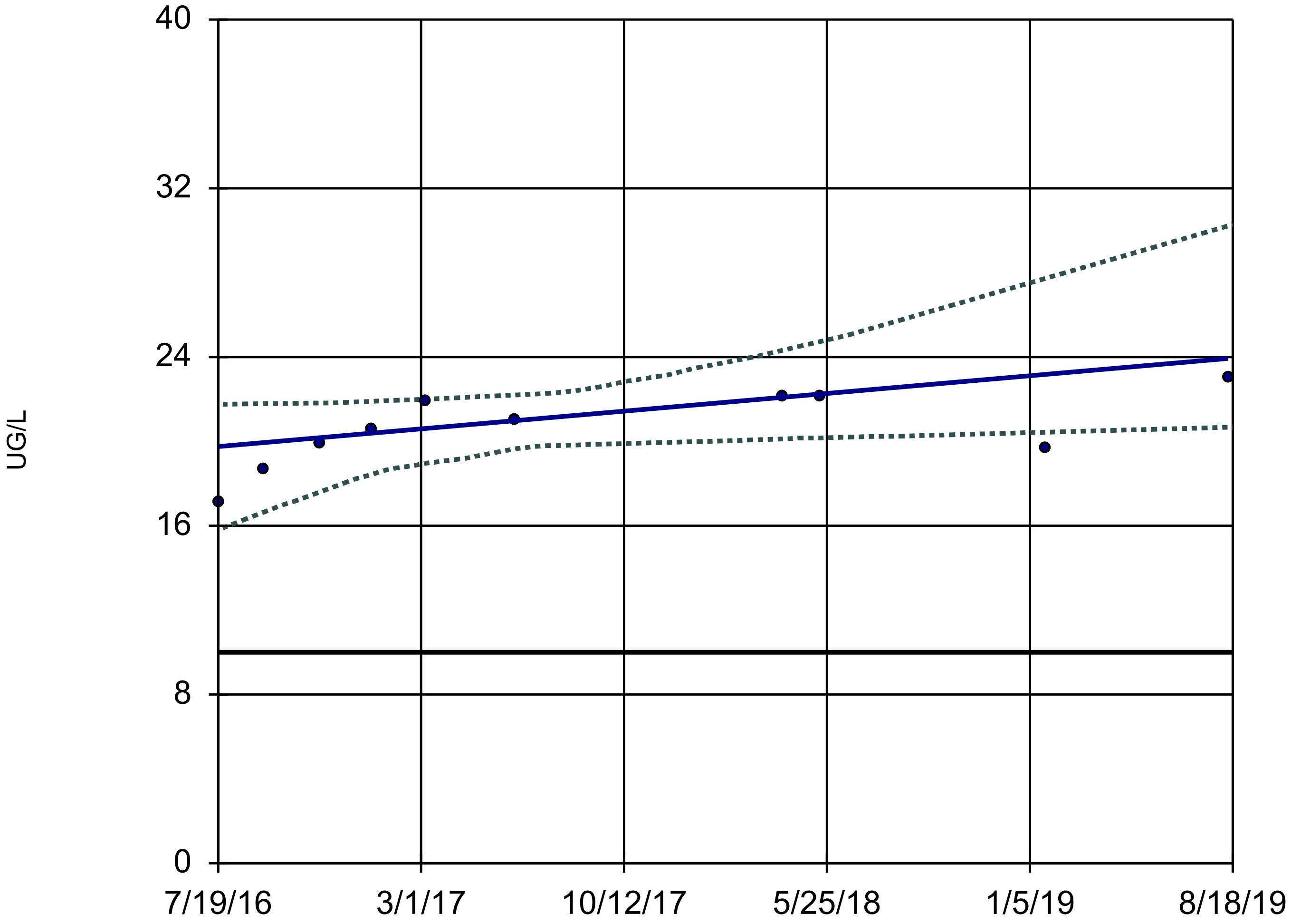
Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Radium [226 + 228] (PCI/L)	M-MW-5	1.939	1.39	5	No	12	50	ln(x)	0.01	Param.
Radium [226 + 228] (PCI/L)	M-MW-6	0.827	0.5945	5	No	12	100	No	0.01	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-7	0.83	0.6655	5	No	10	100	No	0.011	NP (NDs)
Radium [226 + 228] (PCI/L)	M-MW-8	1.483	0.669	5	No	12	75	No	0.01	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-1	0.1	0.043	50	No	10	80	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-2	0.09	0.043	50	No	10	90	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-3	0.09	0.043	50	No	10	90	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-4	0.09	0.043	50	No	10	90	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-5	0.09	0.043	50	No	10	100	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-6	0.09	0.043	50	No	10	90	No	0.011	NP (NDs)
SELENIUM, TOTAL (UG/L)	M-MW-7	11.36	0.5045	50	No	10	10	No	0.01	Param.
SELENIUM, TOTAL (UG/L)	M-MW-8	0.11	0.043	50	No	9	88.89	No	0.002	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-1	0.25	0.0495	2	No	10	80	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-2	0.25	0.018	2	No	10	100	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-3	0.25	0.0495	2	No	10	80	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-4	0.25	0.018	2	No	10	100	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-5	0.25	0.018	2	No	10	100	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-6	0.25	0.018	2	No	10	90	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-7	0.25	0.11	2	No	10	70	No	0.011	NP (NDs)
THALLIUM, TOTAL (UG/L)	M-MW-8	0.25	0.018	2	No	10	100	No	0.011	NP (NDs)

APPENDIX B

Sanitas Trending Confidence Bands Statistical Output

Sen's Slope and 95% Confidence Band

M-MW-5



n = 10

Slope = 1.361
units per year.

Mann-Kendall
statistic = 30
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

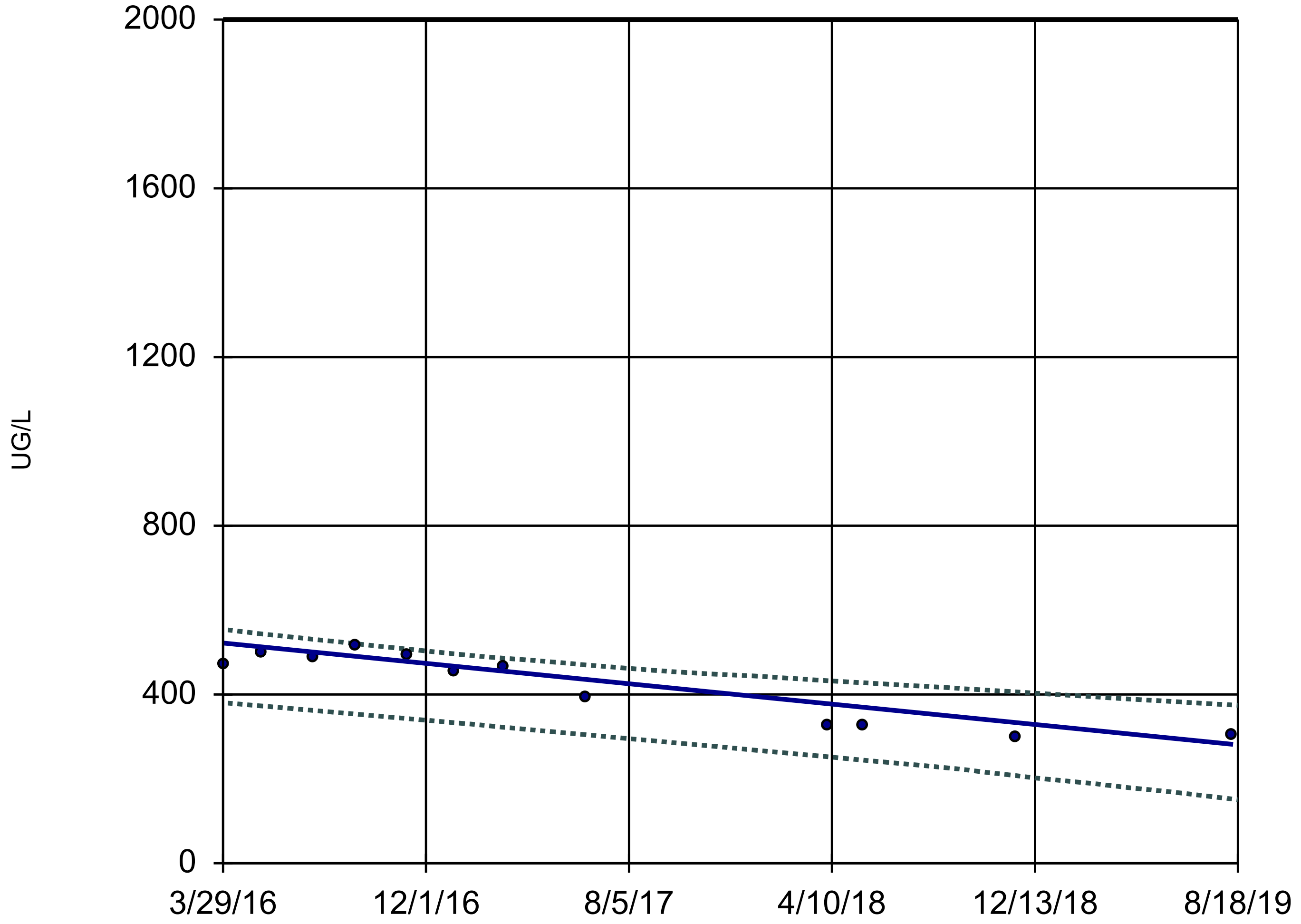
GWPS = 10.

Constituent: ARSENIC, TOTAL   Analysis Run 11/22/2019 8:10 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-2



n = 12

Slope = -71.28
units per year.

Mann-Kendall
statistic = -46
critical = -35

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

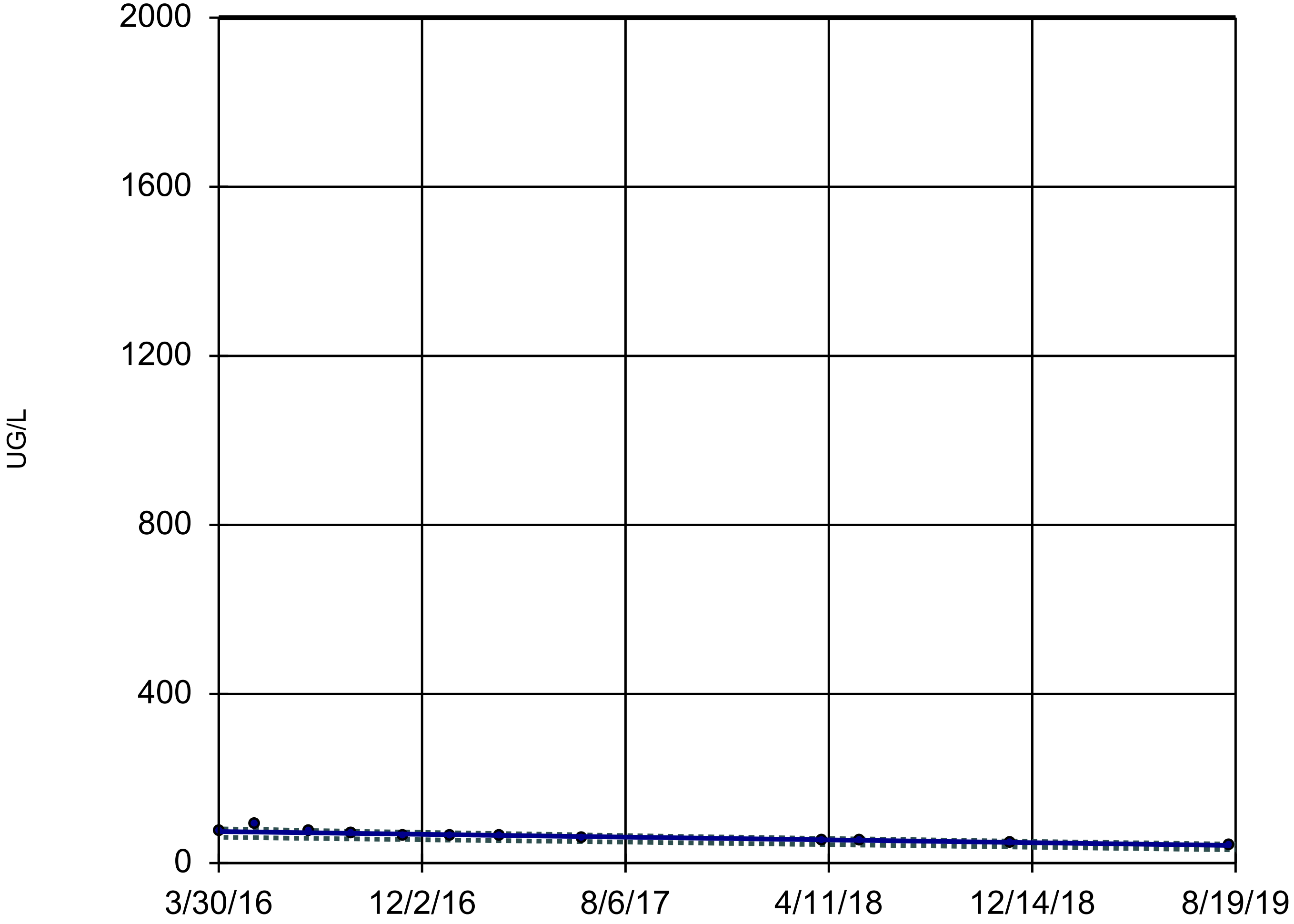
GWPS = 2000.

Constituent: BARIUM, TOTAL   Analysis Run 11/22/2019 8:10 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-6



n = 12

Slope = -9.754
units per year.

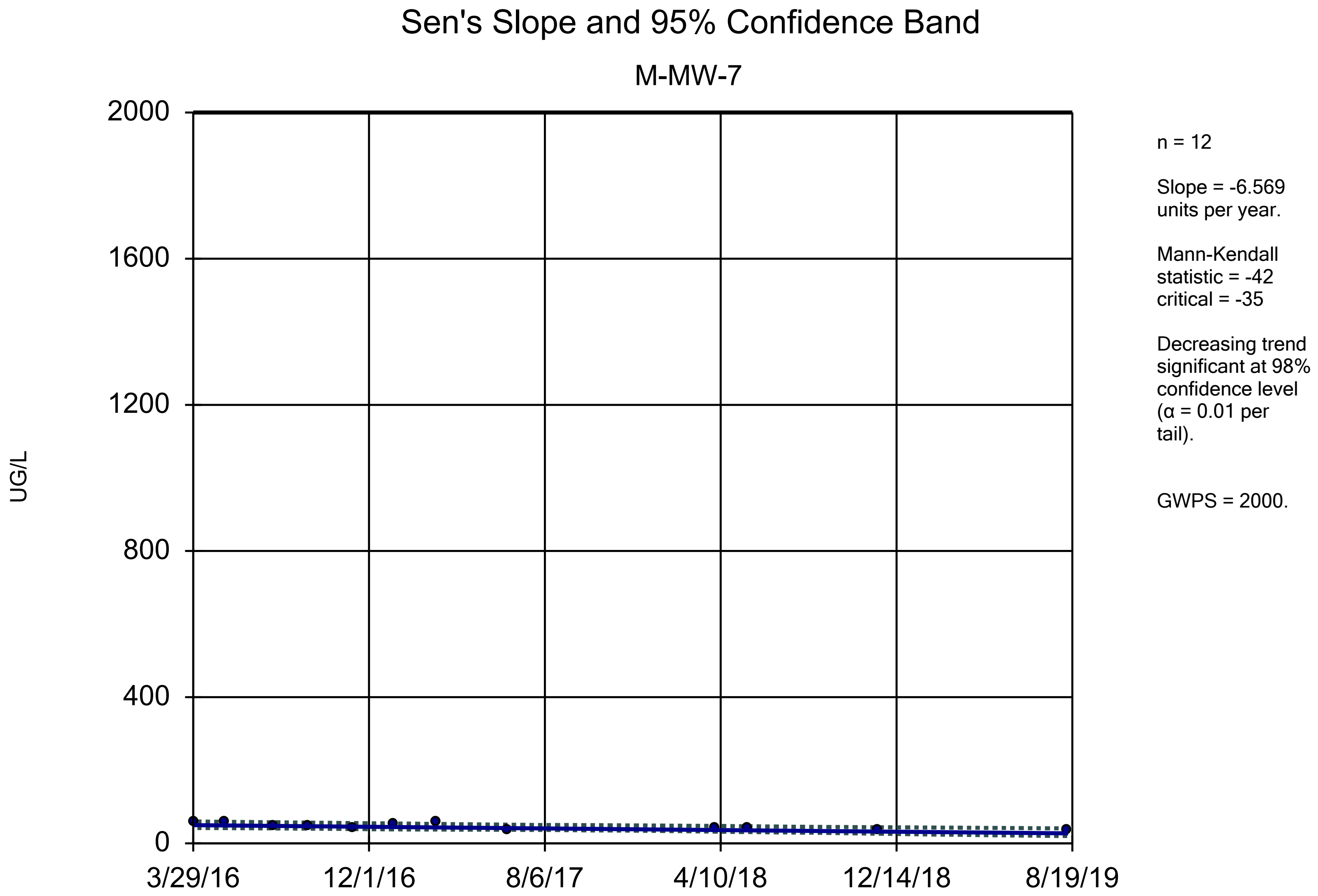
Mann-Kendall
statistic = -62
critical = -35

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 2000.

Constituent: BARIUM, TOTAL   Analysis Run 11/22/2019 8:10 AM

Meramec E.C.   Client: Ameren   Data: MEC Data



Constituent: BARIUM, TOTAL   Analysis Run 11/22/2019 8:10 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

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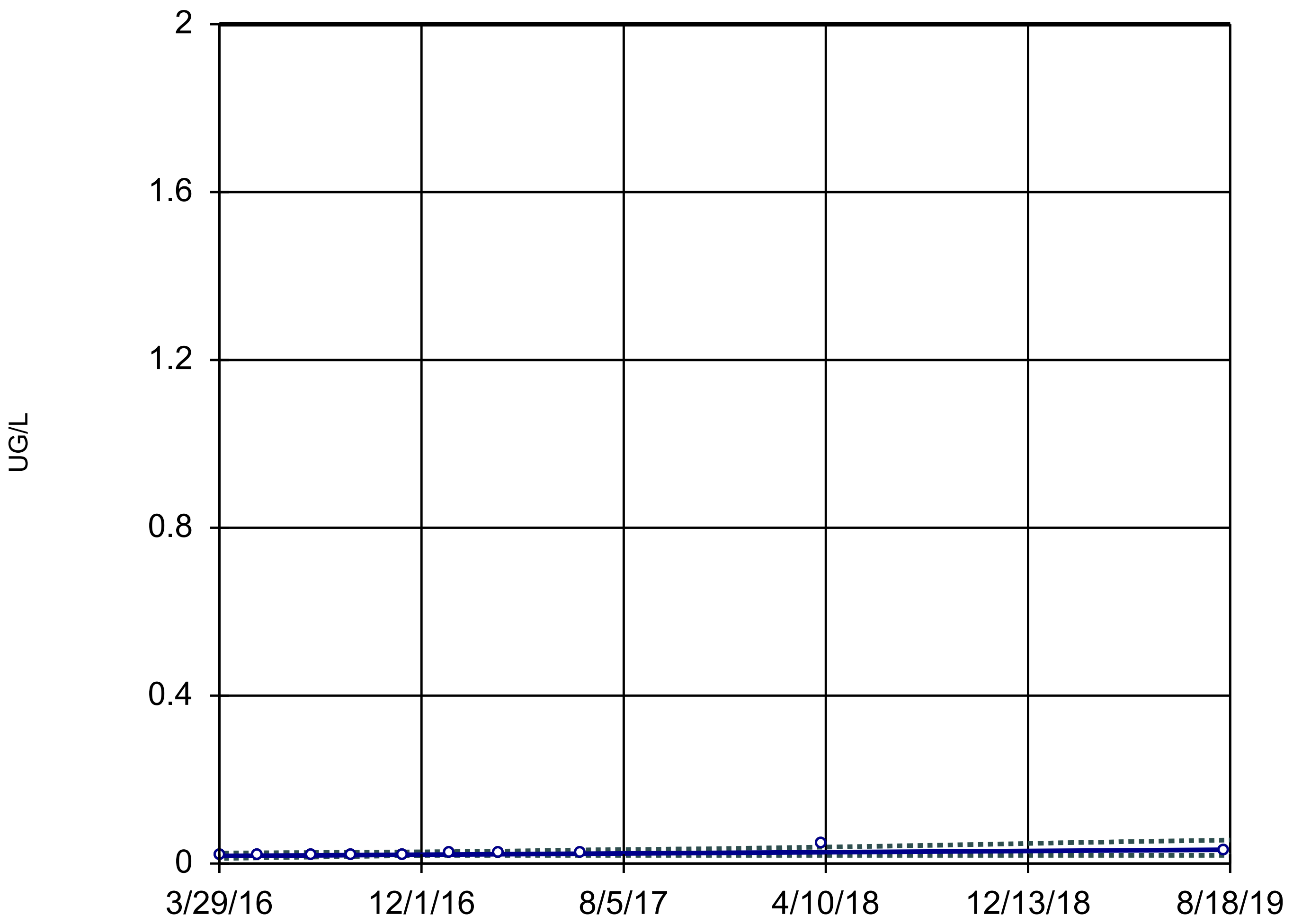
Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band



n = 10

Slope = 0.004331
units per year.

Mann-Kendall
statistic = 28
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 2.

Constituent: MERCURY, TOTAL   Analysis Run 11/22/2019 8:11 AM

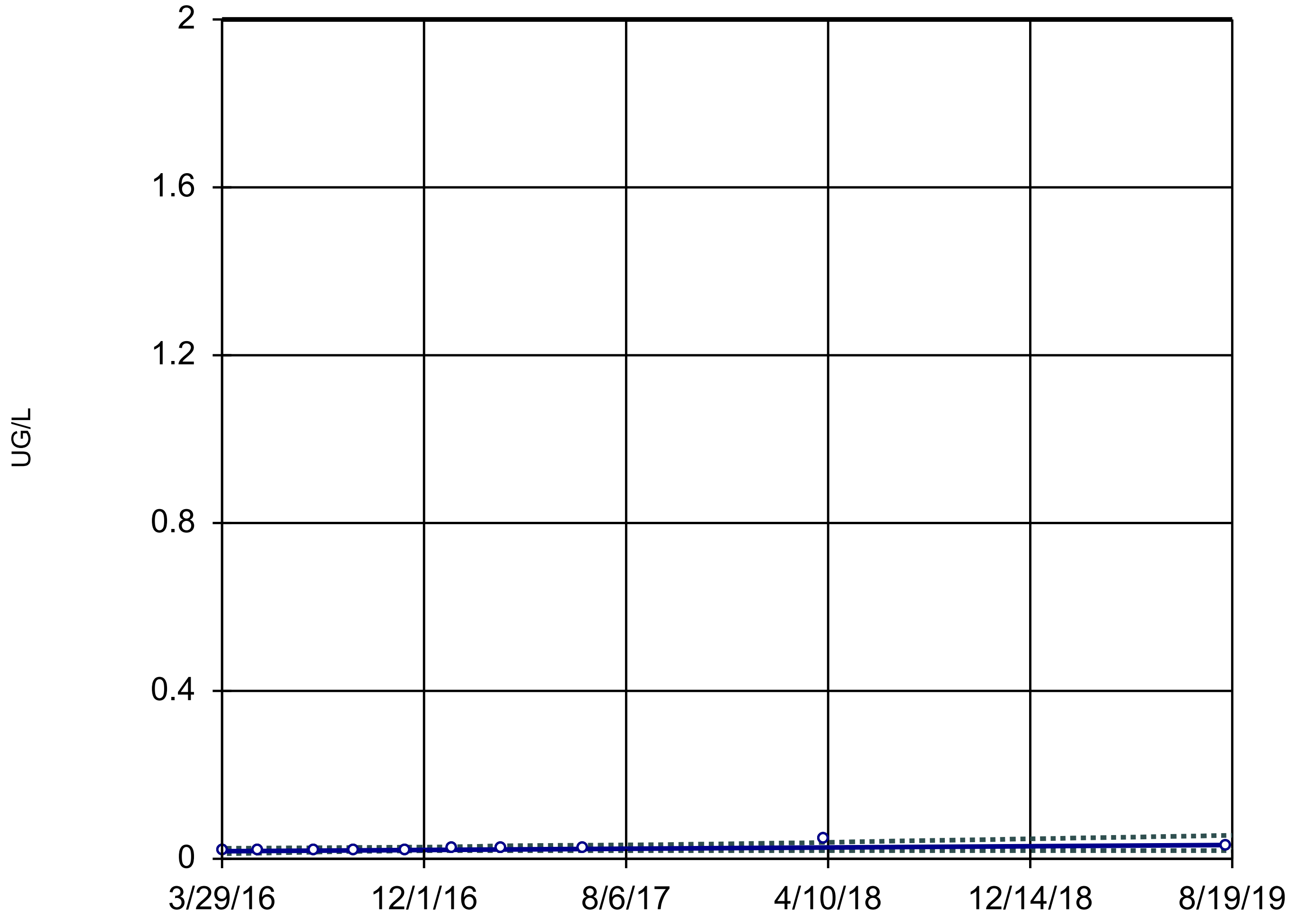
Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

M-MW-5



n = 10

Slope = 0.004287
units per year.

Mann-Kendall
statistic = 28
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 2.

Constituent: MERCURY, TOTAL   Analysis Run 11/22/2019 8:11 AM

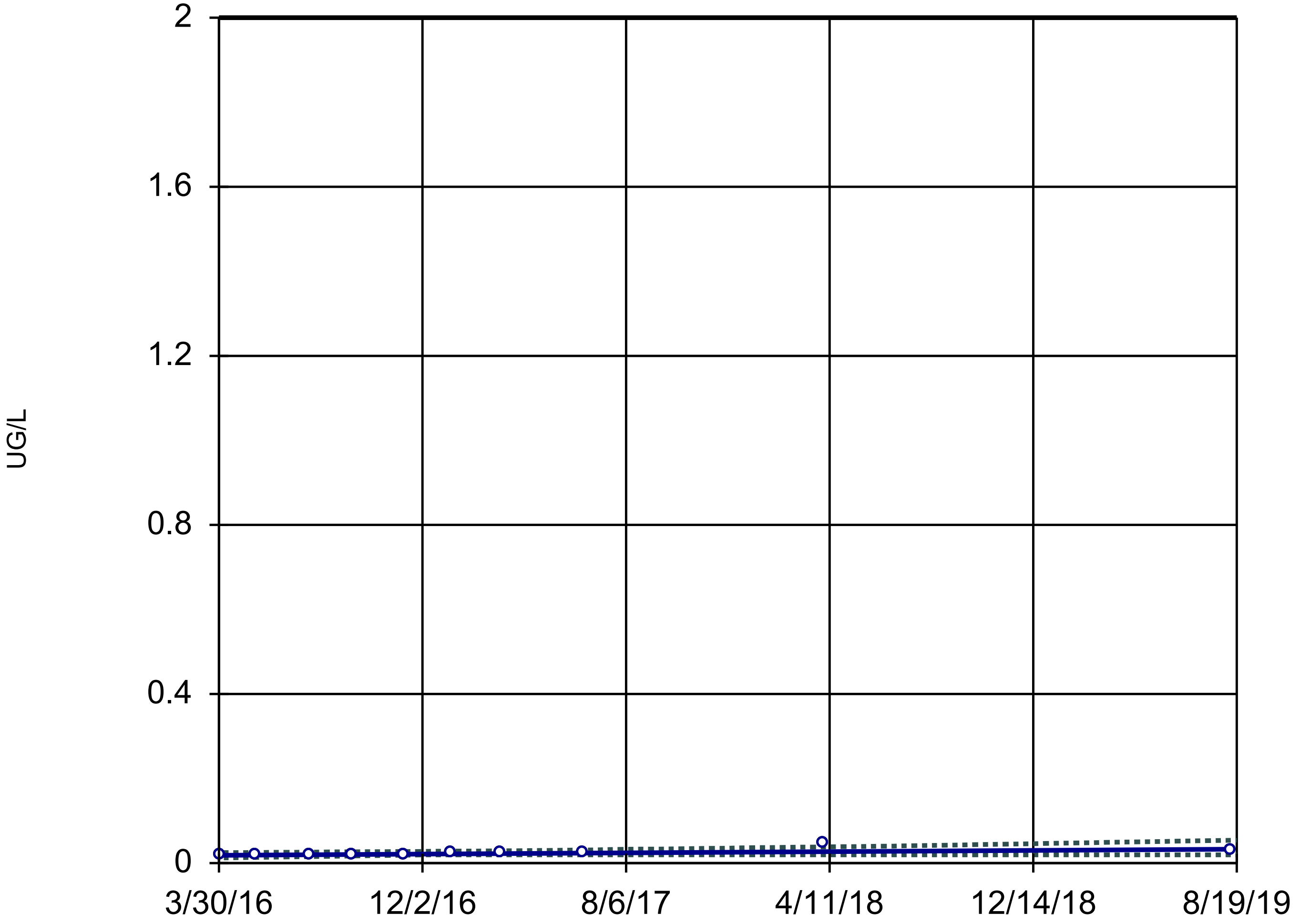
Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

M-MW-6



n = 10

Slope = 0.004287
units per year.

Mann-Kendall
statistic = 28
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 2.

Constituent: MERCURY, TOTAL Analysis Run 11/22/2019 8:11 AM

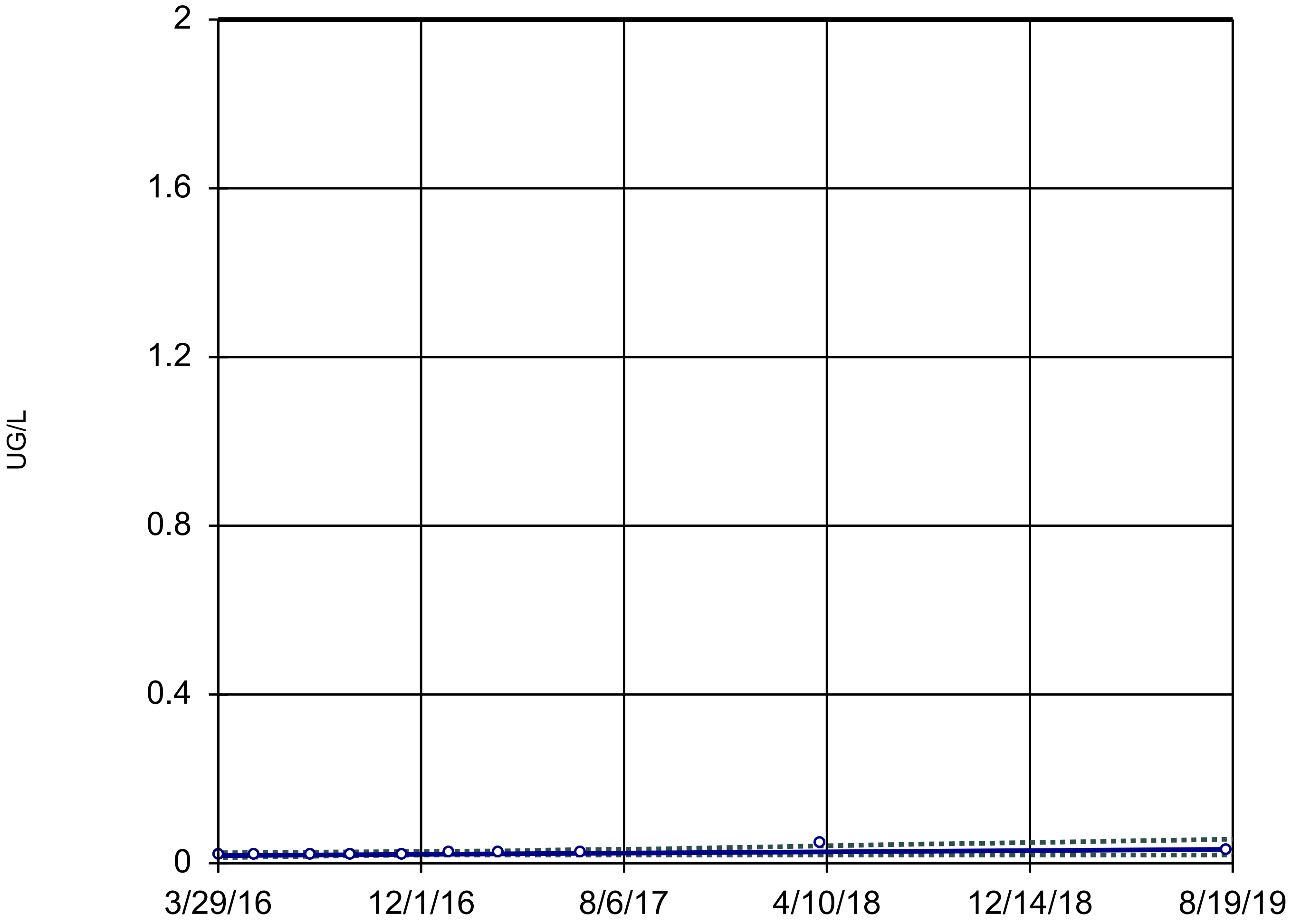
Meramec E.C. Client: Ameren Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

M-MW-7



n = 10

Slope = 0.004287
units per year.

Mann-Kendall
statistic = 28
critical = 27

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 2.

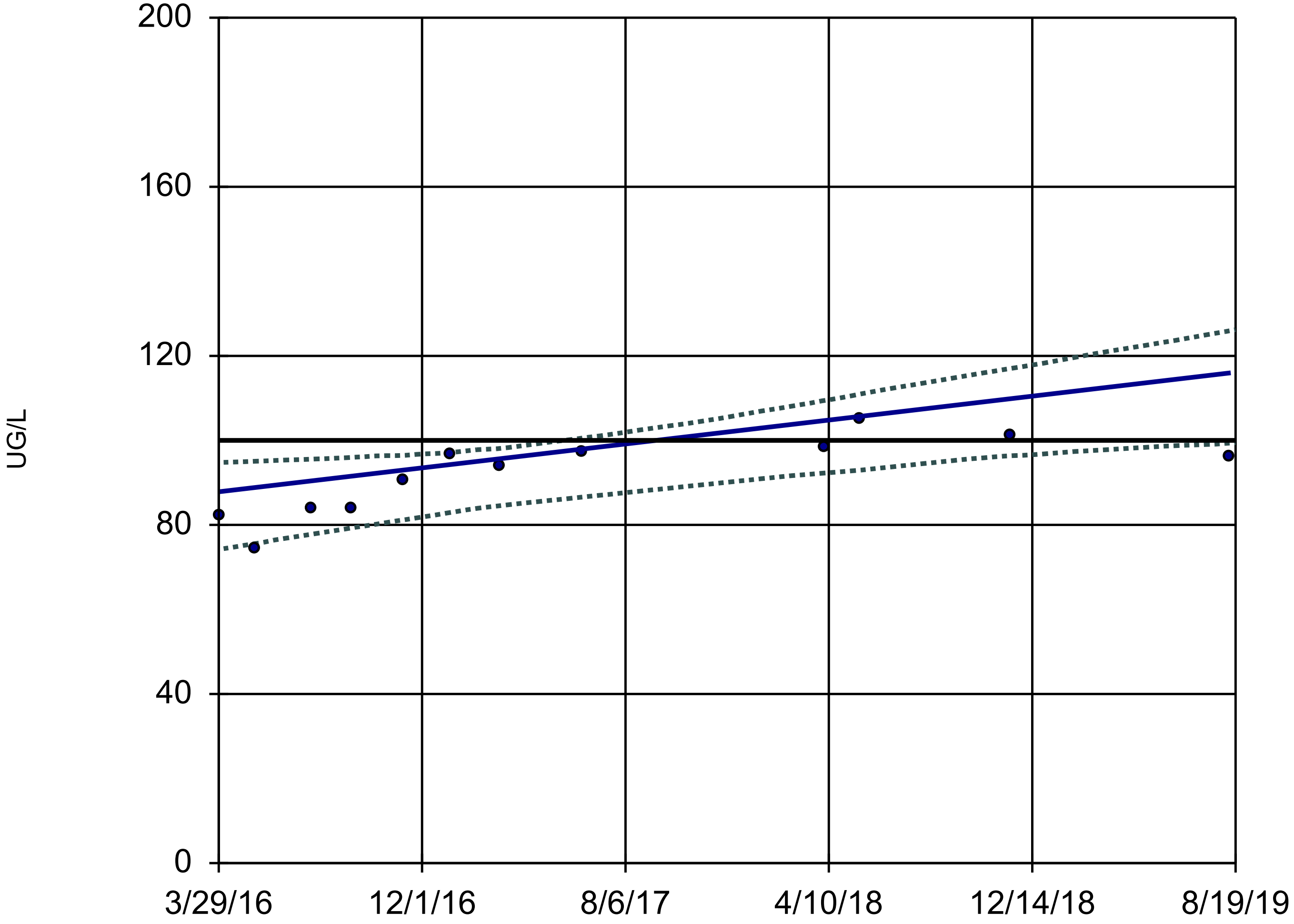
Constituent: MERCURY, TOTAL   Analysis Run 11/22/2019 8:11 AM

Meramec E.C.   Client: Ameren   Data: MEC Data

Sanitas™ v.9.6.23 For the statistical analyses of ground water by Golder Associates only. UG

Sen's Slope and 95% Confidence Band

M-MW-5



n = 12

Slope = 8.333
units per year.

Mann-Kendall
statistic = 48
critical = 35

Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

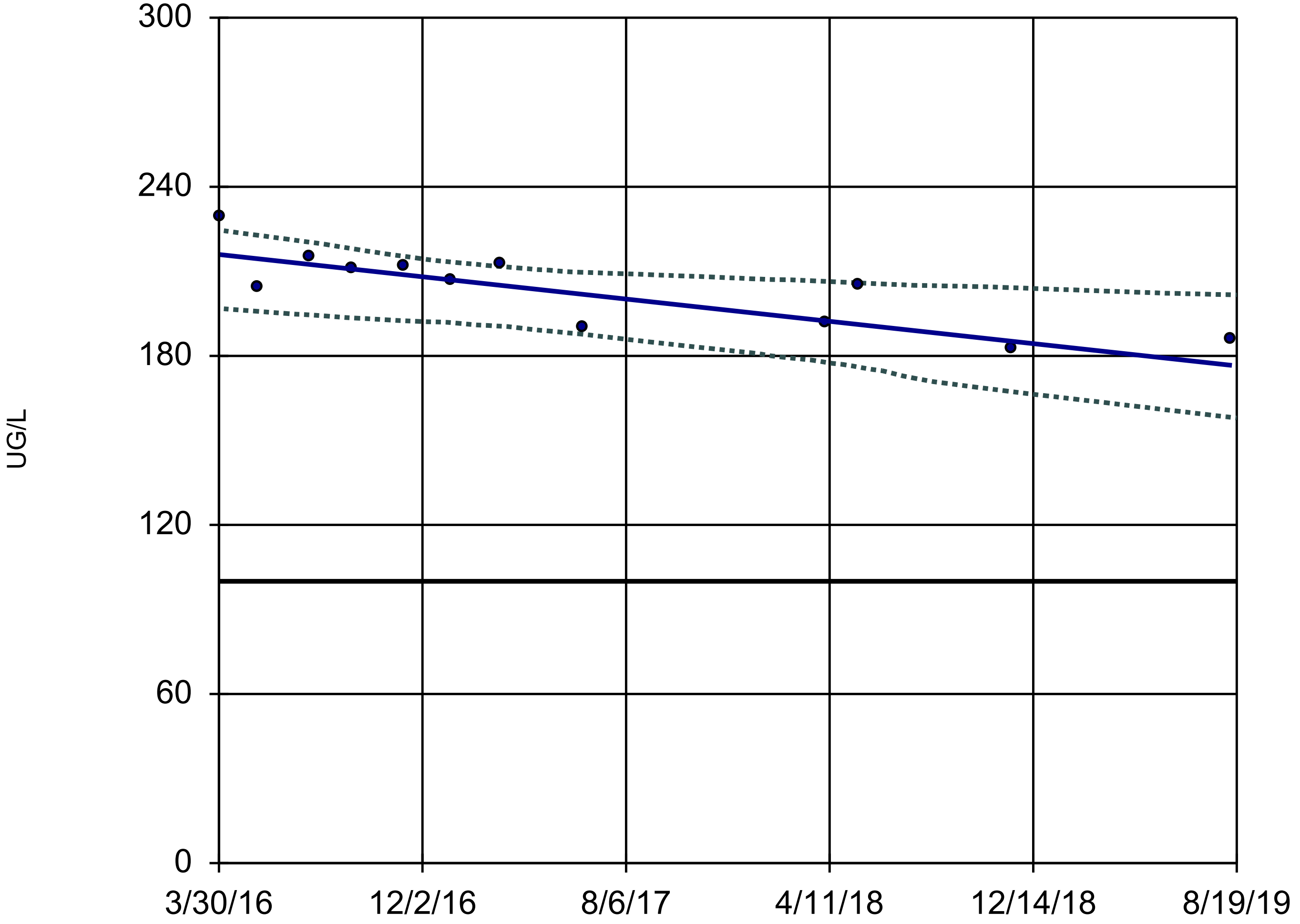
GWPS = 100.

Constituent: MOLYBDENUM, TOTAL Analysis Run 11/22/2019 8:11 AM

Meramec E.C. Client: Ameren Data: MEC Data

Sen's Slope and 95% Confidence Band

M-MW-8



n = 12

Slope = -11.66
units per year.

Mann-Kendall
statistic = -38
critical = -35

Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

GWPS = 100.

Constituent: MOLYBDENUM, TOTAL Analysis Run 11/22/2019 8:11 AM

Meramec E.C. Client: Ameren Data: MEC Data

Trend Test

Meramec E.C. Client: Ameren Data: MEC Data Printed 11/22/2019, 8:14 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
ANTIMONY, TOTAL (UG/L)	M-MW-1	0	6	20	No	8	75	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-2	0	3	27	No	10	90	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-3	0	3	27	No	10	90	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-4	0	-7	-27	No	10	90	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-5	0	-9	-27	No	10	90	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-6	0.002028	11	27	No	10	50	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-7	0	1	20	No	8	0	n/a	n/a	0.02	NP
ANTIMONY, TOTAL (UG/L)	M-MW-8	-0.01017	-12	-27	No	10	70	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-1	0.0199	7	31	No	11	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-2	0	0	35	No	12	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-3	0.4885	26	31	No	11	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-4	0.5069	29	31	No	11	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	**M-MW-5**	**1.361**	**30**	**27**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.02**	**NP**
ARSENIC, TOTAL (UG/L)	M-MW-6	-0.7116	-17	-31	No	11	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-7	0	2	35	No	12	0	n/a	n/a	0.02	NP
ARSENIC, TOTAL (UG/L)	M-MW-8	-0.106	-12	-31	No	11	0	n/a	n/a	0.02	NP
BARIUM, TOTAL (UG/L)	M-MW-1	-3.68	-19	-35	No	12	0	n/a	n/a	0.02	NP
BARIUM, TOTAL (UG/L)	**M-MW-2**	**-71.28**	**-46**	**-35**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.02**	**NP**
BARIUM, TOTAL (UG/L)	M-MW-3	-9.07	-17	-35	No	12	0	n/a	n/a	0.02	NP
BARIUM, TOTAL (UG/L)	M-MW-4	-7.17	-30	-35	No	12	0	n/a	n/a	0.02	NP
BARIUM, TOTAL (UG/L)	M-MW-5	-16.93	-10	-35	No	12	0	n/a	n/a	0.02	NP
BARIUM, TOTAL (UG/L)	**M-MW-6**	**-9.754**	**-62**	**-35**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.02**	**NP**
BARIUM, TOTAL (UG/L)	**M-MW-7**	**-6.569**	**-42**	**-35**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.02**	**NP**
BARIUM, TOTAL (UG/L)	M-MW-8	-21.48	-24	-35	No	12	0	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-1	0	0	27	No	10	80	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-2	-0.00...	-21	-27	No	10	100	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-3	-0.00...	-21	-27	No	10	100	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-4	0	-5	-27	No	10	70	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-5	-0.00...	-21	-27	No	10	100	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-6	-0.00...	-16	-23	No	9	100	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-7	-0.00...	-16	-23	No	9	100	n/a	n/a	0.02	NP
BERYLLIUM, TOTAL (UG/L)	M-MW-8	-0.00...	-21	-27	No	10	100	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-1	0	-4	-27	No	10	80	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-2	0	-9	-27	No	10	100	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-3	0	-4	-23	No	9	100	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-4	0	-4	-23	No	9	100	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-5	0	-6	-27	No	10	80	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-6	0.02103	21	27	No	10	60	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-7	0.1	23	27	No	10	20	n/a	n/a	0.02	NP
CADMIUM, TOTAL (UG/L)	M-MW-8	0	2	27	No	10	60	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-1	-0.1845	-19	-35	No	12	25	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-2	-0.05794	-9	-35	No	12	33.33	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-3	-0.1103	-18	-35	No	12	50	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-4	-0.1776	-27	-35	No	12	50	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-5	-0.06273	-15	-35	No	12	50	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-6	-0.02208	-11	-35	No	12	58.33	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-7	-0.09339	-11	-35	No	12	50	n/a	n/a	0.02	NP
CHROMIUM, TOTAL (UG/L)	M-MW-8	-0.04154	-13	-35	No	12	75	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-1	0.009294	23	23	No	9	100	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-2	0.006541	27	27	No	10	100	n/a	n/a	0.02	NP

Trend Test

Meramec E.C. Client: Ameren Data: MEC Data Printed 11/22/2019, 8:14 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
COBALT, TOTAL (UG/L)	M-MW-3	0.007866	7	27	No	10	60	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-4	0.006541	27	27	No	10	100	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-5	0.006541	27	27	No	10	100	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-6	1.708	16	27	No	10	0	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-7	0.009246	23	23	No	9	100	n/a	n/a	0.02	NP
COBALT, TOTAL (UG/L)	M-MW-8	0.006541	27	27	No	10	100	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-1	0	-1	-35	No	12	0	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-2	-0.00...	-12	-44	No	14	21.43	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-3	-0.01032	-15	-39	No	13	30.77	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-4	-0.01883	-23	-39	No	13	15.38	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-5	-0.00...	-12	-39	No	13	0	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-6	-0.00...	-4	-39	No	13	7.692	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-7	0.03515	20	48	No	15	0	n/a	n/a	0.02	NP
FLUORIDE, TOTAL (MG/L)	M-MW-8	0	-1	-35	No	12	0	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-1	0	-6	-27	No	10	80	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-2	-0.2669	-10	-27	No	10	60	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-3	0	14	27	No	10	90	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-4	0	-2	-27	No	10	80	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-5	-0.156	-13	-27	No	10	70	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-6	0	12	27	No	10	90	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-7	0.1322	13	27	No	10	80	n/a	n/a	0.02	NP
LEAD, TOTAL (UG/L)	M-MW-8	0	3	27	No	10	70	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-1	0	9	31	No	11	81.82	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-2	0.1592	9	31	No	11	36.36	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-3	-0.06827	-4	-31	No	11	36.36	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-4	0.04279	2	31	No	11	0	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-5	-0.7742	-5	-31	No	11	0	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-6	0.7573	7	27	No	10	0	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-7	3.293	7	31	No	11	0	n/a	n/a	0.02	NP
LITHIUM, TOTAL (UG/L)	M-MW-8	1.06	23	31	No	11	0	n/a	n/a	0.02	NP
MERCURY, TOTAL (UG/L)	M-MW-1	0.003996	18	27	No	10	90	n/a	n/a	0.02	NP
MERCURY, TOTAL (UG/L)	M-MW-2	0.004003	18	27	No	10	90	n/a	n/a	0.02	NP
MERCURY, TOTAL (UG/L)	M-MW-3	0.004003	18	27	No	10	90	n/a	n/a	0.02	NP
MERCURY, TOTAL (UG/L)	**M-MW-4**	**0.004331**	**28**	**27**	**Yes**	**10**	**100**	**n/a**	**n/a**	**0.02**	**NP**
MERCURY, TOTAL (UG/L)	**M-MW-5**	**0.004287**	**28**	**27**	**Yes**	**10**	**100**	**n/a**	**n/a**	**0.02**	**NP**
MERCURY, TOTAL (UG/L)	**M-MW-6**	**0.004287**	**28**	**27**	**Yes**	**10**	**100**	**n/a**	**n/a**	**0.02**	**NP**
MERCURY, TOTAL (UG/L)	**M-MW-7**	**0.004287**	**28**	**27**	**Yes**	**10**	**100**	**n/a**	**n/a**	**0.02**	**NP**
MERCURY, TOTAL (UG/L)	M-MW-8	0.004003	16	27	No	10	90	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	M-MW-1	0.116	26	35	No	12	91.67	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	M-MW-2	0.09732	16	35	No	12	75	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	M-MW-3	1.332	26	35	No	12	25	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	M-MW-4	0.6885	14	35	No	12	0	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	**M-MW-5**	**8.333**	**48**	**35**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.02**	**NP**
MOLYBDENUM, TOTAL (UG/L)	M-MW-6	0.5122	1	35	No	12	0	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	M-MW-7	39.5	14	35	No	12	0	n/a	n/a	0.02	NP
MOLYBDENUM, TOTAL (UG/L)	**M-MW-8**	**-11.66**	**-38**	**-35**	**Yes**	**12**	**0**	**n/a**	**n/a**	**0.02**	**NP**
Radium [226 + 228] (PCI/L)	M-MW-1	-0.0683	-25	-31	No	11	90.91	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-2	0.04024	14	35	No	12	66.67	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-3	0.1502	20	35	No	12	33.33	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-4	-0.03385	-10	-35	No	12	91.67	n/a	n/a	0.02	NP

Trend Test

Meramec E.C. Client: Ameren Data: MEC Data Printed 11/22/2019, 8:14 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Radium [226 + 228] (PCI/L)	M-MW-5	0.01531	2	35	No	12	50	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-6	-0.03362	-14	-35	No	12	100	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-7	0.01506	1	27	No	10	100	n/a	n/a	0.02	NP
Radium [226 + 228] (PCI/L)	M-MW-8	0.1018	12	35	No	12	75	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-1	0	5	27	No	10	80	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-2	0	-9	-27	No	10	90	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-3	0	-9	-27	No	10	90	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-4	0	-13	-27	No	10	90	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-5	-0.01461	-27	-27	No	10	100	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-6	-0.00...	-21	-27	No	10	90	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-7	0.2109	3	27	No	10	10	n/a	n/a	0.02	NP
SELENIUM, TOTAL (UG/L)	M-MW-8	0	-7	-23	No	9	88.89	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-1	-0.06523	-26	-27	No	10	80	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-2	-0.06186	-21	-27	No	10	100	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-3	-0.06191	-26	-27	No	10	80	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-4	-0.06186	-21	-27	No	10	100	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-5	-0.06165	-21	-27	No	10	100	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-6	-0.06534	-23	-27	No	10	90	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-7	-0.06165	-26	-27	No	10	70	n/a	n/a	0.02	NP
THALLIUM, TOTAL (UG/L)	M-MW-8	-0.06181	-21	-27	No	10	100	n/a	n/a	0.02	NP

APPENDIX E

Nature and Extent Technical Memorandum

Technical Memorandum

DATE January 2020 **Project No.** 153140601

TO Bill Kutosky
Ameren Missouri

CC Susan Knowles, Craig Giesmann, Charley Henderson, Paul Pike

FROM Jeffrey Ingram, Mark Haddock **EMAIL Jingram@Golder.com**

NATURE AND EXTENT INVESTIGATION, MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MISSOURI

Dear Mr. Kutosky,

Golder Associates Inc. (Golder) is pleased to submit this Technical Memorandum summarizing recent groundwater sampling and groundwater level measurements near the Ameren Missouri (Ameren) Meramec Energy Center (MEC) in St. Louis County, Missouri. This Technical Memorandum provides the groundwater sampling results and groundwater level measurement results from this ongoing investigation of Coal Combustion Residual (CCR) impacts from the MEC Surface Impoundments to groundwater. A figure displaying the locations of the monitoring wells used for this investigation is provided as **Figure 1**.

1.0 PROJECT SCOPE OF WORK

The scope of work for this investigation included the following:

- Collect multiple samples in the nature and extent monitoring network for CCR Rule constituents
- Complete multiple rounds of groundwater elevation measurements to produce potentiometric surface maps
- Tabulate sampling results and prepare a Technical Memorandum

2.0 GROUNDWATER SAMPLING

Groundwater sampling was completed in November 2018 and August 2019. Sampling was completed using low flow sampling techniques and guidelines as provided in the MEC Groundwater Monitoring Plan. Tables summarizing the analytical results are provided in **Tables 1** and **2**. Laboratory data report packets and data validation memos are included in the 2019 MEC Annual Report.

Samples were collected from four (4) piezometers that were previously installed onsite and were selected for nature and extent purposes. Well construction diagrams for these monitoring wells are provided in the 2018 Annual Report.

3.0 GROUNDWATER LEVEL MONITORING

Multiple rounds of water level measurements were collected from available monitoring wells. A table displaying the groundwater level monitoring results is provided in **Table 3.** Measurements were used to create site-wide

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potentiometric surface maps for evaluating groundwater flow direction. Potentiometric surface maps are provided in the 2018 and 2019 Annual Reports for the MEC.

4.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this letter report or need additional information, please contact the undersigned at 314-984-8800.

GOLDER ASSOCIATES INC.

Jeffrey S. Ingram

Mark N. Haddock

Jeffrey Ingram, R.G.
Project Geologist

Mark Haddock, P.E., R.G.
Principal, Practice Leader

JSI/MNH

Attachments or Enclosures:

Tables
Table 1 – Nature and Extent Groundwater Sampling Analytical Results – November 2018
Table 2 – Nature and Extent Groundwater Sampling Analytical Results – August 2019
Table 3 – Summary of Groundwater Elevation Monitoring Results

Figures
Figure 1 – Site Location Aerial Map and Monitoring Well and Piezometer Location Map

Tables

Table 1
Nature and Extent Groundwater Sampling Analytical Results - November 2018
Meramec Energy Center, St. Louis County, MO

Analyte	Units	Nature and Extent Piezometers			
		MW-9 (AMW-1)	MW-10 (AMW-2)	TP-1	TP-2
Field Parameters					
DATE	NA	11/20/2018	11/19/2018	11/20/2018	11/19/2018
DISSOLVED OXYGEN	mg/L	0.61	0.17	0.13	0.12
pH	SU	6.85	6.72	7.56	6.91
REDOX POTENTIAL	mV	137.8	32.9	-65.6	-77.6
SPECIFIC CONDUCTIVITY	mS/cm	1.04	1.04	0.59	1.55
TURBIDITY	NTU	1.26	4.42	4.05	3.52
Appendix III Parameters					
BORON, TOTAL	µg/L	7,690	1,980	640	2,550
CALCIUM, TOTAL	µg/L	170,000	190,000	77,100	217,000
CHLORIDE, TOTAL	mg/L	38.4	63.1	21.3	242
FLUORIDE, TOTAL	mg/L	0.19 J	0.30	0.30	0.36
SULFATE, TOTAL	mg/L	344	200	ND	475
TOTAL DISSOLVED SOLIDS	mg/L	319	941	404	1,450
Appendix IV Parameters					
ANTIMONY, TOTAL	µg/L	ND	ND	ND	ND
ARSENIC, TOTAL	µg/L	18.0	11.7	1.9	3.8
BARIUM, TOTAL	µg/L	325	147	386	58.8
BERYLLIUM, TOTAL	µg/L	ND	ND	ND	ND
CADMIUM, TOTAL	µg/L	ND	ND	0.039 J	ND
CHROMIUM, TOTAL	µg/L	0.19 J	0.23 J	0.17 J	ND
COBALT, TOTAL	µg/L	ND	ND	ND	ND
LEAD, TOTAL	µg/L	ND	ND	4.1 J	ND
LITHIUM, TOTAL	µg/L	16.4	36.0	17.2	42.7
MERCURY, TOTAL	µg/L	ND	ND	ND	ND
MOLYBDENUM, TOTAL	µg/L	39.1	4.3 J	3.1 J	6.2 J
RADIUM [226 + 228]	pCi/L	ND	1.488	-	-
SELENIUM, TOTAL	µg/L	ND	ND	ND	ND
THALLIUM, TOTAL	µg/L	ND	ND	ND	ND
Additional Parameters					
ALKALINITY	mg/L	365	525	387	403
IRON, FERRIC, TOTAL	mg/L	14.7	13.9	6.5 J	13.8
IRON, FERROUS, TOTAL	mg/L	4.7 J	2.4 J	1.9 J	2.1 J
IRON, TOTAL	µg/L	19,400	16,300	8,420	15,900
MAGNESIUM, TOTAL	µg/L	56,900	47,700	31,300	56,200
MANGANESE, TOTAL	µg/L	513	704	110	578
PHOSPHORUS, TOTAL	mg/L	1.1	0.69	0.58	0.68
POTASSIUM, TOTAL	µg/L	5,340	7,780	3,160	7,890
SODIUM, TOTAL	µg/L	45,400	49,000	44,900	167,000

Notes:
1) Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - Standard Units, mV - millivolts mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit, pCi/L - picoCuries per liter.
2) " - " Not sampled.
3) J - Result is an estimated value.
4) ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect.
5) NA - Not Applicable.
6) Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.

Created By: EMS
Checked By: KAB
Reviewed By: CMR

Table 2
Nature and Extent Groundwater Sampling Analytical Results - August 2019
Meramec Energy Center, St. Louis County, MO

Analyte	Units	Nature and Extent	
		TP-1	TP-2
Field Parameters			
DATE	NA	8/14/2019	8/13/2019
DISSOLVED OXYGEN	mg/L	0.21	0.13
pH	SU	7.31	7.01
REDOX POTENTIAL	mV	-179.0	-99.5
SPECIFIC CONDUCTIVITY	mS/cm	0.760	2.156
TURBIDITY	NTU	4.94	3.35
Appendix III Parameters			
BORON, TOTAL	µg/L	558	2,410
CALCIUM, TOTAL	µg/L	69,800	221,000 J
CHLORIDE, TOTAL	mg/L	20.2	271
FLUORIDE, TOTAL	mg/L	0.25	0.47
SULFATE, TOTAL	mg/L	ND	456
TOTAL DISSOLVED SOLIDS	mg/L	440	1,630
Appendix IV Parameters			
ANTIMONY, TOTAL	µg/L	ND	ND
ARSENIC, TOTAL	µg/L	14.3	4.0
BARIUM, TOTAL	µg/L	346	64.6
BERYLLIUM, TOTAL	µg/L	ND	ND
CADMIUM, TOTAL	µg/L	ND	ND
CHROMIUM, TOTAL	µg/L	4.2	0.084 J
COBALT, TOTAL	µg/L	ND	ND
LEAD, TOTAL	µg/L	ND	ND
LITHIUM, TOTAL	µg/L	10.5	43.3
MERCURY, TOTAL	µg/L	ND	ND
MOLYBDENUM, TOTAL	µg/L	ND	107
RADIUM [226 + 228]	pCi/L	ND	ND
SELENIUM, TOTAL	µg/L	ND	ND
THALLIUM, TOTAL	µg/L	ND	ND
Additional Parameters			
ALKALINITY	mg/L	386	392
IRON, TOTAL	µg/L	4,930	15,900
MAGNESIUM, TOTAL	µg/L	30,400	62,400
MANGANESE, TOTAL	µg/L	71.8	584
POTASSIUM, TOTAL	µg/L	2,940	8,230
SODIUM, TOTAL	µg/L	40,000	196,000 J

Notes:

1) Unit Abbreviations: µg/L - micrograms per liter, mg/L - milligrams per liter, SU - Standard Units, mV - millivolts mS/cm - millisiemens per centimeter, NTU - nephelometric turbidity unit, pCi/L - picoCuries per liter.
2) J - Result is an estimated value.
3) ND - Constituent was analyzed for, but was not detected above the Method Detection Limit (MDL) and is considered a non-detect.
4) NA - Not Applicable.
5) Radium [226 + 228] is reported as the sum of Radium 226 and Radium 228 activity concentrations unless the sum of Radium 226 and Radium 228 Minimum Detectable Concentrations (MDC) is higher in which case it is displayed as ND.

Created By: EMS
Checked By: KAB
Reviewed By: CMR

Table 3
Summary of Groundwater Elevation Monitoring Results
Meramec Energy Center, St. Louis County, MO

	Well ID	Location		Top of Casing	Ground Surface	Groundwater Elevation Measurements 11/19/2018		Groundwater Elevation Measurements 1/9/2019		Groundwater Elevation Measurements 1/28/2019		Groundwater Elevation Measurements 2/26/2019		Groundwater Elevation Measurements 8/12/2019		Groundwater Elevation Measurements 10/3/2019	
		Northing	Easting	FT MSL[4]	FT MSL[4]	DTW[2]	GWE[3]	DTW[2]	GWE[3]	DTW[2]	GWE[3]	DTW[2]	GWE[3]	DTW[2]	GWE[3]	DTW[2]	GWE[3]
CCR Rule Groundwater Monitoring Wells	MW-1	937676.9	865954.1	406.43	404.10	3.96	402.47	3.66	402.77	3.72	402.71	3.59	402.84	2.54	403.89	1.18	405.25
	MW-2	937325.1	864864.5	398.62	396.13	9.54	389.08	10.97	387.65	16.71	381.91	6.86	391.76	9.65	388.97	NC	NC
	MW-3	936750.8	864447.2	397.12	394.63	8.03	389.09	9.44	387.68	15.18	381.94	5.45	391.67	8.02	389.10	NC	NC
	MW-4	935618.0	864629.8	404.10	402.03	14.87	389.23	16.23	387.87	21.70	382.40	12.64	391.46	14.80	389.30	5.54	398.56
	MW-5	934874.4	864781.0	402.93	400.83	13.54	389.39	14.82	388.11	20.17	382.76	11.50	391.43	13.44	389.49	4.55	398.38
	MW-6	933905.2	865153.5	418.12	415.84	28.52	389.60	29.56	388.56	34.59	383.53	27.23	390.89	28.47	389.65	20.22	397.90
	MW-7	934334.4	866242.5	417.94	415.67	28.53	389.41	29.55	388.39	34.24	383.70	27.01	390.93	28.41	389.53	20.17	397.77
	MW-8	935303.6	866797.8	423.37	421.03	33.37	390.00	34.46	388.91	39.42	383.95	31.71	391.66	33.04	390.33	24.80	398.57
	BMW-1	935220.4	867989.4	419.08	416.79	24.64	394.44	25.72	393.36	28.90	390.18	24.21	394.87	24.71	394.37	20.64	398.44
	BMW-2	937927.1	866342.2	409.02	406.80	12.82	396.20	12.11	396.91	12.44	396.58	12.34	396.68	11.52	397.50	10.30	398.72
	MW-9 (AMW-1)	935106.5	864425.3	393.71	391.12	4.40	389.31	5.75	387.96	11.32	382.39	NC	NC	4.01	389.70	NC	NC
	MW-10 (AMW-2)	934137.4	867158.9	405.62	402.83	16.49	389.13	17.93	387.69	23.53	382.09	13.94	391.68	16.00	389.62	6.83	398.79
Nature and Extent Wells	TP-1	935109.7	864437.0	393.71	390.68	4.14	389.57	5.28	388.43	10.40	383.31	NC	NC	3.90	389.81	NC	NC
	TP-2	934151.5	867171.1	405.22	402.35	16.03	389.19	17.47	387.75	23.07	382.15	13.57	391.65	15.53	389.69	6.47	398.75
Groundwater Elevation Piezometers	BMW-3	938110.9	865000.6	396.16	393.45	NA	NA	NA	NA	14.26	381.90	4.44	391.72	7.10	389.06	NC	NC
	BMW-4	938425.9	864543.5	396.34	393.52	NA	NA	NA	NA	14.52	381.82	4.02	392.32	7.27	389.07	NC	NC
	BMW-5	938750.3	864082.0	402.05	399.53	NA	NA	NA	NA	20.37	381.68	9.61	392.44	13.00	389.05	NC	NC
River Level	Mississippi	934893.5	868520.6	NA	NA	NA	389.35	NA	388.04	NA	381.93	NA	392.75	NA	389.88	NC	399.62

Notes:

1.) Mississippi River Level is provided by Ameren.

2.) DTW - Depth to water measured in feet below top of casing.

3.) GWE - Groundwater elevation measured in feet above mean sea level.

4.) MSL - Feet above mean sea level.

5.) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone feet.

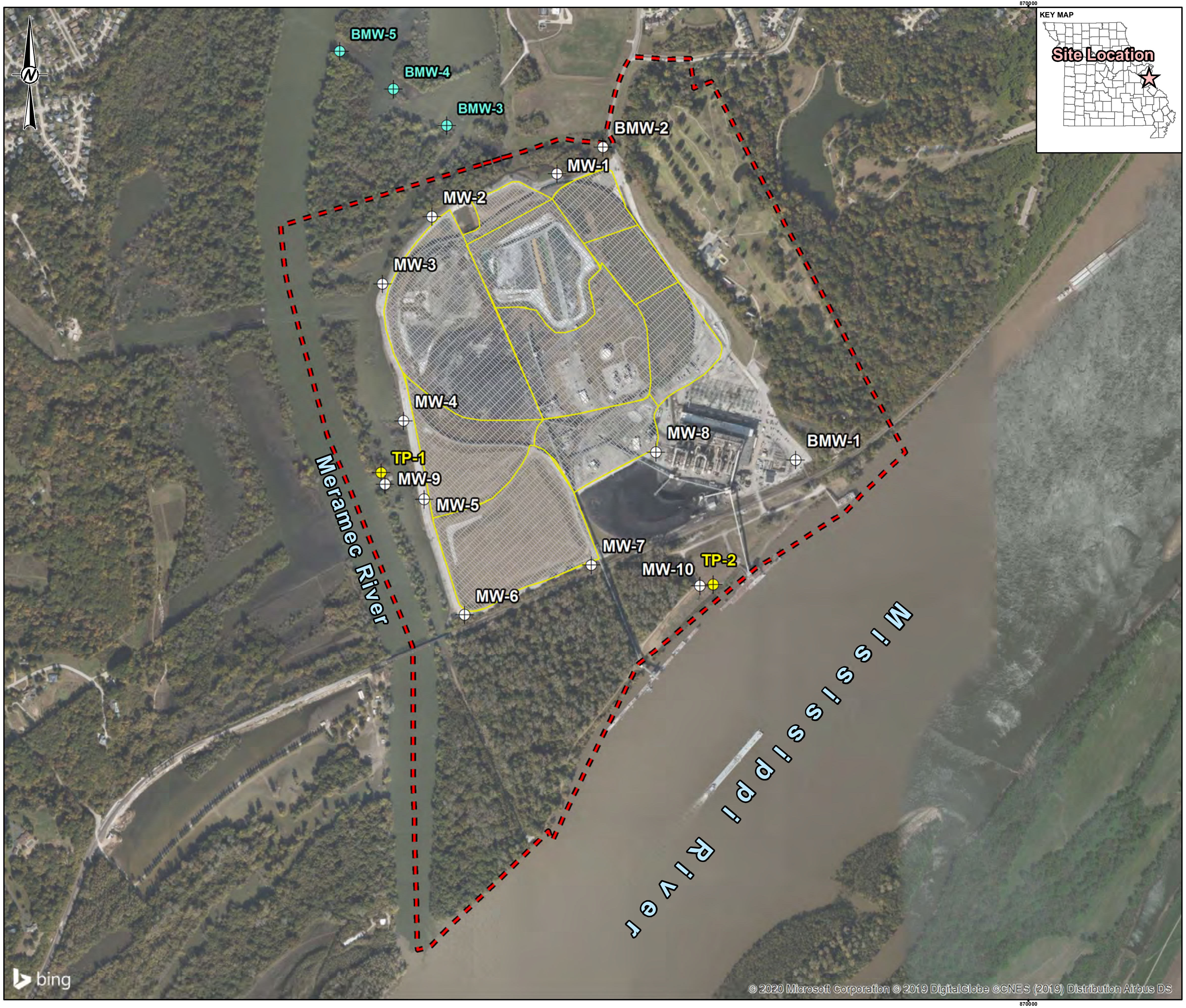
6.) Vertical Datum: NAVD88 feet.

7.) NA - Not Applicable.

8.) NC - Not collected due to flooding conditions.

Created By: EMS
Checked By: TJG
Reviewed By: CMR

Figures



LEGEND

▬ ▬	Meramec Energy Center Property Boundary
▨	Meramec Surface Impoundments

Monitoring Well/Piezometer Locations

⊕	CCR Rule Monitoring Well
⊕	Nature and Extent Piezometer
⊕	Groundwater Elevation Piezometer

0 500 1,000 1,500 2,000 2,500
Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.

2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION AERIAL MAP AND MONITORING WELL AND PIEZOMETER LOCATION MAP

CONSULTANT

YYYY-MM-DD	2020-01-22
DESIGNED	JSI
PREPARED	EMS
REVIEWED	TJG
APPROVED	CMR

PROJECT NO.	REV.	FIGURE
153140601	0	1

PATH: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 Annual Report\Figure 1 - Monitoring Well Location Map NE.mxd PRINTED ON: 2020-01-29 AT: 10:24:46 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
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APPENDIX F

2019 Potentiometric Surface Maps

LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

= = = Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - JANUARY 9, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2018-12-21
PREPARED	RJF
DESIGN	JSI
REVIEW	KAB
APPROVED	MNH

PROJECT No.	PHASE	FIGURE
153-140601	0004	P1

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\Jan Pot Map UPDATED 1-09-2019 (2).mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

Groundwater Elevation Contour (FT MSL)

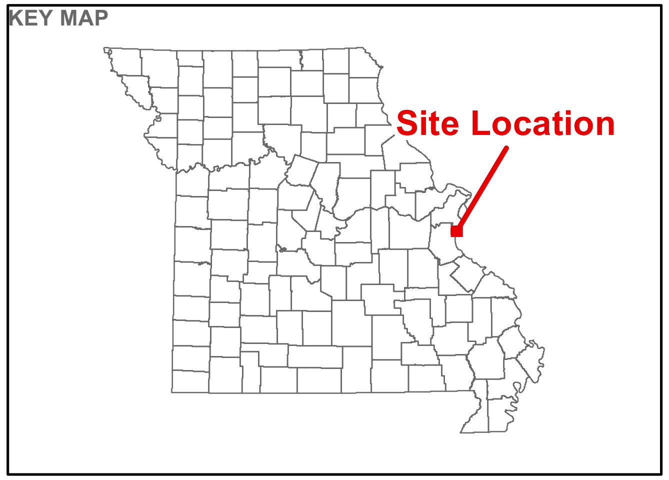
Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP JANUARY 28, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2020-01-29
PREPARED	EMS
DESIGN	JSI
REVIEW	TJG
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004D	0.0	**P2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 BMW Pot Maps\Pot Map Draft MEC 01-31-2019 (3).mxd

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- 🟨 All Surface Impoundments

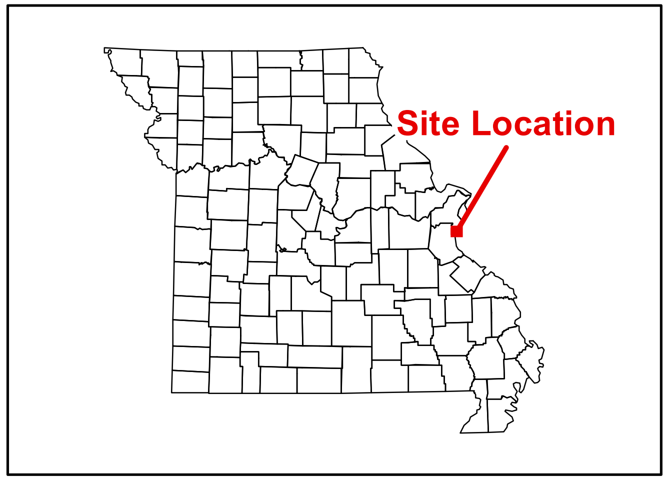
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ● Mississippi River Gauge
- ↖ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.
7. MW-9 (AMW-1) AND TP-1 ACCESS BLOCKED DUE TO HIGH WATER, NO GROUNDWATER ELEVATION DATA RECORDED.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - FEBRUARY 26, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2020-01-29
PREPARED	EMS
DESIGN	JSI
REVIEW	RJF/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	**P3**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019-02-19 Map for XDD\2019-02-26 Pot Map\Pot Map Draft MEC 2019-02-26 (1).mxd

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LEGEND

- 🟥 Meramec Energy Center Property Boundary
- 🟨 All Surface Impoundments

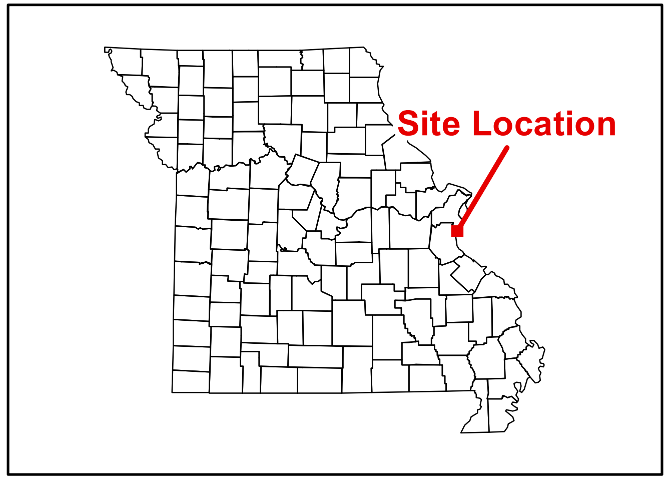
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ● Mississippi River Gauge
- ➔ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - AUGUST 12, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2019-08-29
PREPARED	JSI
DESIGN	JSI
REVIEW	KAB/EMS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	**P4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

0 1 in

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-08 - Pot Map.mxd

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ☐ All Surface Impoundments

Groundwater Elevation Contours

- ━ Groundwater Elevation Contour (FT MSL)
- ‒ ‒ Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⊕ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- ↖ Groundwater Flow Direction

KEY MAP

NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATION MEASUREMNTS COULD NOT BE COLLECTED AT MW-2, MW-3, MW-9 (AMW-1), BMW-3, BMW-4, AND BMW-5 DUE TO FLOODING.
6. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
7. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - OCTOBER 3, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2019-10-18
PREPARED	AMM
DESIGN	JSI
REVIEW	RJF
APPROVED	MNH

PROJECT No.	PHASE	FIGURE
153-140601	0004	P5

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-10-03 - Pot Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

- - Inferred Groundwater Elevation Contour (FT MSL)

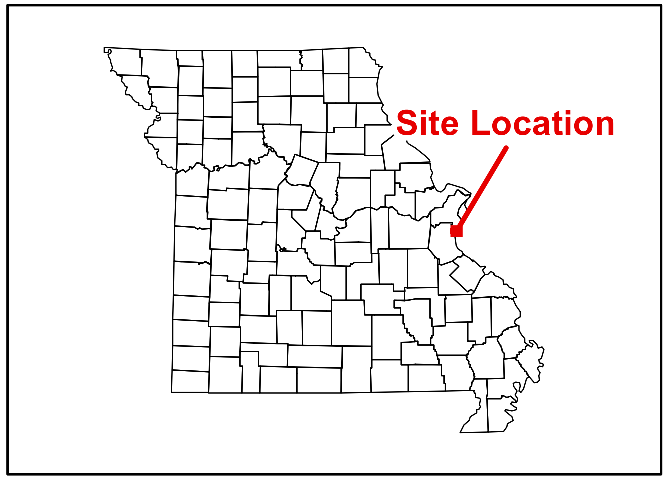
Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well

● Mississippi River Gauge

↖ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.
7. MW-9 (AMW-1) ACCESS BLOCKED DUE TO HIGH WATER, NO GROUNDWATER ELEVATION DATA RECORDED.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000 1,500 2,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - NOVEMBER 18, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-22
PREPARED	AMM
DESIGN	JSI
REVIEW	BTT
APPROVED	CMR

PROJECT No.	PHASE	FIGURE
153-140601	0004	P6

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GOLDER

golder.com

Attachment 7

Corrective Measures Assessment Report

HALEY ALDRICH

www.haleyaldrich.com

CORRECTIVE MEASURES ASSESSMENT
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

by
Haley & Aldrich, Inc.
Cleveland, Ohio

for
Ameren Missouri
St. Louis, Missouri

May 2019

Overview

This Corrective Measures Assessment (CMA) was prepared by Haley & Aldrich, Inc. (Haley & Aldrich) for Union Electric Company d/b/a Ameren Missouri (Ameren) to evaluate five regulated Coal Combustion Residual (CCR) surface impoundments (CCR Units) located at the Ameren Meramec Energy Center (MEC) located in St. Louis County, Missouri. The CMA was completed in accordance with requirements stated in the U.S. Environmental Protection Agency's (USEPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36435 (July 30, 2018) (amending 40 CFR §257.61) (CCR Rule).

Ameren implemented groundwater monitoring under the CCR Rule through a phased approach to allow for a graduated response and evaluation of steps to address groundwater quality associated with the CCR Units. Assessment monitoring completed in 2018 evaluated the presence and concentration of constituents in groundwater specified in the CCR Rule (i.e. Appendix IV). Of the CCR 23 parameters evaluated, only three constituents of concern (COC), arsenic, lithium and molybdenum, exceeded the Groundwater Protection Standards (GWPS) established for the MEC in a very limited number of wells and to a limited extent. More specifically, arsenic excursions occur in only two wells; lithium in only one well and molybdenum in only three wells. As described in **Section 3.3.1**, 95% of Appendix IV parameters tested complied with CCR Rule requirements.

Ameren completed a detailed environmental evaluation of the regulated surface impoundments and surrounding area, including voluntary, supplemental surface water sampling. In 2018, risk evaluations were undertaken to identify whether current groundwater conditions pose an unacceptable risk to human health and the environment, and whether corrective measures mitigate such an unacceptable risk, if present. The risk evaluations concluded that there are **no adverse effects on human health or the environment currently or under reasonably anticipated future uses** from either surface water or groundwater due to CCR management practices at MEC.

In performing this CMA, Haley & Aldrich considered the following: presence and distribution of arsenic, lithium and molybdenum, site configuration, hydrogeologic setting, and the results of the detailed risk evaluation. CCR is managed in impoundments that extend to a depth of approximately 30 feet (ft) below ground surface (bgs). Groundwater within the Meramec and Mississippi River valley alluvium ranges in thickness from not present (zero thickness) at the aquifer pinch-out along the bedrock bluff to the northeast of the MEC, up to greater than 95 ft thick where the bedrock surface has been eroded by the Meramec and Mississippi Rivers. Although groundwater flow direction is influenced by elevation changes of surface water in the Mississippi and Meramec Rivers, groundwater generally/predominantly flows to the southwest, flowing from the bluffs toward the rivers.

To provide a comprehensive CMA, this effort included four CCR Unit closure and groundwater remediation alternatives, including:

- Alternative 1: Closure in place (CIP) with low permeability capping and monitored natural attenuation (MNA);
- Alternative 2: CIP with low permeability capping and in-situ groundwater treatment;
- Alternative 3: CIP with low permeability capping, hydraulic containment (HC) of groundwater, and ex-situ groundwater treatment; and

- Alternative 4: Closure by removal (CBR) with MNA.

These four alternatives were evaluated based on the threshold criteria provided in the CCR Rule and then compared to three of the four balancing criteria stated in the CCR Rule. The four balancing criteria consider:

1. The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
2. The effectiveness of the remedy in controlling the source to reduce further releases;
3. The ease or difficulty of implementing a potential remedy; and
4. The degree to which community concerns are addressed by a potential remedy.

Balancing criteria four, which considers community concerns, will be evaluated following a public information session scheduled for May 2019.

The following observations are made regarding closure scenarios and groundwater remedial alternatives for the CCR Units and are described more fully in this report:

- **Cap Integrity and Hydrogeologic Conditions:** For all CIP alternatives, Ameren intends to install a geomembrane cap and cover system that exceeds by two orders-of-magnitude the performance criteria set forth in the CCR Rule and is referred to in this CMA as a "low permeability cap." Vertical infiltration via precipitation is virtually eliminated following installation of the geomembrane cover system. The CCR Units are situated **above** the groundwater table during normal river conditions which could account for such limited groundwater impacts notwithstanding the MEC's 65 years of operation.

- **No Risk:** Risk assessment evaluations confirm that the CCR Units, even prior to closure, present **no unacceptable risk** to human health or the environment. In fact, concentration levels of arsenic, lithium and molybdenum would need to be **more than 600, more than 24,000 and more than 13,000 times higher**, respectively, than currently measured levels before an adverse impact in the Mississippi River could occur. Therefore, since no adverse risk currently exists, implementation of any of the remedies considered will not result in a meaningful reduction in risk.

- **Groundwater Compliance:** Post-closure, and based on the outcome of geochemical attenuation modeling, concentration levels for lithium and molybdenum are predicted to reduce below GWPS within five years following in situ treatment (See **Figures 4-2, 4-3 and 4-4),** with arsenic reduction modeled to occur in 11 years. Ameren has retained XDD Environmental (XDD) to evaluate and develop in-situ groundwater treatment methods to address arsenic, lithium and molybdenum.

- **Excavation Timeframe:** As described in an Extraction & Transportation Study prepared by the Lochmueller Group, removal of large volumes of CCR stored at the MEC creates extensive logistical challenges – including excavation, transportation, and disposal, and could take decades to complete during which time the impoundments would remain open and would be subject to ongoing infiltration from precipitation.

- **Groundwater Treatment:** Laboratory testing performed by XDD indicates that through modifications to groundwater pH, arsenic concentrations can decrease to below action levels earlier than the modeled estimates. Bench-scale testing and in-situ treatment evaluations are ongoing and will be completed this summer.

In accordance with §257.98, Ameren will implement a groundwater monitoring program to document the effectiveness of the selected remedial alternative. Corrective measures are considered complete when monitoring reflects groundwater downgradient of the CCR Units does not exceed the Appendix IV GWPS for three consecutive years. USEPA is in the process of modifying certain CCR Rule requirements and, depending upon the nature of such changes, assessments made herein could be modified or supplemented to reflect such future regulatory revisions. See *Federal Register (March 15, 2018; 83 FR 11584*).

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List of Acronyms and Abbreviations

Ameren	Ameren Missouri
AMSL	Above Mean Sea Level
bgs	Below Ground Surface
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
CBR	Closure by Removal
CCR	Coal Combustion Residuals
CIP	Closure In-Place
CMA	Corrective Measures Assessment
cm/sec	Centimeters per Second
COC	Constituents of Concern
CSM	Conceptual Site Model
ft	Feet
Golder	Golder Associates Inc.
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standards
Haley & Aldrich	Haley & Aldrich, Inc.
HC	Hydraulic Containment
Lochmueller	Lochmueller Group
MM CY	Million Cubic Yards
MEC	Meramec Energy Center
MSD	Metropolitan Sewer District
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
MNA	Monitored Natural Attenuation
N&E	Nature and Extent
NAS	U.S. National Academy of Sciences
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
ppm	Parts per Million
PRB	Permeable Reactive Barrier
RDA	Recommended Daily Allowance
RO	Reverse Osmosis
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
ug/L	Micrograms per liter
UL	Tolerable Upper Limit
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
XDD	XDD Environmental

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this Corrective Measures Assessment (CMA) for the Coal Combustion Residual (CCR) surface impoundments (CCR Units) located at the Ameren Missouri (Ameren) Meramec Energy Center (MEC) located in St. Louis County, Missouri. Ameren has conducted detailed geologic and hydrogeologic investigations under the USEPA rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36435 (July 30, 2018) (amending 40 CFR §257.61) (CCR Rule). These investigations were, in part, related to determination of requirements related to the potential for both closure and groundwater corrective action.

This CMA includes a summary of the results of groundwater and site investigations at the MEC. Groundwater impacted by the surface impoundments exceeds statistically-derived GWPS for only three constituents: arsenic, lithium and molybdenum at only five monitoring locations. Of these parameters, USEPA has developed drinking water standards only for arsenic. This report evaluates potential corrective measures to address these limited exceedances of the GWPS.

1.1 FACILITY DESCRIPTION/BACKGROUND

The MEC was constructed in the 1950's in a then- rural area of St Louis County on approximately 480-acres (**Figure 1-1)**. A Metropolitan Sewer District (MSD) treatment plant is located to the immediate north of the facility and residential homes are located in the bluffs area above the MEC. Multiple impoundments are located on the property. In 2018, Ameren proactively closed 36 acres located adjacent to the Meramec River[1] with additional closures scheduled for 2021 and in 2023 following retirement of the facility. Site features are shown on **Figure 1-2**.

Meramec Energy Center

Over the past 17 years, Ameren has been able to beneficially use approximately 79% of the fly ash and 26% of the bottom ash produced by the MEC with the remaining CCR managed in the active on-site surface impoundments. The estimated volume of CCR within the CCR Units and exempt units is estimated at approximately 5.2 million cubic yards (MM CY).

1.2 SITE CHARACTERIZATION WORK SUMMARY

Hydrogeologic Assessments were completed in 1988 by Woodward-Clyde Consultants and CH2MHill in 1997. Golder Associates Inc. (Golder) completed subsurface investigations pursuant to the CCR Rule.

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[1] The cover system installed by Ameren complied with the performance requirements set forth in 40 CFR part §257.102(3)

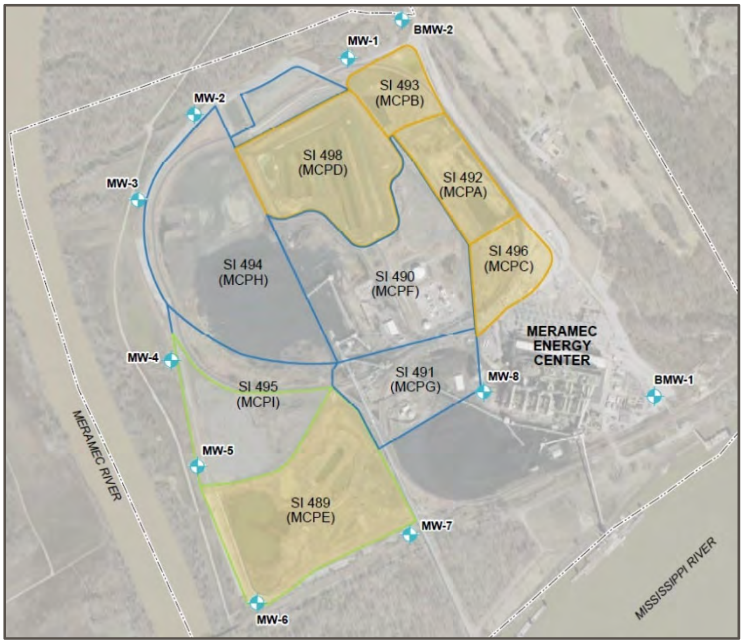
Ameren also voluntarily conducted surface water sampling. All these activities delineated the site-specific geology and hydrogeology to support the development of a hydrogeologic Conceptual Site Model (CSM). The investigation activities at the MEC included:

- Soil borings and sampling;
- Geotechnical testing;
- Well and piezometer installation;
- Slug testing; and
- Groundwater sampling.

Findings from these extensive and updated series of geologic, hydrogeologic and surface water investigations have produced a robust CSM that supports the CMA activities discussed in this report.

1.3 GROUNDWATER MONITORING

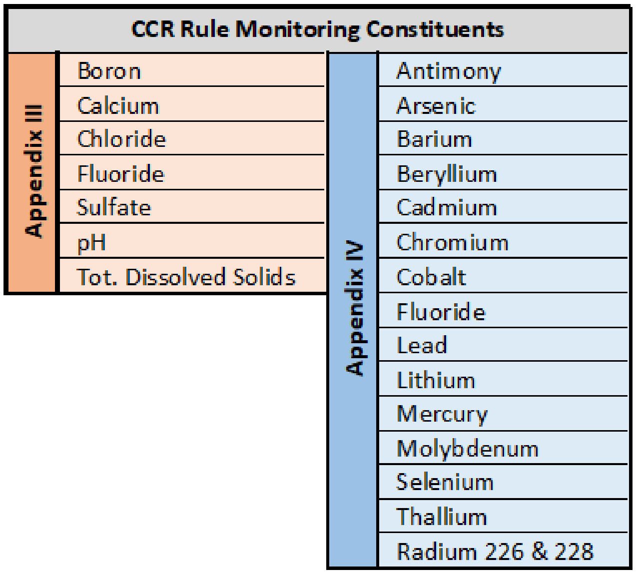
One groundwater monitoring system encompasses all MEC impoundments and is used to monitor facility groundwater. Groundwater monitoring under the CCR Rule occurs through a phased approach to allow for a graduated response (i.e., baseline, detection, and assessment monitoring as applicable) and evaluation of steps to address groundwater quality associated with a CCR unit. Golder prepared a Groundwater Monitoring Plan (GMP) as required by the CCR Rule. The GMP presents the design of the groundwater monitoring system, groundwater sampling and analysis procedures, and groundwater statistical analysis methods.



Groundwater Monitoring Well Locations

Monitoring wells were installed in January and April 2016 and includes two background wells (BMW-1 and BMW-2) and eight downgradient monitoring wells (MW-1 through MW-8) located around the perimeter of the various impoundments. The monitoring wells are screened in the alluvial aquifer below the base elevation of the CCR Units.

Detection monitoring sampling events occurred in 2017 and 2018. The results of the sampling events were then compared to background, or natural groundwater values, using statistical methods to determine if Appendix III constituents at the base of the CCR Units were present at concentrations above background, called statistically significant increases (SSI). Detection of Appendix III analytes triggered a verification sampling event in January 2018 and verified SSIs. The results of this analysis indicated SSIs necessitating the establishment of an Assessment Monitoring Program and respective notification of the same.



CCR Rule Monitoring Constituents			
Appendix III	Boron	Appendix IV	Antimony
	Calcium		Arsenic
	Chloride		Barium
	Fluoride		Beryllium
	Sulfate		Cadmium
	pH		Chromium
	Tot. Dissolved Solids		Cobalt
			Fluoride
			Lead
			Lithium
			Mercury
			Molybdenum
			Selenium
			Thallium
			Radium 226 & 228

During the Assessment Monitoring phase, CCR groundwater monitoring well samples were collected during April, May and November 2018 and subsequently analyzed for Appendix IV constituents. Appendix IV analytical results for the baseline and Assessment Monitoring events are summarized in **Table I**.

1.4 CORRECTIVE MEASURES ASSESSMENT PROCESS

The CMA process involves development of groundwater remediation technologies that will result in the following threshold criteria: protection of human health and the environment, attainment of GWPS, source control, COC removal and compliance with standards for waste management. Once these technologies are demonstrated to meet these criteria, they are then compared to one another with respect to long- and short-term effectiveness, source control, and implementability. Input from the community on such proposed measures will occur as part of a public meeting scheduled for May 2019.

1.5 RISK REDUCTION AND OF REMEDY

The CCR Rule at §257.97 (Selection of Remedy) at (b)(1) requires that remedies must be protective of human health and the environment. Further, at (c) the CCR Rule requires that in selecting a remedy, the owner or operator of the CCR unit shall consider specific evaluation factors, including the risk reduction achieved by each of the proposed corrective measures. Each of the evaluation factors listed here and discussed in **Section 4** are those that consider risk to human health or the environment.

(1)(i) Magnitude of reduction of existing risks;

(1)(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;

(1)(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;

(1)(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy[2];

(5)(i) Current and future uses of the aquifer;

(5)(ii) Proximity and withdrawal rate of users; and

(5)(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents.

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[2] Factors 4 and 5 are not part of the CMA evaluation process as described in §257.97(d)(4), §257.97(d)(5)(i)(ii)(iv); rather they are factors the owner or operator must consider as part of the schedule for remedy implementation.

2. Groundwater Conceptual Site Model

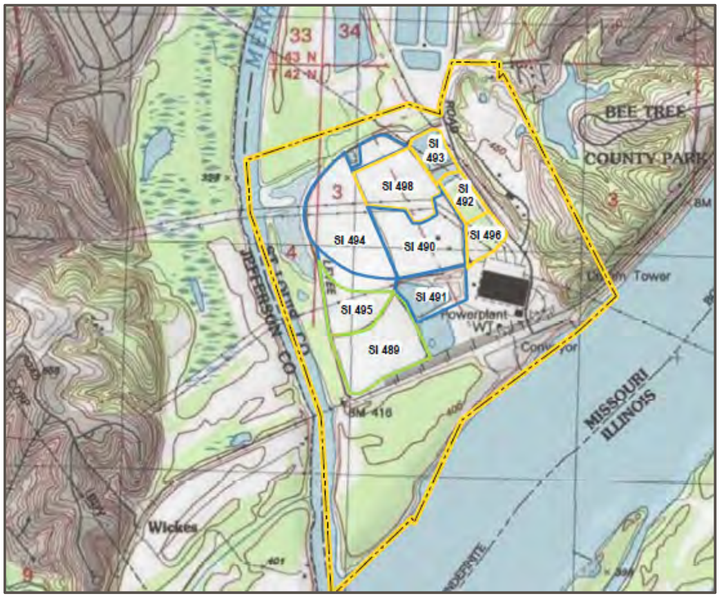
To evaluate the magnitude of risk reduction, the degree of existing risk must first be identified. Prior risk evaluations and data collected are summarized below.

2.1 SITE SETTING

The MEC Site is at the southernmost point in St. Louis County, Missouri approximately 18 miles southwest of downtown St. Louis. The area around the facility is fully developed and public drinking water is provided by American Water of Missouri. There are no users of groundwater at or near the MEC site.

2.2 SITE TOPOGRAPHY

The MEC is in a topographically low area in a valley at the confluence of the Meramec and Mississippi Rivers. Ground surface elevation around the surface impoundments ranges between 395 ft to 421 ft above mean sea level (AMSL). The existing Site grade is as much as 20 ft above the original ground surface. Topographically higher terrain is located west of the Meramec River Valley. The terrain to the east of the Site consists of topographically higher terrain, at elevations generally ranging from 450 AMSL ft to as high as 550 ft AMSL.



Topographic Map

2.3 GEOLOGY AND HYDROGEOLOGY

The geology immediately surrounding the MEC is composed of two distinctly different geological terrains; (1) floodplain deposits of the Mississippi and Meramec River Valleys and (2) older sedimentary bedrock formations. Most of the MEC, including all the plant infrastructure and the CCR Units lie within these floodplain deposits. The river valley area is comprised of floodplain and alluvial deposits that are the result of the water flow and deposition of the Mississippi and Meramec River[3].

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[3] 40 CFR Part 257, Groundwater Monitoring Plan Meramec Energy Center, St. Louis County, Missouri (Golder 2017)

Geologic Cross Section (West to East)

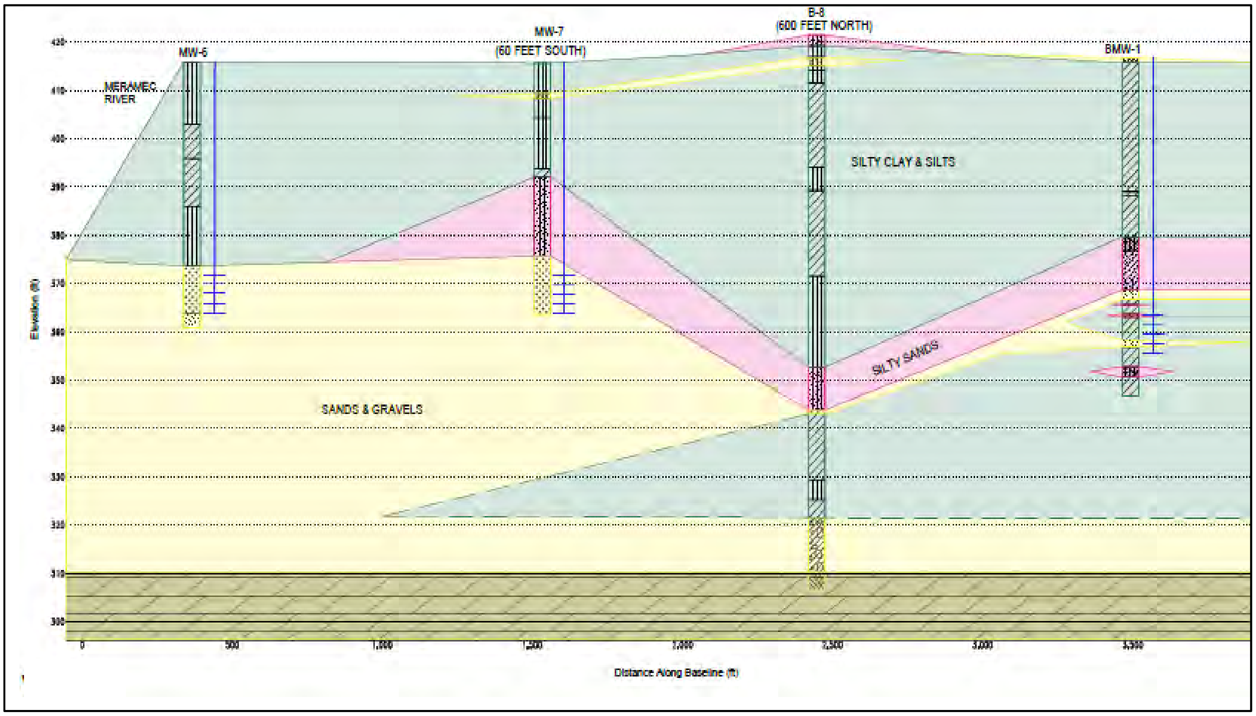

Image from Figure A-3, 2017 Groundwater Monitoring Plan (Golder 2017)

As shown in the geologic cross-section the alluvial materials on the east side of the MEC tend to have more silty clays and fine sands. Alluvial materials to the west, closer to the Meramec River, include coarser materials, including fine-to medium-grained sand with clay, silt, and some gravels[4].

The uppermost aquifer is the alluvial silt, sand and gravel deposits associated with the Meramec and Mississippi River Valley alluvium. These channel deposits are intermixed with a wide variety of clay/silty clay floodplain deposits and, therefore, can appear at varying depths. However, sandy/gravelly units were encountered at many locations at approximately 360-370 ft AMSL, likely deposited from a historic meander of the Meramec River. These alluvial deposits overlie Mississippian-age limestone and shale of the Meramecian Series. The alluvial aquifer varies in thickness from 0 ft thick at the aquifer pinch-out along the bedrock bluff to the northeast of the MEC, up to greater than 95 ft thick where the bedrock surface has been eroded by the Meramec and Mississippi Rivers.

Groundwater flow direction and levels within the alluvial aquifer is dynamic and influenced by seasonal changes in water levels of the adjacent rivers. Under normal conditions, groundwater flows from the bluffs toward the rivers and generally towards the southwest. However, during periods of high river levels, groundwater flow can temporarily reverse in localized areas and decrease in horizontal gradient with little net movement of groundwater occurs[5].

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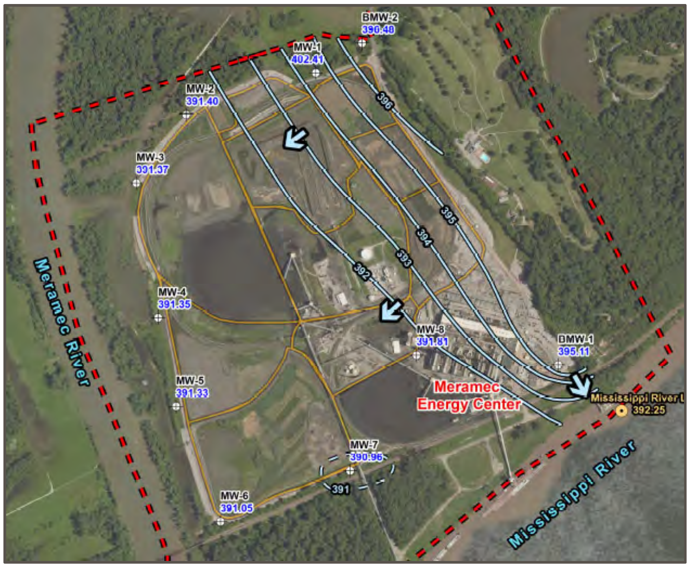
[4] Hydrogeologic Assessment (CH2MHILL, 1997).

[5] 2018 Annual Groundwater Monitoring and Corrective Action Report (Golder 2019).



Groundwater Flow Map-May 17, 2018
Image from Figure C2, 2018 Annual Groundwater Monitoring and Corrective Action Report (Golder 2019)

Groundwater flow direction and gradient were estimated for the downgradient CCR Units monitoring wells using the USEPA's On-line Tool for Site Assessment Calculation for Hydraulic Gradient (Magnitude and Direction) (USEPA, 2016). Results from this assessment indicate that while groundwater flow direction is variable, the overall net groundwater flow is from the bluffs toward the rivers. There are no users of groundwater of the alluvial aquifer at MEC. All private and public wells recorded within a one-mile radius of the facility are upgradient of the facility or located on the opposite side of the Meramec River and are therefore isolated from the MEC. Horizontal gradients determined by CCR Rule compliance wells (not including background or MW-1) range from 0.0002 to 0.0005 ft/ft with an estimated net annual groundwater velocity of approximately 16 ft per year.

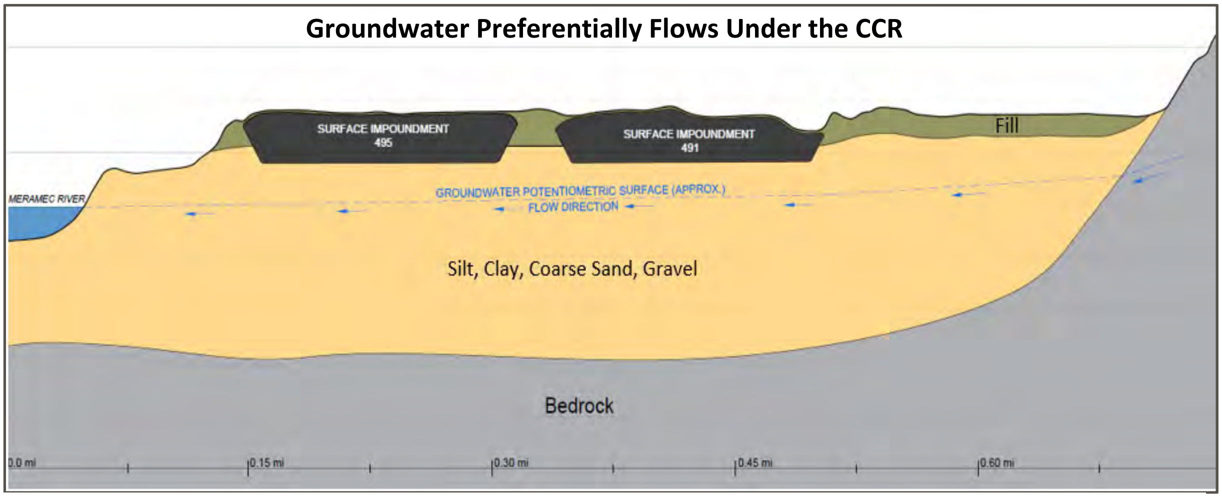

Groundwater Preferentially Flows Under the CCR

Image from Figure 2-2, MEC Groundwater Model Report (Burns & McDonnell 2019)

The existing Site grade is as much as 20 ft above the original ground surface the original grade of the plant was increased during construction by using fill material. The surface impoundments were made by excavating silts and clays and using the materials as fill beneath the plant as well as for surface impoundment berms (CH2MHILL, 1997). The surface impoundments were excavated approximately 10-20 ft below the original grade. Therefore, present day CCR thickness is estimated to be typically 20 to 30 ft below the present Site grade. As reflected above, the bottom elevations of the CCR is **higher** than the normal groundwater table. As such, groundwater flows under the surface impoundments.

Vertical hydraulic gradients are based on comparing the groundwater elevations in the monitoring wells to the water levels in the active surface impoundments. On average, the groundwater elevation of the impoundments is approximately 9 to 30 ft higher than the alluvial groundwater zone but can change seasonally based on river levels. During high river level conditions, the difference in groundwater elevation between the surface impoundments and the alluvial groundwater zone is the smallest.

2.4 GROUNDWATER PROTECTION STANDARDS

Golder completed a statistical evaluation of groundwater samples using the methods and procedures outlined in the Groundwater Monitoring Plan's *Statistical Analysis Plan* (Golder 2017) to develop site-specific GWPS for each Appendix IV constituents.

Groundwater results were compared to the site-specific GWPS. As shown on **Figure 2-1,** statistically significant levels (SSL) above the GWPS are limited to five monitoring wells: arsenic at MW-4, MW-5; lithium at MW-6; molybdenum at MW-6, MW-7 and MW-8.

Parameter	Site GWPS	Units
Antimony	6	µg/L
Arsenic	10	µg/L
Barium	2000	µg/L
Beryllium	4	µg/L
Cadmium	5	µg/L
Chromium	100	µg/L
Cobalt	6	µg/L
Fluoride	4	mg/l
Lead	15	µg/L
Lithium	40	µg/L
Mercury	2	µg/L
Molybdenum	100	µg/L
Radium 226+228	5	pCi/L
Selenium	50	µg/L
Thallium	2	µg/L

Groundwater Protection Standards
ug/L – micrograms per liter
mg/l – milligrams per liter
pCi/L – picoCuries per liter

2.5 NATURE AND EXTENT OF GROUNDWATER IMPACTS

Ameren initiated a nature and extent (N&E) investigation as required by the CCR Rule in 2018 by installing two monitoring wells and two temporary piezometers (N&E wells). The N&E wells are screened in two different, depth zones of the alluvial aquifer: shallow zone and deep zone. Well screen lengths range from 5 to 10 ft long and total depths range from approximately 31 to 91 ft bgs.

Analytical results from the N&E wells indicate arsenic concentrations are limited in their extent to the shallow zone of the alluvial aquifer to the west of the CCR Units. Arsenic concentrations to the west of the CCR Units are similar to the Assessment Monitoring results, but decrease to less than the GWPS, 10 micrograms per liter (ug/L) in the deep alluvial zone. Monitoring wells to the south near the Mississippi River are similar to those near the CCR Units to the north, with concentrations below the GWPS for arsenic.

Based on the analytical results from the N&E wells molybdenum concentrations are limited in extent in the alluvial aquifer towards both the Meramec River to the west and toward the Mississippi River to the south. Results from the N&E wells are below the GWPS (100 ug/L) in both the shallow and deep alluvial aquifer samples.

Analytical results from the N&E wells also indicate that lithium concentrations west of the CCR Units are below the GWPS. Results to the south of the CCR Units nearer to the Mississippi River are consistent with the Assessment Monitoring wells to the south of the CCR Units with results that are very close in range (36 to 42.7 ug/L) to the GWPS of Lithium (40 ug/L).

The extent of contamination is limited to the alluvial aquifer and the results from the N&E wells were used to develop corrective measures alternatives.

2.6 SURFACE WATER SAMPLING

Ash management operations at the MEC have not impacted adjacent surface water bodies. Ameren voluntarily collected samples of surface water from the Mississippi River, Meramec River and Creek/Drainage surface water along the northern boundary of the facility. Golder collected surface water samples from 12 locations in the Mississippi River and 9 locations in the Meramec River. At each sample location, shallow samples were collected near the surface of the river. Where the depth of water was greater than four feet, a second sample was collected mid-depth in the river (referred to here as a deep sample). A total of 40 samples were collected from the Mississippi River and a total of 26 samples were collected in the Meramec River. In addition, shallow surface water samples were collected from three locations in the creek / drainage bed that runs along the northwestern boundary of the MEC. A total of six samples were collected in the creek. Surface water sampling locations are shown on **Figure 2-2.**

Samples were analyzed for the same Appendix III and Appendix IV CCR constituents listed in **Section 1.3**, with the exception of radium (all CCR monitoring well data are below the GWPS for radium). Sample results were also compared to human health and ecological risk-based screening levels. The screening levels and comparison of the surface water results to the screening levels are provided in **Appendix A.**

In summary, the results of this investigation demonstrate that the Mississippi River and Meramec River sampling **do not** show evidence of impact of CCR constituents derived from the surface impoundments[6].

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[6] In some samples, the concentrations of arsenic, lead, or thallium are above risk-based screening levels, however, the results are statistically **no different** in upstream and downstream samples indicating that the CCR Units are not the source of the constituents detected in the rivers.

3. Risk Assessment and Exposure Evaluation

As described in this report, Ameren has conducted detailed environmental evaluations of the MEC and its environs. These investigations have been detailed in a risk evaluation report available to the public on the Ameren website:

- February 2018: Human Health and Ecological Assessment of the Meramec Energy Center. Available at: https://www.ameren.com/-/media/corporate-site/files/environment/ccr-rule/2017/groundwater-monitoring/Meramec-haley-aldrich-report.ashx?la=en&hash=76A0B8C34676EA9D3A7C8F61284917F50E02ED46

The purpose of this risk evaluation was to identify whether current groundwater conditions pose a risk to human health and the environment and, if so, whether the corrective measures identified in this report mitigate such risk.

3.1 APPROACH

The risk evaluation provided in the 2018 risk assessment report evaluated the environmental setting of the MEC, which has been in operation for 65 years, including its location and ash management operations at the facility. Golder provided information on groundwater location and direction, the rate(s) of groundwater flow, and where waterbodies may intercept groundwater flow.

A conceptual model was then developed based on this physical setting information and used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify locations where ecological populations could come into contact with surface water. Based on this conceptual model approach, Ameren's environmental consultants and risk assessors identified surface water sampling locations to allow evaluation of potential impact to the environment. Sampling results were then evaluated, as appropriate, on both a human health and ecological risk basis.

Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people. Generally, there are four components to the process (USEPA, 1989): (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

The USEPA develops "screening levels" of constituent concentrations in groundwater (and other media) that are considered protective of specific human exposures. These screening levels are referred to as "Regional Screening Levels" and are published by USEPA and updated twice yearly (USEPA, 2018a). In developing the screening levels, USEPA uses a specific target risk level (component 4) combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water). Similarly, ecological screening levels for surface water are developed by Federal agencies to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects.

Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists but indicate that further evaluation may be warranted.

The surface water and groundwater data were evaluated using human health risk-based and ecological risk-based screening levels drawn from Federal sources. The screening levels are used to determine if the concentration levels of constituents could pose an unacceptable risk to human health or the environment. The evaluation also considers whether constituents are present in groundwater and surface water above screening levels, and if so, if the results could be due to the ash management operations.

3.2 CONCEPTUAL SITE MODEL

There are no on-site users of alluvial groundwater adjacent to the MEC. As documented in the 2018 risk assessment report, all private and public wells recorded within a one-mile radius of the facility are upgradient of the facility or located on the opposite side of the Meramec River and, therefore, such groundwater is isolated from the facility (see the February 2018 report for more details).

3.3 RESULTS

3.3.1 Alluvial Aquifer

Figure 1-2 shows the location of the CCR monitoring wells at the MEC CCR Unit. A summary of the screening results is presented in the following table.

Table: Assessment Monitoring Reflects High Percentage Compliance

	Meramec Energy Center – Shallow Alluvial Aquifer
Percent of Assessment Monitoring Parameter Compliance	95%
Percent of Assessment Monitoring Parameter Results Requiring Corrective Action (Constituents)	5% Arsenic, Lithium, Molybdenum

The striking aspect of the analysis is how few results are above conservative GWPS applicable to the Site, given that the wells are located directly adjacent to and at the base of the surface impoundments, and the facility has been in operation for 65 years. Note that out of the 1,818 groundwater analyses conducted, only 76 results are above the GWPS. Put another way, over 95% of the groundwater results for the CCR Rule monitoring wells located at the edges of the MEC surface impoundments (MW-1 through MW-8) are below the GWPS.

3.3.2 Surface Water

The Mississippi River and the Meramec River sampling results do not show evidence of impact of constituents derived from MEC[7].

There are no analytical results for the Mississippi River that are above drinking water screening levels with the exception of arsenic and thallium in one sampling location and the MEC is not the source[8].

3.3.3 National Pollutant Discharge Elimination System Outfall

The outfalls for the MEC are identified as 003 and 009 and are shown on **Figure 2-2**. These are permitted outfalls under the National Pollutant Discharge Elimination System program. The outfall effluent water is tested for toxicity on a periodic basis as required by the permit. The biological toxicity testing results for Outfalls 003 and 009 at the MEC shows no evidence of aquatic toxicity in the outfall effluent.

3.4 CONCLUSION

The sampling results for the Mississippi River, the Meramec River, and the adjacent creek-drainage area are important. Although groundwater at the edge of the impoundment(s) shows that three constituents are present in some wells to a very limited extent above the GWPS, less than 5% of the results are above a GWPS, and the adjacent surface water bodies do not show evidence of impact of constituents derived from the surface impoundments at MEC. This is important because the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Impacts to groundwater do not mean that surface waters are impaired. The degree of interface between groundwater and surface waters is variable and complex and dependent upon a variety of factors including gradient and flow rate. It is possible, however, to determine the maximum concentration level that would need to be present on-site in groundwater and still be protective of the surface water environment. Groundwater and surface waters flow at very different rates and volumes and ultimately all such waters near the MEC flow towards the Mississippi River. The Mississippi is the largest river system in North America and as groundwater at the facility flows into the river, it is diluted by more than 100,000 times.

This conservative estimate of dilution is used to further understand how high an arsenic, lithium, or molybdenum groundwater concentration would have to be to potentially have an adverse impact on the Mississippi River. The tables below show how this factor is applied to the most conservative of the human health and ecological risk-based screening levels for surface water.

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[7] There are no analytical results for the Meramec River that are above drinking water screening levels, with the exception of lead. The total lead results upstream and downstream are similar and, thus, indicative of normal river conditions. Furthermore, all dissolved concentrations of lead are below the screening level, indicating that lead is associated with particulate in the river. In addition, groundwater samples on-site indicate that lead is either below screening levels or non-detected, thus, indicating that lead in the river is not attributable to the surface impoundments. Lead is not a COC at the MEC under the CCR Rule.

[8] The arsenic concentrations in the Mississippi River, Meramec River, and the creek/drainage along the northern portion of the facility are slightly above the human health recreational screening levels, however, the concentrations are statistically no different in upstream and downstream samples for both arsenic and thallium indicating that the facility is not the source of the arsenic and thallium detected in the rivers.

CALCULATING RISK-BASED SCREENING LEVELS FOR MEC GROUNDWATER BASED ON THE MISSISSIPPI RIVER

	Estimated Dilution Factor for the Mississippi River	100,000			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum MEC Groundwater Concentration**
Arsenic	0.00014	14	0.0221	M-MW-5	>600
Lithium	0.04	4000	0.164	M-MW-6	>24,000
Molybdenum	0.1	10000	0.717	M-MW-7	>13,000

CALCULATING RISK-BASED SCREENING LEVELS FOR MEC GROUNDWATER BASED ON THE MERAMEC RIVER

	Estimated Dilution Factor for the Meramec River	700			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Target Level and the Maximum MEC Groundwater Concentration**
Arsenic	0.00014	0.098	0.0221	M-MW-5	>4
Lithium	0.04	28	0.164	M-MW-6	>100
Molybdenum	0.1	70	0.717	M-MW-7	>90

***Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.**

The groundwater alternative risk-based screening levels are calculated in units of milligrams of constituent per liter of water (mg/L). One mg/L is equivalent to one part per one million parts.

The tables identify the maximum groundwater concentrations of arsenic, lithium, and molybdenum detected in the MEC monitoring wells. The comparison between the target levels and the maximum concentrations indicates that there is a wide margin of safety between the two values. This margin is shown in the last column of each table. To illustrate, concentration levels of arsenic, lithium, and molybdenum would need to be **more than 600, 24,000, and 13,000 times higher,** respectively, than currently measured levels before an adverse impact in the Mississippi River could occur.

The comprehensive evaluation summarized here demonstrates that there are no adverse impacts on human health from either surface water or groundwater uses resulting from coal ash management practices at the MEC.

3.4.1 Trace Elements in Coal Ash

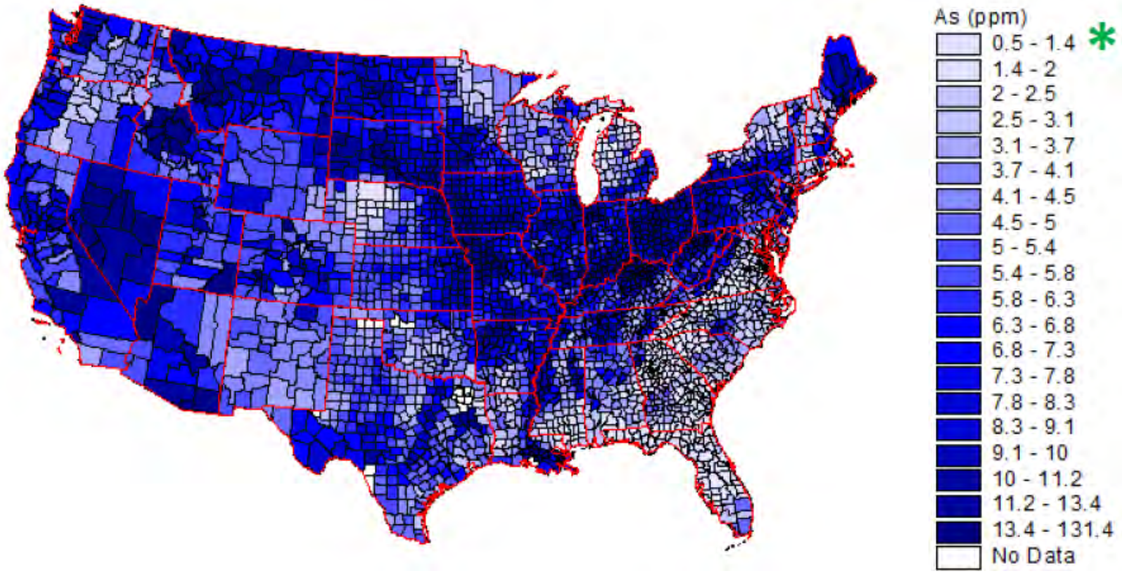
All of the inorganic minerals and elements that are present in coal ash are also present naturally in our environment. Arsenic, lithium, and molybdenum are referred to as trace elements, so called because they are present in soils (and in coal ash) at such low concentrations (in the milligrams per kilogram (mg/kg) or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

- 1 penny in a large container holding $10,000 worth of pennies, or
- 1 second in 11.5 days, or
- 1 inch in 15.8 miles

All of the constituents present in coal ash occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S. These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in our vitamins, such as molybdenum. Thus, we are exposed to these trace elements in our natural environment every day, and in many ways.

3.4.2 Arsenic

Arsenic is present in soils across the U.S. The USGS map of arsenic in surface soils in the U.S. is shown below.



Arsenic is Present in our Natural Environment – Background Levels in Soils in the U.S.

Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

*The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg (USEPA, 2018a). Thus, the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Because arsenic is naturally present in soils and rocks, it is also naturally present in our groundwaters and surface waters. Just as for soil, there are background levels of constituents in groundwater. Constituent concentrations in groundwater that is upgradient of a source represent background conditions. To demonstrate a release to groundwater by a source, concentrations downgradient of the source must be greater than the background/upgradient concentrations at a statistically significant level for a consistent period of time. Thus, it is not surprising that arsenic is present in both of the CCR background wells for the MEC.

3.4.3 Lithium

Lithium is present in groundwater at the MEC at levels above the GWPS in one well location. The fact sheet in **Appendix B** provides information on lithium so that the groundwater data can be considered in context. There is no public exposure to groundwater at the MEC and concentration levels of lithium in adjacent surface waters are all well below health-based regulatory standards.

Lithium is naturally occurring in soils and water. Primary dietary sources of lithium are grains and vegetables, dairy products and meat. Estimates for daily dietary intake of lithium have been reported from different sources and varies amongst different countries. Ranges have included 0.0168 – 0.105 mg Li/day to 2.310 – 5.600 mg Li/day from food and water.

Lithium is used medicinally in the U.S. and globally as the leading treatment for bipolar disease. Adult daily dosages are approximately 900 mg/day or higher, and recommended doses for children are approximately 600 mg/day.

However, there are limited studies on lithium of the type upon which to base a toxicity value to use in human health risk assessment. USEPA has derived a provisional toxicity value (i.e., the value does not have the normal level of review or confidence compared to final toxicity values published by USEPA) that equates to a drinking water screening level of 0.04 mg/L, and a general intake of 0.14 mg/day for an adult. Note that this level is below many estimates of daily intake in humans presented above, and well below the typical therapeutic doses presented above.

3.4.4 Molybdenum

Haley & Aldrich has prepared a fact sheet (**Appendix C**) that provides information on molybdenum so that the groundwater data can be considered in context. There is no public exposure to groundwater at the MEC and concentration levels of molybdenum in adjacent surface waters are all well below health-based regulatory standards.

As discussed in more detail in **Appendix C**, molybdenum is an essential nutrient for humans, and the Institute of Medicine of the U.S. National Academy of Sciences (NAS) has provided recommended daily allowances (RDA) and tolerable upper limits (UL) to be used as guidelines for vitamins and supplements and other exposures (NAS, 2001).

The RDA for a nutrient is “the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) health individuals” (NAS, 2001). The RDA for molybdenum for adults set by the NAS in 2001 is 0.045 mg/day and is based on the amount of molybdenum needed to achieve a steady healthy balance in the body for the majority of the population.
The UL for molybdenum set by the NAS is 2 mg/day. This level is based on an evaluation of the potential toxicity of molybdenum at high levels of intake. Based on the UL, a safe drinking water level for molybdenum is 0.6 mg/L or 600 ug/L, or six-fold higher than the level set by USEPA of 0.1 mg/L or 100 ug/L in the CCR Rule. This difference serves to underscore the conservatism of the USEPA value when evaluating groundwater under the CCR Rule. Below is a chart that depicts groundwater and surface

water samples collected from Ameren's four energy centers and compares concentration levels based on both the NAS tolerable upper limit and the GWPS established by the USEPA in the CCR Rule. As reflected in the chart, over 90% of the groundwater results across all four energy centers and all but **one sample** at Meramec are below the standard the National Academy of Science developed for vitamins and supplements.

	Labadie	Meramec	Rush Island	Sioux
Groundwater				
Number of Samples	208	88	77	244
Molybdenum greater than CCR GWPS of 0.1 mg/L (a)	81	35	38	77
Molybdenum greater than NAS standard of 0.6 mg/L (b)	3	1	11	49
Surface Water				
Number of Samples	67	74	50	80
Molybdenum greater than 0.1 mg/L (a)	0	0	0	0

Notes:

mg/L - milligrams per liter.

(a) - Drinking water-based groundwater protection standard specified in the CCR Rule.

(b) - Alternative health-protective drinking water screening level based on the National Academy of Sciences review of molybdenum.

3.5 EVALUATION OF RISK IN THE CORRECTIVE MEASURES ASSESSMENT

In summary, there are no adverse impacts resulting from coal ash management practices at the MEC on human health or the environment from either surface water or groundwater uses. There are no users of groundwater near the MEC or its CCR units. In fact, as described above, concentrations of arsenic, lithium, and molybdenum detected in groundwater would need to be **more than 600, 24,000, and 13,000 times higher**, respectively**,** before such an unacceptable risk could exist under current and reasonable anticipated future uses.

Although the purpose of this CMA is to evaluate remedies to address assumed risks from the SSLs, the current conditions at the MEC, even prior to closure, do not pose an unacceptable risk to human health or the environment. Therefore, the risk-based evaluation provides additional support for the selection of a remedy moving forward.

4. Corrective Measures Alternatives

4.1 CORRECTIVE MEASURES ASSESSMENT GOALS

The overall goal of this CMA is to identify and evaluate the appropriateness of potential corrective measures to prevent further releases of Appendix IV constituents above their GWPS, to remediate releases of Appendix IV constituents detected during groundwater monitoring above their GWPS that have already occurred, and to restore groundwater in the affected area to conditions that do not exceed the GWPS for these Appendix IV constituents. The corrective measures evaluation that is discussed below and subsequent sections provides an analysis of the effectiveness of four potential corrective measures in meeting the requirements and objectives of remedies as described under §257.97 (also shown graphically on **Figure 4-1**). This assessment also meets the requirements promulgated in §257.96 which require the assessment to evaluate:

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to residual contamination;
- The time required to complete the remedy; and
- The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy.

The criteria listed above are included in the balancing criteria considered during the corrective measures evaluation, described in **Section 5**.

4.2 GROUNDWATER MODELING

Modeling is an analytical tool used to create estimates based on computer-simulated conditions. Groundwater flow and geochemical modeling[9] performed by Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) evaluated the hydrogeologic and geochemical conditions at the CCR Unit. Burns & McDonnell used the numerical computer code MODFLOW to simulate groundwater flow and the software package MT3DMS to simulate groundwater transport of dissolved phase constituents.

4.3 GROUNDWATER TREATMENT EVALUATION

In-situ treatment to reduce the concentrations of dissolved metals in groundwater can occur via stabilization of metals through precipitation of a metal compound, co-precipitation of the target metal within the structure of another compound, and/or sorption of the target metal onto other compounds in the subsurface. In simple terms, groundwater amendments are injected into the aquifer to create a chemical reaction that attenuates metals through precipitation or sorption.

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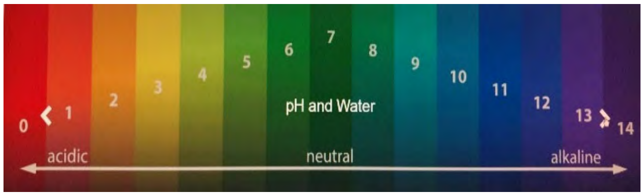
[9] Groundwater flow modeling was performed using MODFLOW 2000 supported by Groundwater Vistas as the graphical user interface.

Chemical precipitation is an available and demonstrated groundwater treatment technology recognized by USEPA [10]. Groundwater geochemistry (including oxidation reduction potential (ORP)) can greatly impact metals mobility at a site, where some metal compounds may be more soluble under highly oxidative (positive ORP) conditions while others are more soluble under reduced conditions (negative ORP). Also, the solubilities of many metal compounds are highly dependent on pH.

Ameren has retained XDD Environmental to research and develop appropriate treatment options for arsenic, lithium, and molybdenum and is performing bench-scale treatability studies to demonstrate the effectiveness of treatment options on a site-specific basis. Laboratory results indicate that through pH adjustments arsenic concentrations at the MEC will fall to below action levels. Appropriate treatment trains for molybdenum and lithium at the MEC are under evaluation and bench-scale treatment results for all four of Ameren's energy centers are expected to be completed in the Summer of 2019.



pH and Water (USGS - Water Science School publication).

4.4 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures can terminate when groundwater impacted by the CCR Units does not exceed the Appendix IV GWPS for three consecutive years of groundwater monitoring. In accordance with §257.97, the groundwater corrective measures to be considered must meet, at a minimum, the following threshold criteria:

1. Be protective of human health and the environment;
2. Attain the GWPS;
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of COCs to the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, considering factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for waste management.

The remedial alternatives presented below contemplate both CIP (Alternative 1 through 3) and CBR (Alternative 4) of the unit. Both closure methods are expressly authorized under the CCR Rule.

4.4.1 Alternative 1 – Closure in Place with Capping and Monitored Natural Attenuation

The regulated surface impoundments would be closed in place with a low-permeability geomembrane and soil protective layer to reduce infiltration of surface water to groundwater thereby isolating source material. This cap selection exceeds regulatory requirements by more than two orders of magnitude ($<1x10^{-7}$ centimeters per second (cm/sec) planned versus $1x10^{-5}$ cm/sec required by the CCR Rule). Over time, decreased surface water infiltration and porewater flux through the CCR would allow the concentration of COCs in downgradient groundwater to decline and overall groundwater concentrations

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[10] EPA, "Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category: EPA's Response to Public Comments; Part 7 of 10", SE05958A6, p. 7-20

of COCs to attenuate. Geochemical modeling results indicate that the dissolved phase plume of arsenic, lithium, and molybdenum remaining above the GWPS post-closure would remain stable and within the MEC property boundary long-term as such levels attenuate. The timelines for MNA duration for arsenic, lithium, and molybdenum are shown on **Figures 4-2, 4-3, and 4-4**, respectively.

CIP can be completed safely, in compliance with applicable federal and state regulations, and be protective of public health and the environment. In general, CIP consists of installing a cap/cover designed to significantly reduce infiltration from surface water or rainwater, resist erosion, contain CCR materials, and prevent exposures to CCR. For this alternative, Ameren would install a geomembrane cover layer with a permeability that is 100 times lower than what the CCR Rule requires thus further reducing infiltration. At the MEC, site preparation, construction and installation of cap and cover systems take approximately 12 to 18 months and additional closure activities are planned for 2021 with all remaining closures expected to be completed within four years.

MNA is a viable remedial technology recognized by both state and federal regulators that is applicable to inorganic compounds in groundwater. The USEPA defines MNA as "the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods". The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants (USEPA, 2015). When combined with a low-permeability cap to address the source by limiting the infiltration of precipitation into and through the CCR, MNA can over time reduce concentrations of arsenic, lithium, and molybdenum in groundwater at the waste boundary.

Following the installation of the cap system, Ameren would implement post-closure care activities. Post closure care includes long-term groundwater monitoring until such time that groundwater conditions return to below regulatory levels and cap system maintenance. Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.2 Alternative 2 – CIP with Capping and In-Situ Groundwater Treatment

Similar to Alternative 1, the regulated surface impoundments would be CIP with a low-permeability ($<1 \times 10^{-7}$ cm/sec) geomembrane to reduce infiltration of surface water to groundwater and to isolate source material. COCs would be addressed through in-situ injection of groundwater amendments downgradient of the regulated surface impoundments, or through the installation of a permeable reactive barrier (PRB). Over time, decreased surface water infiltration and porewater flux would allow the concentration of COCs to attenuate and active remediation (injections or PRB replenishment) could cease.

Following the installation of the low-permeability cover and in-situ treatment system (via a trench or injection wells), Ameren would implement post-closure care activities that include periodic amendment injections or periodic replenishment of the treatment reagents within the PRB, long-term groundwater sampling to monitor treatment system performance, and cover system maintenance. Based upon laboratory testing performed by XDD, the timeline for in-situ treatment is expected to be less than Alternative 1 as shown on **Figures 4-2, 4-3, and 4-4**.

Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.3 Alternative 3 – CIP with Capping and Hydraulic Containment Through Groundwater Pumping and Ex-situ Treatment

The regulated surface impoundments would be closed in place with a low-permeability (<1 x 10^{-7} cm/sec) geomembrane to reduce infiltration of surface water to groundwater and isolate source material. Pumping wells would be used to hydraulically control the migration of constituents downgradient. However, pumping wells would generate large volumes of effluent that would require ex-situ treatment, likely with an ion exchange or a reverse osmosis (RO) treatment system. Both treatment systems are complex with ongoing operation and maintenance and would generate a secondary waste stream – including regeneration/replacement of the ion exchange media or concentration reject water from the RO system. Approvals and permitting would be required for the construction and installation of the treatment systems and discharge of the treated groundwater.

Implementation of a large-scale hydraulic containment (HC) system will require a detailed design effort with bench scale testing to verify groundwater treatment. Pilot testing, such as pumping tests and additional groundwater modeling, will be needed to verify the hydraulic capture zone. While HC is a widely used remediation technology, it has not been commonly used as part of a large-scale CCR unit closure strategy.

The timeline for active treatment is expected to be comparable to Alternatives 1 and 2 because treatment would continue until source concentrations attenuate to levels less than the GWPS. With active groundwater pumping along the boundary of the impoundments, such process creates a waste stream that must be permitted and managed prior to discharge back into the Meramec River.

Following the installation of the low-permeability cover, groundwater pumping well network, and ex-situ treatment system, Ameren would implement post-closure care activities that includes operation and maintenance of the hydraulic containment (HC) system, long-term groundwater sampling to monitor HC system performance, and cover system maintenance. Future development of the capped surface could be used for solar photovoltaic arrays or other site staging/ancillary operational needs.

4.4.4 Alternative 4 – Closure by Removal with Monitored Natural Attenuation

This alternative evaluates the removal of CCR from the impoundments at the Site. While this alternative would eliminate (through removal) the source, it takes over 20 years to implement during which time the impoundments would remain open and the ponded ash subject to ongoing infiltration for the duration of the removal activities. As with Alternatives 1 and 2, concentrations of COCs in downgradient groundwater would decline via natural attenuation processes.

The MEC is located in a heavily developed area of St. Louis County and, as a consequence, any large scale excavation operation would have several potential community impacts, safety concerns and challenges. Given the magnitude of the total estimated haul volume (5.2 MM CY) along with the travel distance to one or more off-site and potentially out of state landfills, injuries and fatalities would be likely. A study completed by the Lochmueller Group (Lochmueller) **(Appendix D)** estimated that the time period needed to transport material off-site to a commercial landfill could be 20 years or greater.

As the report makes clear, there is simply a limit on how much excavation and roundtrip truck hauls can occur on a given eight-hour workday. The Lochmueller study bases its time estimate on assumed productivity rates that are subject to potential disruptions (e.g., weather conditions, truck synchronizing, available landfill capacity, travel route traffic congestion, road enhancements, etc.) that could impact overall CBR timeframe. The study identified productivity targets for other Ameren facilities at approximately 200 truckloads a day (**one every 2.5 minutes**).

The presence of a nearby school just up the road from the MEC negatively impacts transportation to and from the site. It is likely that the frequency of hauling trips would need to be reduced during school days to accommodate community concerns. Haulers would need to avoid trips past the school during school arrival and departure times, thereby reducing the hauling workday from 8 hours to 5 ½ to 6 hours. Additionally, further review of local restrictions and approvals would be required to verify that any selected landfill, particularly if located in Illinois, could receive the ash for disposal.

Excavated materials from the MEC would not be suitable for beneficial use applications, due to the ash production quality and chemical reactions that occurred during the placement of class C fly ash via wet sluicing. Traditional beneficial use applications for class C fly ash, such as replacement for cement in the production of ready-mix concrete and concrete related products require the materials to be capable of reacting chemically to produce cementitious bonds. The capability to produce these chemical reactions have been expended with the wet-sluicing process of CCR into the surface impoundments. In addition, historical F ash materials at MEC site have already been recovered and utilized as part of the Taum Sauk reconstruction project. No recoverable F ash is available from the site[11].

Technical and logistical challenges of implementing a large-scale ash removal project also need to be considered (removal of CCR over 30-ft deep adjacent to the Meramec and Mississippi rivers). Removal activities will be difficult and require implementation of CCR stabilization methods and temporary staging/stockpiling of material for drying prior to transportation off-site; these considerations will affect productivity and increase removal duration. Excavation and construction safety during the removal duration is another major concern due to heavy equipment (bulldozers, excavators, front end loaders, off-road trucks) and dump truck operation within the active MEC site. Additional community impacts associated with the use of heavy equipment and truck traffic are also a consideration for this alternative. During the long removal period (20-years or more), the ash in the non-closed impoundments remain exposed to infiltration via precipitation.

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[11] Information provided by Ameren technical staff, May 10, 2019.

5. Comparison of Corrective Measures Alternatives

The purpose of this section is to evaluate, compare, and rank the six corrective measures alternatives using the balancing criteria described in §257.97.

5.1 EVALUATION CRITERIA

In accordance with §257.97, remedial alternatives that satisfy the threshold criteria are then compared to four balancing (evaluation) criteria. The balancing criteria allow a comparative analysis for each corrective measure, thereby providing the basis for final corrective measure selection. The four balancing criteria include the following:

1. The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful;
2. The effectiveness of the remedy in controlling the source to reduce further releases;
3. The ease or difficulty of implementing a potential remedy; and
4. The degree to which community concerns are addressed by a potential remedy.

Public input and feedback will be considered following the public information session to be held in May 2019.

5.2 COMPARISON OF ALTERNATIVES

This section compares the alternatives to each other based on evaluation of the balancing criteria listed above. The goal of this analysis is to identify the alternative that is technologically feasible, relevant and readily implementable, provides adequate protection to human health and the environment, and minimizes impacts to the community.

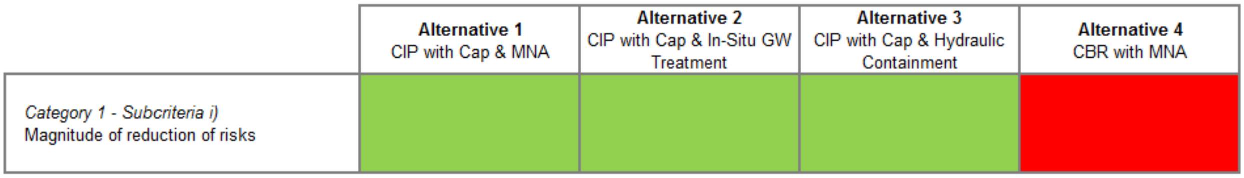
A graphic is provided within each subsection below to provide a visual snapshot of the favorability of each alternative, where green represents favorable, yellow represents less favorable, and red represents unfavorable.

5.2.1 The Long- and Short-Term Effectiveness and Protectiveness of the Potential Remedy, along with the Degree of Certainty that the Remedy will Prove Successful

This balancing criterion takes into consideration the following sub criteria relative to the long-term and short-term effectiveness of the remedy, along with the anticipated success of the remedy.

5.2.1.1 Magnitude of reduction of existing risks

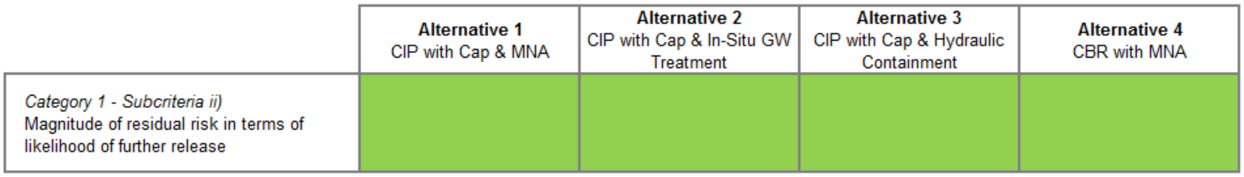
As summarized in **Section 3**, no unacceptable risk to human health and the environment exists with respect to the surface impoundments. Therefore, none of the remedial alternatives are necessary to reduce an assumed risk posed by Appendix IV constituents in groundwater because no such adverse risk currently exists. However, other types of impacts can be posed by the various remedial alternatives considered here. The remedial alternatives that pose the least external impact are Alternative 1 (CIP with MNA) because it involves the least amount of construction and operations and maintenance activities and associated impacts, and Alternative 2 (CIP with in-situ treatment) since treatment will reduce concentrations of constituents in groundwater short-term without generating a secondary waste stream. Alternative 4 (CBR with MNA) has the highest risk to human health and the environment related to excessive and prolonged truck traffic, which increases the likelihood of roadway accidents during the period of time needed to complete the CBR project. Construction of the treatment system and the cap will be required for Alternative 3 (CIP with HC) and a waste stream including a high volume of effluent will be generated posing additional risk but this alternative, like Alternatives 1 and 2, pose a lesser risk than Alternative 4.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria i) Magnitude of reduction of risks	🟩	🟩	🟩	🟥

5.2.1.2 *Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy*

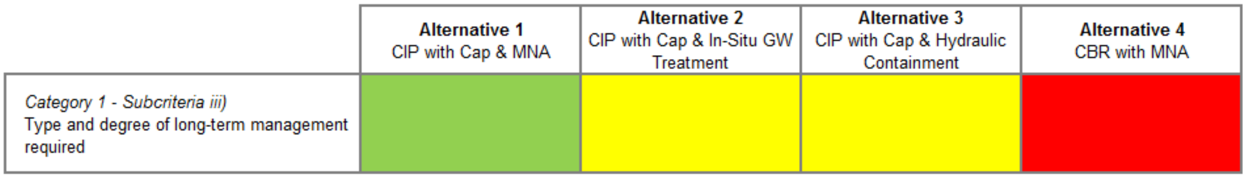
Alternative 4 (CBR with MNA) has the lowest long-term residual risk in that the source material is removed. However, implementation of this alternative would take 20 years or greater to implement during which time the source material (ash) is subject to ongoing infiltration (because it remains open to the environment during removal), relative to the other alternatives. For Alternatives 1 through 3, the CCR would be CIP with the installation of a low permeability ($<1 \times 10^{-7}$ cm/s) geomembrane that virtually eliminates infiltration of precipitation and isolates the source material. Dissolved phase COCs to groundwater are addressed through MNA process. Alternatives 2 and 3 also provide additional measures to address potential groundwater impacts through in-situ treatment and hydraulic controls. but Alternative 3 will result in an additional waste stream.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria ii) Magnitude of residual risk in terms of likelihood of further release	🟩	🟩	🟩	🟩

5.2.1.3 *The type and degree of long-term management required, including monitoring, operation, and maintenance*

Alternative 1 (CIP with MNA) is the most favorable alternative with respect to this criterion because it requires the least amount of long-term management and involves no mechanical systems as part of the remedy. Alternative 4 (CBR with MNA) is least favorable because off-site removal is estimated to take 20 years or greater to complete and is logistically complex with transportation and coordination with off-site disposers (commercial landfills). The remaining alternatives fall between Alternatives 1 and 4 because they involve active remediation systems to implement and/or maintain throughout their remediation life cycle.

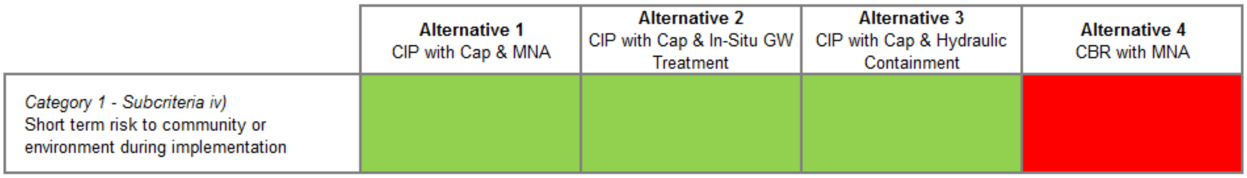


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria iii) Type and degree of long-term management required	🟩	🟨	🟨	🟥

5.2.1.4 Short-term risks that might be posed to the community or the environment during implementation of such a remedy

The highest short-term impact posed to the community or environment would be during implementation of Alternative 4 (CBR with MNA), making this alternative the least favorable. Potential environmental impacts include noise and emissions from heavy equipment, the potential for a release during excavation and dewatering, and fugitive dust emissions. Community impacts include general impacts to the community due to increased truck traffic on public roads during the entire project duration, along with an increased potential for traffic accidents and fatalities, noise, and truck emissions.

For Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC), risk to the community during implementation is considered the same and would be minimal compared to Alternative 4. Periodic sampling of the monitoring well network to verify treatment system effectiveness will pose no risk to the community.

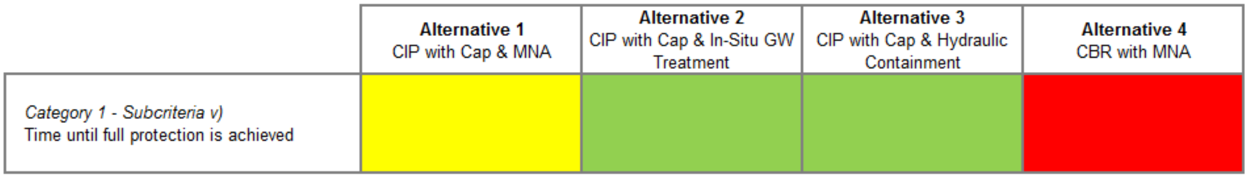


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria iv) Short term risk to community or environment during implementation	🟩	🟩	🟩	🟥

5.2.1.5 Time until full protection is achieved

There is currently no unacceptable risk to human health and the environment associated with groundwater at the regulated surface impoundments; therefore, protection is already achieved. Based upon predictive modeling, Alternative 1 (CIP with MNA) arsenic concentrations will attain GWPS in approximately 27 years (see **Figures 4-2, 4-3, and 4-4**). Alternatives 2 (CIP with in-situ treatment) and 3 (CIP with HC) take the least amount of time for COC concentrations to attain the GWPS (see **Figures 4-2, 4-3, and 4-4**) but a waste stream is produced by implementation of Alternative 3. These two alternatives are favorable given the shorter timeframe to achieve concentrations less than the GWPS.

Alternative 4 (CBR with MNA) could take approximately 20 years or greater to fully implement followed by a period of groundwater monitoring to verify natural attenuation of the existing groundwater plume, which makes this alternative unfavorable. As detailed in the Lochmueller report, implementation is limited mainly by the amount of material that can be excavated and hauled during a workday, disposal facility capacity, and the volume of ash.

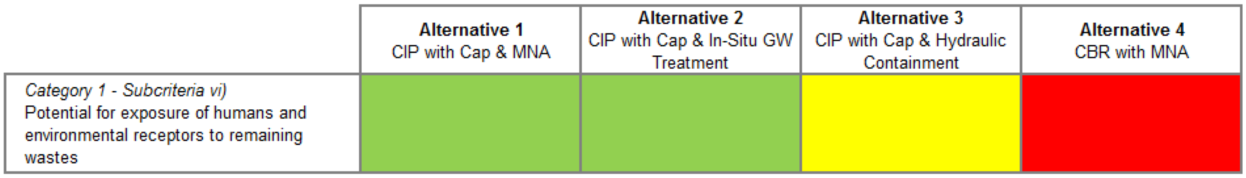


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria v) Time until full protection is achieved	🟨	🟩	🟩	🟥

5.2.1.6 *Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment*

Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) all have similar, minimal potential for exposure of humans and environmental receptors during regrading and cap construction; monitoring well system installation; and installation of the in-situ treatment system, or HC system. Alternative 1 (CIP with MNA) is the most favorable alternative since, aside from capping, no additional contact with CCR or impacted groundwater would be needed. Alternative 2 (CIP with in-situ treatment) is also favorable because treatment occurs below ground and no waste stream is generated. Alternative 3 (CIP with HC) is slightly less favorable since a secondary waste stream will be generated and will need to be managed either onsite or offsite, which creates a potential for exposure.

Alternative 4 (CBR with MNA) has high potential for exposure which makes this alternative the least favorable remedy for this criterion. A high potential for exposure exists during the excavation and transport of the CCR over local roadways, if Alternative 4 is implemented.



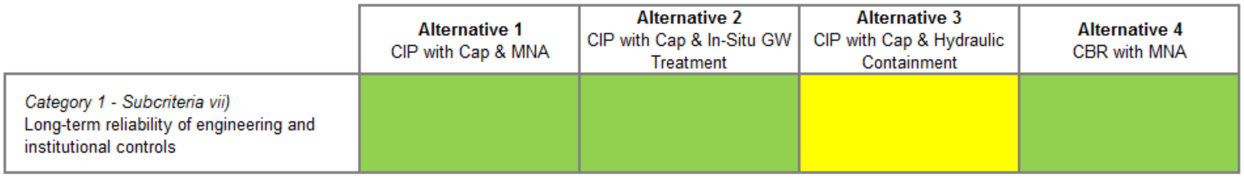
	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria vi) Potential for exposure of humans and environmental receptors to remaining wastes	🟩	🟩	🟨	🟥

5.2.1.7 *Long-term reliability of the engineering and institutional controls*

Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) are expected to have high long-term reliability, as capping and long-term monitoring are common methods for long-term waste management. HC and ex-situ treatment (Alternatives 3) are considered reliable, proven technologies and would have high long-term reliability, but rely require bench scale testing and rely on mechanical systems to operate. Of the CIP alternatives, Alternative 1 (CIP with MNA) is considered the most favorable because no additional ongoing Operations and Maintenance (O&M) would be needed, other than periodic groundwater sampling and verification of decreasing concentrations.

For Alternatives 1 through 3, which include CIP, institutional controls such as the recording of an environmental covenant restricting the use of groundwater can easily be implemented because the surface impoundments are located on property owned by Ameren.

Alternative 4 (CBR with MNA) engineering and institutional controls would have high long-term reliability because the CCR will have been removed from the surface impoundments. With the CCR no longer in place, no additional engineering and institutional controls are anticipated.

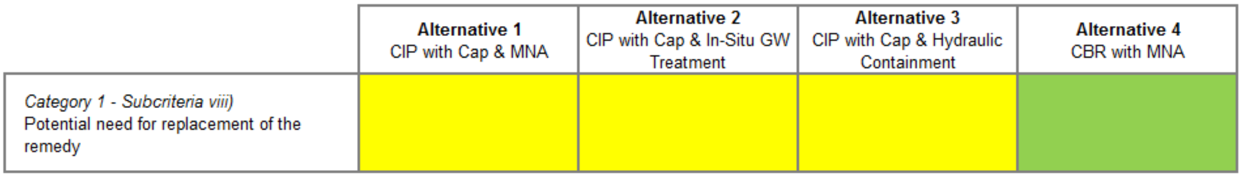


	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria vii) Long-term reliability of engineering and institutional controls	🟩	🟩	🟨	🟩

5.2.1.8 *Potential need for replacement of the remedy*

Closure of the surface impoundments by CBR (Alternative 4) is considered permanent and can be effective in appropriate circumstances. From the perspective of needing to replace the remedy, source removal (Alternative 4) is permanent but takes decades to implement.

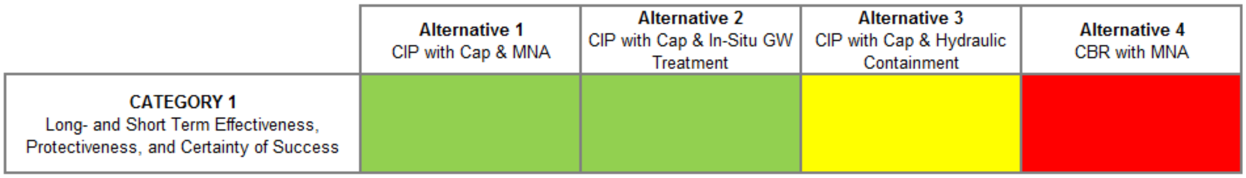
Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) are expected to have permanent closures with capping in place. Should monitoring results indicate that the selected remedial alternative is not effective at reducing the concentration of COCs over time, alternate and/or additional active remedial methods for groundwater may be considered in the future.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 1 - Subcriteria viii) Potential need for replacement of the remedy	🟨	🟨	🟨	🟩

5.2.1.9 *Long- and short-term effectiveness and protectiveness criterion summary*

The graphic below provides a summary of the long- and short-term effectiveness and protectiveness of the potential remedy, along with the degree of certainty that the remedy will prove successful. Alternative 1 (CIP with MNA) is the most favorable, while Alternative 4 (CBR with MNA) is the least favorable. Alternative 1 is expected to be effective both short- and long-term and does not include additional treatment technology aside from MNA. Alternative 2 (CIP with in-situ treatment) is comparable to Alternative 1 because it has a shorter potential timeframe to meet the GWPS despite requiring treatment, but no secondary waste stream is generated. A secondary waste stream is generated under Alternative 3 (CIP with HC). Alternative 4 (CBR with MNA) will require a lengthy construction period, and therefore is not effective in the short-term, and creates short-term risk (for 20 plus years) to the community during construction. Further, to implement Alternative 4 (CBR and MNA) the CCR Units will be open to the environment during the 20 plus year removal process resulting in no source control for decades.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 1 Long- and Short Term Effectiveness, Protectiveness, and Certainty of Success	🟩	🟩	🟨	🟥

5.2.2 The Effectiveness of the Remedy in Controlling the Source to Reduce Further Releases

This balancing criterion takes into consideration the ability of the remedy to control a future release, and the extensiveness of treatment technologies that will be required.

5.2.2.1 *The extent to which containment practices will reduce further releases*

For remedial Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC) installation of the low permeability cap will reduce the infiltration of surface water into the surface impoundments and decrease the flux of COCs to groundwater over time. Groundwater mounding and an associated outward hydraulic gradient present during operation is expected to dissipate after closure. Alternatives 2 and 3 are considered the most favorable because treatment technologies will be implemented to further limit down-gradient migration of COCs in groundwater.

Under Alternative 4 (CBR with MNA), no further releases are anticipated following removal of the CCR material. However, the implementation of Alternative 4 is anticipated to require multiple decades to complete with MNA monitoring following completion of construction. During the period of construction, there would be no source control of the Appendix IV constituents because the CCR Units will be open to the environment.

For Alternatives 2 (CIP with in-situ treatment) and 3 (CIP with HC), additional containment or treatment practices (in-situ treatment and HC with ex-situ treatment) will address COCs in groundwater migrating downgradient from the surface impoundments, achieving the performance criteria at the waste boundary. Alternative 3, however, will create additional waste streams requiring management on and off-site. Alternative 1 will not have an additional containment technology beyond natural attenuation but is expected to reduce the concentrations below the GWPS over time.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 2 - Subcriteria i) Extent to which containment practices will reduce further releases	🟨	🟩	🟩	🟨

5.2.2.2 The extent to which treatment technologies may be used

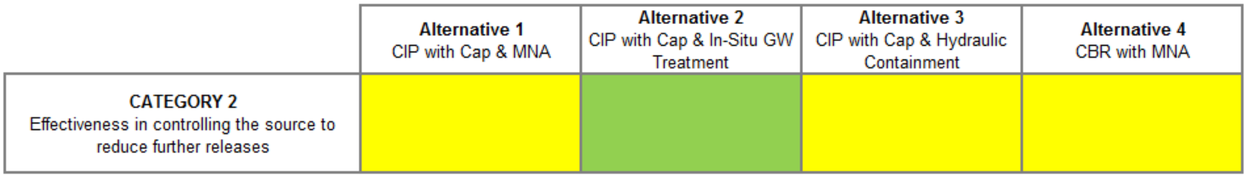
No groundwater treatment technologies, other than natural attenuation, will be used for Alternatives 1 and 4. There would be no ongoing operation and maintenance of a treatment technology, other than periodic groundwater monitoring. Alternative 1 relies only on low-permeability capping, and therefore is the most favorable.

Alternative 2 will use one additional technology, in-situ treatment, while Alternatives 3 will use two additional technologies, HC and ex-situ treatment. The operation of an ex-situ treatment system will create a secondary waste stream, such as concentrated reject water (RO) requiring off-site disposal, or depleted resin (ion exchange) requiring regeneration or off-site disposal.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 2 - Subcriteria ii) Extent to which treatment technologies may be used	🟩	🟩	🟨	🟩

5.2.2.3 Effectiveness of the remedy in controlling the source to reduce further releases summary

The graphic below provides a summary of the effectiveness of the remedial alternatives to control the source to reduce further releases. Alternative 2 (CIP with in-situ treatment) is the most favorable, while Alternatives 1 (CIP with MNA), 3 (CIP with HC), and 4 (CBR with MNA) are the least favorable. The construction period for Alternative 2 (CIP with in-situ treatment) is expected to be brief and will begin treating groundwater at the unit boundary immediately. Further releases under Alternative 4 (CBR with MNA) will not be addressed until construction is complete.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 2 Effectiveness in controlling the source to reduce further releases	🟨	🟩	🟨	🟨

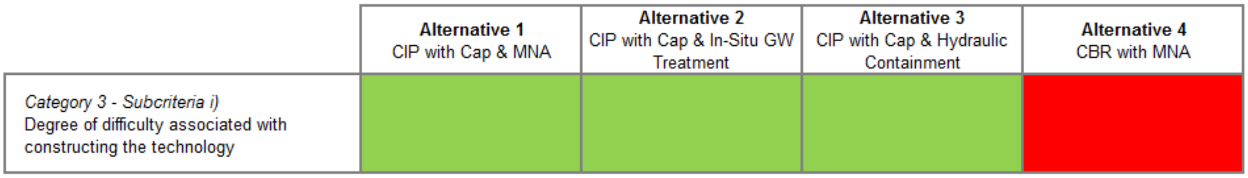
5.2.3 The Ease or Difficulty of Implementing a Potential Remedy

This balancing criterion takes into consideration technical and logistical challenges required to implement a remedy, including practical considerations such as equipment availability and disposal facility capacity.

5.2.3.1 Degree of difficulty associated with constructing the technology

CIP with a low permeability cap will be straightforward and can be implemented with common construction methods for Alternatives 1 (CIP with MNA), 2 (CIP with in-situ treatment), and 3 (CIP with HC). No construction difficulties are anticipated if Alternatives 1, 2, and 3 are implemented. Specialty equipment or contractors are not required. Alternative 2 may be slightly more difficult to implement should a subsurface trench be required for a permeable barrier and Alternative 3 does require construction and installation of a treatment system. For Alternative 1, no additional treatment technology is needed other than monitoring wells for groundwater monitoring.

Alternative 4 (CBR with MNA) will be difficult to implement due to technical and logistical challenges. Alternative 4 will include large-scale excavation adjacent to the Meramec River and the transportation of 5.2 MM CY of CCR over local roadways. Alternative 4 will include large-scale construction, specialty equipment and contractors, long project durations, and significant technical challenges.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria i) Degree of difficulty associated with constructing the technology	🟩	🟩	🟩	🟥

5.2.3.2 Expected operational reliability of the technologies

Alternative 1 (CIP with MNA) is considered the most favorable from an operational perspective because capping with MNA has a proven track record and requires limited O&M. Alternatives 2 and 3 are expected to be reliable but will utilize additional groundwater treatment technologies. Alternative 4 (CBR with MNA) is considered a reliable alternative as all CCR material would be removed, although implementation would be challenging.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria ii) Expected operational reliability of the technologies	🟩	🟨	🟨	🟩

5.2.3.3 Need to coordinate with and obtain necessary approvals and permits from other agencies

Alternative 1 (CIP with MNA) is the most favorable since the implementation of the remedy is straightforward and only includes capping and MNA. Alternative 4 (CBR with MNA) will require confirmation that off-site landfills are permitted to accept the ash and that there are no local siting restrictions that apply and permitting for large-scale construction will likely be required. Permitting is expected to be straightforward for CIP Alternatives 2 and 3. Additional approval and permitting may be required for Alternative 2 (CIP with in-situ treatment) because this alternative includes subsurface application of groundwater amendments and permitting would likely be required for Alternative 3 for treated groundwater discharge.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria iii) Need to coordinate with and obtain necessary approvals and permits from other agencies	🟩	🟨	🟨	🟥

5.2.3.4 Availability of necessary equipment and specialists

Alternative 1 (CIP with MNA) is the most favorable since specialty equipment and specialists will not be required to implement the MNA remedy. Equipment needed to implement Alternatives 2 and 3 are expected to be readily available.

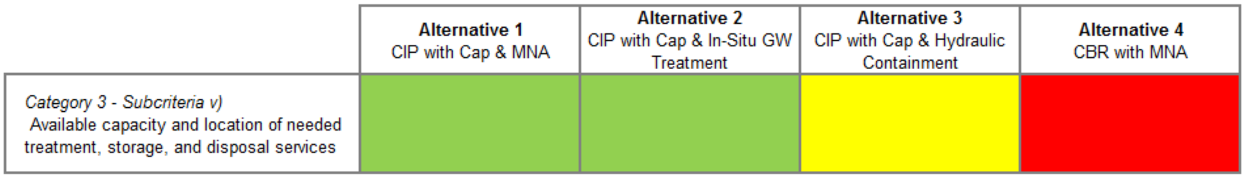
Alternative 4 (CBR with MNA) is the least favorable since specialty remediation contractors will be needed to implement full removal, which will include large-scale construction and transportation of material to off-site disposal facilities.

	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria iv) Availability of necessary equipment and specialists	🟩	🟩	🟩	🟥

5.2.3.5 Available capacity and location of needed treatment, storage, and disposal services

The Lochmueller Study assists in the evaluation of the CBR alternative (Alternative 4) by evaluating available capacity at an Illinois landfill reasonably proximate to the MEC that could potentially receive CCR for disposal. Three such landfills were identified in the main report text associated with material disposal from a separate Ameren site. However, further work would be required to confirm that the landfills identified are permitting to accept the ash for disposal and that there are no local siting restrictions preventing those landfills from accepting the ash material. Due to the disposal requirements, Alternative 4 (CBR with MNA) is the least favorable alternative.

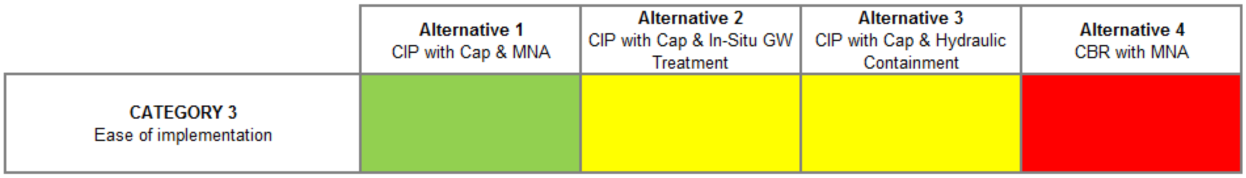
Because the regulated surface impoundments will be CIP for Alternatives 1, 2, and 3, treatment, storage, and disposal services for CCR material will not be needed. Temporary stockpiling of CCR during regrading and capping can be completed within the current boundaries of the ash unit. Alternative 1 is the most favorable alternative since no active treatment is included. For Alternative 3, the ex-situ treatment system will generate a concentrated waste stream which will require off-site transportation and disposal that the other alternatives would not require.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
Category 3 - Subcriteria v) Available capacity and location of needed treatment, storage, and disposal services	🟩	🟩	🟨	🟥

5.2.3.6 Ease or difficulty of implementation summary

The graphic below provides a summary of the ease or difficulty that will be needed to implement each alternative. Alternative 1 (CIP with MNA) is the most favorable, while Alternative 4 (CBR with MNA) is the least favorable.



	Alternative 1 CIP with Cap & MNA	**Alternative 2** CIP with Cap & In-Situ GW Treatment	**Alternative 3** CIP with Cap & Hydraulic Containment	**Alternative 4** CBR with MNA
CATEGORY 3 Ease of implementation	🟩	🟨	🟨	🟥

6. Summary

This Corrective Measures Assessment has evaluated the following alternatives:

- Alternative 1 – Closure in Place with Capping and Monitored Natural Attenuation
- Alternative 2 – CIP with Capping and In-Situ Groundwater Treatment
- Alternative 3 – CIP with Capping and Hydraulic Containment Through Groundwater Pumping and Ex-situ Treatment
- Alternative 4 – Closure by Removal with Monitored Natural Attenuation

In accordance with §257.97, each of these alternatives has been evaluated in the context of the following threshold criteria:

- Be protective of human health and the environment;
- Attain the GWPS;
- Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of COCs to the environment;
- Remove from the environment as much of the contaminated material that was released from the CCR units as is feasible, considering factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
- Comply with standards (regulations) for waste management.

In addition, in accordance with §257.97(c), each of the alternatives has been evaluated in the context of the following balancing criteria:

- The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of eight factors.
- The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the extent to which containment practices will reduce further releases and the extent to which treatment technologies may be used.
- The ease or difficulty of implementing a potential remedy(s) based on consideration of five types of factors

This Corrective Measures Assessment, and the input received during the public comment period, will be used to identify a final corrective measure for implementation at the MEC.

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TABLES

TABLE I
GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total	Arsenic Total	Barium Total	Beryllium Total	Cadmium Total	Chromium Total	Fluoride Total	Cobalt Total	Lead Total	Lithium Total	Mercury Total	Molybdenum Total	Selenium Total	Thallium Total
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Site GWPS	**6**	**10**	**2000**	**4**	**5**	**100**	**4**	**6**	**15**	**40**	**2**	**100**	**50**	**2**
BMW-1	5/13/2016	0.71 J	1.2	254	1 U	0.5 U	1 U	0.42	5 U	5 U	16	0.2 U	5.6 J	0.39 J	1 U
	6/16/2016	1 U	1.3	239	1 U	0.5 U	0.50 J	0.42	5 U	5 U	12	0.2 U	6.6 J	0.32 J	1 U
	7/19/2016	0.081 J	5.5	232	1 U	0.5 U	0.47 J	0.37	5 U	5 U	15.2	0.2 U	6.8 J	1 U	1 U
	9/7/2016	0.62 J	0.99 J	237	1 U	0.5 U	1 U	0.38	5 U	5 U	13.4	0.2 U	7.2 J	0.36 J	1 U
	11/10/2016	0.64 J	1.1	230	1 U	0.5 U	0.46 J	0.44	5 U	5 U	14.2	0.2 U	20 U	0.29 J	1 U
	1/6/2017	1 U	0.89 J	241	1 U	0.5 U	1 U	0.44	5 U	5 U	14.6	0.2 U	5.4 J	0.19 J	1 U
	3/7/2017	0.60 J	2.1	221	1 U	0.5 U	1.8	0.39	5 U	5 U	14.9	0.2 U	6.7 J	0.18 J	1 U
	6/14/2017	0.60 J	1.7	224	1 U	0.5 U	1 U	0.38	5 U	5 U	12.8	0.2 U	6.4 J	0.11 J	1 U
	11/6/2017							0.48							
	4/4/2018	0.51 J	1.9	237	1 U	0.5 U	0.11 J	0.18 J	5 U	10 U	13.8	0.2 U	4.3 J	1 U	1 U
	5/17/2018		1.5	251			1 U	0.36			500 UO		5.1 J		
	11/19/2018		1.4	204			0.11 J	0.43			15		4.6 J		
BMW-2	3/29/2016	1 U	0.80 J	485	1 U	0.5 U	0.62 J	0.38	5 U	5 U	5.7 J	0.2 U	20 U	1 U	1 U
	5/13/2016	1 U	1.3	538	1 U	0.5 U	1 U	0.34	5 U	3.1 J	8.3 J	0.2 U	20 U	1 U	1 U
	7/19/2016	0.63 J	1.2	503	1 U	0.5 U	0.36 J	0.25	5 U	5 U	6.8 J	0.2 U	0.53 J	0.28 J	1 U
	9/7/2016	1 U	1.2	534	1 U	0.5 U	0.65 J	0.34	5 U	3.5 J	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	1.6	528	1 U	0.5 U	0.66 J	0.28	5 U	5 U	6.9 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	1.8	553	1 U	0.5 U	1 U	0.26	5 U	5 U	7.5 J	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	1.5	566	1 U	0.5 U	1.2	0.28	5 U	5 U	7.4 J	0.2 U	20 U	1 U	1 U
	6/14/2017	1 U	1.8	547	1 U	0.5 U	1 U	0.27	5 U	2.5 J	5.6 J	0.2 U	20 U	1 U	1 U
	11/6/2017							0.28							
	4/4/2018	1 U	1.1	537	1 U	0.31 J	0.45 J	0.10 J	5 U	10 U	9.3 J	0.2 U	20 U	1 U	1 U
	5/17/2018		1.7	566			1 U	0.31			500 UO		10 U		
	11/19/2018		1.1	524			0.45 J	0.35			6.5 J		20 U		
MW-1	3/29/2016	0.063 J	0.83 J	352	1 U	0.042 J	0.97 J	0.3	1.5 J	5 U	10 U	0.2 U	20 U	1 U	1 U
	5/17/2016	1 U	0.63 J	375	1 U	0.5 U	1 U	0.3	5 U	4.3 J	10 U	0.041 J	0.84 J	1 U	1 U
	7/18/2016	1 U	0.49 J	374	1 U	0.5 U	0.79 J	0.25	5 U	4.9 J	10 U	0.2 U	20 U	1 U	1 U
	9/8/2016	1 U	0.62 J	378	1 U	0.5 U	0.88 J	0.22	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	0.46 J	364	1 U	0.5 U	0.77 J	0.24	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	0.38 J	357	1 U	0.5 U	1 U	0.25	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	0.67 J	372	1 U	0.5 U	1 U	0.25	5 U	5 U	10 U	0.2 U	20 U	1 U	0.064 J
	6/14/2017	0.032 J	1 U	374	0.23 J	0.5 U	1.6	0.23	5 U	5 U	10 U	0.2 U	20 U	1 U	0.076 J
	11/6/2017							0.26							
	4/4/2018	0.028 J	0.71 J	359	0.17 J	0.22 J	0.74 J	0.069 J	5 U	10 U	7.1 J	0.2 U	20 U	0.10 J	1 U
	5/18/2018		1.2	358			0.52 J	0.28			500 UO		10 U		
	11/20/2018		0.68 J	370			0.36 J	0.3			5.3 J		20 U		
MW-2	3/29/2016	1 U	2	471	1 U	0.5 U	0.74 J	0.17 J	5 U	2.6 J	10 U	0.2 U	1.2 J	1 U	1 U
	5/16/2016	1 U	2.5	500	1 U	0.5 U	1 U	0.16 J	5 U	2.8 J	6.0 J	0.040 J	20 U	1 U	1 U
	7/18/2016	1 U	1.4	490	1 U	0.5 U	0.43 J	0.11 J	5 U	5 U	6.1 J	0.2 U	2.1 J	1 U	1 U
	9/8/2016	1 U	1.6	515	1 U	0.5 U	1.3	0.088 J	5 U	2.7 J	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	1.3	491	1 U	0.5 U	0.70 J	0.11 J	5 U	5 U	6.0 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	1.5	456	1 U	0.5 U	1 U	0.093 J	5 U	5 U	10 U	0.2 U	20 U	1 U	1 U
	3/7/2017	1 U	1.8	466	1 U	0.5 U	1.7	0.11 J	5 U	5 U	5.2 J	0.2 U	20 U	1 U	1 U
	6/14/2017	1 U	1.6	393	1 U	0.5 U	1 U	0.2 U	5 U	2.4 J	3.2 J	0.2 U	2.5 J	1 U	1 U
	11/6/2017							0.11 J							
	1/2/2018							0.15 J							
	4/4/2018	0.16 J	1.8	324	1 U	0.5 U	0.16 J	0.2 U	5 U	10 U	8.2 J	0.2 U	20 U	1 U	1 U
	5/17/2018		2.5	328			1 U	0.13 J			500 UO		10 U		
	11/19/2018		1.7	299			0.31 J	0.2 U			6.4 J		20 U		
MW-3	3/29/2016	1 U	4.6	238	1 U	0.5 U	0.93 J	0.14 J	1.0 J	5 U	10 U	0.2 U	2.5 J	1 U	1 U
	5/17/2016	1 U	6.1	255	1 U	0.5 U	1 U	0.14 J	5 U	5 U	8.0 J	0.041 J	1.9 J	1 U	1 U
	7/18/2016	1 U	1 UO	253	1 U	0.5 U	0.50 J	0.082 J	5 U	5 U	7.1 J	0.2 U	3.4 J	1 U	1 U
	9/8/2016	1 U	7.7	270	1 U	0.5 U	1 U	0.076 J	1.0 J	5 U	10 U	0.2 U	20 U	1 U	1 U
	11/10/2016	1 U	7.8	244	1 U	0.5 U	0.52 J	0.091 J	1.5 J	5 U	5.6 J	0.2 U	20 U	1 U	1 U
	1/6/2017	1 U	6.6	201	1 U	0.5 U	1 U	0.079 J	5 U	5 U	5.1 J	0.2 U	3.1 J	1 U	1 U
	3/7/2017	1 U	7.9	217	1 U	0.5 U	1 U	0.13 J	5 U	5 U	8.1 J	0.2 U	5.0 J	1 U	0.053 J
	6/14/2017	0.031 J	7.1	206	1 U	0.5 U	1 U	0.2 U	1.7 J	2.5 J	3.7 J	0.2 U	5.2 J	1 U	0.061 J
	11/6/2017							0.2 U							
	4/4/2018	1 U	8.1	253	1 U	0.11 J	0.34 J	0.2 U	5 U	10 U	9.0 J	0.2 U	2.6 J	1 U	1 U
	5/17/2018		8.3	264			0.64 J	0.12 J			500 UO		10 U		
	11/19/2018		7.8	232			1 U	0.2 U			10 U		3.6 J		

TABLE I
GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total ug/L	Arsenic Total ug/L	Barium Total ug/L	Beryllium Total ug/L	Cadmium Total ug/L	Chromium Total ug/L	Fluoride Total mg/L	Cobalt Total ug/L	Lead Total ug/L	Lithium Total ug/L	Mercury Total ug/L	Molybdenum Total ug/L	Selenium Total ug/L	Thallium Total ug/L
	Site GWPS	6	10	2000	4	5	100	4	6	15	40	2	100	50	2
MW-4	3/29/2016	1 U	**10.5**	222	1 U	0.5 U	0.68 J	0.21	5 U	5 U	22.4	0.2 U	51.7	1 U	1 U
	5/16/2016	1 U	**13**	222	0.47 J	0.5 U	1 U	0.21	5 U	3.6 J	22.7	0.2 U	49.7	1 U	1 U
	7/19/2016	1 U	**13.3 J**	216	1 U	0.5 U	1	0.15 J	5 U	5 U	23.2	0.2 U	54	1 U	1 U
	9/8/2016	1 U	**13.7**	229	1 U	0.5 U	0.61 J	0.13 J	5 U	5 U	20.3	0.2 U	52.5	1 U	1 U
	11/10/2016	1 U	**14.5**	213	1 U	0.5 U	0.56 J	0.16 J	5 U	5 U	26.3	0.2 U	54.4	1 U	1 U
	1/6/2017	1 U	**13.3**	214	1 U	0.5 U	1 U	0.12 J	5 U	2.7 J	22.4	0.2 U	50.4	1 U	1 U
	3/7/2017	1 U	**14.6**	228	1 U	0.5 U	1 U	0.18 J	5 U	5 U	23.5	0.2 U	53.8	1 U	1 U
	6/14/2017	1 U	**14.8**	219	0.23 J	0.5 U	1 U	0.12 J	5 U	5 U	20.9	0.2 U	56	1 U	1 U
	11/6/2017							0.14 J							
	4/4/2018	0.027 J	**14.4**	214	0.28 J	0.16 J	0.33 J	0.2 U	5 U	10 U	27	0.2 U	55	0.12 J	1 U
	5/17/2018		**15**	218			1 U	0.18 J			500 UO		55.6		
	11/19/2018		**14.8**	200			0.25 J	0.2 U			23.3		51.1		
MW-5	3/29/2016	1 U	8	289	1 U	0.5 U	0.42 J	0.25	5 U	5 U	19.6	0.2 U	82.2	1 U	1 U
	5/13/2016	1 U	**13.4**	292	1 U	0.5 U	1 U	0.25	5 U	4.2 J	21.2	0.2 U	74.4	1 U	1 U
	7/19/2016	1 U	**17.1**	293	1 U	0.5 U	1 U	0.21	5 U	3.3 J	20.9	0.2 U	84	1 U	1 U
	9/8/2016	1 U	**18.7**	301	1 U	0.5 U	0.42 J	0.16 J	5 U	3.2 J	18.3	0.2 U	83.8	1 U	1 U
	11/10/2016	1 U	**19.9**	305	1 U	0.5 U	0.37 J	0.25 J	5 U	5 U	25.3	0.2 U	90.4	1 U	1 U
	1/6/2017	1 U	**20.6**	304	1 U	0.052 J	1 U	0.17 J	5 U	5 U	22.9	0.2 U	96.5	1 U	1 U
	3/7/2017	1 U	**21.9**	312	1 U	0.5 U	1 U	0.21	5 U	5 U	23.1	0.2 U	93.7	1 U	1 U
	6/14/2017	1 U	**21**	308	1 U	0.5 U	1 U	0.16 J	5 U	5 U	20.2	0.2 U	97.3	1 U	1 U
	11/6/2017							0.18 J							
	4/5/2018	1 U	**22.1**	245	1 U	0.5 U	0.22 J	0.10 J	5 U	10 U	26.2	0.2 U	98.3	1 U	1 U
	5/18/2018		**22.1**	259			1 U	0.24			500 UO		**105**		
	11/19/2018		1.8	195			0.14 J	0.22			18.1		**101**		
	1/24/2019		**19.7**												
MW-6	3/30/2016	0.062 J	5	75.4	1 U	0.5 U	0.37 J	0.17 J	0.86 J	5 U	**129**	0.2 U	**137**	1 U	1 U
	5/13/2016	1 U	8.3	94.4	1 U	0.5 U	1 U	0.15 J	0.74 J	5 U	**164**	0.2 U	**124**	1 U	1 U
	7/19/2016	1 U	1 U	72.5	1 U	0.5 U	1 U	0.13 J	5.7	5 U	**130**	0.2 U	**129**	1 U	1 U
	9/8/2016	1 U	4.8	69.3	1 U	0.5 U	1 U	0.097 J	3.8 J	5 U	**123**	0.2 U	**120**	1 U	1 U
	11/10/2016	0.066 J	3	66.8	1 U	0.5 U	0.54 J	0.38	**6.1**	5 U	**130**	0.2 U	**135**	1 U	1 U
	1/6/2017	1 U	2.5	66.5	1 U	0.050 J	1 U	0.10 J	**6.5**	5 U	**138**	0.2 U	**163**	1 U	1 U
	3/7/2017	0.030 J	4	66.3	1 U	0.5 U	1 U	0.16 J	5.7	2.7 J	**140**	0.2 U	**157**	1 U	0.038 J
	6/15/2017	0.073 J	2.3	59.6	1 U	0.027 J	1 U	0.12 J	**7.8**	5 U	**129**	0.2 U	**147**	1 U	1 U
	11/6/2017							0.3							
	4/3/2018	0.043 J	4.9	53.8	0.36 J	0.069 J	2.4	0.13 J	4.1 J	10 U	**144**	0.2 U	**134**	1 U	1 U
	5/18/2018		5.5	55			0.71 J	0.15 J			**419 J**		**140**		
	11/19/2018		2.9	49.4			0.12 J	0.2 U			**131**		**135**		
MW-7	3/29/2016	0.41 J	2.6	57.4	1 U	0.081 J	0.91 J	0.31	5 U	5 U	37.8	0.2 U	**451**	1.5	1 U
	5/13/2016	0.37 J	3.8	59.6	1 U	0.11 J	1 U	0.36	1.2 J	5 U	**40.3**	0.2 U	**338**	0.55 J	1 U
	7/19/2016	0.065 J	3.7	49.1	1 U	0.5 U	0.74 J	0.25	5 U	5 U	**50.9**	0.2 U	**359**	1 U	1 U
	9/7/2016	0.40 J	2.4	44.8	1 U	0.5 U	1 U	0.52	5 U	5 U	**43.6**	0.2 U	**351**	10.3	1 U
	11/10/2016	0.39 J	2.4	43.3	1 U	0.22 J	0.57 J	0.6	5 U	5 U	**58.3**	0.2 U	**331**	12.9	1 U
	1/6/2017	1 U	2.4	51.5	1 U	0.33 J	1 U	0.64	5 U	2.7 J	**71.1**	0.2 U	**297**	16.6	1 U
	3/7/2017	0.44 J	2.5	56	1 U	0.20 J	1 U	0.3	5 U	2.8 J	**74.2**	0.2 U	**314**	7.7	0.11 J
	6/15/2017	0.39 J	2.1	36.3	1 U	0.14 J	1.5	0.46	5 U	5 U	38.1	0.2 U	**717**	0.61 J	0.13 J
	11/6/2017							0.61							
	1/3/2018							0.35							
	4/3/2018	0.42 J	3.2	41.8	0.35 J	0.22 J	1 U	0.31 J	5 U	10 U	**62**	0.2 U	**502**	0.45 J	0.12 J
	5/18/2018		4.8	40.2			1 U	0.4			**287 J**		**560**		
	11/19/2018		2.6	37.9			0.25 J	0.31 J			**48.6**		**461**		

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GROUNDWATER ANALYTICAL RESULTS - APPENDIX IV CONSTITUENTS
CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Monitoring Well ID	Date Sampled	Antimony Total	Arsenic Total	Barium Total	Beryllium Total	Cadmium Total	Chromium Total	Fluoride Total	Cobalt Total	Lead Total	Lithium Total	Mercury Total	Molybdenum Total	Selenium Total	Thallium Total
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Site GWPS	6	10	2000	4	5	100	4	6	15	40	2	100	50	2
MW-8	3/30/2016	0.060 J	6.6	179	1 U	0.5 U	0.88 J	0.29	5 U	5 U	27.6	0.2 U	**229**	1 U	1 U
	5/16/2016	1 U	6.2	218	1 U	0.5 U	1 U	0.28	5 U	4.8 J	30.4	0.047 J	**204**	1 U	1 U
	7/19/2016	0.38 J	2.1	236	1 U	0.11 J	1 U	0.23	5 U	5 U	32	0.2 U	**215**	9	1 U
	9/8/2016	1 U	5.6	234	1 U	0.5 U	1 U	0.20 J	5 U	5 U	26.1	0.2 U	**211**	1 U	1 U
	11/10/2016	1 U	5.9	211	1 U	0.5 U	1 U	0.21	5 U	5 U	30.8	0.2 U	**212**	1 U	1 U
	1/6/2017	1 U	5.2	226	1 U	0.052 J	1 U	0.34	5 U	5 U	32.2	0.2 U	**207**	1 U	1 U
	3/7/2017	0.37 J	6.1	240	1 U	0.5 U	1.2	0.22	5 U	5.2	33	0.2 U	**213**	1 U	1 U
	6/14/2017	1 U	5.8	227	1 U	0.5 U	1 U	0.2	5 U	5 U	31.4	0.2 U	**190**	1 U	1 U
	11/6/2017							0.23							
	4/5/2018	1 U	6	199	1 U	0.035 J	0.20 J	0.2 UO	5 U	3.4 J	32.4	0.2 U	**192**	1 U	1 U
	5/17/2018		6.5	196			1 U	0.23			500 UO		**205**		
	11/19/2018		5.8	168			1 U	0.22			33.7		**183**		
AMW-1	11/20/2018	1 U	**18**	325	1 U	0.5 U	0.19 J	0.19 J	5 U	10 U	16.4	0.2 U	39.1	1 U	1 U
AMW-2	11/19/2018	1 U	**11.7**	147	1 U	0.5 U	0.23 J	0.3	5 U	10 U	36	0.2 U	4.3 J	1 U	1 U
TP-1	11/20/2018	1 U	1.9	386	1 U	0.039 J	0.17 J	0.3	5 U	4.1 J	17.2	0.2 U	3.1 J	1 U	1 U
TP-2	11/19/2018	1 U	3.8	58.8	1 U	0.5 U	1 U	0.36	5 U	10 U	**42.7**	0.2 U	6.2 J	1 U	1 U

Notes:
49 Bold denotes concentration exceeding the GWPS
Blank cells - Constituent not included in this analysis.
mg/L - milligrams per liter.
ug/L - micrograms per liter.
GWPS - Groundwater Protection Standard.

Qualifiers:
J - Value is estimated.
U - Constituent was not detected, value is the reporting limit.
O - Value identified as an outlier.

Site GWPS is either the MCL/Health Based GWPS or based on background levels (calculated as described in the Statistical Analysis Plan for Assessment Monitoring), whichever is higher. GWPS and background values calculated using baseline sampling results from monitoring wells BMW-1 and BMW-2.

FIGURES

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0001_SITE_LOCUS.mxd — USER: hwachholz — LAST SAVED: 5/7/2019 10:43:41 AM

LEGEND

- MERMEC ENERGY CENTER PROPERTY BOUNDARY
- ACTIVE SURFACE IMPOUNDMENT
- EXEMPT SURFACE IMPOUNDMENT
- CAPPED AND CLOSED SURFACE IMPOUNDMENT

N

0 1,000 2,000

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. IMAGERY SOURCE: ESRI

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

SITE LOCATION MAP

MAY 2019

FIGURE 1-1

LEGEND

⊕ CCR GROUNDWATER MONITORING WELL

🟨 REGULATED SURFACE IMPOUNDMENT

☐ ACTIVE SURFACE IMPOUNDMENT

☐ CAPPED AND CLOSED SURFACE IMPOUNDMENT

☐ EXEMPT SURFACE IMPOUNDMENT

—·-·— MERAMEC ENERGY CENTER PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. CCR - COAL COMBUSTION RESIDUALS.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 800 1,600
SCALE IN FEET

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

SITE FEATURES

MAY 2019

FIGURE 1-2

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0002_SITE_FEATURES_.mxd — USER: hwachholz — LAST SAVED: 5/9/2019 10:17:06 AM

GIS FILE PATH: \\haleyaldrich.com\share\cle_common\Projects\132002 - Ameren Ash Pond Closure Assessment\008-Meramec\GIS\Maps\2019_05\132002_008_0002_MW_ABOVE_GWPS_.mxd — USER: hwachholz — LAST SAVED: 5/14/2019 9:27:28 AM

LEGEND

⊕ CCR GROUNDWATER MONITORING WELL

⊕ NATURE AND EXTENT MONITORING WELL

◐ NATURE AND EXTENT PIEZOMETER

▨ REGULATED SURFACE IMPOUNDMENT

☐ ACTIVE SURFACE IMPOUNDMENT

☐ CAPPED AND CLOSED SURFACE IMPOUNDMENT

☐ EXEMPT SURFACE IMPOUNDMENT

— · — MERAMEC ENERGY CENTER PROPERTY BOUNDARY

MW-4 MW-5 ⊕ As = ARSENIC CONCENTRATION ABOVE THE GWPS

MW-6 ⊕ Li = LITHIUM CONCENTRATION ABOVE THE GWPS

MW-6 MW-7 MW-8 ⊕ Mo = MOLYBDENUM CONCENTRATION ABOVE THE GWPS

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. CCR - COAL COMBUSTION RESIDUALS.
3. GWPS- GROUNDWATER PROTECTION STANDARD
4. AERIAL IMAGERY SOURCE: ESRI

N

0 800 1,600

SCALE IN FEET

HALEY ALDRICH

CORRECTIVE MEASURES ASSESSMENT
AMEREN MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

MONITORING WELL LOCATIONS WITH STATISTICALLY SIGNIFICANT LEVELS ABOVE THE GWPS

MAY 2019

FIGURE 2-1

Path: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\Meramec Energy Center\MEC River Sampling\MEC - Surface Water Sampling Locations - V2.mxd

LEGEND

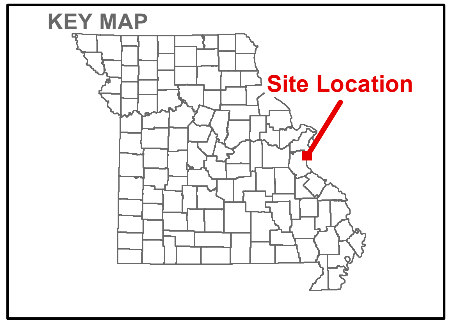
- Meramec Energy Center Property Boundary
- Unnamed Creek/Drainage
- NPDES Outfall Location
- All Surface Impoundments

May 2018 Surface Water Samples (M2)

- △ Small Creek/Drainage Sample
- ▲ Meramec River Sample
- ▲ Mississippi River Sample

September 2017 Surface Water Samples (M)

- ⊗ Small Creek/Drainage Sample
- ⊗ Meramec River Sample
- ⊗ Mississippi River Sample
- Surface Water Flow Direction



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. SAMPLE LOCATIONS BASED ON HANDHELD TRIMBLE GPS MEASUREMENTS. SAMPLE LOCATION REPRESENTS CENTERPOINT BETWEEN SAMPLE STARTING AND ENDING LOCATION.
3. PREFIX M- USED FOR SAMPLES COLLECTED IN SEPTEMBER 2017 AND M2- USED FOR SAMPLES COLLECTED IN MAY 2018.
4. NPDES - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 2,000 2,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
AMEREN HYDROGEOLOGICAL CONSULTING

TITLE
SURFACE WATER SAMPLING LOCATIONS
MERAMEC ENERGY CENTER

CONSULTANT

GOLDER

YYYY-MM-DD	2018-05-31
PREPARED	JS
DESIGN	JS
REVIEW	JSI
APPROVED	MNH

PROJECT No.	PHASE	
130-1560	0006	Figure 2-2

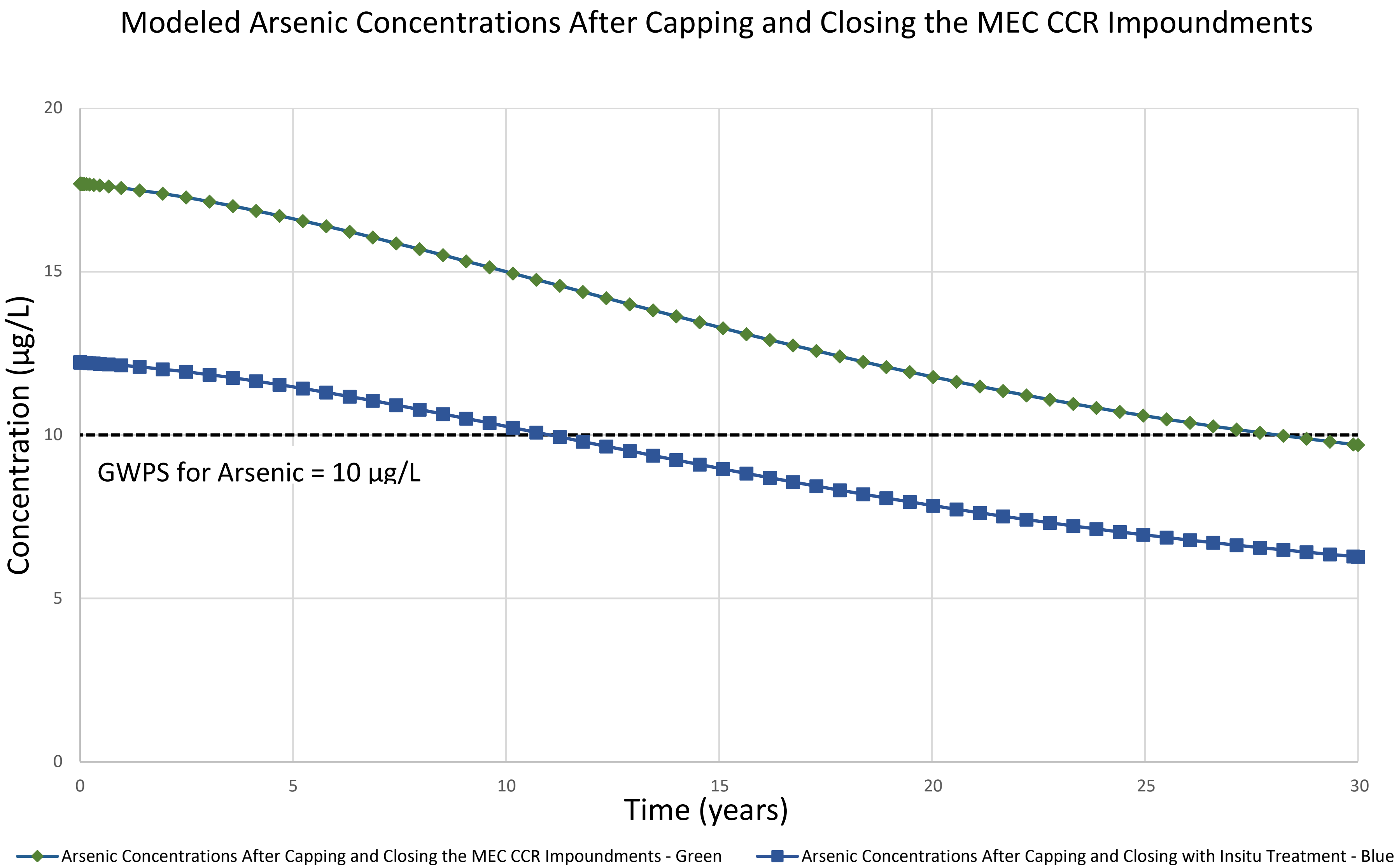
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

1 in

0

FIGURE 4-1
REMEDIAL ALTERNATIVE ROADMAP
CORRECTIVE MEASURES ASSESSMENT
COAL COMBUSTION RESIDUAL (CCR) SURFACE IMPOUNDMENTS
MERAMEC ENERGY CENTER - ST. LOUIS COUNTY, MISSOURI

Alternative Number	Remedial Alternative Description	Surface Impoundments Closure Description	Groundwater Remedy Components		
			A. Groundwater Remedy Approach	**B. Groundwater Treatment Method**	**C. Post-Closure Actions**
1	**Closure In Place (CIP) with Capping and Monitored Natural Attenuation (MNA)**	**CIP with Geomembrane and Soil Cap**	**Natural Attenuation with Monitoring** Mitigate off-site migration of groundwater with CCR constituents above GWPS through process of natural attenuation	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**MNA** Long-term groundwater monitoring to confirm reduction of CCR constituents
2	**CIP with Capping and In-Situ Groundwater Treatment**	**CIP with Geomembrane and Soil Cap**	**Subsurface Treatment System** Mitigate off-site migration of groundwater with CCR constituents above GWPS using in-situ treatment technology	**In-Situ Treatment** Subsurface treatment to reduce Appendix IV constituent concentrations in groundwater	**In-Situ Treatment Long-Term** Continue periodic in-situ treatment of groundwater to maintain reduction of CCR constituents in groundwater
3	**CIP with Capping and Hydraulic Containment through Groundwater Pumping and Ex-Situ Treatment**	**CIP with Geomembrane and Soil Cap**	**Hydraulic Containment** Mitigate off-site migration of groundwater with CCR constituents above GWPS using extraction wells	**Ex-Situ Treatment** Treatment system (ion exchange or reverse osmosis) to remove CCR constituents from groundwater	**Pump & Treat Long-Term** Operate groundwater treatment system long-term to maintain reduction of CCR constituents in groundwater
4	**Closure by Removal (CBR) with MNA**	**CBR**	**Natural Attenuation with Monitoring** Mitigate off-site migration of groundwater with CCR constituents above GWPS through process of natural attenuation	**No Active Treatment** No active treatment technologies for groundwater to address CCR constituents	**MNA** Long-term groundwater monitoring to confirm reduction of CCR constituents



Notes:

µg/L = micrograms per Liter

CCR = Coal Combustion Residual

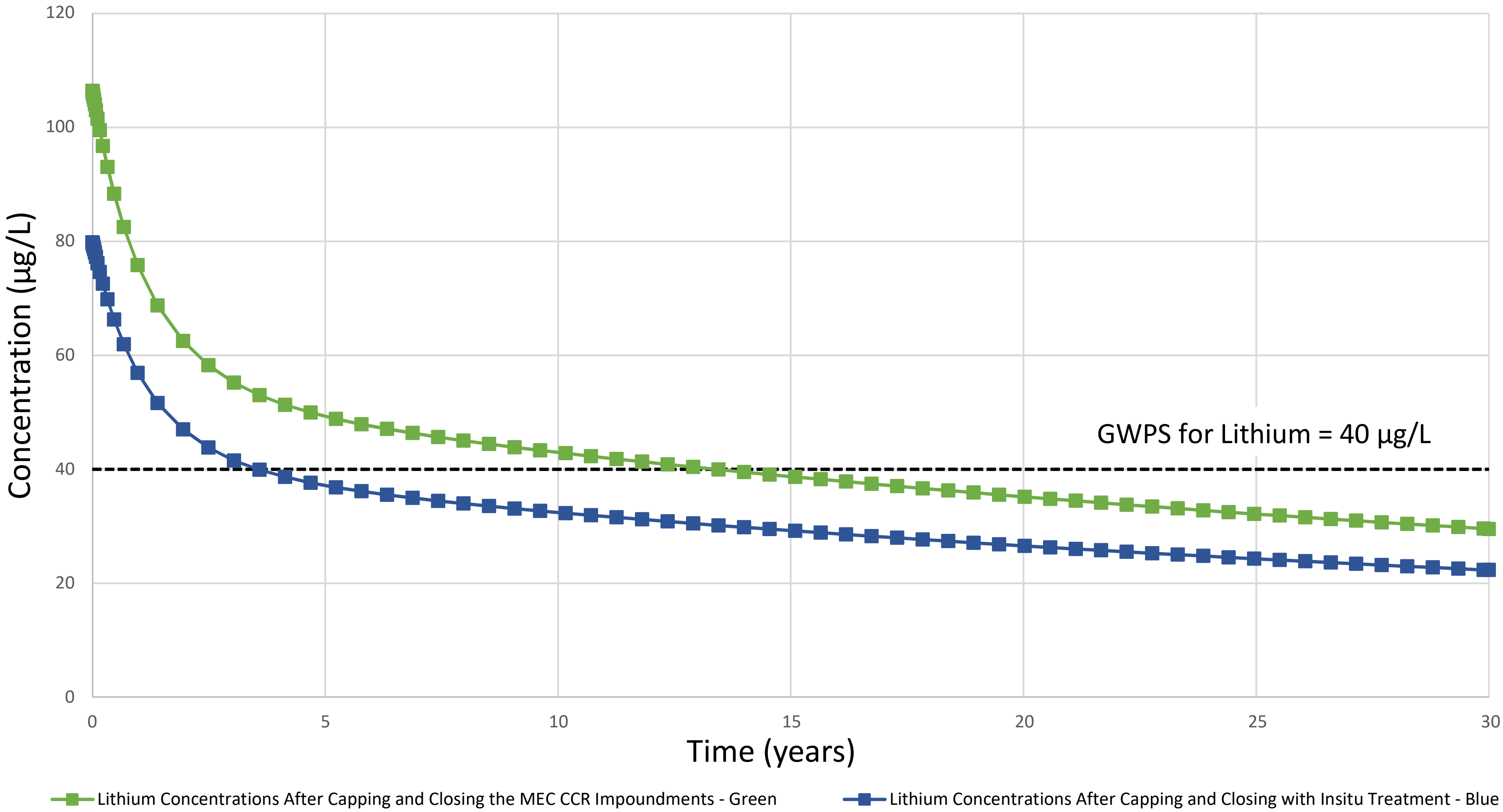
GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

Figure 4-2

Modeled Arsenic Concentrations After Capping and Closing the CCR Units and Groundwater Remediation

Modeled Lithium Concentrations After Capping and Closing the MEC CCR Impoundments



Notes:

µg/L = micrograms per Liter

CCR = Coal Combustion Residuals

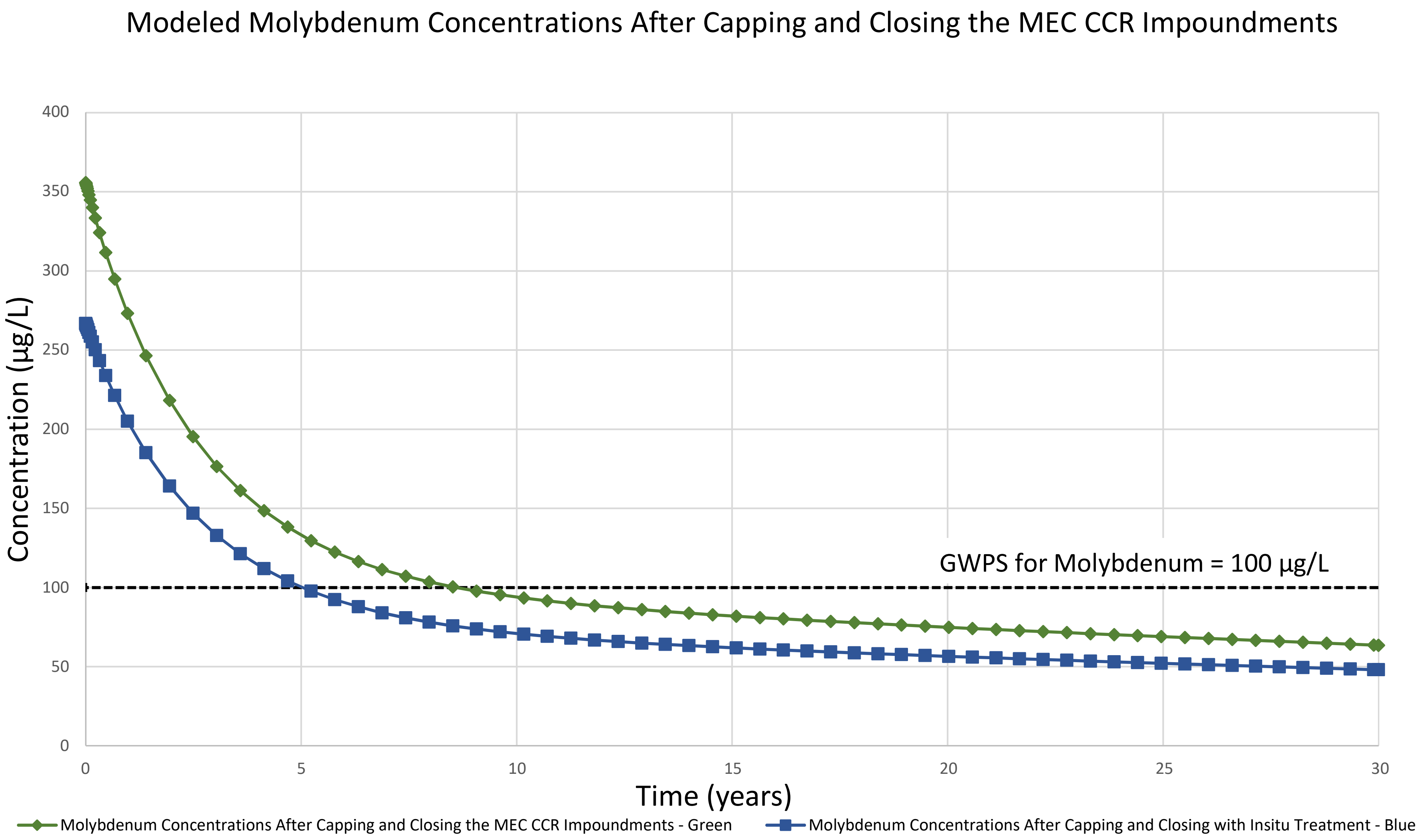
GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

BURNS McDONNELL

Figure 4-3

Modeled Lithium Concentrations After Capping and Closing the CCR Units and Groundwater Remediation



Notes:

µg/L = micrograms per Liter

CCR = Coal Combustion Residuals

GWPS = Groundwater Protection Standard

MEC = Meramec Energy Center

BURNS McDONNELL

Figure 4-4

Modeled Molybdenum Concentrations After Capping and Closing the CCR Units and Groundwater Remediation

APPENDIX A

Surface Water Screening Tables

Appendix A
Meramec Energy Center Surface Water Screening Tables – TOC

TABLES

TABLE 1
HUMAN HEALTH SCREENING LEVELS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Drinking Water Screening Levels (mg/L)			Surface Water Screening Levels (mg/L)	
Constituent	**CASRN**	**MCLs (b)**	**SMCLs (b)**	**November 2018 USEPA Tapwater RSLs (c)**	**Drinking Water (d)**	**Recreational Use (a) (e)**
Antimony	7440-36-0	0.006	NA	0.0078 (m)	0.006	0.64
Arsenic	7440-38-2	0.01	NA	0.000052	0.01	0.00014 (i)
Barium	7440-39-3	2	NA	3.8	2	NA
Beryllium	7440-41-7	0.004	NA	0.025	0.004	NA
Boron	7440-42-8	NA	NA	4	4	NA
Cadmium	7440-43-9	0.005	NA	0.0092	0.005	NA
Calcium	7440-70-2	NA	NA	NA	NA	NA
Chloride	7647-14-5	NA	250	NA	250	NA
Chromium	16065-83-1 (g)	0.1 (j)	NA	22 (n)	0.1	NA
Cobalt	7440-48-4	NA	NA	0.006	0.006	NA
Fluoride	16984-48-8	4	2	0.8	4	NA
Lead	7439-92-1	0.015 (k)	NA	0.015	0.015	NA
Lithium	7439-93-2	NA	NA	0.04	0.04	NA
Mercury	7487-94-7 (h)	0.002 (l)	NA	0.0057 (o)	0.002	NA
Molybdenum	7439-98-7	NA	NA	0.1	0.1	NA
Radium 226/228 (pCi/L)	RADIUM226228	5	NA	NA	5	NA
Selenium	7782-49-2	0.05	NA	0.1	0.05	4.2
Sulfate	7757-82-6	NA	250	NA	250	NA
Thallium	7440-28-0	0.002	NA	0.0002 (f)	0.002	0.00047
Total Dissolved Solids	TDS	NA	500	NA	500	NA
pH (std)	PHFLD	NA	6.5 - 8.5	NA	6.5 - 8.5	NA

Notes:

AWQC - Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Re
GWPS - Groundwater Protection Standar
HI - Hazard Index (noncancer child).
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.

NA - not available.
pCi/L - picoCurie per liter.
RSL - Risk-based Screening Levels (USEPA).
TR - Target Risk (carcinogenic).
USEPA - United States Environmental Protection Agency.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.
(e) - The selected Human Health Recreational Use Screening Level is the Federal USEPA AWQC for Human Health Consumption of Orga
(f) - RSL for Thallium (Soluble Salts) used for Thallium.
(g) - CAS number for Trivalent Chromium.
(h) - CAS number for Mercuric Chloride.
(i) - Value applies to inorganic form of arsenic only.
(j) - Value for Total Chromium.
(k) - Lead Treatment Technology Action Level is 0.015 mg/L.
(l) - Value for Inorganic Mercury.
(m) - RSL for Antimony (metallic) used for Antimony.
(n) - RSL for Chromium (III), Insoluble Salts used for Chromium.
(o) - RSL for Mercuric Chloride used for Mercury.

TABLE 2
ECOLOGICAL SCREENING LEVELS - MISSISSIPPI AND MERAMEC RIVERS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Federal Water Quality Criteria (mg/L)							
		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Acute (a)		**Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Chronic (a)**		**Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Acute (b)**		**Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Chronic (b)**	
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	0.34	0.34	0.15	0.15	0.34	0.34	0.15	0.15
Barium	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.0036 (c)	0.0033 (d)	0.0013 (c)	0.0012 (d)	0.0042 (f)	0.0038 (g)	0.0015 (f)	0.0013 (g)
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	860	NA	230	NA	860	NA	230	NA
Chromium	7440-47-3	3.1 (e,c)	0.97 (e,d)	0.15 (e,c)	0.13 (e,d)	3.5 (e,f)	1.1 (e,g)	0.17 (e,f)	0.14 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	NA	NA	NA
Lead	7439-92-1	0.19 (c)	0.13 (d)	0.0073 (c)	0.0051 (d)	0.23 (f)	0.15 (g)	0.0089 (f)	0.0060 (g)
Lithium	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0016	0.0014	0.00091	0.00077	0.0016	0.0014	0.00091	0.00077
Molybdenum	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	3.1	NA	NA	NA	3.1	NA
Sulfate	14808-79-8	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	TDS	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in May 2018 - see note (c).
USEPA provides AWQC for both total and dissolved results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in September 2017 - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 192 mg/L as CaCO3 used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 192 mg/L as CaCO3 used.
(e) - Value for trivalent chromium used.
(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 224 mg/L as CaCO3 used.
(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Meramec Rivers of 224 mg/L as CaCO3 used.

TABLE 3
ECOLOGICAL SCREENING LEVELS - UNAMED CREEK/DRAINAGE
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

		Federal Water Quality Criteria (mg/L)							
		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Acute (a)		Site-Specific USEPA Aquatic Life AWQC - 2018 Hardness Data Freshwater Chronic (a)		Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Acute (b)		Site-Specific USEPA Aquatic Life AWQC - 2017 Hardness Data Freshwater Chronic (b)	
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	0.34	0.34	0.15	0.15	0.34	0.34	0.15	0.15
Barium	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.0040 (c)	0.0037 (d)	0.0015 (c)	0.0013 (d)	0.0048 (f)	0.0043 (g)	0.0017 (f)	0.0015 (g)
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	860	NA	230	NA	860	NA	230	NA
Chromium	7440-47-3	3.4 (e,c)	1.1 (e,d)	0.16 (e,c)	0.14 (e,d)	3.9 (e,f)	1.2 (e,g)	0.19 (e,f)	0.16 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	NA	NA	NA
Lead	7439-92-1	0.22 (c)	0.15 (d)	0.0084 (c)	0.0057 (d)	0.27 (f)	0.18 (g)	0.011 (f)	0.0069 (g)
Lithium	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0016	0.0014	0.00091	0.00077	0.0016	0.0014	0.00091	0.00077
Molybdenum	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	3.1	NA	NA	NA	3.1	NA
Sulfate	14808-79-8	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	TDS	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.

(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in May 2018 - see note (c).
USEPA provides AWQC for both total and dissolved results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness using hardness data collected in September 2017 - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.
(e) - Value for trivalent chromium used.
(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.
(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Meramec River - Human Health Drinking Water						Meramec River - Human Health Recreational					
	Dissolved			Total			Dissolved			Total		
Constituent	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream
Antimony												
Arsenic							9 : 9 100%	9 : 9 100%	10 : 10 100%	9 : 9 100%	9 : 9 100%	10 : 10 100%
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead				3 : 9 33%	2 : 9 22%	1 : 10 10%						
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium												
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Meramec River - Ecological						Mississippi River - Human Health Drinking Water					
	Dissolved			Total			Dissolved			Total		
Constituent	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream	Upstream	Adjacent	Downstream
Antimony												
Arsenic								2 : 20 10%				
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead				8 : 9 89%	6 : 9 67%	7 : 10 70%						
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium								2 : 20 10%				
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Mississippi River - Human Health Recreational						Mississippi River - Ecological					
	Dissolved			Total			Dissolved			Total		
Constituent	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**	**Upstream**	**Adjacent**	**Downstream**
Antimony												
Arsenic	10 : 10 100%	20 : 20 100%	10 : 10 100%	10 : 10 100%	20 : 20 100%	10 : 10 100%						
Barium												
Beryllium												
Boron												
Cadmium												
Calcium												
Chloride												
Chromium												
Cobalt												
Fluoride												
Lead										1 : 10 10%		
Lithium												
Mercury												
Molybdenum												
pH												
Selenium												
Sulfate												
Thallium		2 : 20 10%										
TDS												
Radium 226/228												

Notes:
Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 4
SUMMARY OF SCREENING RESULTS
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

	Unnamed Creek/Drainage - Human Health Drinking Water		Unnamed Creek/Drainage - Human Health Recreational		Unnamed Creek/Drainage - Ecological	
Constituent	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**
Antimony						
Arsenic			6 : 6 100%	6 : 6 100%		
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chloride						
Chromium						
Cobalt						
Fluoride						
Lead						
Lithium						
Mercury						
Molybdenum						
pH						
Selenium						
Sulfate						
Thallium						
TDS		1 : 6 17%				
Radium 226/228						

Notes:

Blank cells - no results above screening levels for the specified constituent / media.
Number of exceedences : total number of samples.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
Constituent	**CAS**	**Units**	**USEPA MCLs (b)**	**USEPA SMCLs (b)**	**USEPA Tapwater RSLs (c)**		**M2-MEC-7S**	**M2-MEC-8D**	**M2-MEC-8S**	**M2-MEC-9D**	**M2-MEC-9S**	**M2-MEC-4S**	**M2-MEC-5D**	**M2-MEC-5S**	**M2-MEC-6D**	**M2-MEC-6S**	**M2-MEC-1S**	**M2-MEC-2D**	**M2-MEC-2S**	**M2-MEC-3D**	**M2-MEC-3S**
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA	NA	4	4						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	NA	250	NA	250	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006														0.00089 J	
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04															
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1															
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Sulfate	14808-79-8	mg/L	NA	250	NA	250	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:

Blank cells - Non-detect value.	mg/L - milligrams per liter.
* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Upstream					Mississippi River Adjacent									
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	NA	250	NA	250	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	250	NA	250	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:

Blank cells - Non-detect value.	mg/L - milligrams per liter.
* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels				Mississippi River Downstream				
Constituent	**CAS**	**Units**	**USEPA MCLs (b)**	**USEPA SMCLs (b)**	**USEPA Tapwater RSLs (c)**	**Selected Drinking Water Screening Level (h)**	**M2-MIS-1S**	**M2-MIS-2D**	**M2-MIS-2S**	**M2-MIS-3D**	**M2-MIS-3S**
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006					
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	NA	250	NA	250	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002					
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05					
Sulfate	14808-79-8	mg/L	NA	250	NA	250	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002					
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	303	423	404	351	348

Notes:

Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.

mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004						0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA	NA	4	4									0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005															
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006															
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015															
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04															
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1															
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002															

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Upstream					Mississippi River Adjacent									
Constituent	CAS	Units	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006															
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0023	0.0021	0.0022	0.0015	0.0016	0.002 J	0.0521	0.052	0.0014	0.0015	0.0024	0.0023	0.0021	0.0014	0.0014
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004															
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005													0.00046 J		
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1															
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006															
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002															
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05															
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002							0.0506	0.0512							

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006					
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004	0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	0.005	NA	0.0092	0.005					
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1					
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006					
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002					
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05					
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002					

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River												
							River Upstream				River Adjacent				River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			0.0038										
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004													
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005													
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	NA	250	NA	250	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002													
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1						0.0016					0.0014		
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05													
Sulfate	14808-79-8	mg/L	NA	250	NA	250	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River																			
							River Upstream					River Adjacent										River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004																				
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005																				
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	NA	250	NA	250	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006											0.0008									
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	250	NA	250	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:

Blank cells - Non-detect value.

* - Constituent was not detected in any samples.

CAS - Chemical Abstracts Service.

J - Estimated value.

MCL - Maximum Contaminant Level.

mg/L - milligrams per liter.

NA - Not Available.

RSL - Regional Screening Level.

SMCL - Secondary Maximum Contaminant Level.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.

(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm

(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

(d) - RSL for Mercuric Chloride used for Mercury.

(e) - The drinking water standard or MCL for chromium is based on total chromium.

(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.

(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.

(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Meramec River												
							River Upstream				River Adjacent				River Downstream				
Constituent	CAS	Units	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006													
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004													
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005													
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1													
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006									0.00073		0.00074		
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015													
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04													
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002													
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1						0.0013							
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05													
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Risk-Based Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 5d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Mississippi River																			
							River Upstream					River Adjacent										River Downstream				
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006																				
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004								0.0014												
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005																				
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006																				
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05	0.0036									0.0051						0.0043		0.0039		
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Risk-Based Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium
that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			AWQC (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	NA	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	NA	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	NA															
Calcium	7440-70-2	mg/L	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	NA	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	NA															
Cobalt	7440-48-4	mg/L	NA														0.00089 J	
Fluoride	16984-48-8	mg/L	NA	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	NA	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA															
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA															
Selenium	7782-49-2	mg/L	4.2															
Sulfate	14808-79-8	mg/L	NA	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	0.00047															
Total Hardness as CaCO3	471-34-1	mg/L	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Mississippi River Upstream					Mississippi River Adjacent									
			AWQC (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	NA	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	NA	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	NA															
Calcium	7440-70-2	mg/L	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	NA	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	NA	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	NA	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	NA	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	4.2				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	0.00047															
Total Hardness as CaCO3	471-34-1	mg/L	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Mississippi River Downstream				
				M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	0.64					
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	NA	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	NA		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	NA	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	NA	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	NA	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	NA	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	NA	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	NA					
Molybdenum	7439-98-7	mg/L	NA	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	4.2					
Sulfate	14808-79-8	mg/L	NA	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	0.00047					
Total Hardness as CaCO3	471-34-1	mg/L	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	303	423	404	351	348

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)		Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
					M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	0.64																
Arsenic	7440-38-2	mg/L	0.00014	(c)	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	NA		0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	NA							0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA										0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	NA																
Calcium	7440-70-2	mg/L	NA		28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	NA																
Cobalt*	7440-48-4	mg/L	NA																
Lead	7439-92-1	mg/L	NA																
Lithium	7439-93-2	mg/L	NA																
Mercury*	7439-97-6	mg/L	NA																
Molybdenum	7439-98-7	mg/L	NA																
Selenium	7782-49-2	mg/L	4.2																
Thallium	7440-28-0	mg/L	0.00047																

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Mississippi River Upstream					Mississippi River Adjacent									
			AWQC (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	0.64															
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0023 🟩	0.0021 🟩	0.0022 🟩	0.0015 🟩	0.0016 🟩	0.002 J 🟩	0.0521 🟩	0.052 🟩	0.0014 🟩	0.0015 🟩	0.0024 🟩	0.0023 🟩	0.0021 🟩	0.0014 🟩	0.0014 🟩
Barium	7440-39-3	mg/L	NA	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	NA															
Boron	7440-42-8	mg/L	NA	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	NA													0.00046 J		
Calcium	7440-70-2	mg/L	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	NA															
Cobalt*	7440-48-4	mg/L	NA															
Lead	7439-92-1	mg/L	NA		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	NA															
Molybdenum	7439-98-7	mg/L	NA	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	4.2															
Thallium	7440-28-0	mg/L	0.00047							0.0506 🟩	0.0512 🟩							

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			USEPA	Mississippi River Downstream				
Constituent	**CAS**	**Units**	**AWQC (b)**	**M2-MIS-1S**	**M2-MIS-2D**	**M2-MIS-2S**	**M2-MIS-3D**	**M2-MIS-3S**
Antimony*	7440-36-0	mg/L	0.64					
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	NA	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	NA	0.00018 J				
Boron	7440-42-8	mg/L	NA	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	NA					
Calcium	7440-70-2	mg/L	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	NA					
Cobalt*	7440-48-4	mg/L	NA					
Lead	7439-92-1	mg/L	NA		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	NA					
Molybdenum	7439-98-7	mg/L	NA	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	4.2					
Thallium	7440-28-0	mg/L	0.00047					

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

				Meramec River												
			USEPA	River Upstream				River Adjacent				River Downstream				
Constituent	CAS	Units	AWQC (b)	M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.64			0.0038										
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	NA	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	NA													
Boron	7440-42-8	mg/L	NA	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	NA													
Calcium	7440-70-2	mg/L	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	NA	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	NA	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	NA	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	NA	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	NA													
Molybdenum	7439-98-7	mg/L	NA						0.0016					0.0014		
Selenium	7782-49-2	mg/L	4.2													
Sulfate	14808-79-8	mg/L	NA	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium*	7440-28-0	mg/L	0.00047									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - Value applies to inorganic form of arsenic only.

TABLE 6c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

				Mississippi River																			
			USEPA	River Upstream					River Adjacent										River Downstream				
Constituent	CAS	Units	AWQC (b)	M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony*	7440-36-0	mg/L	0.64														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	NA	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	NA																				
Boron	7440-42-8	mg/L	NA	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	NA																				
Calcium	7440-70-2	mg/L	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	NA	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	NA	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA											0.0008									
Fluoride	16984-48-8	mg/L	NA	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	NA	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	NA																				
Molybdenum	7439-98-7	mg/L	NA	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	4.2						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium*	7440-28-0	mg/L	0.00047											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Meramec River												
				River Upstream				River Adjacent				River Downstream				
				M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	0.64													
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	NA	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	NA													
Boron	7440-42-8	mg/L	NA	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	NA													
Calcium	7440-70-2	mg/L	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	NA													
Cobalt	7440-48-4	mg/L	NA									0.00073		0.00074		
Lead	7439-92-1	mg/L	NA													
Lithium	7439-93-2	mg/L	NA													
Mercury*	7439-97-6	mg/L	NA													
Molybdenum	7439-98-7	mg/L	NA						0.0013							
Selenium	7782-49-2	mg/L	4.2													
Thallium*	7440-28-0	mg/L	0.00047									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science
and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 6d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			USEPA	Mississippi River																			
				River Upstream					River Adjacent										River Downstream				
Constituent	**CAS**	**Units**	**AWQC (b)**	**M-MIS-10S**	**M-MIS-11D**	**M-MIS-11S**	**M-MIS-12D**	**M-MIS-12S**	**M-MIS-4S**	**M-MIS-5D**	**M-MIS-5S**	**M-MIS-6D**	**M-MIS-6S**	**M-MIS-7S**	**M-MIS-8D**	**M-MIS-8S**	**M-MIS-9D**	**M-MIS-9S**	**M-MIS-1S**	**M-MIS-2D**	**M-MIS-2S**	**M-MIS-3D**	**M-MIS-3S**
Antimony*	7440-36-0	mg/L	0.64																				
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	NA	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	NA								0.0014												
Boron	7440-42-8	mg/L	NA	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	NA																				
Calcium	7440-70-2	mg/L	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	NA	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA																				
Lead	7439-92-1	mg/L	NA	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	NA																				
Molybdenum	7439-98-7	mg/L	NA	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	4.2	0.0036									0.0051						0.0043		0.0039		
Thallium*	7440-28-0	mg/L	0.00047																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00061 J	0.00064 J	0.00061 J	0.00063 J	0.00064 J	0.00062 J	0.00061 J	0.00058 J	0.00064 J	0.00069 J	0.00069 J	0.00066 J	0.00061 J	0.00059 J	0.00069 J
Barium	7440-39-3	mg/L	NA	NA	0.134	0.139	0.133	0.14	0.133	0.135	0.14	0.135	0.139	0.136	0.135	0.141	0.137	0.137	0.135
Beryllium	7440-41-7	mg/L	NA	NA	0.00017 J	0.00017 J													
Boron	7440-42-8	mg/L	NA	NA						0.0151 J					0.0142 J	0.0151 J	0.0143 J	0.0139 J	0.0139 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)															
Calcium	7440-70-2	mg/L	NA	NA	28.6	28.8	28.3	29.1	28.3	28.8	28.9	28.9	28.7	29	28.6	28.9	29.3	28.3	28.5
Chloride	16887-00-6	mg/L	860	230	6.4	6.5	6.5	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.5	6.4	6.7	6.4	6.3
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)															
Cobalt	7440-48-4	mg/L	NA	NA														0.00089 J	
Fluoride	16984-48-8	mg/L	NA	NA	0.074 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.12 J	0.11 J	0.11 J
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0081 J	0.0092 J	0.0077 J	0.0086 J	0.005 J	0.0071 J	0.0094 J	0.0057 J	0.0114	0.0054 J	0.0065 J	0.0097 J	0.0062 J	0.0096 J	0.0067 J
Lithium	7439-93-2	mg/L	NA	NA															
Mercury*	7439-97-6	mg/L	0.0016	0.00091															
Molybdenum	7439-98-7	mg/L	NA	NA															
Selenium	7782-49-2	mg/L	NA	3.1															
Sulfate	14808-79-8	mg/L	NA	NA	12.2	13.3	13.1	15.4	13.1	13	12.9	12.9	13	12.8	13.2	12.9	13	12.9	12.9
Thallium*	7440-28-0	mg/L	NA	NA															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	135	135	133	137	133	135	136	136	135	136	136	137	138	134	135
Total Dissolved Solids	TDS	mg/L	NA	NA	163	165	166	160	134	162	163	169	163	179	260	177	172	177	173

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River Upstream					Mississippi River Adjacent									
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-10S	M2-MIS-11D	M2-MIS-11S	M2-MIS-12D	M2-MIS-12S	M2-MIS-4S	M2-MIS-5D	M2-MIS-5S	M2-MIS-6D	M2-MIS-6S	M2-MIS-7S	M2-MIS-8D	M2-MIS-8S	M2-MIS-9D	M2-MIS-9S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0034	0.0034	0.0031	0.0023	0.0024	0.0034	0.0029	0.003	0.0021	0.0022	0.0033	0.0031	0.0034	0.002	0.0021
Barium	7440-39-3	mg/L	NA	NA	0.139	0.146	0.136	0.106	0.118	0.136	0.122	0.131	0.105	0.0973	0.137	0.144	0.14	0.0934	0.1
Beryllium	7440-41-7	mg/L	NA	NA	0.00017 J		0.0002 J								0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	0.0659 J	0.058 J	0.0522 J	0.0368 J	0.0408 J	0.0656 J	0.0503 J	0.0531 J	0.0341 J	0.0347 J	0.0651 J	0.0561 J	0.0576 J	0.0345 J	0.0338 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)															
Calcium	7440-70-2	mg/L	NA	NA	61.1	61.7	57.2	51.8	54	61	56.4	58.4	50.2	50.4	62.5	58.9	60.1	48.3	49.6
Chloride	16887-00-6	mg/L	860	230	24.5	24.6	24.6	28.4	28.3	23.2	24.1	24	28.8	29	23.2	23.6	23.6	30.4	29.6
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)	0.0044 J	0.0056	0.0047 J	0.0043 J	0.0045 J	0.0044 J	0.0029 J	0.0045 J	0.0043 J	0.003 J	0.0035 J	0.0053	0.0039 J	0.0028 J	0.004 J
Cobalt	7440-48-4	mg/L	NA	NA	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0022 J	0.002 J	0.0016 J	0.0019 J	0.0015 J	0.0015 J	0.0017 J	0.0025 J	0.002 J	0.0014 J	0.0015 J
Fluoride	16984-48-8	mg/L	NA	NA	0.35	0.32	0.32	0.25	0.26	0.29 J	0.24	0.25	0.19 J	0.18 J	0.3	0.27	0.27	0.18 J	0.17 J
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0063 J	0.0087 J	0.0067 J	0.0069 J	0.0068 J	0.0052 J	0.0048 J	0.0071 J	0.0071 J	0.0065 J	0.006 J	0.0061 J	0.005 J	0.004 J	0.0059 J
Lithium	7439-93-2	mg/L	NA	NA	0.026	0.0232	0.0202	0.0095 J	0.012	0.0252	0.0176	0.0189	0.0092 J	0.0096 J	0.028	0.0229	0.0227	0.0068 J	0.0076 J
Mercury*	7439-97-6	mg/L	0.0016	0.00091															
Molybdenum	7439-98-7	mg/L	NA	NA	0.002 J	0.0023 J	0.0017 J	0.0012 J	0.0013 J	0.002 J	0.0014 J	0.0016 J	0.0013 J	0.00097 J	0.0023 J	0.0016 J	0.0018 J	0.0013 J	0.0012 J
Selenium	7782-49-2	mg/L	NA	3.1				0.0068 J											
Sulfate	14808-79-8	mg/L	NA	NA	132	107	105	53.9	54.5	127	85.1	90.3	44.9	44.5	128	105	105	39.7	42.4
Thallium*	7440-28-0	mg/L	NA	NA															
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	250	253	235	214	222	253	232	239	206	207	256	242	246	200	205
Total Dissolved Solids	TDS	mg/L	NA	NA	440	392	389	347	426	446	400	379	319	330	442	469	401	298	225

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7a
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River Downstream				
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M2-MIS-1S**	**M2-MIS-2D**	**M2-MIS-2S**	**M2-MIS-3D**	**M2-MIS-3S**
Antimony*	7440-36-0	mg/L	NA	NA					
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0022	0.0031	0.0032	0.0025	0.0026
Barium	7440-39-3	mg/L	NA	NA	0.142	0.139	0.138	0.111	0.11
Beryllium	7440-41-7	mg/L	NA	NA		0.00029 J		0.00022 J	0.00018 J
Boron	7440-42-8	mg/L	NA	NA	0.0413 J	0.0623 J	0.0642 J	0.0407 J	0.044 J
Cadmium	7440-43-9	mg/L	0.0036 (d)	0.0013 (d)	0.00065 J		0.00045 J		
Calcium	7440-70-2	mg/L	NA	NA	50.7	61.9	62	53	53.4
Chloride	16887-00-6	mg/L	860	230	16.2	23.3	23.4	26	25.6
Chromium	7440-47-3	mg/L	3.1 (c,d)	0.15 (c,d)	0.0021 J	0.0041 J	0.005	0.0035 J	0.0036 J
Cobalt	7440-48-4	mg/L	NA	NA	0.0011 J	0.0024 J	0.0021 J	0.002 J	0.0022 J
Fluoride	16984-48-8	mg/L	NA	NA	0.18 J	0.26	0.26	0.2	0.21
Lead	7439-92-1	mg/L	0.19 (d)	0.0073 (d)	0.0049 J	0.0059 J	0.006 J	0.0068 J	0.0062 J
Lithium	7439-93-2	mg/L	NA	NA	0.0155	0.022	0.0252	0.0119	0.0137
Mercury*	7439-97-6	mg/L	0.0016	0.00091					
Molybdenum	7439-98-7	mg/L	NA	NA	0.0012 J	0.0021 J	0.0023 J	0.0015 J	0.0015 J
Selenium	7782-49-2	mg/L	NA	3.1					
Sulfate	14808-79-8	mg/L	NA	NA	73.2	109	104	63.4	66.7
Thallium*	7440-28-0	mg/L	NA	NA					
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	215	254	254	214	219
Total Dissolved Solids	TDS	mg/L	NA	NA	303	423	404	351	348

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Meramec River Upstream					Meramec River Adjacent					Meramec River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MEC-7S	M2-MEC-8D	M2-MEC-8S	M2-MEC-9D	M2-MEC-9S	M2-MEC-4S	M2-MEC-5D	M2-MEC-5S	M2-MEC-6D	M2-MEC-6S	M2-MEC-1S	M2-MEC-2D	M2-MEC-2S	M2-MEC-3D	M2-MEC-3S
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00058 J	0.00058 J	0.00065 J	0.00059 J	0.00059 J	0.00061 J	0.00056 J	0.00066 J	0.00056 J	0.00064 J	0.00063 J	0.00062 J	0.0006 J	0.00061 J	0.00059 J
Barium	7440-39-3	mg/L	NA	NA	0.13	0.127	0.128	0.127	0.128	0.127	0.128	0.13	0.129	0.128	0.127	0.127	0.128	0.129	0.13
Beryllium	7440-41-7	mg/L	NA	NA						0.00018 J	0.00018 J	0.00019 J		0.00018 J	0.00018 J	0.00019 J	0.00024 J	0.00018 J	
Boron	7440-42-8	mg/L	NA	NA									0.0129 J		0.0129 J				
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)															
Calcium	7440-70-2	mg/L	NA	NA	28.4	28.4	28.2	28.2	28.5	28.3	28.3	28.7	28.6	28.4	28.1	28.2	28.4	28.5	28.8
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)															
Cobalt*	7440-48-4	mg/L	NA	NA															
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)															
Lithium	7439-93-2	mg/L	NA	NA															
Mercury*	7439-97-6	mg/L	0.0014	0.00077															
Molybdenum	7439-98-7	mg/L	NA	NA															
Selenium	7782-49-2	mg/L	NA	NA															
Thallium	7440-28-0	mg/L	NA	NA															

Notes:

Blank cells - Non-detect value.
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.

J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b
COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS -
TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River Upstream					Mississippi River Adjacent									
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M2-MIS-10S**	**M2-MIS-11D**	**M2-MIS-11S**	**M2-MIS-12D**	**M2-MIS-12S**	**M2-MIS-4S**	**M2-MIS-5D**	**M2-MIS-5S**	**M2-MIS-6D**	**M2-MIS-6S**	**M2-MIS-7S**	**M2-MIS-8D**	**M2-MIS-8S**	**M2-MIS-9D**	**M2-MIS-9S**
Antimony*	7440-36-0	mg/L	NA	NA															
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0023	0.0021	0.0022	0.0015	0.0016	0.002 J	0.0521	0.052	0.0014	0.0015	0.0024	0.0023	0.0021	0.0014	0.0014
Barium	7440-39-3	mg/L	NA	NA	0.0969	0.0829	0.0856	0.066	0.0727	0.0981	0.0823	0.0848	0.0634	0.0698	0.096	0.0899	0.0906	0.065	0.0665
Beryllium	7440-41-7	mg/L	NA	NA															
Boron	7440-42-8	mg/L	NA	NA	0.0648 J	0.0502 J	0.0538 J	0.0343 J	0.0369 J	0.068 J	0.0501 J	0.0514 J	0.0328 J	0.0346 J	0.0675 J	0.0578 J	0.059 J	0.0336 J	0.0331 J
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)													0.00046 J		
Calcium	7440-70-2	mg/L	NA	NA	62.8	57.7	60.1	49.5	52.6	61.5	53.6	55	51.8	52.7	64.7	59.4	60.8	50.6	52.2
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)															
Cobalt*	7440-48-4	mg/L	NA	NA															
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)		0.003 J				0.0042 J									
Lithium	7439-93-2	mg/L	NA	NA	0.0246	0.016	0.0172	0.0079 J	0.011	0.0269	0.0156	0.0192	0.0046 J	0.0074 J	0.0255	0.0213	0.0219	0.0054 J	
Mercury*	7439-97-6	mg/L	0.0014	0.00077															
Molybdenum	7439-98-7	mg/L	NA	NA	0.002 J	0.0017 J	0.002 J	0.0014 J	0.0018 J	0.0022 J	0.0016 J	0.0019 J	0.0015 J	0.0014 J	0.0024 J	0.0017 J	0.0021 J	0.0012 J	0.0015 J
Selenium	7782-49-2	mg/L	NA	NA															
Thallium	7440-28-0	mg/L	NA	NA							0.0506	0.0512							

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7b

COMPARISON OF MAY 2018 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)

AMEREN MISSOURI MERAMEC ENERGY CENTER

ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Mississippi River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M2-MIS-1S	M2-MIS-2D	M2-MIS-2S	M2-MIS-3D	M2-MIS-3S
Antimony*	7440-36-0	mg/L	NA	NA					
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0018	0.0025	0.0023	0.0021	0.0019
Barium	7440-39-3	mg/L	NA	NA	0.109	0.0917	0.0941	0.0732	0.0798
Beryllium	7440-41-7	mg/L	NA	NA	0.00018 J				
Boron	7440-42-8	mg/L	NA	NA	0.0408 J	0.0666 J	0.0573 J	0.0435 J	0.0479 J
Cadmium	7440-43-9	mg/L	0.0033 (d)	0.0012 (d)					
Calcium	7440-70-2	mg/L	NA	NA	48.5	58.5	61.8	50.8	54
Chromium*	7440-47-3	mg/L	0.97 (c,d)	0.13 (c,d)					
Cobalt*	7440-48-4	mg/L	NA	NA					
Lead	7439-92-1	mg/L	0.13 (d)	0.0051 (d)		0.0034 J		0.0035 J	0.004 J
Lithium	7439-93-2	mg/L	NA	NA	0.0136	0.0207	0.0231	0.0106	0.0131
Mercury*	7439-97-6	mg/L	0.0014	0.00077					
Molybdenum	7439-98-7	mg/L	NA	NA	0.0015 J	0.0024 J	0.0017 J	0.0017 J	0.0021 J
Selenium	7782-49-2	mg/L	NA	NA					
Thallium	7440-28-0	mg/L	NA	NA					

Notes:

Blank cells - Non-detect value.	J - Estimated value.
* Constituent was not detected in any samples.	mg/L - milligrams per liter.
AWQC - USEPA Ambient Water Quality Criteria.	NA - Not Available.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 192 mg/L as CaCO3 used.

TABLE 7c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS
TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Meramec River												
					River Upstream				River Adjacent				River Downstream				
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony	7440-36-0	mg/L	NA	NA			0.0038										
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0018	0.0014	0.0013	0.0012	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0015	0.0014	0.0015
Barium	7440-39-3	mg/L	NA	NA	0.186	0.18	0.193	0.186	0.193	0.19	0.194	0.18	0.19	0.195	0.191	0.188	0.19
Beryllium*	7440-41-7	mg/L	NA	NA													
Boron	7440-42-8	mg/L	NA	NA	0.0305	0.0256	0.0248	0.0257	0.0749	0.0609	0.0289	0.0282	0.0364	0.0305	0.0312	0.0336	0.0306
Cadmium*	7440-43-9	mg/L	0.0042 (d)	0.0015 (d)													
Calcium	7440-70-2	mg/L	NA	NA	44.1	43.1	43.9	42.9	44.4	44.6	44.1	42.9	44	44.9	44	43.1	43.7
Chloride	16887-00-6	mg/L	860	230	20.6	19.8	19.9	20	20.3	20.4	19.6	19.8	19.6	19.8	19.9	19.5	20
Chromium	7440-47-3	mg/L	3.5 (c,d)	0.17 (c,d)	0.0013		0.0018		0.0014	0.00092	0.0011	0.0012	0.0018	0.0015		0.0014	0.0009
Cobalt	7440-48-4	mg/L	NA	NA			0.00073		0.00085								
Fluoride	16984-48-8	mg/L	NA	NA	0.18	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18
Lead	7439-92-1	mg/L	0.23 (d)	0.0089 (d)	0.0172	0.0112	0.0205	0.0196	0.0175	0.0139	0.018	0.0121	0.014	0.0142	0.0146	0.0155	0.0143
Lithium	7439-93-2	mg/L	NA	NA				0.0042		0.0057			0.0035				0.0035
Mercury*	7439-97-6	mg/L	0.0016	0.0009													
Molybdenum	7439-98-7	mg/L	NA	NA						0.0016					0.0014		
Selenium	7782-49-2	mg/L	NA	3.1													
Sulfate	14808-79-8	mg/L	NA	NA	24.3	23.4	23.1	23.1	26.7	26.6	23.2	23.2	24.5	23.1	23.9	23.3	23.3
Thallium	7440-28-0	mg/L	NA	NA									0.000073		0.000075		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	212	211	214	209	212	214	213	209	214	219	213	209	213
Total Dissolved Solids	TDS	mg/L	NA	NA	242	240	229	248	254	250	227	247	245	249	238	224	245

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value
for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7c
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River																			
					River Upstream					River Adjacent										River Downstream				
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MIS-10S	M-MIS-11D	M-MIS-11S	M-MIS-12D	M-MIS-12S	M-MIS-4S	M-MIS-5D	M-MIS-5S	M-MIS-6D	M-MIS-6S	M-MIS-7S	M-MIS-8D	M-MIS-8S	M-MIS-9D	M-MIS-9S	M-MIS-1S	M-MIS-2D	M-MIS-2S	M-MIS-3D	M-MIS-3S
Antimony	7440-36-0	mg/L	NA	NA														0.0035			0.0057			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.003	0.0028	0.003	0.0024	0.0022	0.0032	0.0028	0.0027	0.0024	0.0023	0.0035	0.0029	0.0027	0.0022	0.0022	0.0028	0.003	0.003	0.0024	0.0026
Barium	7440-39-3	mg/L	NA	NA	0.102	0.0987	0.103	0.081	0.0807	0.106	0.0976	0.0967	0.081	0.0825	0.124	0.0999	0.0978	0.0783	0.078	0.133	0.106	0.103	0.0859	0.11
Beryllium*	7440-41-7	mg/L	NA	NA																				
Boron	7440-42-8	mg/L	NA	NA	0.0953	0.0822	0.0858	0.0547	0.0573	0.0943	0.0803	0.0755	0.0593	0.0587	0.0981	0.0842	0.0846	0.0548	0.0535	0.0801	0.0902	0.0888	0.0665	0.0674
Cadmium*	7440-43-9	mg/L	0.0042 (d)	0.0015 (d)																				
Calcium	7440-70-2	mg/L	NA	NA	57	56	56.8	52.6	52.4	57.9	55.8	52.4	51.5	52.1	59.5	56.6	55.1	50.7	51.1	59.4	57.1	57.5	52	52.9
Chloride	16887-00-6	mg/L	860	230	24.9	24.6	24.7	25.4	25.7	25	24.6	24.7	25.7	25.9	25.1	24.7	24.9	26	26	24	24.7	24.7	24.8	24.9
Chromium	7440-47-3	mg/L	3.5 (c,d)	0.17 (c,d)	0.00072	0.0018	0.0015	0.0013	0.0014	0.0013	0.0014	0.002	0.0013	0.0016	0.0018	0.0015	0.0012	0.0012	0.00093	0.0016		0.0016	0.0012	0.002
Cobalt	7440-48-4	mg/L	NA	NA											0.0008									
Fluoride	16984-48-8	mg/L	NA	NA	0.37	0.35	0.35	0.27	0.28	0.37	0.32	0.33	0.27	0.27	0.37	0.34	0.34	0.26	0.26	0.32	0.35	0.34	0.3	0.31
Lead	7439-92-1	mg/L	0.23 (d)	0.0089 (d)	0.0028			0.0035	0.0026	0.0037	0.0035			0.0028	0.0043	0.0032	0.0034		0.0033	0.0056	0.0033	0.0027		0.0029
Lithium	7439-93-2	mg/L	NA	NA	0.0321	0.0288	0.0284	0.0169	0.012	0.032	0.0277	0.0215	0.0172	0.0158	0.0331	0.0255	0.0267	0.0123	0.0113	0.0266	0.0323	0.0302	0.0193	0.021
Mercury*	7439-97-6	mg/L	0.0016	0.0009																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.0029	0.0026	0.0025	0.002	0.002	0.0026	0.0024	0.0024	0.0026	0.0027	0.0032	0.0024	0.0023	0.0022	0.0021	0.0029	0.0027	0.0028	0.0024	0.0025
Selenium	7782-49-2	mg/L	NA	3.1						0.005			0.004											
Sulfate	14808-79-8	mg/L	NA	NA	140	130	129	71	69.8	140	111	110	61.8	63.2	140	120	123	57.2	57.6	109	130	123	87.9	88.4
Thallium	7440-28-0	mg/L	NA	NA											0.00016							0.000062		
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	236	233	235	230	230	238	234	221	226	227	245	237	229	223	224	243	235	240	224	226
Total Dissolved Solids	TDS	mg/L	NA	NA	398	391	384	300	309	393	374	357	290	303	408	389	373	288	277	355	393	390	332	328

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - USEPA Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Meramec River												
					River Upstream				River Adjacent				River Downstream				
Constituent	CAS	Units	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-MEC-7S	M-MEC-8S	M-MEC-9D	M-MEC-9S	M-MEC-4S	M-MEC-5S	M-MEC-6D	M-MEC-6S	M-MEC-1S	M-MEC-2D	M-MEC-2S	M-MEC-3D	M-MEC-3S
Antimony*	7440-36-0	mg/L	NA	NA													
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0016	0.0013	0.0011	0.0011	0.0014	0.0013	0.0012	0.0011	0.0013	0.0012	0.0011	0.0011	0.0012
Barium	7440-39-3	mg/L	NA	NA	0.167	0.166	0.176	0.172	0.18	0.177	0.177	0.173	0.171	0.172	0.174	0.18	0.176
Beryllium*	7440-41-7	mg/L	NA	NA													
Boron	7440-42-8	mg/L	NA	NA	0.0281	0.0266	0.0263	0.025	0.0625	0.0596	0.0282	0.027	0.0359	0.0285	0.0341	0.0314	0.0289
Cadmium*	7440-43-9	mg/L	0.0038 (d)	0.0013 (d)													
Calcium	7440-70-2	mg/L	NA	NA	41.2	40.2	41.9	41.2	43.2	42.8	42.1	41.2	41.1	41	41.3	41.7	41.9
Chromium	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)													
Cobalt	7440-48-4	mg/L	NA	NA									0.00073		0.00074		
Lead	7439-92-1	mg/L	0.15 (d)	0.0060 (d)													
Lithium	7439-93-2	mg/L	NA	NA													
Mercury*	7439-97-6	mg/L	0.0014	0.00077													
Molybdenum	7439-98-7	mg/L	NA	NA						0.0013							
Selenium	7782-49-2	mg/L	NA	NA													
Thallium	7440-28-0	mg/L	NA	NA									0.000057				0.00005

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 7d
COMPARISON OF SEPTEMBER 2017 MERAMEC AND MISSISSIPPI RIVER SURFACE WATER RESULTS TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Mississippi River																			
					River Upstream					River Adjacent										River Downstream				
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M-MIS-10S**	**M-MIS-11D**	**M-MIS-11S**	**M-MIS-12D**	**M-MIS-12S**	**M-MIS-4S**	**M-MIS-5D**	**M-MIS-5S**	**M-MIS-6D**	**M-MIS-6S**	**M-MIS-7S**	**M-MIS-8D**	**M-MIS-8S**	**M-MIS-9D**	**M-MIS-9S**	**M-MIS-1S**	**M-MIS-2D**	**M-MIS-2S**	**M-MIS-3D**	**M-MIS-3S**
Antimony*	7440-36-0	mg/L	NA	NA																				
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0028	0.0026	0.0025	0.0019	0.0019	0.0028	0.0024	0.0024	0.0019	0.002	0.0027	0.0024	0.0025	0.0018	0.0021	0.0024	0.0025	0.0024	0.0021	0.0021
Barium	7440-39-3	mg/L	NA	NA	0.0965	0.0887	0.0899	0.066	0.0656	0.0936	0.0826	0.0845	0.0687	0.0688	0.0949	0.0844	0.0861	0.0645	0.0674	0.112	0.0874	0.0872	0.073	0.0746
Beryllium*	7440-41-7	mg/L	NA	NA								0.0014												
Boron	7440-42-8	mg/L	NA	NA	0.0979	0.0859	0.0862	0.0542	0.0566	0.0946	0.0771	0.0812	0.0593	0.057	0.0943	0.0806	0.0836	0.0515	0.0579	0.0804	0.0873	0.082	0.0627	0.0672
Cadmium*	7440-43-9	mg/L	0.0038 (d)	0.0013 (d)																				
Calcium	7440-70-2	mg/L	NA	NA	58.1	56	56	51	50.2	57.2	54.1	53.8	51.4	52.9	57.2	54.3	54.5	50.2	51.2	52	55.5	51	51.9	52.5
Chromium	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)	0.00079	0.00074		0.00076		0.00093	0.00096				0.00075				0.0011					0.00099
Cobalt	7440-48-4	mg/L	NA	NA																				
Lead	7439-92-1	mg/L	0.15 (d)	0.0060 (d)	0.0026	0.0027		0.0024			0.0027						0.0025						0.003	
Lithium	7439-93-2	mg/L	NA	NA	0.0306	0.0241	0.032	0.0132	0.0144	0.0289	0.023	0.0316	0.0176	0.0155	0.0335	0.0287	0.032	0.0135	0.0166	0.0264	0.0263	0.0278	0.019	0.0207
Mercury*	7439-97-6	mg/L	0.0014	0.00077																				
Molybdenum	7439-98-7	mg/L	NA	NA	0.0032	0.0025	0.0027	0.0025	0.0018	0.0029	0.0025	0.0031	0.0026	0.0026	0.0028	0.0026	0.0027	0.0017	0.0022	0.0023	0.0034	0.0024	0.0027	0.0022
Selenium	7782-49-2	mg/L	NA	NA	0.0036									0.0051						0.0043		0.0039		
Thallium	7440-28-0	mg/L	NA	NA																		0.000053		

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as CaCO3 used.

TABLE 8a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Unnamed Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	0.004	NA	0.025	0.004		0.00021 J	
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	NA	250	NA	250	146	30.2	20.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.56	0.71	0.33
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0037 J	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Sulfate	14808-79-8	mg/L	NA	250	NA	250	58.5	140	77.3
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002			
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	570	374	283

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.

NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Screening Levels				Unnamed Creek / Drainage		
Constituent	**CAS**	**Units**	**USEPA MCLs (b)**	**USEPA SMCLs (b)**	**USEPA Tapwater RSLs (c)**	**Selected Drinking Water Screening Level (h)**	**M2-C-1**	**M2-C-2**	**M2-C-3**
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0788	0.165	0.137
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4		0.964	0.246
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	82.6	53.4	42.6
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1		0.0069	
Cobalt*	7440-48-4	mg/L	NA	NA	0.006	0.006			
Lead*	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015			
Lithium*	7439-93-2	mg/L	NA	NA	0.04	0.04			
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05		0.0124 J	
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002			

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in May 2018.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.5	69.7	69.4
Chloride	16887-00-6	mg/L	NA	250	NA	250	54.8	44	44.1
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			
Fluoride	16984-48-8	mg/L	4	2	0.8	4	0.63	0.56	0.56
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015		0.0035	
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Sulfate	14808-79-8	mg/L	NA	250	NA	250	49.1	97.6	97.8
Thallium*	7440-28-0	mg/L	0.002	NA	0.0002	0.002		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	NA	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	500	NA	500	386	414	407

Notes:

Blank cells - Non-detect value.

* - Constituent was not detected in any samples.	NA - Not Available.
CAS - Chemical Abstracts Service.	RSL - Regional Screening Level.
J - Estimated value.	SMCL - Secondary Maximum Contaminant Level.
MCL - Maximum Contaminant Level.	USEPA - United States Environmental Protection Agency.
mg/L - milligrams per liter.	

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.

(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm

(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

(d) - RSL for Mercuric Chloride used for Mercury.

(e) - The drinking water standard or MCL for chromium is based on total chromium.

(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.

(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.

(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 8d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS -
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Screening Levels			Selected Drinking Water Screening Level (h)	Creek / Drainage		
			USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)		M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.006	NA	0.0078	0.006			
Arsenic	7440-38-2	mg/L	0.01	NA	0.000052	0.01	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	2	NA	3.8	2	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	0.004	NA	0.025	0.004			
Boron	7440-42-8	mg/L	NA	NA	4	4	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	0.005	NA	0.0092	0.005			
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	0.1 (e)	NA	22 (f)	0.1		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA	NA	0.006	0.006			
Lead	7439-92-1	mg/L	0.015 (g)	NA	0.015	0.015			
Lithium	7439-93-2	mg/L	NA	NA	0.04	0.04	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	0.002	NA	0.0057 (d)	0.002			
Molybdenum	7439-98-7	mg/L	NA	NA	0.1	0.1	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	0.05	NA	0.1	0.05			
Thallium	7440-28-0	mg/L	0.002	NA	0.0002	0.002	0.000053	0.000041	0.000085

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - milligrams per liter.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > Selected Drinking Water Screening Level.

(a) - Surface water samples collected in September 2017.
(b) - USEPA 2018 Edition of the Drinking Water Standards and Health Advisories. Spring 2018.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2018). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - RSL for Mercuric Chloride used for Mercury.
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, the basis of which has been questioned by USEPA's Science Advisory Board.
(g) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(h) - Selected Drinking Water Screening Level uses the following hierarchy:
Federal USEPA MCL for Drinking Water.
Federal USEPA SMCL for Drinking Water.
Federal November 2018 USEPA Tapwater RSL.

TABLE 9a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS -
TO HUMAN HEALTH AWQC SCREENING LEVELS -
TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Unnamed Creek / Drainage		
				M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	NA	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	NA		0.00021 J	
Boron	7440-42-8	mg/L	NA	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	NA	146	30.2	20.6
Chromium	7440-47-3	mg/L	NA	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	NA	0.56	0.71	0.33
Lead	7439-92-1	mg/L	NA		0.0037 J	
Lithium	7439-93-2	mg/L	NA		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	4.2			
Sulfate	14808-79-8	mg/L	NA	58.5	140	77.3
Thallium*	7440-28-0	mg/L	0.00047			
Total Hardness as CaCO3	471-34-1	mg/L	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	570	374	283

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 9b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Unnamed Creek / Drainage		
			AWQC (b)	M2-C-1	M2-C-2	M2-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	NA	0.0788	0.165	0.137
Beryllium	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA		0.964	0.246
Cadmium	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	82.6	53.4	42.6
Chromium*	7440-47-3	mg/L	NA		0.0069	
Cobalt*	7440-48-4	mg/L	NA			
Lead	7439-92-1	mg/L	NA			
Lithium	7439-93-2	mg/L	NA			
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	4.2		0.0124 J	
Thallium	7440-28-0	mg/L	0.00047			

Notes:
Blank cells - Non-detect value.
* - Constituent was not detected in any samples.
AWQC - Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria.
USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only
apply to total concentrations.
(c) - Value applies to inorganic form of arsenic only.

TABLE 9c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA AWQC (b)	Creek / Drainage		
				M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	NA	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.5	69.7	69.4
Chloride	16887-00-6	mg/L	NA	54.8	44	44.1
Chromium	7440-47-3	mg/L	NA	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA			
Fluoride	16984-48-8	mg/L	NA	0.63	0.56	0.56
Lead	7439-92-1	mg/L	NA		0.0035	
Lithium	7439-93-2	mg/L	NA	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	4.2			
Sulfate	14808-79-8	mg/L	NA	49.1	97.6	97.8
Thallium*	7440-28-0	mg/L	0.00047		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	386	414	407

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - Value applies to inorganic form of arsenic only.

TABLE 9d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO HUMAN HEALTH AWQC SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	USEPA	Creek / Drainage		
			AWQC (b)	M-C-1	M-C-2	M-C-3
Antimony*	7440-36-0	mg/L	0.64			
Arsenic	7440-38-2	mg/L	0.00014 (c)	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	NA	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	NA			
Boron	7440-42-8	mg/L	NA	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	NA			
Calcium	7440-70-2	mg/L	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	NA		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA			
Lead	7439-92-1	mg/L	NA			
Lithium	7439-93-2	mg/L	NA	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	NA			
Molybdenum	7439-98-7	mg/L	NA	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	4.2			
Thallium*	7440-28-0	mg/L	0.00047	0.000053	0.000041	0.000085

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.

-- - Constituent not included in this analysis.

AWQC - Ambient Water Quality Criteria.

CAS - Chemical Abstracts Service.

mg/L - milligrams per liter.

NA - Not Available.

USEPA - United States Environmental Protection Agency.

🟩 Detected Concentration > AWQC.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - Value applies to inorganic form of arsenic only.

TABLE 10a
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS -
TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Unnamed Creek / Drainage		
Constituent	**CAS**	**Units**	**Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M2-C-1**	**M2-C-2**	**M2-C-3**
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0016	0.0035	0.0019
Barium	7440-39-3	mg/L	NA	NA	0.0918	0.182	0.151
Beryllium	7440-41-7	mg/L	NA	NA		0.00021 J	
Boron	7440-42-8	mg/L	NA	NA	0.0246 J	0.789	0.257
Cadmium*	7440-43-9	mg/L	0.0040 (d)	0.0015 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.8	48.5	38.5
Chloride	16887-00-6	mg/L	860	230	146	30.2	20.6
Chromium	7440-47-3	mg/L	3.4 (c,d)	0.16 (c,d)	0.0023 J	0.0064	
Cobalt	7440-48-4	mg/L	NA	NA	0.0014 J		0.0012 J
Fluoride	16984-48-8	mg/L	NA	NA	0.56	0.71	0.33
Lead	7439-92-1	mg/L	0.22 (d)	0.0084 (d)		0.0037 J	
Lithium	7439-93-2	mg/L	NA	NA		0.0266	0.0095 J
Mercury*	7439-97-6	mg/L	0.0016	0.00091			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0052 J	0.0249	0.0079 J
Selenium*	7782-49-2	mg/L	NA	3.1			
Sulfate	14808-79-8	mg/L	NA	NA	58.5	140	77.3
Thallium*	7440-28-0	mg/L	NA	NA			
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	265	206	174
Total Dissolved Solids	TDS	mg/L	NA	NA	570	374	283

Notes:

Blank cells - Non-detect value.
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.

J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.

TABLE 10b
COMPARISON OF MAY 2018 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Unnamed Creek / Drainage		
Constituent	**CAS**	**Units**	**Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M2-C-1**	**M2-C-2**	**M2-C-3**
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.0013	0.0031	0.0016
Barium	7440-39-3	mg/L	NA	NA	0.0788	0.165	0.137
Beryllium	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA		0.964	0.246
Cadmium	7440-43-9	mg/L	0.0037 (d)	0.0013 (d)			
Calcium	7440-70-2	mg/L	NA	NA	82.6	53.4	42.6
Chromium*	7440-47-3	mg/L	1.1 (c,d)	0.14 (c,d)		0.0069	
Cobalt*	7440-48-4	mg/L	NA	NA			
Lead	7439-92-1	mg/L	0.15 (d)	0.0057 (d)			
Lithium	7439-93-2	mg/L	NA	NA			
Mercury*	7439-97-6	mg/L	0.0014	0.00077			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0052 J	0.0313	0.0077 J
Selenium	7782-49-2	mg/L	NA	NA		0.0124 J	
Thallium	7440-28-0	mg/L	NA	NA			

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in May 2018.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 215 mg/L as CaCO3 used.

TABLE 10c
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - TOTAL (UNFILTERED) SAMPLE RESULTS (a) AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

Constituent	CAS	Units	Federal Water Quality Criteria		Creek / Drainage		
			USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	M-C-1	M-C-2	M-C-3
Antimony	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00077	0.0022	0.0025
Barium	7440-39-3	mg/L	NA	NA	0.0734	0.107	0.122
Beryllium*	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA	0.03	0.366	0.358
Cadmium*	7440-43-9	mg/L	0.0048 (d)	0.0017 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.5	69.7	69.4
Chromium	7440-47-3	mg/L	3.9 (c,d)	0.19 (c,d)	0.0011	0.0011	
Cobalt	7440-48-4	mg/L	NA	NA			
Fluoride	16984-48-8	mg/L	NA	NA	0.63	0.56	0.56
Lead	7439-92-1	mg/L	0.27 (d)	0.011 (d)		0.0035	
Lithium	7439-93-2	mg/L	NA	NA	0.0039	0.014	0.0132
Mercury*	7439-97-6	mg/L	0.0016	0.00091			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0067	0.0119	0.0115
Selenium	7782-49-2	mg/L	NA	3.1			
Sulfate	14808-79-8	mg/L	NA	NA	49.1	97.6	97.8
Thallium	7440-28-0	mg/L	NA	NA		0.000042	0.000092
Total Hardness as CaCO3	HARDNESS	mg/L	NA	NA	263	252	253
Total Dissolved Solids	TDS	mg/L	NA	NA	386	414	407

Notes:

Blank cells - Non-detect value.

* Constituent was not detected in any samples.	mg/L - milligrams per liter.
-- - Constituent not included in this analysis.	NA - Not Available.
AWQC - USEPA Ambient Water Quality Criteria.	ND - Not Detected.
CAS - Chemical Abstracts Service.	USEPA - United States Environmental Protection Agency.

🟧	Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨	Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.

(c) - Value for trivalent chromium used.

(d) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 256mg/L as CaCO3 used.

TABLE 10d
COMPARISON OF SEPTEMBER 2017 UNNAMED CREEK/DRAINAGE SURFACE WATER RESULTS - TO ECOLOGICAL SCREENING LEVELS - DISSOLVED (FILTERED) SAMPLE RESULTS (a)
AMEREN MISSOURI MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

			Federal Water Quality Criteria		Creek / Drainage		
Constituent	**CAS**	**Units**	**USEPA Aquatic Life AWQC Freshwater Acute (b)**	**USEPA Aquatic Life AWQC Freshwater Chronic (b)**	**M-C-1**	**M-C-2**	**M-C-3**
Antimony*	7440-36-0	mg/L	NA	NA			
Arsenic	7440-38-2	mg/L	0.34	0.15	0.00084	0.0023	0.0024
Barium	7440-39-3	mg/L	NA	NA	0.0712	0.105	0.123
Beryllium*	7440-41-7	mg/L	NA	NA			
Boron	7440-42-8	mg/L	NA	NA	0.0308	0.389	0.392
Cadmium*	7440-43-9	mg/L	0.0043 (d)	0.0015 (d)			
Calcium	7440-70-2	mg/L	NA	NA	78.8	69.5	70.7
Chromium	7440-47-3	mg/L	1.2 (c,d)	0.16 (c,d)		0.00095	0.00085
Cobalt	7440-48-4	mg/L	NA	NA			
Lead	7439-92-1	mg/L	0.18 (d)	0.0069 (d)			
Lithium	7439-93-2	mg/L	NA	NA	0.0047	0.0147	0.0152
Mercury*	7439-97-6	mg/L	0.0014	0.00077			
Molybdenum	7439-98-7	mg/L	NA	NA	0.0066	0.0132	0.0128
Selenium	7782-49-2	mg/L	NA	NA			
Thallium	7440-28-0	mg/L	NA	NA	0.000053	0.000041	0.000085

Notes:
Blank cells - Non-detect value.
* Constituent was not detected in any samples.
-- - Constituent not included in this analysis.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - milligrams per liter.
NA - Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.

🟧 Detected Concentration> USEPA Aquatic Life AWQC Chronic.
🟨 Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.

(a) - Surface water samples collected in September 2017.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (d).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for Unnamed Creek/Drainage of 256 mg/L as CaCO3 used.

APPENDIX B

What You Need to Know About Lithium

WHAT YOU NEED TO KNOW ABOUT LITHIUM

Lithium is present in at least one groundwater sample from two monitoring wells at the Ameren Meramec Energy Center (MEC) in Missouri above the screening level used by the U.S. Environmental Protection Agency (USEPA) under the Coal Combustion Residuals (CCR) Rule. The purpose of this fact sheet is to provide information on lithium so that data can be considered in context. There is no public exposure to groundwater at the Meramec Energy Center and concentration levels of litium in adjacent surface waters of the Mississippi River and the Missouri River are all well below health-based regulatory standards. In fact, for lithium to pose a risk to surface water, concentration levels would need to be more than **24,000 times higher** than the level observed at Meramec.

LITHIUM IS NATURALLY OCCURING

Lithium is naturally occurring in soils and water. Based on a literature review, Aral and Vecchio-Sadus (2008) reported that typical background lithium concentrations are between 0.001 and 0.01 mg/L (milligrams of lithium per liter of water) in surface waters, approximately 0.17 mg/L in seawater, and around 0.003 mg/L in rivers. Some natural mineral waters may contain up to 100 mg/L of lithium (Schrauzer, 2002). Lithium is also present in soil between 3 and 350 mg/kg (milligrams of lithium per kilogram of soil) and in the earth's crust between 20 and 60 mg/kg (Aral and Vecchio-Sadus, 2008). Lithium is typically found in sediment at concentrations of approximately 56 mg/kg. United States Geological Survey (USGS, 2013) estimates the average concentration of lithium in soil in the U.S. is 21 mg/kg.

Lithium is not routinely evaluated in groundwater samples as it is not a typical constituent of concern and the concentrations are often below instrument detection limits. The USGS conducted the first comprehensive analysis of trace-element concentrations in groundwater that were evaluated from samples collected between 1992 and 2003 from aquifers across the U.S. (USGS, 2011). Lithium was one of the trace elements evaluated in the study and samples from drinking-water wells in dry regions had greater concentrations than other areas. The study found that the maximum concentration of lithium in the analysis of 936 groundwater samples was 1.2 mg/L with a 90th percentile concentration of 0.054 mg/L and a median concentration of 0.006 mg/L (USGS, 2011).

Lithium is Present in Our Diet

Primary dietary sources of lithium are grains and vegetables, dairy products and meat. Estimates for daily dietary intake of lithium have been reported from different sources and varies amongst different countries. Ranges have included 0.0168 to 0.105 mg lithium/day with other authors estimating daily intake from food and tap water ranging from 2.31 to 5.6 mg lithium/day (USEPA, 2008). Schrauzer (2002) reports the daily estimate to be from 0.65 to 3.1 mg lithium/day for a 70 kg (154 lb) adult. The

U.S. Food and Drug Administration has not established a recommended daily value for lithium; however, a provisional recommended daily allowance (RDA) has been proposed to be 1 mg lithium/day for a 70 kg adult based on the lithium intake data in different countries (Schrauzer, 2002).

The USEPA provisional toxicity value (2008; see below) is roughly equivalent to an intake of 0.14 mg lithium/day for a 70 kg (154 lb) adult (i.e., USEPA would suggest that a safe intake of lithium is at or below this level). However, many of the estimated daily exposures and the recommended daily allowances for lithium from the diet and tapwater are above the USEPA level, and there have been no reported findings that these lithium exposures have resulted in any toxicological effects; this suggests that the current USEPA level overestimates potential risks associated with lithium exposures.

Lithium is Used Medicinally

Lithium is used medicinally in the U.S. and globally as the leading treatment for bipolar disease. Adult daily dosages are approximately 900 mg lithium/day or higher, and recommended doses for children are approximately 600 mg lithium/day. These intakes are much higher than the USEPA provisional level.

USEPA'S ORAL TOXICITY VALUE FOR LITHIUM

There are limited studies on lithium of the type upon which to base a toxicity value to use in human health risk assessment. USEPA has derived a provisional toxicity value (i.e., the value does not have the normal level of review or confidence compared to final toxicity values published by USEPA) that equates to a drinking water screening level of 0.04 mg/L, and a general intake of 0.14 mg/day for an adult. As noted above, this level is below many estimates of daily intake in humans presented above, and well below the typical therapeutic doses presented above.

DRINKING WATER SCREENING LEVELS FOR LITHIUM

Using this toxicity value, the USEPA regional screening level (RSL) for lithium for tapwater (drinking water) is 0.04 mg/L (USEPA, 2018b). This is also the screening level identified by USEPA for the CCR Rule (USEPA, 2018a). Surface water samples taken by Ameren of the Mississippi and Meramec Rivers near the MEC and evaluated for lithium were all below the drinking water screening level. Lithium was rarely detected in the Meramec River; lithium concentrations detected in the Mississippi River were similar upstream and downstream indicating that MEC is not the source of lithium in the Mississippi River.

OTHER LITHIUM TOXICITY EVALUATIONS

In 1990, Schauzer et al. published data for 27 Texas counties showing that incidence rates of suicide, homicide, and rape were significantly higher in counties whose drinking water contained little or no lithium compared to counties with water lithium levels ranging from 0.7 – 0.17 mg/L. The authors suggested that continuous exposure to low dose lithium may have a generally beneficial effect on human behavior. Since that publication, additional studies investigating the anti-suicidal effects of lithium as a trace element in drinking water have been conducted throughout the world.

A review of these studies published recently by Liaugaudaite (2016) found that 7 of the 9 studies reported an association between low levels of lithium and suicide rates suggesting that lithium levels in drinking water could reduce the suicide risk in the general population. The mean lithium levels in the drinking water from these 7 studies ranged from 0.0007 to 0.219 mg/L, which is around less than a thousandth of the minimum daily dose of lithium given for bipolar disorders and depression.

For example, Ohgami et al. (2009) examined lithium levels in tap water in 18 municipalities of Oita prefecture in Japan and found that the levels ranged from 0.0007 to 0.059 mg/L. The standardized mortality ratio of suicide across the municipalities was significantly and negatively associated with lithium levels in males as well as females (Ohgami et al, 2009).

Additional studies conducted in Japan, Austria, Texas, Greece, and Austria corroborate these results finding that higher lithium levels in the drinking water were associated with lower suicide rates. One negative study has been reported in England. However, the evidence that has been accumulating over the years, especially in the last 5-10 years, that small doses of lithium can have beneficial effects has even recently been the topic of an opinion editorial piece in the New York Times by a psychiatrist and faculty member at Weill Cornell Medical College who cites the different studies and questions why more research is not being conducted to evaluate this trend in the literature that shows lithium at low levels in drinking water could have an impact on suicide levels, violent acts and even dementia (Fels, 2014). She concludes that for the public health issue of suicide prevention alone, studies should be conducted with lithium to determine if it should be considered an essential trace element nutrient which would then allow its addition to vitamins, foods, etc. which could result in beneficial clinical, societal, and behavioral outcomes.

These data suggest that long term exposure to low levels of lithium in drinking water, which can range from 0.0007 to 0.219 mg/L may actually have beneficial effects in humans. The tap water screening level of 0.04 mg/L used by USEPA in the CCR Rule is well below the high end of this range. Therefore, lithium levels could be as high as 0.219 mg/L without adverse effect, well above the maximum concentration level observed at Meramec of 0.164 mg/L.

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APPENDIX C

What You Need to Know About Molybdenum

WHAT YOU NEED TO KNOW ABOUT MOLYBDENUM

Molybdenum is the one constituent that is present in at least one groundwater sample at each of the four Ameren energy centers in Missouri above the screening level used by the U.S. Environmental Protection Agency (USEPA) under the Coal Combustion Residuals (CCR) Rule. The purpose of this fact sheet is to provide information on molybdenum so that data can be considered in context. There is no public exposure to groundwater at the Ameren energy centers and concentration levels of molybdenum in adjacent surface waters are all well below health-based regulatory standards.

SOURCES OF INFORMATION ON MOLYBDENUM

Molybdenum had been evaluated by regulatory and health agencies in the U.S. As discussed below, molybdenum is an essential nutrient for humans, and the Institute of Medicine of the U.S. National Academy of Sciences (NAS) has provided recommended daily allowances and tolerable upper limits to be used as guidelines for vitamins and supplements and other exposures (NAS, 2001).

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency within the U.S. Department of Health and Human Services. The ATSDR Toxicological Profile for Molybdenum (ATSDR, 2017) provides a comprehensive summary and interpretation of available toxicological and epidemiological information on molybdenum and provides information on the naturally occurring levels in our environment and in our diet.

The U.S. Environmental Protection Agency (USEPA) published an oral toxicity value for molybdenum in 1992 (USEPA, 1992); this value serves as the basis for the tapwater screening level for molybdenum of 0.1 milligrams per liter (mg/L) or 100 micrograms per liter (ug/L) that was included in the Phase 1 Part update to the CCR Rule (USEPA, 2018a).

MOLYBDENUM IS NATURALLY OCCURRING AND AN ESSENTIAL NUTRIENT FOR PLANTS AND HUMANS

Molybdenum is a naturally occurring trace element that can be found extensively in nature. Biologically, molybdenum plays an important role as a micronutrient in plants and animals, including humans.

Molybdenum in Our Natural Environment

Molybdenum naturally accumulates in poorly drained soils and soils with high organic content (for example, peat bogs and wetlands). It is also present at high concentrations in “black shales,” which are shale deposits with high organic content. The U.S. Geological Survey (USGS, 2013) reports that the average concentration in U.S. soils is approximately 1 milligram per kilogram of soil (mg/kg). USGS (2011) estimates the median concentration of molybdenum in groundwater is 0.001 milligrams per liter (mg/L), with most concentrations below 0.008 mg/L.

Molybdenum in Our Diet

Molybdenum is considered an essential nutrient or trace element for living beings. It is required in several mammalian enzyme systems and is present in most adult multi-vitamins. A deficiency syndrome has only been seen in people with a genetic defect that prevents the synthesis of a specific enzyme for which molybdenum is a cofactor. The deficiency leads to severe neurological damage and early death.

Because it is present in soils, it is also present in our diet. Food derived from above ground plants, such as legumes, leafy vegetables, and cauliflower generally has a relatively higher concentration of molybdenum in comparison to food from tubers or animals. Beans, cereal grains, leafy vegetables, legumes, liver, and milk are reported as the richest sources of molybdenum in the average diet (ATSDR, 2017). The amount of molybdenum in plants varies according to the amount in the soil. The National Academy of Sciences (NAS) has estimated that the average dietary intakes of molybdenum by adult men and women are 0.109 and 0.076 milligrams per day (mg/day), respectively. A study of the dietary intake of adult residents in Denver, Colorado reported a mean molybdenum ingestion rate of 180 µg/day (range 120–240 µg/day) (ATSDR, 2017).

Molybdenum for Health

How Much Do You Need - Daily Allowance:

The Institute of Medicine of the NAS sets dietary intake values for essential nutrients. The recommended dietary allowance (RDA) for a nutrient is "the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) health individuals" (NAS, 2001). The RDA for molybdenum for adults set by the NAS in 2001 is 0.045 milligram per day (mg/day) and is based on the amount of molybdenum needed to achieve a steady healthy balance in the body for the majority of the population.

How Much is Too Much - Upper Limits:

In addition to the RDA, the NAS also defines a Tolerable Upper Intake Level (UL) for essential nutrients. The UL is "the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population." Thus, the RDA is a level that is considered to be sufficient for the health of the general population, while intake can be as high as the UL and pose no adverse health effects.

The UL for molybdenum set by the NAS is 2 mg/day. This level is based on an evaluation of the potential toxicity of molybdenum at high levels of intake. The most sensitive effect in the literature is associated with reproductive outcomes in rats, and the study was used to develop an oral toxicity value for humans of 0.03 milligrams of molybdenum ingested per day per kilogram of body weight (mg/kg-day). This value is used with an average adult body weight of 68-70 kg (154 lbs) to set the UL[1].

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[1] The oral toxicity value identifies a level of intake in terms of milligrams of constituent per kilogram of body weight per day (mg/kg-day) that is considered to be safe for daily exposure for a lifetime. The oral toxicity value is used to calculate a safe drinking water level as follows: if the oral toxicity value is 0.03 mg/kg-day, and a 70 kg adult that consumes 2 liters of water per day, then the safe drinking water level = (0.03 mg/kg-day) x (70 kg) ÷ (2 liters water/day) = 1.05 milligrams per liter (mg/L).

USEPA'S ORAL TOXICITY VALUE FOR MOLYBDENUM

USEPA developed a lower oral toxicity value for molybdenum of 0.005 mg/kg-day (USEPA, 1992) based on a 1962 study of a small population (52 exposure subjects) in Armenia that had a high level of molybdenum in their diet. This population had high levels of uric acid and experienced gout. The findings from the Armenian study have not been replicated, and other regulatory bodies such as the NAS and ATSDR have rejected the study due to its many deficiencies. [It is likely that the observance of gout in the Armenian population had some other cause.]

The NAS concluded that there were "serious methodological difficulties with the [Armenian] study" and noted that no other studies in humans or animals have replicated this effect. The NAS toxicity value is 0.03 mg/kg-day, six-fold higher than the USEPA value. Based on the NAS toxicity value and USEPA assumptions (for body weight and drinking water intake) results in a calculated safe drinking water level of 0.6 mg/L or 600 ug/L.

ATSDR noted the study of the Armenian population was not considered suitable for derivation of a chronic-duration oral toxicity value for molybdenum due to deficiencies in the control group size and composition, and a lack of controlling for confounders, such as diet and alcohol, that could affect the results. ATSDR developed an oral toxicity value of 0.008 mg/kg-day, using the same study reproductive outcomes in rats as the NAS, but applying different assumptions, most notably a 3-fold higher uncertainty factor. Based on the ATSDR toxicity value and USEPA assumptions (for body weight and drinking water intake) results in a calculated safe drinking water level of 0.16 mg/L or 160 ug/L.

MOLYBDENUM UNDER THE CCR RULE

When the CCR Rule was published in 2015, groundwater standards were provided only for those Appendix IV constituents that have primary drinking water standards published by the USEPA under the Safe Drinking Water Act – values known as MCLs or maximum contaminant levels. Molybdenum does not have an MCL[2]. In a subsequent 2018 CCR rule-making, USEPA designated a health-based groundwater protection standard for molybdenum of 0.1 mg/L or 100 ug/L. That is the value used to evaluate groundwater at the Ameren facilities. This level is very conservative and could be much higher and still protective of human health, as described above. [Note that in its March 3, 2019 report the Environmental Integrity Project used a screening level for molybdenum of 0.04 mg/L (or 40 ug/L), which is not the level USEPA has required in the CCR Rule.]

However, based on the USEPA toxicity value, the drinking water levels USEPA has developed for molybdenum are:

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[2] USEPA is in the process of gathering information on the occurrence of molybdenum in public drinking water systems. The decision to develop an MCL (which is a multi-year process) is based on occurrence in public drinking water systems, the severity of adverse health effects, whether the constituent is present in public drinking water systems at levels of public health concern, and whether regulation would provide a meaningful opportunity for health risk reduction. No decision has yet been made as to whether molybdenum will be a candidate for the development of a drinking standard. Note that when USEPA included molybdenum for public water supply testing, it cited USEPA 1992, ATSDR 2017, and NAS 2001 as toxicity references. No mention was made of the differences in toxicity studies used or the values developed.

- 0.1 mg/L – The USEPA tapwater value in its Regional Screening Level (RSL) table and the value identified by USEPA for the CCR Rule (USEPA, 2018b). This is the value USEPA uses in the CCR Rule (USEPA, 2018a).
- 0.2 mg/L – The USEPA Office of Water value for the Drinking Water Equivalent Level (DWEL), which is a *lifetime exposure* concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a constituent is from drinking water (USEPA, 2018c).
- 0.04 mg/L – The USEPA Office of Water value for the Health Advisory Level (HA), which is based on the DWEL, but using a default assumption that only 20% of intake can come from water (USEPA, 2018c).

Therefore, drinking water concentrations of molybdenum up to 0.2 mg/L to are expected to be **without** adverse health effects. Based on the NAS review, daily exposure to drinking water concentrations of molybdenum up to 0.6 mg/L would be **without** adverse health effects.

WHAT THIS MEANS FOR THE AMEREN ENERGY CENTERS

This information from the NAS has been used to evaluate the levels of molybdenum in groundwater at the Ameren Energy Centers and in nearby surface waters. A total of 930 groundwater and surface water samples were collected from the four energy centers. The concentration levels in approximately 866 samples were below the screening level based on the National Academy of Science Tolerable Upper Intake Level (UL), while 241 are above the GWPS established by USEPA in the CCR Rule.

	Labadie	Meramec	Rush Island	Sioux
Groundwater				
Number of Samples	208	88	77	244
Molybdenum greater than CCR GWPS of 0.1 mg/L (a)	81	35	38	77
Molybdenum greater than NAS standard of 0.6 mg/L (b)	3	1	11	49
Surface Water				
Number of Samples	67	74	50	80
Molybdenum greater than 0.1 mg/L (a)	0	0	0	0

Notes:
mg/L - milligrams per liter.
(a) - Drinking water-based groundwater protection standard specified in the Coal Combustion Residuals Rule.
(b) - Alternative health-protective drinking water screening level based on the National Academy of Sciences review of molybdenum.

The groundwater results were collected from monitoring wells placed as close as practical to the ash basins' boundaries and provide near-source groundwater monitoring results. The groundwater downgradient of each of the Ameren ash basins is not used as a source of drinking water. Deep bedrock groundwater used as drinking water in the vicinity of Labadie and in the vicinity of Rush Island was sampled and demonstrated no impacts from CCR.

Surface water adjacent to each of the energy centers was sampled and all results for molybdenum in surface water are well below the USEPA drinking water screening level of 0.1 mg/L.

Thus, although there are some results for molybdenum in groundwater that are above the USEPA drinking water screening level, the groundwater at these facilities is not used as a source of drinking water, and molybdenum is not present in any of the adjacent water bodies above the drinking water screening level. These results confirm that molybdenum does not pose a risk to human health or the environment at any of the Ameren facilities.

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APPENDIX D

Extraction and Transportation Assessment

LOCHMUELLER GROUP

ADDENDUM

Meramec, Labadie and Sioux Ash Pond Closure: Extraction and Transportation Assessment

Lochmueller Group applied the methodology from the Extraction and Transportation Study for the Rush Island Energy Center to develop high-level estimates of the costs and timeframes associated with hypothetical CCR excavation processes at the Labadie, Sioux and Meramec Energy Centers. Specifically, the formula used to estimate daily productivity (i.e. number of trucks hauling excavated material offsite) was adapted for use at Labadie, Sioux and Meramec along with site-specific considerations.

Estimates from the Rush Island Study assumed a maximum of 192 truck loads per day over an 8-hour work day (24 per hour), with 155 to 193 days of annual operation. Once loaded, trucks would make multiple roundtrips to the closest available commercial landfill. Such estimates assume that the excavation, staging, and loading process is capable of accommodating a steady stream of trucks loading **every 2.5 minutes** and that such material can be quickly unloaded at the receiving commercial landfill without significant delay. While such productivity rates are undoubtedly optimistic, the resulting estimates nevertheless are useful in capturing the enormity of such projects and are sufficient at a planning-level.

It is important to note that the existing onsite utility waste landfills (UWLs) at Labadie and Sioux were designed and permitted to manage production needs of the energy centers through each facility's retirement date. To facilitate permanent storage, excavated CCR material would need to be transported offsite to a commercial landfill **or** Ameren Missouri would need to permit and construct new onsite landfills. Given the absence of an existing utility waste landfill at Meramec, onsite disposal options were considered for the Labadie and Sioux locations only.

Each facility presents unique challenges that are likely to impact cost estimates and closure times beyond the scope of this assessment. For example, the regulatory process for construction of an onsite landfill would require multiple levels of approval, including environmental permits, zoning or land use authorization, and potentially a certificate of issuance from the Missouri Public Service Commission. Opposition to such projects may further delay the regulatory approval process such that it would be years *before* construction could commence.[1]

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[1] Efforts to permit and construct the Labadie UWL commenced in 2008 with the completion of Preliminary Site Investigation (PSI). The landfill was placed in service in 2016 after years of opposition from environmental groups and litigation. See *Petition for Writ of Certiorari [to invalidate county landfill ordinance] Franklin County Circ. Ct., 11/23/11, Case # 11AB-C286; Appeal to Franklin County Board of Adjustment, #14-00002, Filed 1/8/14 (of Land Use Administrator 10/10/13 and 12/10/13 Decisions), Denied by BZA 6/24/14; Appealed to Circ. Ct. by Writ of Certiorari, Cause # 14AB-CC00155, 7/24/14; Intervention and Motion to Dismiss in PSC Case EA 2012-0281, Ameren Application to PSC for CCN to operate landfill (PSC overruled Motion to Dismiss on 4/17/13); Administrative Hearing Commission Petition for Review [of MDNR Solid Waste Disposal Construction Permit], Filed 1-30-15, #15-0136, dismissed by AHC 3/5/15.* See also *Campbell v. County Commission of Franklin County, 453 S.W.3d 762 (Mo. banc 2015).*

Based on experience, it would be virtually impossible to sustain productivity at the planning level rate over extended, multi-year timeframe due to a variety of unpredictable factors. Excavation activities could be limited or precluded for several days following weather events. Other potential disruptions could include:

- loading equipment failure
- site restrictions that limit the number of excavation equipment
- traffic congestion on travel route
- truck breakdown
- staffing
- weather conditions
- commercial landfill available capacity in Illinois and Missouri
- landfill unloading equipment failure

In addition, site specific conditions can impact productivity. For example, an elementary school is located along Fine Road between the Meramec Energy Center and Telegraph Road. To accommodate local safety concerns, the hauling company would likely limit trips during the beginning and end of the school day, thereby limiting effective hauling hours to 5-6 per day during the school year.

Route 94 east of the Sioux Energy Center travels beneath multiple narrow, low-clearance railroad overpasses in the West Alton area. An entirely new roadway by-passing West Alton would avoid the railroad entirely, but would require regulatory approvals, land acquisition, and potentially eminent domain. Assumptions were adjusted to account for these impacts, but it is not possible to foresee every challenge and quantify every impact likely to surface.

Scenarios:

The following summarizes the assessment of five scenarios for CCR removal for the Meramec, Labadie and the Sioux Energy Centers. The assessment utilized the same methodology, assumptions, and unit costing information as for Rush Island. The volume of ash, hauling distances, and the anticipated infrastructure upgrades were adjusted for each site.

For each scenario, the total volume of excavated ash, total cost of removal, and closure duration are summarized. The reported volume of ash incorporates a swell factor. The closure duration is measured from the time the decision is made to close the ponds (i.e. removal from service) until such time that the CCR material is fully removed. It was assumed that 5 years of preparation time would be needed in advance of starting an offsite removal operation, whereas an onsite removal operation would require 10 years of preparation time to account for the regulatory process to secure approvals for construction of new onsite landfills.

The five scenarios are as follows:

1. Labadie Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill
2. Labadie Bottom Ash and Fly Ash Pond CCR Removal to an Onsite Landfill

3. Sioux Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill
4. Sioux Bottom Ash and Fly Ash Pond CCR Removal to an Onsite Landfill
5. Meramec Bottom Ash and Fly Ash Pond CCR Removal to an Offsite Landfill

Scenario 1: Offsite CCR Removal for Labadie

This scenario assumes offsite removal for the Labadie ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Hauling to an offsite landfill in Missouri;
- Landfill placement; and
- Loading and transportation infrastructure.

Labadie Energy Center	**Estimated Ash Volume (CY)** [2]	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	17,325,126	**$2,440 M – $2,930 M**	**35 plus years**

Scenario 2: Onsite CCR Removal for Labadie

This scenario assumes onsite disposal the Labadie ash pond sites and includes the following:

- Pre-CCR removal preparation (10 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an onsite landfill located near the existing ponds;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading infrastructure.

Labadie Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	17,325,126	**$1,270 M - $1,520 M**	**40 plus years**

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[2] Estimated volumes do not include any dry amendment materials.

Scenario 3: Offsite CCR Removal for Sioux

This scenario assumes offsite removal for the Sioux ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an offsite landfill in Illinois[3];
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading and transportation infrastructure.

Sioux Energy Center	Estimated Ash Volume (CY)	Estimated Total Removal Cost	Closure Duration (Years)
	6,079,808	**$890 M - $1,060 M**	**15 plus years**

Scenario 4: Onsite CCR Removal for Sioux

This scenario assumes onsite disposal the Sioux ash pond sites and includes the following:

- Pre-CCR removal preparation (10 years, included on a prorated basis in the Closure Duration for each pond);
- Stabilization, loading, and pond restoration;
- Hauling to an onsite landfill located near the existing ponds;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Landfill placement; and
- Loading infrastructure.

Sioux Energy Center	Estimated Ash Volume (CY)	Estimated Total Removal Cost	Closure Duration (Years)
	6,079,808	**$470 M - $570 M**	**20 plus years**

Scenario 5: Onsite CCR Removal for Meramec

This scenario assumes offsite removal for the Meramec ash pond sites and includes the following:

- Pre-CCR removal preparation (5 years, included on a prorated basis in the Closure Duration for each pond);

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[3] Lochmueller did not review local siting requirements but many Illinois counties contain such restrictions.

- Stabilization, loading, and pond restoration;
- Hauling to an offsite landfill in Illinois;
- Seasonal impacts from wet and winter weather conditions impeding productivity;
- Site specific constraints with transportation access and associated limitations;
- Landfill placement; and
- Loading and transportation infrastructure.

Meramec Energy Center	**Estimated Ash Volume (CY)**	**Estimated Total Removal Cost**	**Closure Duration (Years)**
	5,194,923	**$740 M - $890 M**	**20 plus years**

APRIL 29, 2019

EXTRACTION & TRANSPORTATION STUDY: Rush Island Ash Pond Closure Assessment

Rush Island Site

Jefferson County, Missouri

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Table of Contents

Introduction

Lochmueller Group completed the following planning-level assessment of the costs and logistics associated with extracting, stabilizing, and transporting coal combustion residuals (CCR) from the existing ash pond system at the Rush Island Power Generation Center to existing offsite, commercially available landfill facilities. The Rush Island site is located along the Mississippi River in Jefferson County, Missouri approximately nine (9) miles southeast of Festus, Missouri. The purpose of this assessment is to describe the methods, determine the impacts, and quantify the order-of-magnitude costs associated with removing and transporting all CCR from its current disposal location at the Rush Island site to a private landfill for permanent storage.

Extraction & Stabilization

Description of Method

Extraction and stabilization of the CCR material from the CCR unit at Rush Island Energy Center is complicated due to its depth and location. In addition, the CCR unit contains both Class C and F fly ash that complicates excavation methods. CCR material from the unit would need to be excavated at depths of up to 100 feet, dewatered, dried and conditioned, before being and loaded into trucks and transported offsite.

Removal of the CCR material would require multiple phases including dry extraction, partially wet extraction and fully submerged extraction. The various phases are described below:

Dry Extraction:

This phase includes the handling and removal of the existing CCR material from the current surface elevation down to the groundwater elevation (approximately 18’ below the ground surface (BGS) elevation) (Geotechnical Investigation and Report, prepared by CEC and dated December 20, 2011). Generally, it is assumed that this material can be direct loaded and transported without additional drying or conditioning procedures (moisture content between approximately 25% and 35%). The work associated with this phase includes the extraction, on-site transportation to Staging/Loading Areas, storage, and loading onto transportation for off-site removal. Standard earth-moving equipment and procedures would be utilized including dozers, loaders, and excavators. In general, dozers would be used to excavate and move the CCR material into piles and loaders would be used to load the CCR material into the waiting trucks for transport off-site. Excavators would be used in a support role to dig in areas where dozers are not efficient. Sub-areas of the pond area would need to be established to facilitate extraction operations. The general size of these sub-areas, laterally and vertically, will be determined based on on-site conditions as the operation progresses and the CCR material is removed.

Partially Wet Extraction:

This phase includes the handling and removal of the existing CCR material from the groundwater elevation to a point in which hydraulic excavation is feasible (18’ below ground surface to 28’ below ground surface). This material is assumed to be in acceptable condition for loading and transportation with no additional drying and conditioning after the dewatering procedure described below is completed.

Dewatering of this material would involve excavation of channels to promote material drying prior to excavation and transportation. Water would be diverted from excavated depressions utilizing pumps and piping systems to transport the water away from the material excavation area. After sufficient dewatering and drying time, the CCR materials would be removed using the same means as described for dry excavation.

Fully Submerged Extraction:

CCR materials located further down in the pond (28’ below ground surface to 100’ below ground surface) may be saturated and would require drying and conditioning prior to off-site transport. Such materials would need to be extracted via hydraulic dredging methods. The complexities and potential costs associated with such dredging efforts are significantly higher per unit volume than the “Dry Extraction” and “Partially Wet Extraction” phases. In fact, successful pond closures at the depths required for the Rush Island site could were not discovered. Removal operations for CCR ponds with depths up to 50 feet were found.

This method employs equipment that removes the CCR material directly from the bottom of the CCR unit and pumps the “slurry” through a piping system to “geotubes” located in nearby drying areas. Geotubes are a geotextile filtration “bag” manufactured by sewing together multiple sheets of geotextiles using polyester or polypropylene. As the dredged water enters the geotubes, the geotextile captures the CCR materials as the water drains. Chemical addition during the pumping and piping operation using coagulants and flocculants will be necessary to aid in the dewatering process. The specific makeup of CCR materials are site specific. Therefore, selection of the most effective and efficient coagulants and flocculants will require bench testing. Maintenance of the dredging equipment, piping system, drying areas, settling ponds, and temporary roads will be necessary to facilitate the operation.

Significantly large drying areas will be required to accommodate the multi-week week drying procedure. After dewatering is complete, the geotubes are opened and the CCR material is loaded onto transportation for off-site removal. The transportation of material for off-site removal was the assumed limiting factor for the overall CCR disposal process flow based on the analysis performed in this study. However, extended, unforeseen weather conditions can contribute to additional lost working time due to icy conditions, mechanical system freeze-ups, or flooding.

Site Restoration:

This phase includes the final restoration of the site. This would include removal of all temporary access roads and residual ash in project area. Backfilling would likely need to occur for at least some volume of the remaining pond in conjunction with excavation activities to minimize infiltration from the Mississippi River. The closest source of backfill material would be sand dredged from the Mississippi River. Stabilization of the site with vegetative practices would be required for erosion control. The river banks and the remaining embankment along the river would require additional analysis and appropriate stabilization, but may include a combination of vegetation, large rocks or manufactured concrete products.

Extraction and Stabilization Impacts

Safety

Accidents

Workforce safety during the operation is a significant risk factor. With several unit processes operating with heavy machinery, proper safety planning is important. Accidents can be minimized during operations, but the planning and implementation of a safety plan will have significant costs associated with the effort.

Exposure

There is not only immediate physical injury risks, but there is also exposure risk to the people working on the site. Proper safety equipment will be necessary to limit exposure to potentially harmful substances in the CCR material removal process such as flocculants and coagulant used for the dewatering process.

Environment

Floodplain

The project area is currently shown within the 100 year floodplain for both the current and pending FIRM maps. The potential for the area to experience flooding during excavation activities creates additional risk to the extraction and stabilization operations.

River Embankment

The existing ash ponds are adjacent to the Mississippi River. There is a strip of land that separates these surface water bodies and serves and an embankment that separates the pond from the river. Proper excavation techniques and monitoring will need to be employed to ensure the land between the two surface water bodies remains stable during excavation and dredging activities. After dredging activities are complete, the embankment will require analysis to confirm stability. Removal of the embankment and/or significant re-stabilization may be necessary for the restoration of the site.

Emissions

The heavy equipment used during the extraction and stabilization phase of the project includes dozers, loaders, excavators, hydraulic dredges, and onsite hauling trucks. These types of equipment typically utilize diesel fuel and would generate emissions during operations. These emissions are in addition to the emissions discussed in the transportation impacts section of this assessment.

Fugitive Ash Particulate

As the CCR material is being extracted and stabilized, fugitive ash particulate will be created and would need to be managed through an ash management plan.

Capital Projects

Onsite Access Roads

The onsite access road utilized for the offsite hauling trucks is discussed in the transportation section of this assessment. The construction of temporary on-site hauling roads will be required throughout the extraction and stabilization process. These haul roads will need to be modified frequently in order to provide efficient transportation of the CCR to the stabilization and loading areas and to maintain dust control.

Geotube Staging Areas

Geotube staging areas will need to be constructed within the project area that are relatively flat to allow for proper dewatering of the CCR. These staging areas will be temporary and will need to be moved throughout the closure process as CCR is removed during different phases of the operation. Filtrate from the geotubes would be directed back to the settling ponds for treatment.

Water Treatment Facilities

The existing ponds could be utilized throughout the CCR removal process for settling any remaining solids from the filtrate from the drying process. There may be a need for the construction of new settling ponds toward the end of the process to fully remove CCR from the existing ponds. The filtrate will likely contain suspended solids and some form of treatment or settling may need to be evaluated depending on the final characteristics of the filtrate.

Loading Areas

Once the CCR is stabilized, the material may require some additional layout and loading area to ensure the material is dry enough for offsite hauling and ultimate placement in a landfill. The loading areas will need to be constructed as appropriate for the CCR removal areas that are active. The loading areas will require the construction of scales for measuring the weight of trucks and truck washing facilities to wash down tires of residual ash material.

Restoration of Former Ash Ponds

The post-CCR-removal condition of the ponds will be dependent on the final planned use of the area. Some options may include backfilling, removing embankment, creating or restoring habitat, etc. Achieving the desired future use may include utilizing the soil material that would remain between the pond and the river to backfill some of the remaining pond area. Sand backfill material could also be dredged from the Mississippi river for additional backfill material. Overall stabilization of the site would be required and would include vegetative, natural rock, and manufactured products to meet regulatory requirements.

Transportation & Disposal

This section addresses the transportation of CCR material from the site and its permanent disposal at a private landfill.

Modal Options (Truck, Rail, Barge)

The Rush Island site is located along the Mississippi River. Additionally, a BNSF rail line runs adjacent to the site. Therefore, the ability to haul CCR by barge and rail from Rush Island may be possible. However, significant infrastructure improvements would be required at the Rush Island site to provide ash loading capabilities for these modes.

The preferred landfill locations are all located within 80 miles of Rush Island. None of the sites have direct water access. Therefore, any CCR transported by barge from Rush Island would need to be transferred from barge to truck to reach the landfill destinations. The inefficiency of this transfer would render barge transportation considerably more costly than truck hauling. Moreover, most of the landfill sites are located further inland (east or west) from Rush Island such that north-south travel along the Mississippi River would not be beneficial.

With regards to rail, none of the preferred landfill sites have direct rail access. Several sites are located adjacent to rail corridors but spurs would need to be constructed to facilitate direct landfill access and allow for the temporary storage and unloading of rail cars. Additionally, three of the four preferred landfill sites are located in Illinois, which would require trains to travel through the congested St. Louis rail network to cross the Mississippi River. Rail is most efficient when transporting bulk materials over long distances. Given the relatively short travel distance to each landfill site, rail would not be cost-competitive with truck hauling.

This assessment assumed truck hauling to be the most cost-effective and feasible mode of transport. All subsequent analyses reflect truck hauling.

Truck Hauling

To determine a timeframe for extraction and removal of all CCR from its current, impounded location, the following was assumed:

- Truck hauling via 40-foot end load dump trucks loaded via conventional equipment – each trailer has a payload capacity of 25 tons based on a typical 80,000 lb. gross loaded maximum;
- 8-hour daily operation and a range of 155 to 193 days of annual operation (accounting for weekends, holidays, and time lost due to weather and imperfect execution);
- Loading operations on the Rush Island site occur adjacent to the impoundment and on the south portion of the site; and
- A maximum daily haul rate of 5,000 tons.

The resulting transportation haul assumptions are summarized in **Table 1**.

Table 1: Transportation Haul Summary

Total Tons of CCR Removed	Annual Tons of CCR Removed	Closure Duration*
21.6 million	742,772 to 928,465	28-34 Years

*Measured from the decision to begin extraction until fully removed

To accommodate the volume of truck traffic identified in **Table 1**, roadways internal to the Rush Island site would need to be improved. Specifically, a heavy-duty concrete roadway would need to be constructed along the western perimeter of the site extending from Big Hollow Road south to the ash pond area. Multiple at-grade railroad crossings with the site's rail spur would be required.

In the vicinity of the pond area, staging would need to be provided to accommodate several trucks in queue for multiple loading stations. Hence, a large loading station would need to be constructed. Once loaded, trucks would need to proceed to a washout area and scaled to verify the truck is loaded properly. A quick route back to the loading pad from the scale area would be needed for any overweight trucks.

Landfill Options

Four preferred landfills were identified as potential destinations for the CCR removed from the Rush Island site as shown in **Table 2**. Landfill disposal costs supplied by Ameren are similar across the four locations. With costs paid to the landfill being essentially equal, transportation costs would drive the landfill location decision. Assumed haul rates per ton to each landfill location were also supplied by Ameren. The lowest cost haul rate would be to the Progressive Waste site in Richwoods, which is also significantly closer to Rush Island than the other sites. Therefore, this assessment prioritized CCR disposal at the Progressive Waste landfill.

Table 2: Preferred Landfill Locations

Landfill Site	Address	Distance to Site (mi)	Travel Time to Site (min)
Progressive Waste	12581 State Hwy H, Richwoods, MO	34.7	44
Republic Services	4601 Cahokia Road, Roxana, IL	67.3	67
Waste Management	10400 Hillstown Road, Marissa, IL	73.4	82
Perry Ridge	6305 Sacred Heart Road, DuQuoin, IL	79.8	97

Capacity calculations were performed to determine the total space available for CCR disposal in aggregate. The annual disposal amount currently received by the landfill was assumed to remain constant over time and the incremental annual disposal amount due to the Rush Island CCR was added. Based on the capacity of the Progressive Waste site, at the combined disposal volume, it was estimated that the Progressive Waste landfill would become full upon receiving approximately 80 percent of the total CCR from Rush Island.

It was also assumed that the Progressive Waste site could feasibly accept the maximum daily load of trucks (192) and that Progressive Waste would be willing to receive the maximum amount of CCR possible and dedicate the necessary space on site for monofill construction to isolate the CCR material from other waste on site.

Given these assumptions, the calculations indicate that a second landfill site with available capacity would need to receive the final 20 percent of Rush Island CCR material once Progressive Waste reaches capacity. However, for purposes of the subsequent routing and transportation evaluations, it was assumed that the entire Rush Island CCR volume would be disposed at Progressive Waste.

Transportation Route

Many factors were considered when establishing a preferred route suitable for the removal of the CCR from the Rush Island site to the Progressive Waste landfill, including roadway functional classification and the available connectivity between the two sites using the existing roadway network. The selected route is approximately 36.5 miles long and utilizes the following roadways:

- Begin at the Rush Island site on Big Hollow Road
- Johnson Road west
- Danby Road west
- Highway 61 south
- Highway TT west
- Interstate 55 north
- Highway 67 south
- MO-110 west
- MO-21 south
- Highway H west
- End off Highway H at Progressive Waste

This route prioritizes roadways with the highest functional classifications along a reasonably direct line of travel. While a shorter route may be possible, it would rely upon roadways less suitable for truck traffic and therefore was not considered. The selected route emphasizes major numbered state routes, with the exception of leaving the Rush Island site (via Big Hollow Road, Johnson Road, and Danby Road) and accessing Progressive Waste (via Highway H).

The egress route from the Rush Island site utilizes Johnson Road and Danby Road instead of remaining on Big Hollow Road to Drury Road. Johnson Road/Danby Road is the designated route for truck traffic in and out of the Rush Island site. This route also promotes use of the half diamond interchange on Interstate 55 at Route TT, which was constructed approximately 10 years ago for purposes of serving truck traffic to/from the nearby Holcim Cement Plant.

Transportation Impacts

The following transportation impacts would be anticipated as a result of the hauling operation.

Traffic Flow

The selected route between Rush Island and Progressive Waste was evaluated in terms of its ability to accommodate the additional truck traffic, including both loaded and unloaded trucks. Overall, the truck volume distributed over the course of the day would not be expected to generate significant traffic flow impacts. The route emphasizes major roadways, which would be capable of handling the additional traffic. In fact, no improvements were assumed for Interstate 55 or Highway 67.

That said, the following transportation improvements would be recommended to mitigate anticipated impacts of the additional truck traffic at select locations:

- Big Hollow Road, Johnson Road, and Danby Road, which connect the Rush Island site with Highway 61, are not suitable for the volume of truck traffic anticipated. These roadways typically have 11-foot lanes and no shoulders. The horizontal and vertical geometry is substandard in places. The existing asphalt pavement would not likely withstand the effects of heavy truck traffic. It is recommended that this corridor be upgraded to provide an appropriate truck route between Rush Island and Highway 61. The assumed improvements consist of heavy-duty concrete pavement and alignment corrections along the existing roadway.

- The intersection of Danby Road with Highway 61 should be improved to include a dedicated northbound right-turn lane on Highway 61 and enlarged right-turn radius. This turn lane would serve trucks en route to Rush Island from Interstate 55. This intersection would be expected to remain unsignalized.

- The intersection of Route TT with Highway 61 should be improved to include a dedicated southbound right-turn lane on Highway 61 and enlarged right-turn radius. This turn lane would serve trucks en route to Progressive Waste. This intersection would be expected to remain unsignalized.

- The intersection of Highway 21 and Highway 110 was recently realigned and upgraded to current standards, so it should be well-equipped to serve truck turning maneuvers. However, the intersection remains unsignalized. Installation of a signal would be recommended in order to safely and efficiently serve trucks turning from westbound Highway 110 to southbound Highway 21 en route to Progressive Waste.

- The intersection of Highway 21 with Route H is signalized and currently includes a dedicated southbound right-turn lane and dedicated eastbound left-turn lane to serve truck turning movements along the selected route. It is recommended that the eastbound left-turn lane be extended to provide additional storage capacity. The existing turn lane is approximately 75 feet in length, which would accommodate only a single truck and possibly one additional vehicle.

- Route H is a low-volume and narrow two-lane highway with lane widths of approximately 10 feet, low shoulders, and substandard alignment in select areas. While upgrades to this corridor would be beneficial, given the length of the route, significant upgrades for purposes of the hauling operation would likely be deemed cost prohibitive.

Safety & Environment

The safety implications of the truck hauling operation were evaluated using information provided in the Highway Safety Manual (HSM), published by the American Association of State Highway and Transportation Officials (AASHTO). The HSM relates traffic volumes and roadway character to crash expectancy. Changes in volumes would then cause an increase or decrease in the crash expectancy. It is anticipated that the additional truck traffic would result in an increase of 6 crashes total on an annual basis along the entirety of the haul route, as follows:

- Net increase of 2 Severe (Fatal or Injury) Crashes per year
- Net increase of 4 PDO (Property Damage Only) Cashes per year

Additional environmental costs would also be incurred as a result of the hauling operation.[1] In total, transportation safety and environmental costs are estimated to be approximately $490 million to $611 million over the duration of the hauling operation. These costs would not be borne directly by Ameren but instead would be incurred by the general population.

Pavement

The additional truck volume would depreciate the pavement design life and accelerate pavement deterioration along the selected route. To compensate for the increased wear, pavement mill and overlay were assumed at 5-year increments along all segments of the route, with the exception of Interstate 55 (which as an interstate should be build to withstand truck traffic) and the upgraded access route to the Rush Island site (which would be reconstructed with heavy duty concrete).

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[1] According to the Environmental Protection Agency's (EPA) publication on National Average In-Use Emissions from Heavy-Duty Trucks, semi-tractor trailer rigs are responsible for emitting 12.5 grams of pollutants per mile into the air. The economic cost attributable to truck emissions using EPA's methodology was estimated to be $434M. This accounts for increased healthcare costs, lost productivity, welfare costs, environmental remediation, etc.

Conclusion

Lochmueller Group completed the preceding planning-level assessment of the methods and impacts associated with extracting, stabilizing, and transporting CCR from the existing Rush Island Power Generation Center. The purpose of this assessment was to determine the impacts and quantify the order-of-magnitude costs associate with completely removing all CCR from the Rush Island site and transporting it to a private landfill for permanent storage. The information contained herein is provided at a planning-level.

This study assumed that 12,725,000 cubic yards of coal combustion residuals would ultimately need to be removed from the Rush Island site. This would equate to approximately 21,650,000 tons of material to transport. This transport weight was calculated by multiplying the in place cubic yards by a swell factor to account for the uncompacted volume after excavation. The weight of the uncompacted unit volume was established from geotechnical testing data that provided the pounds per cubic foot and the percent moisture content. Based on a range of operating days per calendar year, it would take from 28 to 34 years to extract all material from the site.

Restoration of the site would include backfilling and stabilization with vegetative and structural practices. Restoration costs could be significant in that the resulting 70 – 100 foot depression may need to be backfilled via a dredging operation within the Mississippi River.

The total cost to extract, stabilize, transport, and dispose of the CCR material is summarized below in 2019 dollars. The total cost to Ameren could range from $1.9 to $2.1 Billion, depending upon the total period of removal operations. This includes transportation infrastructure upgrades both internal and external to the Rush Island site as discussed.

Extraction of CCR and Transport to Offsite Landfill	
Ameren Project Costs	
Extraction, Stabilization, Loading, and Restoration	$773-891 Million
Hauling	$372-375 Million
Landfill Placement Costs	$691-757 Million
Transportation Infrastructure (on and off-site)	$66-77 Million
Project Cost Total	**$1.9-$2.1 Billion**

Costs in 2019 Dollars

Attachment 8

Human Health & Ecological Assessment

HALEY ALDRICH

www.haleyaldrich.com

REPORT ON

HUMAN HEALTH AND ECOLOGICAL ASSESSMENT OF THE MERAMEC ENERGY CENTER

AMEREN MISSOURI
ST. LOUIS, MISSOURI

by Haley & Aldrich, Inc.
Boston, Massachusetts

for Ameren Missouri
St. Louis, Missouri

File No. 130182-002
February 2018

MERAMEC ENERGY CENTER

1. Introduction

The Meramec Energy Center (MEC) is a 831 MW natural gas and coal-fueled steam electrical power generating facility located along the Mississippi River at the confluence of the Meramec River, in St. Louis County, Missouri. The facility began operations in 1953 and historically Ameren Missouri managed coal ash in a series of nine (9) on-site surface impoundments. The Company has commenced closure of certain impoundments and closure activities will continue over the next several years. The facility is scheduled to be retired in 2022 at which point the remaining active ash ponds will be closed. Figure 1 shows the location of the facility, and the location of the surface impoundments.

The U.S. Environmental Protection Agency (USEPA) issued a final rule for “Disposal of Coal Combustion Residuals from Electric Utilities” in 2015 (the CCR Rule). One of the requirements in the CCR Rule is that utilities monitor groundwater at coal ash management facilities, and that the data be reported publicly. Ameren Missouri is complying with the CCR Rule, and has posted the required information on their publicly-available website: *https://www.ameren.com/Environment/ccr-rule-compliance*.

This Haley & Aldrich report is a companion document to the recently published 2017 Annual Groundwater Monitoring Report prepared by Golder Associates Inc. ("Golder") to provide interested reviewers with the information needed to interpret and meaningfully understand the groundwater monitoring data. Beyond the specific monitoring requirements of the CCR Rule, Ameren Missouri has also voluntarily taken the additional steps to determine if there has been any off-site impact to surface water from the operation of the surface impoundments. In this report, Haley & Aldrich examines groundwater data reported under the CCR Rule, and the results of surface water samples collected from the Mississippi River and Meramec River, which border the Meramec Energy Center.

Ameren Missouri's comprehensive evaluation demonstrates that there are no adverse impacts resulting from coal ash management practices at the Meramec Energy Center on human health or the environment from either surface water or groundwater uses. In fact, as described in Sections 6 and 7, concentration levels of constituents detected in the groundwater would need to be multiple orders of magnitude higher before such a risk could exist. Details about the evaluation are provided below.

2. Approach

The analysis presented in this report was conducted by evaluating the environmental setting of the Meramec Energy Center, including its location and where ash management has occurred at the facility. Information on where groundwater is located at the facility, the rate(s) of groundwater flow, the direction(s) of groundwater flow, and where waterbodies may intercept groundwater flow was prepared by Golder, and is reviewed and summarized here.

A conceptual model was developed based on this physical setting information, and the model was used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify where ecological populations could come into contact with surface water. This conceptual model approach was used to identify where to collect surface water samples to allow evaluation of potential impact to the environment. Groundwater and surface water data are evaluated on a human health risk basis and an ecological risk basis.

Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people. Generally, there are four components to the process: (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

The USEPA develops “screening levels” of constituent concentrations in groundwater (and other media) that are considered to be protective of specific human exposures. These screening levels are referred to as “Risk-Based Screening Levels” or RSLs, and are published by USEPA and updated twice yearly[1]. In developing the screening levels, USEPA uses a specific target risk level (component 4) combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water). Similarly, ecological screening levels for surface water are developed by Federal and State agencies to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects. Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists, but indicate that further evaluation may be warranted.

The surface water and groundwater data were evaluated using human health risk-based and ecological risk-based screening levels drawn from Federal and State sources. The screening levels are used to determine if the concentration levels of constituents could pose a risk to human health or the environment. The evaluation also considers whether constituents are present in groundwater and surface water above screening levels, and if so, if the results could be due to the ash management operations.

Conceptual Site Model

A conceptual site model (CSM) is used to evaluate the potential for human or ecological exposure to constituents that may have been released to the environment. Some of the questions posed during the CSM evaluation include:

> What is the source? How can constituents be released from the source? What environmental media may be affected by constituent release? How and where do constituents travel within a medium? Is there a point where a receptor (human or ecological) could contact the constituents in the medium? Are the constituent concentrations high enough to potentially exert a toxic effect?

For the evaluation of the ash management operations at the Meramec Energy Center, the coal ash stored at surface impoundments on site is the potential source. Constituents present in the coal ash can be dissolved into infiltrating water (either from precipitation or from groundwater intrusion) and those constituents may then be present in shallow groundwater, also referred to as the alluvial aquifer. Constituents could move with groundwater as it flows, usually in a downgradient/downhill direction.

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[1] USEPA Risk-Based Screening Levels (November 2017). http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

The constituents derived from the coal ash could then be introduced to adjacent surface water bodies; here, that could be the Mississippi River and/or Meramec River. Figure 1 shows the facility location and layout, and identifies direction of groundwater flow and the adjacent surface water bodies. Thus, the environmental media of interest for this evaluation are:

- Groundwater on the facility;
- Mississippi River surface water;
- Meramec River surface water; and
- Creek/Drainage surface water along the northern boundary of the facility.

The direction of groundwater flow has been cataloged for many years at the Meramec Energy Center. The direction and rate of flow can vary with Mississippi and Meramec River stages but as Figure 1 shows, the direction of groundwater flow is mainly from the bluff area on the northern side to the southwest towards the Meramec River and to a lesser extent to the Mississippi River.

The facility is located in a metropolitan area and surrounded by bluffs. Its immediate neighbors include the Metropolitan Sewer District (MSD) wastewater treatment facility and a golf course owned by Ameren Missouri. There are no users of shallow groundwater that are present between the surface impoundments and the Mississippi River and Meramec River. According to a well survey database maintained by the Missouri Department of Natural Resources (MDNR), there are approximately eight (8) private wells and three (3) public wells recorded within a one-mile radius of the facility (see Figure 2). Five of the private wells are located between the Mississippi and Meramec Rivers and are upgradient of the facility. The three public wells and five of the private wells are located in a bluff area on the west side of the Meramec River and the Mississippi River.

American Water and the City of St. Louis provide drinking water to the majority of residents located within the metropolitan area. Water intake locations include the Mississippi River (Chain of Rocks), the Missouri River (Howard Bend), both upstream from the facility, and the Meramec River at a location approximately 5 miles upstream from the Meramec Energy Center. The Mississippi is a source of drinking water for the City of Chester, Illinois; the drinking water intake is located approximately 51.2 miles downstream from the facility.

The Mississippi and Meramec Rivers can be used for human recreation – wading, swimming, boating, fishing. The creek/drainage along the northern portion of the facility is small in size and would be limited mostly to wading.

Both rivers serve as habitat for aquatic species – fish, amphibians, etc.

A depiction of the conceptual site model is shown in Figure 3.

Based on this conceptual site model and the facility setting shown in Figure 1, samples have been collected from each of these environmental media – groundwater, Mississippi River, and Meramec River, as well as the creek/drainage along the northern portion of the facility. The samples have been analyzed for constituents that are commonly associated with coal ash, as discussed below. However, it is recognized by the USEPA that all of these constituents are naturally occurring and can be found in rocks, soils, water and sediments; thus, the challenge is to understand what the naturally occurring background levels are for these constituents. [See Attachment A for a more detailed discussion of the constituents present in coal ash and in our natural environment.] The CCR Rule requires sampling and analysis of upgradient and/or background groundwater just for this reason. The same reasoning applies to the surface water, thus, when sampling surface water for this evaluation, samples were collected upstream to assess background conditions, and downstream to assess whether the facility may be having an impact on surface water quality. The sampling is detailed in the next section.

To answer the question, “Are the constituent concentrations high enough to potentially exert a toxic effect?” health risk-based screening levels from Federal and State sources are used for comparison to the data. To be conservative, all data are compared to risk-based drinking water screening level levels, even though the closest downgradient drinking water intake in the Mississippi River is 51.5 miles downstream near Chester, Illinois. The surface water data is compared to risk-based human recreational screening levels, and to ecological screening levels.

Thus, this conceptual site model has guided the sample collection, sample analysis, and the risk-based sample results evaluation that are provided in the following sections.

3. Sample Collection

Alluvial Aquifer Groundwater

Ten (10) groundwater monitoring wells were installed to evaluate groundwater at the surface impoundments under the CCR Rule. Eight (8) monitoring wells were installed along the perimeter of the surface impoundments to assess groundwater conditions at the ash management area, and two (2) monitoring wells were installed north and east of the facility to assess background groundwater conditions. Figure 1 shows the locations and groundwater elevations of the monitoring wells. Each well is identified by a unique name. MW-1 through MW-8 are located around the perimeter of the surface impoundments, and BMW-1 and BMW-2 are the two background wells.

Each groundwater monitoring well was sampled nine (9) times in 2016 and 2017[2].

Mississippi River

In September 2017, Golder collected surface water samples (not required by the CCR Rule for compliance) from twelve (12) locations in the Mississippi River. These locations are shown on Figure 4. At each sample location, shallow samples were collected near the surface of the river. Where the depth of water was greater than four (4) feet, a second sample was collected mid-depth in the river (referred to here as a deep sample).

To assess water conditions unaffected by facility operations, Golder sampled the Mississippi River at three (3) locations approximately 0.25 miles upstream of the facility (M-MIS-10S through -12S). Five (5) samples were collected to represent the following environments:

- Nearshore on the side closest to the Meramec Energy Center (M-MIS-10S), shallow depth;
- Midstream (M-MIS-12S/D), shallow depth, and deep depth; and
- Near midstream (M-MIS-11S/D), shallow depth, and deep depth.

Golder also sampled the Mississippi River at six (6) locations adjacent to the facility (M-MIS-4S through -9S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, ten (10) samples were collected to represent the following environments:

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[2] The CCR Rule requires eight (8) rounds of sampling events to establish baseline conditions in each well. Under the CCR Rule, the ninth sampling round is defined as the “Detection” sampling round.

- Nearshore on the side closest to the Meramec Energy Center (M-MIS-4S and M-MIS-7S), shallow depth;
- Midstream (M-MIS-6S/D and M-MIS-9S/D), shallow depth, and deep depth; and
- Near midstream (M-MIS-5S/D and M-MIS-8S/D), shallow depth, and deep depth.

Three (3) locations are approximately 0.25 miles downstream of the facility (M-MIS-1S through -3S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, five (5) samples were collected to represent the following environments:

- Nearshore on the side closest to Meramec Energy Center (M-MIS-1S), shallow depth;
- Midstream (M-MIS-3S/D), shallow depth, and deep depth; and
- Near midstream (M-MIS-2S/D), shallow depth, and mid-depth.

Thus, a total of twenty (20) samples were collected from the Mississippi River.

Meramec River

The western border of the Meramec Energy Center is adjacent to Meramec River. Golder collected surface water samples from nine (9) locations in the river in September 2017. These locations are shown on Figure 4.

Three (3) locations are upstream of the facility (M-MEC-7S to -9S), and represent water conditions unaffected by facility operations. Four (4) samples were collected to represent the following environments:

- Nearshore on the side closest to the Meramec Energy Center (M-MEC-7S), shallow depth;
- Midstream (M-MEC-9S/D), shallow depth, and deep depth; and
- Near midstream (M-MEC-8S), shallow depth (this location was not deep enough to collect a deep sample).

Six (6) sampling locations (in two groups) are adjacent to the facility. The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, nine (9) samples were collected to represent the following environments:

- Nearshore on the side closest to the Meramec Energy Center (M-MEC-4S and M-MEC-1S), shallow depth;
- Midstream (M-MEC-5S, and M-MEC-2S/D), shallow depth, and deep depth (location M-MEC-5 was not deep enough to collect a deep sample); and
- Near midstream (M-MEC-6S/D and M-MEC-3S/D), shallow depth, and deep depth.

Thus, a total of thirteen (13) surface water samples were collected from the Meramec River.

Creek/Drainage

A creek/drainage bed runs along the northwestern boundary of Meramec Energy Center. Shallow surface water samples were collected from three (3) locations in the creek in September 2017. These locations are shown on Figure 4. One location is upstream of the facility (M-C-1), one location is adjacent (M-C-2), and one location is downstream of the facility (M-C-3), near the confluence with the

Meramec River. Thus, a total of three (3) surface water samples were collected from the creek/drainage area.

4. Sample Analysis

The CCR Rule identifies the constituents that are included for groundwater testing; these are:

Boron
Calcium
Chloride
pH
Sulfate
Total Dissolved Solids (TDS)
Fluoride

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt

Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226/228

The CCR Rule requires eight (8) rounds of groundwater sampling and analysis. However, nine (9) rounds of groundwater samples collected through June 2017 were analyzed for all constituents. The samples from an additional tenth round from November 2017 were analyzed for the constituents listed in the first column above (these are the Appendix III constituents under the CCR Rule – the remaining are referred to as Appendix IV constituents). The CCR Rule requires statistical methods be used to determine whether a statistically significant increase (SSI) above background exists for the first column constituents. If so, additional assessment monitoring could be required.

So as to create an appropriate dataset for comparison, the above parameters were also used for the surface water sample analysis except for pH and radium 226/228[3]. Two sets of analyses were conducted on the surface water samples. The samples were analyzed for the list above (referred to as the "total (unfiltered)" results), and then an aliquot of each sample was filtered to remove sediments/particulates and then analyzed (referred to as the "dissolved (filtered)" results). This is an important step for the analysis of surface water samples for two reasons:

- Surface water, especially in large rivers, can carry a large sediment load – the total (unfiltered results) include constituent concentrations that are associated with the sediment from upstream locations and not the water; and
- Some of the ecological screening levels used to evaluate the results apply only to dissolved (filtered) data.

The surface water samples were also analyzed for hardness, as some of the ecological screening levels are calculated based on site-specific hardness levels.

5. Risk-Based Screening Levels

A comprehensive set of risk-based screening levels have been compiled for this evaluation for the three types of potential exposures identified in the conceptual site model discussion above:

- Human health drinking water consumption;
- Human health recreational use of surface water; and
- Aquatic ecological receptors for surface water.

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[3] As discussed in Section 6, radium-226/228 was not detected above risk-based screening levels in the CCR Rule monitoring wells.

Table 1 provides the human health drinking water and recreational screening levels available from the State of Missouri sources and from Federal sources. Table 2 provides the ecological screening levels.

Drinking Water Screening Levels

The Missouri State drinking water supply levels are essentially the same as the Federal primary drinking water standards, also known as Maximum Contaminant Levels or MCLs. The Missouri State groundwater screening levels provide some additional screening levels not included on their list of drinking water screening levels.

In addition to the MCLs that are enforceable for municipal drinking water supplies, there are Federal secondary MCLs, or SMCLs, that are generally based on aesthetics (taste, color) and are not risk-based. The USEPA also provides risk-based screening levels (RSLs) for tapwater (drinking water).

The selected screening levels used to evaluate potential drinking water exposures are shown on Table 1. Missouri drinking water supply screening levels were used and supplemented with Federal MCLs, then the USEPA risk-based levels for tapwater (RSLs), and finally the Federal SMCLs.

It is important to note that the CCR Rule limits the evaluation of groundwater monitoring data of ash management areas to Federal MCLs or to a comparison with site-specific background. That comparison and evaluation is provided in the CCR Rule Groundwater Monitoring Report prepared by Golder, which this report supplements. The use of a more comprehensive set of screening levels in this evaluation provides a broader risk-based evaluation of the groundwater data than would be provided by the CCR Rule requirements.

Recreational Screening Levels

Table 1 provides the State of Missouri human health recreational screening levels, based on fish consumption. The Federal Ambient Water Quality Criteria (AWQC) for consumption of organisms are also provided. Both sources were used to identify the screening levels used in this analysis, as listed on Table 1. The drinking water screening levels used to evaluate surface water are protective for other recreational uses of the river such as swimming, wading, and boating. Note that this evaluation of other uses of surface water are above and beyond the requirements of the CCR Rule.

Ecological Screening Levels

The ecological risk-based screening levels for surface water are provided in Tables 2. As noted above, some of the screening levels are based on the hardness of the water. Therefore, Table 2 provides the screening levels for both the Mississippi River and the Meramec River as the hardness data for the two rivers are similar. Note that this ecological evaluation of surface water is above and beyond the requirements of the CCR Rule.

6. Results

The level of analysis and comparison to risk-based screening levels presented below is above and beyond the requirements of the CCR Rule. The analysis of the groundwater results required by the CCR Rule is presented in the 2017 Groundwater Monitoring Annual Report prepared by Golder: *https://www.ameren.com/Environment/managing-ccrs/ash-pond-closure*. This report serves to supplement that report by providing the risk-based analysis of groundwater and surface water, so that the groundwater results can be understood in their broader environmental context.

Alluvial Aquifer Groundwater – CCR Rule Evaluation

Ameren Missouri has filed on its website reports and notification required by the federal CCR Rule, as noted above, and additional reports will be prepared and posted on Ameren's website per the CCR Rule. The statistical analysis of the data has indicated an SSI for samples collected from monitoring wells M-MW-1 through MW-8 (see Figure 1). Analytes exhibiting an SSI include boron, calcium, sulfate, and TDS.

The SSI values reflect a statistical evaluation that compares mathematically the results of the various rounds of samples to background water quality as required under the CCR rule. However, such values without further evaluation do not establish that there is an actual adverse impact to human health or the environment. The CSM process and screening analysis described in this report provides the relevant context for such groundwater monitoring results and whether the MEC poses a true risk to human health and the environment. As explained in the remaining sections of this report, based upon surface water sampling data and the application of risk assessment principles uniformly adopted by USEPA and state environmental regulators including the Missouri Department of Natural Resources (MDNR), no such risk exists.

Alluvial Aquifer Groundwater – Risk-Based Evaluation

Groundwater data from all nine (9) rounds of groundwater monitoring were compared to the human health risk-based drinking water screening levels. Figure 1 shows that the monitoring wells are located at the edge of the surface impoundments and, therefore, provide worst-case groundwater results.

Table 3 compares the results of all sampling rounds to human health drinking water screening levels. Analytical results greater than the screening level are provided; analytical results below the risk-based drinking water screening levels are indicated by "<". The vast majority of the results are below the human health risk-based drinking water screening levels.

A limited number of parameters are above screening values for some, but not all, sampling events. MW-6 has the most results above the screening levels: these are for boron, sulfate, TDS, cobalt, lithium, and molybdenum. MW-7 also has a majority of results for boron, sulfate, TDS, lithium, and molybdenum above the screening levels. Note that shallow groundwater in the vicinity of the ash management areas is not used as a source of drinking water. The drinking water wells within the 1-mile radius of the facility are upgradient and, therefore, not impacted by facility operations.

The striking aspect of the analysis shown in Table 3 is how few results are above a conservative risk-based drinking water screening level for human health, given that the wells are located at the base of the ash management area, and the facility has been in operation for 65 years[4]. Even for the very few results that may be above screening values for some of the sampling events, including the SSI results identified under the CCR Rule, there is no complete drinking water exposure pathway to groundwater. Where there is no exposure, there is no risk.

Mississippi River

The comparison to risk-based screening levels of the analytical results for the Mississippi River are presented in Tables 4 through 6.

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[4] Out of the 1660 groundwater analyses conducted, only 242 results are above a drinking water screening level (see Table 3). Put another way, approximately 85% of the groundwater results for the CCR Rule monitoring wells located at the edge of the MEC impoundments are below drinking water screening levels.

- Table 4 – Comparison to drinking water screening levels – No results are above risk-based screening levels for drinking water.
- Table 5 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. The arsenic results upstream and downstream are similar, thus, indicative of normal river conditions. In addition, groundwater samples on-site indicate that arsenic is either below screening levels or non-detected, thus, indicating that arsenic in the river is not attributable to the surface impoundments.
- Table 6 – Comparison to ecological screening levels – No results are above risk-based ecological screening levels, with the exception of a single result for selenium that was just slightly above the screening level. Selenium was not detected in on-site groundwater above drinking water screening levels thus indicated the selenium in the river is not likely attributable to the surface impoundments.

There are no analytical results for the Mississippi River that above drinking water screening levels. While arsenic concentrations in the river are slightly above the human health recreational screening levels, the concentrations are similar upstream and downstream indicating that the facility is not the source of the arsenic detected in the river. In fact, the concentrations of arsenic in all of the rivers sampled by Ameren for this evaluation (the Mississippi at Sioux, Meramec, and Rush Island; the Missouri River at Labadie and Sioux; and the Meramec River at Meramec) are all very similar with total results ranging from 0.0012 to 0.005 mg/L. This underscores the fact that arsenic is naturally occurring in our environment, as discussed in more detail in Attachment A.

Thus, the Mississippi River sampling results do not show evidence of impact of constituents derived from the MEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Meramec River

The comparison to risk-based screening levels of the analytical results for Meramec River are presented in:

- Table 7 – Comparison to drinking water screening levels – All results are below the risk-based screening levels with the exception of lead. The total lead results upstream and downstream are similar and, thus, indicative of normal river conditions. All dissolved concentrations of lead are below the screening level, indicating that lead is associated with particulate in the river. In addition, groundwater samples on-site indicate that lead is either below screening levels or non-detected, thus, indicating that lead in the river is not attributable to the surface impoundments.
- Table 8 – Comparison to human health recreational screening levels – All results are below the risk-based screening levels with the exception of arsenic. The total and dissolved arsenic results upstream and downstream are similar and, thus, indicative of normal river conditions. In addition, groundwater samples on-site indicate that arsenic is either below screening levels or non-detected, thus, indicating that arsenic in the river is not likely attributable to the surface impoundments.
- Table 9 – Comparison to ecological screening levels – All results are below the risk-based screening levels with the exception of lead. The total lead results upstream and downstream are similar and, thus, likely represent normal river conditions. As noted above, groundwater samples on-site indicate that lead is either below screening levels or non-detected, thus, indicating that the lead in the river is not likely attributable to the surface impoundments.

Total lead concentrations are above drinking water and ecological screening levels in the Meramec River. However, the concentrations are similar upstream and downstream. Lead is not present above drinking water screening levels in site groundwater. Arsenic concentrations in the creek are slightly above the human health recreational screening levels, the concentrations are similar upstream and downstream. Arsenic is not present above drinking water screening levels in site groundwater.

Thus, the Meramec River sampling results do not show evidence of impact of constituents derived from the surface impoundments.

Creek/Drainage

The comparison to risk-based screening levels of the analytical results for Creek/Drainage are presented in:

- Table 10 – Comparison to drinking water screening levels – All results are below risk-based screening levels for drinking water.
- Table 11 – Comparison to human health recreational screening levels – Only total concentrations of arsenic are above the screening level. The total arsenic results upstream and downstream are similar, thus indicative of represent normal creek conditions. In addition, groundwater samples on-site indicate that arsenic is either below screening levels or non-detected, thus, indicating that arsenic in the river is not likely attributable to the surface impoundments.
- Table 12 – Comparison to ecological screening levels – All results are below risk-based screening levels for ecological risk.

There are no analytical results for the creek/drainage that above drinking water screening levels. While arsenic concentrations in the creek/drainage are slightly above the human health recreational screening levels, arsenic is not present above drinking water screening levels in site groundwater, the concentrations are similar upstream and downstream and, thus, likely represent normal conditions and not attributable to the surface impoundments.

Thus, even this small water body immediately adjacent to the impoundments does not show evidence of risk to human health or the environment from ash management operations at the MEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

NPDES Outfall WET Testing Results

Two permitted outfalls under the National Pollutant Discharge Elimination System (NPDES) program are tested for toxicity on a periodic basis as required by the permit. WET (whole effluent toxicity) testing involves mixing Mississippi River water collected upstream with the effluent water from Outfall 003 and from Outfall 009 to simulate mixing of the effluent upon discharge to the river. The tests are conducted on a 10% effluent mixture. Tests are also conducted on the upstream Mississippi River water and on laboratory reconstituted control water. If the effluent treatment results are not statistically different from the control results, then the effluent is considered to have passed the WET test. Table 13 shows the results of the direct aquatic organism toxicity testing that is conducted using the outfall effluents from 2013 through 2017[5]. The results indicate no evidence of aquatic toxicity of the outfall effluent. This is a direct biological measure demonstrating the lack of toxicity of the Outfall 003 and Outfall 009 effluent.

7. Derivation of Risk-Based Screening Levels for Groundwater

The results presented here demonstrate that the 65-year history of ash management activities at the surface impoundments have not had an adverse effect on human health or the environment. While some groundwater results are above drinking water screening levels, there is no pathway of exposure to the on-site groundwater (i.e., the shallow alluvial groundwater is not used as a source of drinking water). For those waters where a theoretical pathway of exposure exists (i.e., the Mississippi River, the Meramec River, and the adjacent creek-drainage area), there is no evidence of impact and all samples are either below screening levels or consistent with background.

Ameren's facilities are located on major river systems with a massive and rapid river flow. In this section, we have attempted to illustrate how the groundwater – which is a fraction of the volume and flow rate of the river – may interact with a surface body under an assumed set of criteria and conditions. (see Attachment B). Such an exercise in assumptions can help put in context whether a theoretical risk to public water supplies exists, particularly where, as here, actual surface water samples have been collected and evaluated.

However, impacts to groundwater does not mean that surface waters are impaired. The degree of interface between groundwater and surface waters is variable and complex and dependent upon a variety of factors including gradient and flow rate. It is possible, however, to determine the maximum concentration level that would need to be present on-site in groundwater and still be protective of the surface water environment, assuming gradient and flow rates are such that groundwater flows into the surface water. Groundwater and surface waters flow at very different rates and volumes. The Mississippi River is the largest river system in North America and as depicted on Table 14 and Attachment B, when compared to groundwater, its dilution factor is greater than 100,000.

It is possible to calculate a protective screening level for groundwater based upon the amount of dilution that occurs under the above assumption. This calculated risk-based screening level for groundwater can be used to determine whether an on-site groundwater concentration level is protective of the river. Stated differently, at what concentration level does groundwater entering the river system pose a human health or ecological risk?

Table 14 and Table 15 are summarized below and show the application of the dilution factor to calculate risk-based screening levels for the following parameters: boron, sulfate, TDS, cobalt, lithium, and molybdenum. These Table 3 constituents have one or more monitoring well concentrations above the drinking water screening levels. For each constituent, the human health drinking water and recreational screening levels are presented as well as the ecological screening level. The lowest of the three screening levels is then identified for surface water and the dilution factor applied to this lowest screening level. The resulting calculation indicates the concentration level that would have to be present in groundwater for there to be a corresponding ecological or human health risk to either Mississippi River or Meramec River bodies.

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[5] Note that presently effluent is discharged only from Outfall 003.

This evaluation is not limited to only those constituents for which SSIs have been identified. The constituents listed here are those for which there is one or more groundwater result above a risk-based screening level[6].

DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER (see Table 14)

	Estimated Dilution Factor for the Mississippi River	100,000			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum MEC Groundwater Concentration**
Boron**	2	200000	30.3	M-MW-7	>6,000
Sulfate**	250	25000000	1250	M-MW-7	>20,000
TDS**	500	50000000	2320	M-MW-7	>21,000
Cobalt	0.006	600	0.0078	M-MW-6	>76,000
Lithium	0.04	4000	0.164	M-MW-6	>24,000
Molybdenum	0.1	10000	0.717	M-MW-7	>13,000

CALCULATING RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MERAMEC RIVER (see Table 15)

	Estimated Dilution Factor for the Meramec River	700			
Constituents	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Target Level and the Maximum MEC Groundwater Concentration**
Boron**	2	1400	30.3	M-MW-7	>40
Sulfate**	250	175000	1250	M-MW-7	>100
TDS**	500	350000	2320	M-MW-7	>100
Cobalt	0.006	4.2	0.0078	M-MW-6	>500
Lithium	0.04	28	0.164	M-MW-6	>100
Molybdenum	0.1	70	0.717	M-MW-7	>90

*** Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.**

**** Constituents for which an SSI has been identified. Note that although an SSI was identified for boron, sulfate, and TDS, these constituents are not present in surface water at concentrations above the risk-based screening levels.**

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[6] Note that under the CCR Rule, statistically significant levels of Appendix IV constituents are determined after Assessment Monitoring has been conducted.

The groundwater alternative risk-based screening levels are calculated in units of milligrams of constituent per liter of water (mg/L). One mg/L is equivalent to one million parts per million.[7]

The table identifies the maximum groundwater concentration of each constituent detected in the MEC monitoring wells. The comparison between the target levels and the maximum concentrations indicates that there is a wide margin of safety between the two values for both the Mississippi River and the Meramec River. This margin is shown in the last column of each table. To illustrate, concentration levels of boron and molybdenum would need to be more than 40 and 90 times higher, respectively, than currently measured levels before an adverse impact in the Meramec River could occur. Similarly, the concentration levels of boron and molybdenum would need to be more than 6,000 and 13,000 times higher, respectively, than currently measured levels before an adverse impact in the Mississippi River could occur.

This means that not only do the present concentrations of constituents in groundwater at the RCPA not pose a risk to human health or the environment, but even much higher concentrations would not be harmful.

8. Closure of the Surface Impoundments

Ameren Missouri has commenced the closure of inactive surface impoundments[8]. Closure of the CCR units will continue in series until the remaining surface impoundments are closed following the retirement of the facility in 2022. Closure is estimated to reduce the movement of CCR constituents from the surface impoundments discharge (or flux) of water into the alluvial aquifer groundwater by 90% or more. This reduction is the result of several factors: closure will cease the flow of water and ash to the surface impoundments, a cap will be installed that will limit infiltration of precipitation, and the closure plan includes stormwater run-on and run-off controls to route stormwater off of the capped area and away from the surface impoundments. It is likely that concentrations of constituents in groundwater at the surface impoundments will decrease post-closure.

9. Summary

This comprehensive evaluation demonstrates that there are no adverse impacts on human health from either surface water or groundwater uses resulting from coal ash management practices at the Meramec Energy Center.

10. Attachments

TABLES

1 HUMAN HEALTH SCREENING LEVELS

2 ECOLOGICAL SCREENING LEVELS

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[7] A million parts per million is equivalent to 1 penny in $10,000 worth of pennies, 1 second in 11.5 days, or 1 inch in 15.8 miles.

[8] Importantly, the CCR Rule promulgated by USEPA in 2015 is both under appeal [Utility Solid Waste Activities, et al v. EPA, Docket No. 15-01219, DC Circuit Court of Appeals Sept 13, 2017, Letter from Pruitt to reconsider.] and is being reconsidered by the current Administration. Notwithstanding any proposed changes to the federal CCR Rule, Ameren Missouri intends to implement its closure plan and schedule.

FIGURES

ATTACHMENTS

TABLES

TABLE 1
HUMAN HEALTH SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

			Missouri State Water Quality Screening Levels (mg/L)			Federal Water Quality Screening Levels (mg/L)				Selected Screening Level (mg/L)	
Constituent	**Abbreviation**	**CASRN**	**Human Health Fish Consumption (a)**	**Drinking Water Supply (a)**	**Groundwater (a)**	**USEPA AWQC Human Health Consumption of Organism Only (b)**	**MCLs (c)**	**SMCLs (c)**	**November 2017 USEPA Tapwater RSLs (d)**	**Drinking Water (e)**	**Recreational Use (f)**
Antimony	Sb	7440-36-0	4.3	0.006	0.006	0.64	0.006	NA	0.0078 (m)	0.006	4.3
Arsenic	As	7440-38-2	NA	0.05	0.05	0.00014 (i)	0.01	NA	0.000052	0.05	0.00014
Barium	Ba	7440-39-3	NA	2	2	NA	2	NA	3.8	2	NA
Beryllium	Be	7440-41-7	NA	0.004	0.004	NA	0.004	NA	0.025	0.004	NA
Boron	B	7440-42-8	NA	NA	2	NA	NA	NA	4	4 (q)	NA
Cadmium	Cd	7440-43-9	NA	0.005	0.005	NA	0.005	NA	0.0092	0.005	NA
Calcium	Ca	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	Cl	7647-14-5	NA	250	NA	NA	NA	250	NA	250	NA
Chromium	Cr	16065-83-1 (g)	NA	0.1	0.1	NA	0.1 (j)	NA	22 (n)	0.1	NA
Cobalt	Co	7440-48-4	NA	NA	1	NA	NA	NA	0.006	0.006	NA
Fluoride	Fl	16984-48-8	NA	4	4	NA	4	2	0.8	4	NA
Lead	Pb	7439-92-1	NA	0.015	0.015	NA	0.015 (k)	NA	0.015	0.015	NA
Lithium	Li	7439-93-2	NA	NA	NA	NA	NA	NA	0.04	0.04	NA
Mercury	Hg	7487-94-7 (h)	NA	0.002	0.002	NA	0.002 (l)	NA	0.0057 (o)	0.002	NA
Molybdenum	Mo	7439-98-7	NA	NA	NA	NA	NA	NA	0.1	0.1	NA
Radium 226/228 (pCi/L)	Ra 226/228	RADIUM226228	NA	NA	NA	NA	5	NA	NA	5	NA
Selenium	Se	7782-49-2	NA	0.05	0.05	4.2	0.05	NA	0.1	0.05	4.2
Sulfate	SO4	7757-82-6	NA	250	NA	NA	NA	250	NA	250	NA
Thallium	Tl	7440-28-0	0.0063	0.002	0.002	0.00047	0.002	NA	0.0002 (p)	0.002	0.0063
Total Dissolved Solids	TDS	TDS	NA	NA	NA	NA	NA	500	NA	500	NA
pH (std)	--	PHFLD	NA	NA	NA	NA	NA	6.5 - 8.5	NA	6.5 - 8.5	NA

Notes:

AWQC - Ambient Water Quality Criteria.	NA - not available.
CASRN - Chemical Abstracts Service Registry Number.	pCi/L - picoCurie per liter.
HI - Hazard Index (noncancer child).	RSL - Risk-based Screening Levels (USEPA).
MCL - Maximum Contaminant Level.	TR - Target Risk (carcinogenic).
mg/L - milligram per liter.	USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. Updated January 29, 2014. Per 10 CSR 20-7.031(4)(B)(2), the criteria for Human Protection Fish Consumption apply to dissolved metals data. All other criteria apply to total concentrations.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.

(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012.
http://water.epa.gov/drink/contaminants/index.cfm

(d) - USEPA Risk-Based Screening Levels (November 2017). Values for tapwater. HI = 1.0, TR = 1E-06.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

(e) - The hierachy for selecting the Human Health Screening Level for Drinking Water is: Missouri State Water Quality Criteria for Drinking Water Supply (a); Federal USEPA MCL for Drinking Water (c); Federal June 2017 USEPA Tapwater RSL (d); Federal USEPA SMCL for Drinking Water (c).

(f) - The hierachy for selecting the Human Health Screening Level for Recreational Use is: Missouri State Water Quality Criteria for Human Health Fish Consumption (a); Federal USEPA AWQC for Human Health Consumption of Organism Only (b).

(g) - CAS number for Trivalent Chromium.

(h) - CAS number for Mercuric Chloride.

(i) - Value applies to inorganic form of arsenic only.

(j) - Value for Total Chromium.

(k) - Lead Treatment Technology Action Level is 0.015 mg/L.

(l) - Value for Inorganic Mercury.

(m) - RSL for Antimony (metallic) used for Antimony.

(n) - RSL for Chromium (III), Insoluble Salts used for Chromium.

(o) - RSL for Mercuric Chloride used for Mercury.

(p) - RSL for Thallium (Soluble Salts) used for Thallium.

(q) - RSL selected for Boron as the Missouri State Water Quality Groundwater screening level is based on irrigation.

TABLE 2
ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Missouri State Water Quality Criteria (mg/L)						**Federal Water Quality Criteria (mg/L)**			
		Site-Specific Protection of Aquatic Life Acute (a)		**Site-Specific Protection of Aquatic Life Chronic (a)**		**Irrigation (a)**	**Livestock Wildlife Watering (a)**	**Site-Specific USEPA Aquatic Life AWQC Freshwater Acute (b)**		**Site-Specific USEPA Aquatic Life AWQC Freshwater Chronic (b)**	
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Total**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony (c)	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	NA	NA	NA	0.02	0.1	NA	0.34	0.34	0.15	0.15
Barium (c)	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	0.005	0.1	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	2	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.011	0.010	0.00049	0.0004	NA	NA	0.0042 (f)	0.0038 (g)	0.0015 (f)	0.0013 (g)
Calcium (c)	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	NA	NA	NA	NA	NA	NA	860	NA	230	NA
Chromium	7440-47-3	3.5	1.1	0.17	0.14	0.1 (e)	NA	3.5 (e,g)	1.1 (e,h)	0.17 (e,g)	0.14 (e,h)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	1	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	4	NA	NA	NA	NA
Lead	7439-92-1	0.23	0.15	0.0089	0.0060	NA	NA	0.23 (f)	0.15 (g)	0.0089 (f)	0.0060 (g)
Lithium (c)	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0024	0.0024	0.0005	0.0005	NA	NA	0.0016	0.0014	0.00091	0.00077
Molybdenum (c)	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	NA	0.005	NA	NA	0.013 (d)	0.013 (d)	0.005 (d)	0.005 (d)
Sulfate	14808-79-8	NA	NA	1608 (g,i)	NA	NA	NA	NA	NA	NA	NA
Thallium (c)	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (c)	TDS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

AWQC - USEPA Ambient Water Quality Criteria.	mg/L - milligram per liter.
CASRN - Chemical Abstracts Service Registry Number.	NA - Not Available.
CMC - Criterion Maximum Concentration.	USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. January 29, 2014.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Total values provided.
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed December 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (f).
USEPA provides AWQC for both total and dissolved results.

(c) - Water quality criteria from the presented sources are not available for this constituent.

(d) - The selenium value is based on the 1999 selenium criterion document for screening purposes.
Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate, a likely overly conservative assumption.

(e) - Value for trivalent chromium used.

(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for Meramec River and Mississippi River of 224 mg/L as $CaCO_3$ used.

(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Meramec River and Mississippi River of 224 mg/L as $CaCO_3$ used.

(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed) for Meramec River and Mississippi River.
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness is between 100 and 500 mg/L,
sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

TABLE 3
SUMMARY OF MERAMEC SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
M-BMW-1 (b)	May-16	<	<	<	<	<	832	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	755	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	772	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	817	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	751	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	752	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	728	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	723	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	764	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-BMW-2 (b)	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-1	Mar-16	<	<	<	<	<	611	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	663	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	675	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	623	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	609	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	608	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	632	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	643	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	612	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-2	Mar-16	4.53	<	<	<	313	716	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	5.4	<	<	<	329	847	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	4.06	<	<	<	299	811	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	4.74	<	<	<	312	802	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	290	756	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	5.88	<	<	<	352	750	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	6.6	<	<	<	399	850	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	6.04	<	<	<	317	809	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	5.08	<	<	NA	330	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-3	Mar-16	5.61	<	<	<	<	682	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	5.96	<	<	<	264	755	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	8.28	<	<	<	309	872	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	9.39	<	<	<	344	957	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	8.41	<	<	<	348	854	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	6.75	<	<	<	<	729	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	6.8	<	<	<	315	832	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	6.63	<	<	<	278	816	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	6.66	<	<	NA	318	809	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-4	Mar-16	8.98	<	<	<	370	918	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	8.36	<	<	<	380	1030	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	8.71	<	<	<	366	993	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	8.54	<	<	<	378	995	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	8.58	<	<	<	402	908	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	8.66	<	<	<	403	925	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	8.89	<	<	<	404	976	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	9	<	<	<	378	964	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	8.54	<	<	NA	404	928	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-5	Mar-16	7.3	<	<	<	374	918	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	6.9	<	<	<	355	940	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	7.07	<	<	<	341	1030	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	7.13	<	<	<	391	1050	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	7.97	<	<	<	438	1010	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	8.97	<	<	<	446	1000	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	9.24	<	<	<	425	1060	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	9.04	<	<	<	410	1090	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	8.72	<	<	NA	426	1030	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-6	Mar-16	18.8	<	<	<	580	1280	<	<	<	<	<	<	<	<	<	0.129	<	0.137	<	<	<
	May-16	25.9	<	<	<	631	1310	<	<	<	<	<	<	<	<	<	0.164	<	0.124	<	<	<
	Jul-16	14.7	<	<	<	555	1370	<	<	<	<	<	<	<	<	<	0.13	<	0.129	<	<	<
	Sep-16	14.8	<	<	<	547	<	<	<	<	<	<	<	<	<	<	0.123	<	0.12	<	<	<
	Nov-16	13.8	<	<	<	610	1290	<	<	<	<	<	<	<	0.0061	<	0.13	<	0.135	<	<	<
	Jan-17	9.8	<	<	<	672	1500	<	<	<	<	<	<	<	0.0065	<	0.138	<	0.163	<	<	<
	Mar-17	11.1	<	<	<	656	1510	<	<	<	<	<	<	<	<	<	0.14	<	0.157	<	<	<
	Jun-17	10.9	<	<	<	504	1320	<	<	<	<	<	<	<	0.0078	<	0.129	<	0.147	<	<	<
	Nov-17	8.6	<	<	NA	696	1590	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SUMMARY OF MERAMEC SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
M-MW-7	Mar-16	21.5	<	<	<	911	1590	<	<	<	<	<	<	<	<	<	<	<	0.451	<	<	<
	May-16	18.7	<	<	<	941	1660	<	<	<	<	<	<	<	<	<	0.0403	<	0.338	<	<	<
	Jul-16	21.1	<	<	<	881	1780	<	<	<	<	<	<	<	<	<	0.0509	<	0.359	<	<	<
	Sep-16	20.3	<	<	<	1000	1740	<	<	<	<	<	<	<	<	<	0.0436	<	0.351	<	<	<
	Nov-16	21.4	<	<	<	756	1690	<	<	<	<	<	<	<	<	<	0.0583	<	0.331	<	<	<
	Jan-17	30.3	<	<	<	999	2060	<	<	<	<	<	<	<	<	<	0.0711	<	0.297	<	<	<
	Mar-17	25.5	<	<	<	1250	2220	<	<	<	<	<	<	<	<	<	0.0742	<	0.314	<	<	<
	Jun-17	19.3	<	<	<	896	1630	<	<	<	<	<	<	<	<	<	<	<	0.717	<	<	<
	Nov-17	25.6	<	<	NA	1220	2320	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-MW-8	Mar-16	9.94	<	<	<	469	875	<	<	<	<	<	<	<	<	<	<	<	0.229	<	<	<
	May-16	9.56	<	<	<	449	959	<	<	<	<	<	<	<	<	<	<	<	0.204	<	<	<
	Jul-16	9.05	<	<	<	437	985	<	<	<	<	<	<	<	<	<	<	<	0.215	<	<	<
	Sep-16	8.64	<	<	<	455	<	<	<	<	<	<	<	<	<	<	<	<	0.211	<	<	<
	Nov-16	8.89	<	<	<	478	881	<	<	<	<	<	<	<	<	<	<	<	0.212	<	<	<
	Jan-17	8.91	<	<	<	448	886	<	<	<	<	<	<	<	<	<	<	<	0.207	<	<	<
	Mar-17	9.39	<	<	<	456	908	<	<	<	<	<	<	<	<	<	<	<	0.213	<	<	<
	Jun-17	8.39	<	<	<	407	957	<	<	<	<	<	<	<	<	<	<	<	0.19	<	<	<
	Nov-17	7.6	<	<	NA	435	917	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		62:90	0:90	0:90	0:80	61:90	78:90	0:90	0:80	0:80	0:80	0:80	0:80	0:80	3:80	0:80	14:80	0:80	24:80	0:80	0:80	0:80

Notes:

< - less than the Human Health Drinking Water Screening Leve
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level
mg/L - milligram per liter.

NA - Not Applicable/Not Analyzed
RSL - Risk-Based Screening Level
SL - Screening Level
TDS - Total Dissolved Solids
USEPA - United States Environmental Protection Agency

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarch
Missouri State Water Quality Criteria for Drinking Water Supply
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background wells

TABLE 4
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	HH DW SL	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MIS-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-MIS-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MIS-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
- Missouri State Water Quality Criteria for Drinking Water Supply.
- Federal USEPA MCL for Drinking Water.
- Federal November 2017 USEPA Tapwater RSL.
- Federal USEPA SMCL for Drinking Water.

TABLE 4
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	HH DW SL	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MIS-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MIS-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MIS-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 5
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON
TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MIS-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.003	0.0028	<	<	<	<	<	<	<	<
M-MIS-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0028	0.0026	<	<	<	<	<	<	<	<
M-MIS-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.003	0.0025	<	<	<	<	<	<	<	<
M-MIS-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.0019	<	<	<	<	<	<	<	<
M-MIS-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0019	<	<	<	<	<	<	<	<
ADJACENT																						
M-MIS-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0032	0.0028	<	<	<	<	<	<	<	<
M-MIS-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0028	0.0024	<	<	<	<	<	<	<	<
M-MIS-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0027	0.0024	<	<	<	<	<	<	<	<
M-MIS-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.0019	<	<	<	<	<	<	<	<
M-MIS-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0023	0.002	<	<	<	<	<	<	<	<
M-MIS-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0027	<	<	<	<	<	<	<	<
M-MIS-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0029	0.0024	<	<	<	<	<	<	<	<
M-MIS-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0027	0.0025	<	<	<	<	<	<	<	<
M-MIS-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0018	<	<	<	<	<	<	<	<
M-MIS-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0021	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MIS-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0028	0.0024	<	<	<	<	<	<	<	<
M-MIS-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.003	0.0025	<	<	<	<	<	<	<	<
M-MIS-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.003	0.0024	<	<	<	<	<	<	<	<
M-MIS-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.0021	<	<	<	<	<	<	<	<
M-MIS-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0026	0.0021	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Recreational Use Screening Level.	REC - Recreational Use.
HH - Human Health.	SL - Screening Level.
mg/L - milligram per liter.	S.U. - Standard Units.
NA - Not Applicable/Not Analyzed.	TDS - Total Dissolved Solids.
pCi/L - picoCurie per liter.	USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 5
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample Location ID	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MIS-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MIS-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MIS-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 6
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	ECO SL	2	2	NA	NA	230	6.5-8.5	1608	NA	4	NA	NA	0.15	0.15	NA	NA	0.1	0.1	0.0015	0.0015	0.167	0.167
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MIS-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-MIS-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MIS-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MIS-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 6
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	ECO SL	1	1	0.0089	0.0089	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MIS-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MIS-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	0.0051 J	<	<	NA	<
M-MIS-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MIS-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MIS-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.

SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 7
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample Location ID	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MEC-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-MEC-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MEC-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.

pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 7
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

Sample Location ID		**Human Health Drinking Water Screening (a)**															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	HH DW SL	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MEC-7S	Sep-17	<	<	0.0172	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9D	Sep-17	<	<	0.0205	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9S	Sep-17	<	<	0.0196	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MEC-4S	Sep-17	<	<	0.0175	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6D	Sep-17	<	<	0.018	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MEC-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3D	Sep-17	<	<	0.0155	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 8
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON
TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MEC-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0016	<	<	<	<	<	<	<	<
M-MEC-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0014	0.0013	<	<	<	<	<	<	<	<
M-MEC-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0013	0.0011	<	<	<	<	<	<	<	<
M-MEC-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0012	0.0011	<	<	<	<	<	<	<	<
ADJACENT																						
M-MEC-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0014	<	<	<	<	<	<	<	<
M-MEC-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0016	0.0013	<	<	<	<	<	<	<	<
M-MEC-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0014	0.0012	<	<	<	<	<	<	<	<
M-MEC-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0013	0.0011	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MEC-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0016	0.0013	<	<	<	<	<	<	<	<
M-MEC-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0014	0.0012	<	<	<	<	<	<	<	<
M-MEC-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0015	0.0011	<	<	<	<	<	<	<	<
M-MEC-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0014	0.0011	<	<	<	<	<	<	<	<
M-MEC-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0015	0.0012	<	<	<	<	<	<	<	<

Notes:

< - Less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 8
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	HH REC SL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MEC-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MEC-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MEC-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - Less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 9
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	ECO SL	2	2	NA	NA	230	6.5-8.5	1608	NA	4	NA	NA	0.15	0.15	NA	NA	0.1	0.1	0.0015	0.0015	0.167	0.167
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-MEC-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-MEC-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-MEC-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
M-MEC-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 9
SUMMARY OF MERAMEC RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	ECO SL	1	1	0.0089	0.0089	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-MEC-7S	Sep-17	<	<	0.0172	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-8S	Sep-17	<	<	0.0112	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9D	Sep-17	<	<	0.0205	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-9S	Sep-17	<	<	0.0196	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-MEC-4S	Sep-17	<	<	0.0175	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-5S	Sep-17	<	<	0.0139	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6D	Sep-17	<	<	0.018	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-6S	Sep-17	<	<	0.0121	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-MEC-1S	Sep-17	<	<	0.014	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2D	Sep-17	<	<	0.0142	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-2S	Sep-17	<	<	0.0146	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3D	Sep-17	<	<	0.0155	<	<	<	<	<	<	<	<	<	<	<	NA	<
M-MEC-3S	Sep-17	<	<	0.0143	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 10
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample Location ID	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-C-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-C-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-C-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - Less than the Human Health Drinking Water Screening Level.
CCR - Coal Combustion Residuals.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 10
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON
TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample Location ID	**HH DW SL**	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-C-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-C-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-C-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - Less than the Human Health Drinking Water Screening Level.
CCR - Coal Combustion Residuals.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 11
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON
TO HUMAN HEALTH RECREATIONAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	ecreational	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	HH REC SL	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-C-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.00077 J	0.00084 J	<	<	<	<	<	<	<	<
ADJACENT																						
M-C-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0023	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-C-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0025	0.0024	<	<	<	<	<	<	<	<

Notes:
< - Less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
pCi/L - picoCurie per liter.
NA - Not Applicable/Not Analyzed.

REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 11
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	HH REC SL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-C-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-C-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-C-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
- < - Less than the Human Health Recreational Use Screening Level.
- HH - Human Health.
- mg/L - milligram per liter.
- pCi/L - picoCurie per liter.
- NA - Not Applicable/Not Analyzed.
- REC - Recreational Use.
- SL - Screening Level.
- S.U. - Standard Units.
- TDS - Total Dissolved Solids.
- USEPA - United States Environmental Protection Agency.

Qualifiers:
- J - Value is estimated.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
  - Missouri State Water Quality Criteria for Human Health Fish Consumption.
  - USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 12
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1608	NA	4	NA	NA	0.15	0.15	NA	NA	0.1	0.1	0.0015	0.0015	0.167	0.167
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
M-C-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
M-C-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
M-C-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 12
SUMMARY OF CREEK/DRAINAGE SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
	ECO SL	1	1	0.0089	0.0089	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Sample Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
M-C-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
M-C-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
M-C-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.	SL - Screening Level.
ECO - Ecological.	S.U. - Standard Units.
mg/L - milligram per liter.	TDS - Total Dissolved Solids.
NA - Not Applicable/Not Analyzed.	USEPA - United States Environmental Protection Agency.
pCi/L - picoCurie per liter.	

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 13
SUMMARY OF WHOLE EFFLUENT TOXICITY TESTING RESULTS FOR NPDES OUTFALL 003 AND 009
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

Sampling Event	Treatment	Percent Survival at 48 hours *Pimephales promelas*	Percent Survival at 48 hours *Ceriodaphnia dubia*
Outfall 003 (Ash Retention Pond)			
January 2013	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
January 2014	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
January 2015	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	98%	100%
January 2016	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
January 2017	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
Outfall 009 (489 Pond)			
July 2016	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%

Notes:

NPDES - Natual Pollutant Discharge Elimination System.

No significant difference (alpha = 0.05) between effluent and control survival data for the above test.
Effluent passes in all tests conducted from 2013 through 2017.
10% Effluent - Outfall 003 and Outfall 009 effluent mixed with Mississippi River water.
Reconstituted Control - Laboratory reconstituted water.
Upstream Control - Mississippi River water.

TABLE 14
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVEF
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	100,000			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum MEC Groundwater Concentration**
Boron	4	NA	2	2	200000	30.3	M-MW-7	>6,000
Sulfate	250	NA	1773	250	25000000	1250	M-MW-7	>20,000
TDS	500	NA	NA	500	50000000	2320	M-MW-7	>21,000
Cobalt	0.006	NA	1	0.006	600	0.0078	M-MW-6	>76,000
Lithium	0.04	NA	NA	0.04	4000	0.164	M-MW-6	>24,000
Molybdenum	0.1	NA	NA	0.1	10000	0.717	M-MW-7	>13,000

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
  Missouri State Water Quality Criteria for Drinking Water Supply.
  Federal USEPA MCL for Drinking Water.
  Federal November 2017 USEPA Tapwater RSL.
  Federal USEPA SMCL for Drinking Water.
(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
  Missouri State Water Quality Criteria for Human Health Fish Consumption.
  USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.
(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
  Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
  USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
  Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
  USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
  Missouri State Water Quality Criteria for Irrigation.
  Missouri State Water Quality Criteria for Livestock Wildlife Watering.
(d) - Estimated value, see text and Attachment B for derivation.

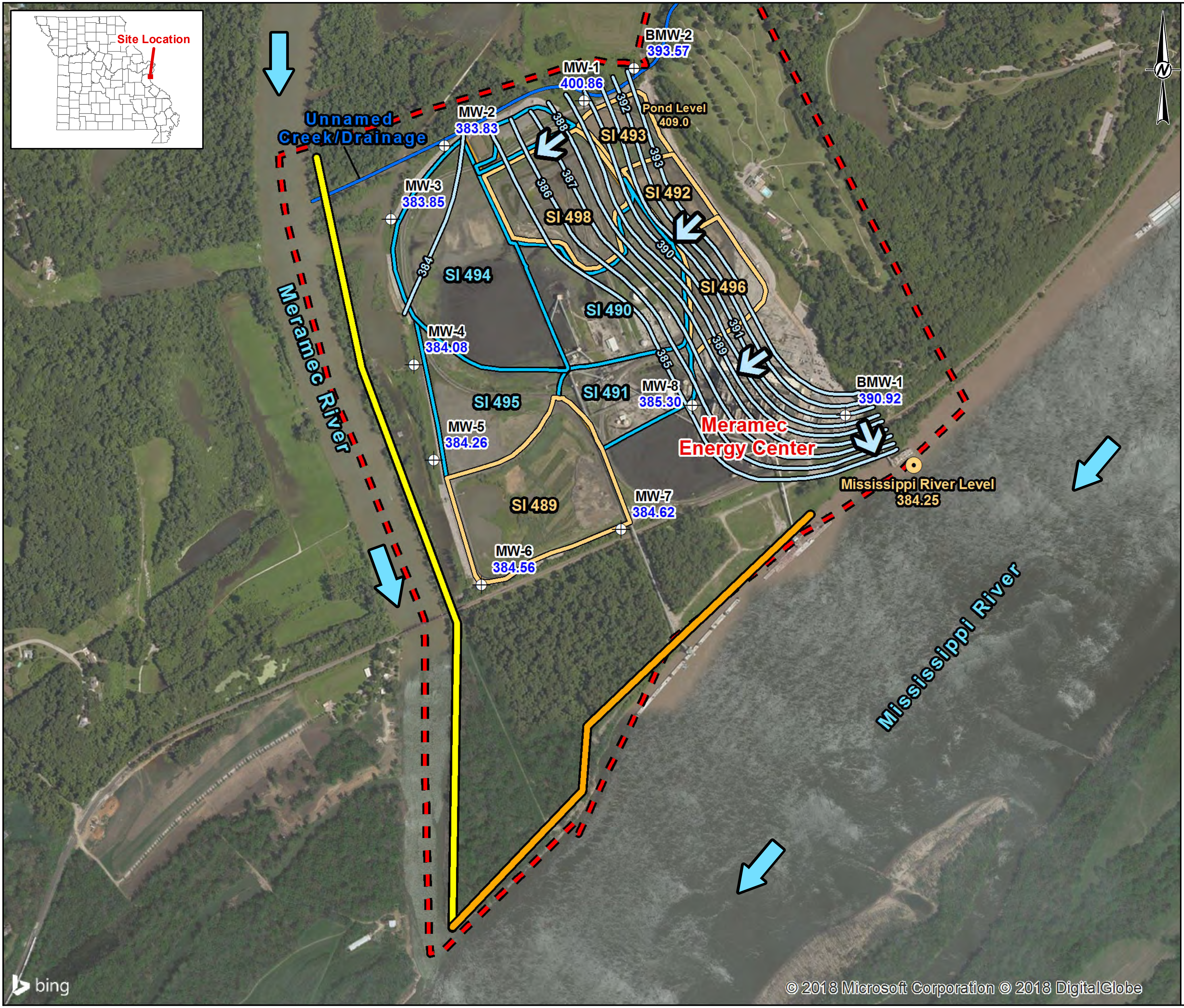
TABLE 15
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MERAMEC RIVEF
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	700			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum MEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk Based Screening Level and the Maximum MEC Groundwater Concentration**
Boron	4	NA	2	2	1400	30.3	M-MW-7	>40
Sulfate	250	NA	1773	250	175000	1250	M-MW-7	>100
TDS	500	NA	NA	500	350000	2320	M-MW-7	>100
Cobalt	0.006	NA	1	0.006	4.2	0.0078	M-MW-6	>500
Lithium	0.04	NA	NA	0.04	28	0.164	M-MW-6	>100
Molybdenum	0.1	NA	NA	0.1	70	0.717	M-MW-7	>90

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
    Missouri State Water Quality Criteria for Drinking Water Supply.
    Federal USEPA MCL for Drinking Water.
    Federal November 2017 USEPA Tapwater RSL.
(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
    Missouri State Water Quality Criteria for Human Health Fish Consumption.
    USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.
(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
    Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
    USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
    Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
    USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
    Missouri State Water Quality Criteria for Irrigation.
    Missouri State Water Quality Criteria for Livestock Wildlife Watering.
(d) - Estimated value, see text and Attachment B for derivation.

FIGURES



LEGEND

- Meramec Energy Center Property Boundary
- Active Surface Impoundment
- Exempt Surface Impoundment
- Length of Groundwater Discharge Used in the Dilution Factor Calculations for the Meramec River
- Length of Groundwater Discharge Used in the Dilution Factor Calculations for the Mississippi River
- Unnamed Creek/Drainage

Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⊕ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- Groundwater Flow Direction
- Surface Water Flow Direction

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER ON JULY 18, 2016.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 2,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
AMEREN HYDROGEOLOGICAL CONSULTING

TITLE
ESTIMATED LENGTH OF DISCHARGE AND EXAMPLE GROUNDWATER FLOW MAP

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-12-19
PREPARED	JS
DESIGN	JS
REVIEW	RJF
APPROVED	MNH

PROJECT No.
130-1560

FIGURE
1

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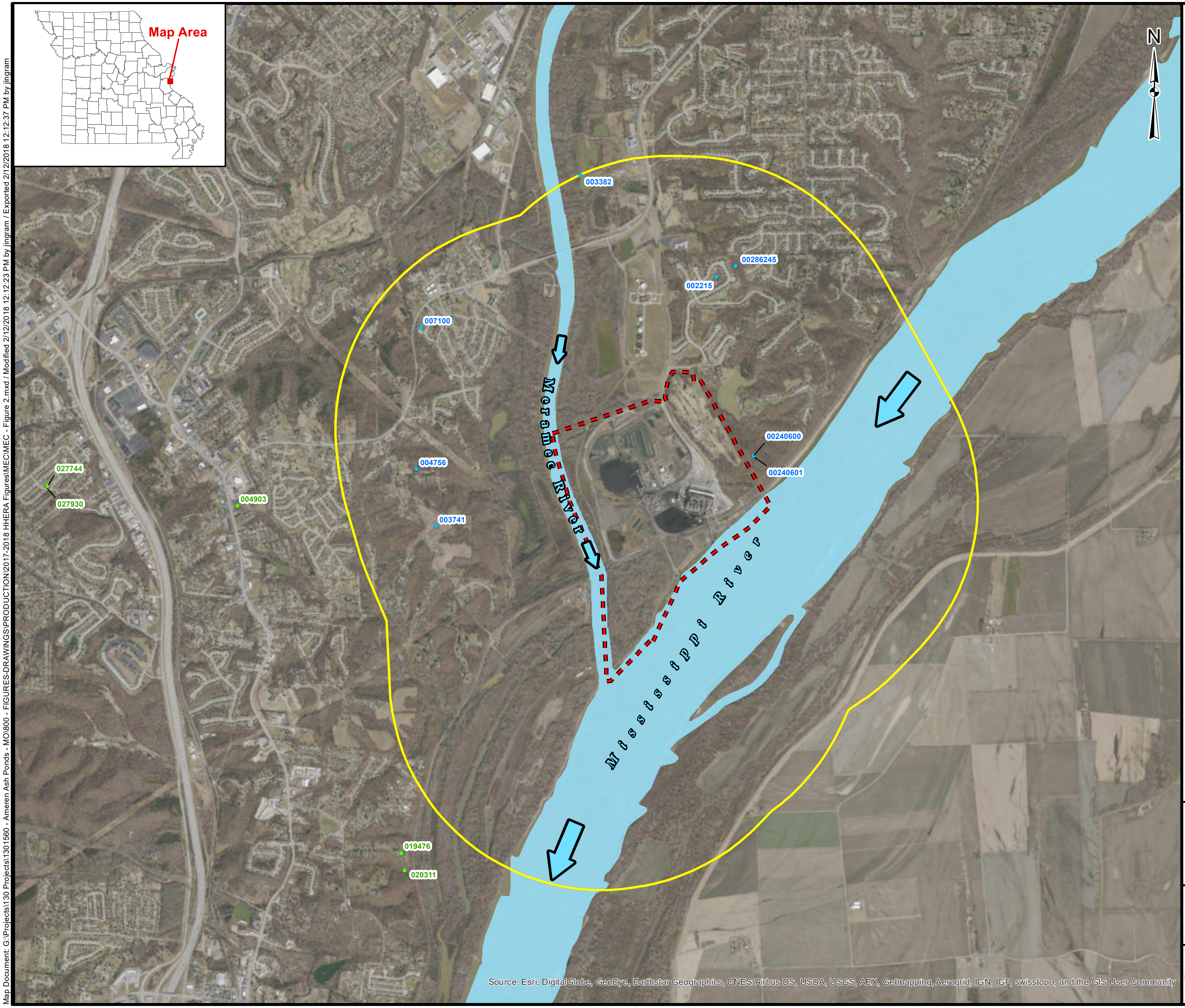


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- 🟨 Approximate 1-Mile Radius
- ● Private Well
- ● Public Well
- ⬋ Surface Water Flow Direction

NOTES

1.) Wells are labeled with state issued reference number or log ID.
2.) Search radius is approximately one mile beyond the Ameren property boundary line.
3.) Wells in Illinois are not shown.
4.) See Table 1 for details on wells within the 1-mile radius.
5.) Private wells outside of the approximate 1-mile radius are not shown for clarity.

REFERENCES

1.) MDNR - Missouri Department of Natural Resources
2.) MSDIS - Missouri Spatial Data Information Service
3.) University of Missouri - Columbia - Department of Geography - MSDIS Database
4.) Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs
5.) Missouri Environmental Geology Atlas 2007 (MEGA)
6.) MDNR Wellhead Protection Program
7.) COORDINATE SYSTEM: NAD 1983 UTM Zone 15N

0 2,000 4,000
Feet

PROJECT

Ameren

AMEREN MISSOURI COAL FIRED POWER PLANTS
ST. LOUIS COUNTY, MISSOURI

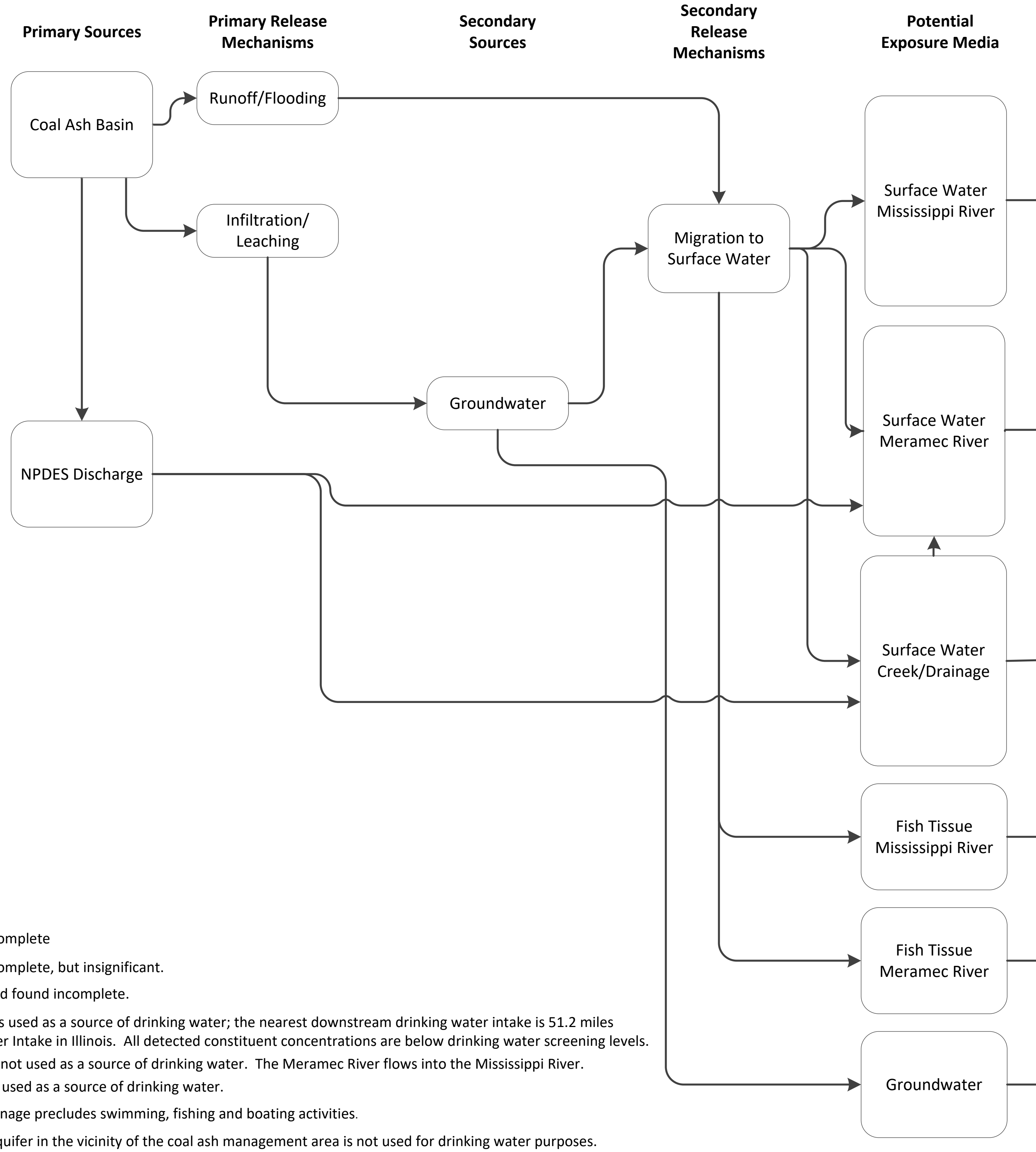
TITLE

PRIVATE WELL LOCATION WITHIN 1-MILE RADIUS OF FACILITY BOUNDARY

Golder Associates

PROJECT No. 130-1560			FILE No.	MEC - Figure 2.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
GIS	JSI	2/12/2018	FIGURE 2	
CHECK	MWD	2/12/2018		
REVIEW	MNH	2/12/2018		

FIGURE 3
CONCEPTUAL SITE MODEL
MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MO
AMEREN MISSOURI



	Potential Human Health Receptors					Potential Ecological Receptors
Potential Exposure Route	**Current/Future Off-Site Resident Adult/Child**	**Current/Future Off-Site Recreational Swimmer**	**Current/Future Off-Site Recreational Wader**	**Current/Future Off-Site Recreational Boater**	**Current/Future Off-Site Recreational Fisher**	**Aquatic Receptors**
Drinking Water Use	⊙ (a)	○	○	○	○	NA
Incidental Ingestion	○	⊙	⊙	⊙	⊙	NA
Dermal Contact	○	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	⊙ (b)	○	○	○	○	NA
Incidental Ingestion	○	⊙	⊙	⊙	⊙	NA
Dermal Contact	○	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	○ (c)	○	○	○	○	NA
Incidental Ingestion	○	○	⊙	○	○	NA
Dermal Contact	○	○ (d)	⊙	○ (d)	○ (d)	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Ingestion	○	○	○	○	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Ingestion	○	○	○	○	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	○ (e)	○	○	○	○	NA
Aquatic Exposure	NA	NA	NA	NA	NA	○ (f)

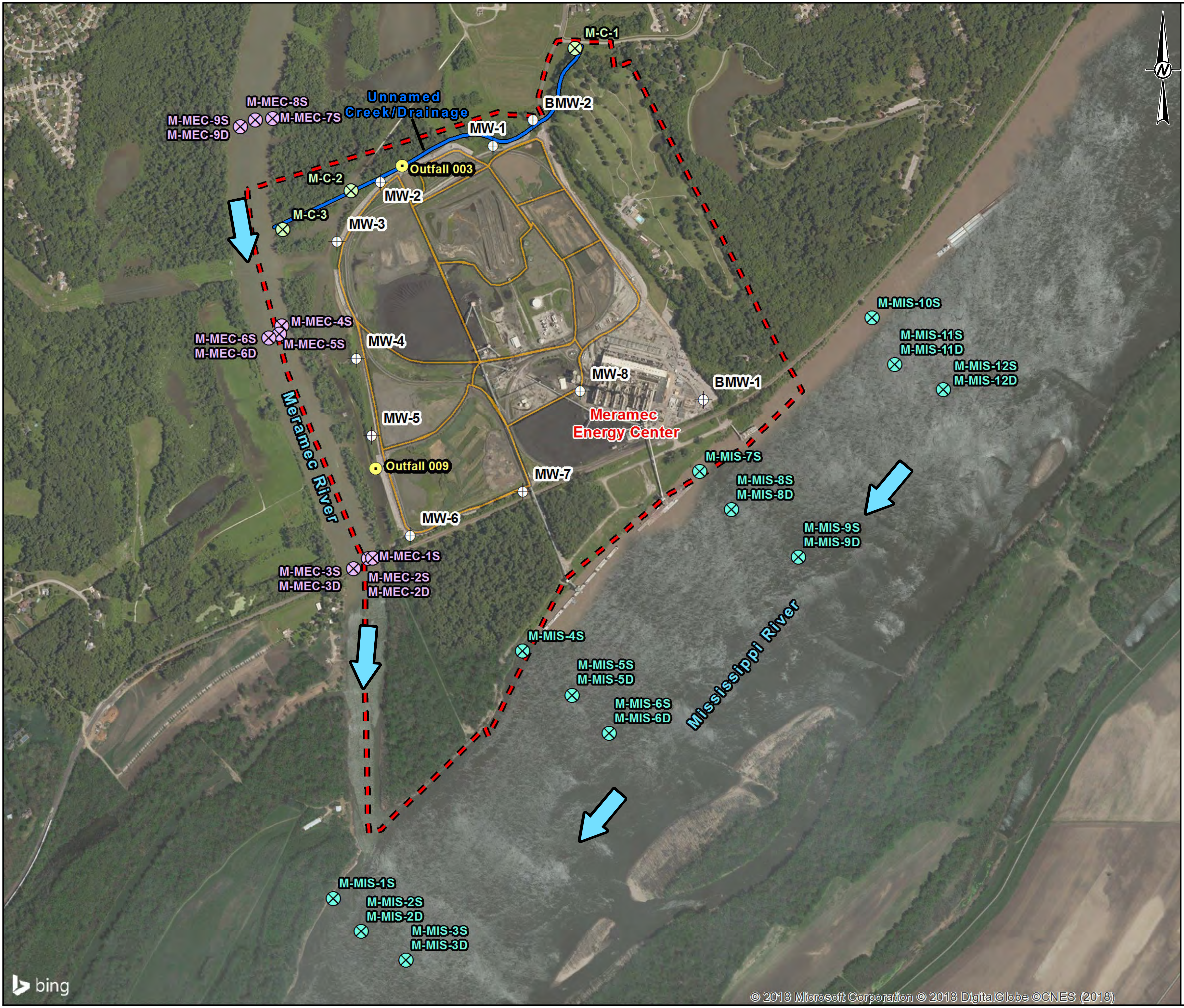
Notes:

- ● Pathway potentially complete
- ⊙ Pathway potentially complete, but insignificant.
- ○ Pathway evaluated and found incomplete.

(a) The Mississippi River is used as a source of drinking water; the nearest downstream drinking water intake is 51.2 miles downstream at Chester Intake in Illinois. All detected constituent concentrations are below drinking water screening levels.
(b) The Meramec River is not used as a source of drinking water. The Meramec River flows into the Mississippi River.
(c) Creek/Drainage is not used as a source of drinking water.
(d) The size of Creek/Drainage precludes swimming, fishing and boating activities.
(e) The shallow alluvial aquifer in the vicinity of the coal ash management area is not used for drinking water purposes.
(f) Ecological Receptors are not exposed to groundwater.

NA – Not Applicable.

NPDES - National Pollutant Discharge Elimination System.



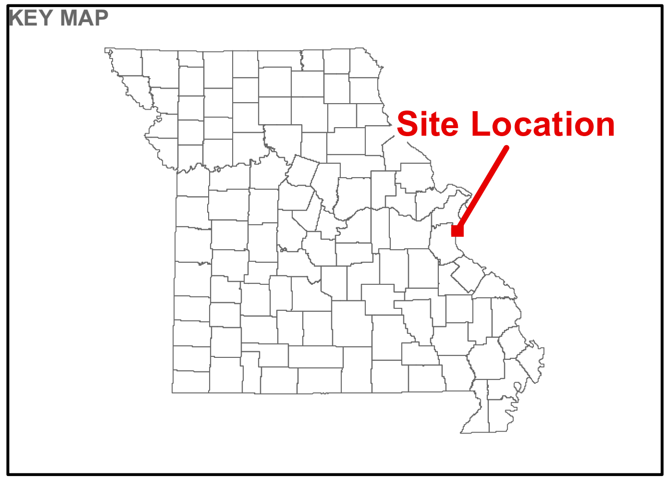
LEGEND

🟥 Meramec Energy Center Property Boundary
▭ All Surface Impoundments
━ Unnamed Creek/Drainage

Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well
⊗ Creek/Drainage Sample Location
⊗ Meramec River Sample Location
⊗ Mississippi River Sample Location
⊙ NPDES Outfall Location
↙ Surface Water Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
3. SAMPLE LOCATIONS BASED ON HANDHELD TRIMBLE GPS UNIT.
4. SAMPLE LOCATIONS REPRESENT MIDPOINT BETWEEN STARTING AND ENDING LOCATIONS.
5. NPDES - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

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Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
AMEREN HYDROGEOLOGICAL CONSULTING

TITLE
SURFACE WATER SAMPLING LOCATIONS
MERAMEC ENERGY CENTER

CONSULTANT

YYYY-MM-DD	2017-09-28
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
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ATTACHMENT A

Constituents Present in Coal Ash and in Our Natural Environment

Attachment A

Constituents Present in Coal Ash and in Our Natural Environment

It is important to understand what constituents are present in coal ash, which can be released to the environment, and to understand the natural occurrence of these constituents in our environment.

Coal is a type of sedimentary rock that is a natural component of the earth's crust and the inorganic minerals and elements it contains are also naturally occurring. It is the organic component of coal that burns and produces energy, and it is the inorganic minerals and elements that remain after combustion the make up the coal ash, or coal combustion products (CCPs).

A.1 Major, Minor and Trace Constituents in Coal Ash

All of the inorganic minerals and elements that are present in coal ash are also present in our natural environment. This is one fact that that the public seems either not to understand or will not acknowledge. **Figure A-1** shows the major and minor components of fly ash, bottom ash, volcanic ash, and shale. It is important to understand that the constituents that are the focus of many of the concerns expressed by the public about the toxicity of coal ash (e.g., lead, arsenic, mercury, cadmium, selenium, etc.) are trace elements, so called because they are present in such low concentrations (in the mg/kg or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

- 1 penny in a large container holding $10,000 worth of pennies, or
- 1 second in 11.5 days, or
- 1 inch in 15.8 miles

These trace elements have been referred to by the public and even in the popular press as "toxic"—without any context provided for what this means. Moreover, claims have been made that there is no safe level of exposure to any of these elements.

This is simply not true, and there are two important facts that must be understood to put this in context. The first relates to background levels of constituents in our environment and the second relates to toxicity.

A.2 Background Levels in Soils

The first fact that must be understood is that all of the constituents present in coal ash occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S. Prime examples include arsenic, lead, mercury and selenium. With respect to arsenic, **Figure A-2** shows the range of background levels of arsenic in soils across the U.S., as published by the USGS. The USGS is conducting a "national geochemical survey" to identify background levels of elements in soils in the U.S. (USGS, 2013). **Figures A-3 – A-6** provide maps prepared by the USGS demonstrating the naturally-occurring presence of other trace elements in soils in the U.S., including aluminum and copper (**Figure A-3**), iron and lead (**Figure A-4**), manganese and mercury (**Figure A-5**), and selenium and zinc (**Figure A-6**).

These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in our vitamins, such as manganese and selenium. Thus, we are exposed to these trace elements in our natural environment every day, and in many ways.

A.3 Toxicity and Risk

The second fact is that all constituents and materials that we encounter in our natural environment can be toxic, but what determines whether a toxic effect actually occurs is how one is exposed to the constituent, the amount of material to which one may be exposed, and the timing and duration of that exposure. Without sufficient exposure the science tells us that there are no toxic effects. Put another way, when a toxic effect is demonstrated by a particular constituent, it is generally caused by high levels of exposure over a long-term duration. The fundamental principles here are:

- All constituents can exert toxic effects (from aspirin[1] to table salt to water to minerals).
- For such toxic effects to occur, exposure must occur at a sufficiently high level for a sufficiently long period of time.
- If there is no exposure, there is no risk.

A.4 Risk-Based Screening Levels

The U.S. Environmental Protection Agency (USEPA) uses information on the potential toxicity of constituents to identify concentrations of trace elements in soil in a residential setting that are considered by USEPA to be protective for humans (including sensitive groups) over a lifetime (USEPA, 2014c). Specifically, residential soil screening levels are levels that are protective of a child and adult's daily exposure to constituents present in soil or a solid matrix over a residential lifetime. In the context of regulatory decision making, at sites where constituent concentrations fall below these screening levels, no further action or study is warranted under the federal Superfund program. Missouri Department of Natural Resources also applies this concept to the development of screening levels in its Risk-Based Corrective Action program (MDNR, 2006).

Figure A-7 shows USEPA's residential soil screening levels for a variety of trace elements that are present in coal ash. USEPA considers it to be safe for children to be exposed to these concentrations of each of these trace elements in soils on a daily basis, throughout their lifetime. What this tells us is that by developing these residential soil screening levels, USEPA considers the presence of these levels of these constituents in soils to be safe for humans, even for exposure on a daily basis. It is, therefore, simply not true that there are no safe levels of exposure to these constituents.

A.5 Comparison of Coal Ash Constituent Concentrations to Risk-Based Screening Levels and Background

A comparison of constituent concentrations in coal ash, as reported by the USGS (USGS, 2011a) to USEPA's risk-based screening levels for residential soil indicates that with only a few exceptions, constituent concentrations in coal ash are below screening levels developed by the USEPA for residential soils, and are similar in concentration to background U.S. soils. Details of this evaluation are provided in the report titled "Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS

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[1] For example, if one takes two aspirin every four hours as directed, aspirin is not toxic. If one takes the entire bottle at once, the aspirin is very toxic.

Coal Ash Data from Five US Power Plants" (AECOM, 2012). The study is available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf.

Figure A-8 is an updated chart from this study comparing ranges of trace element concentrations in fly ash produced from coal from the Powder River Basin in Wyoming (the same type of coal used at Rush Island Energy Center) to USEPA screening levels, and to background levels in soils in the U.S. The USEPA screening levels for residential soils (USEPA, 2014c) are shown as the green vertical bars, the ranges for the Wyoming coal fly ash are shown in purple on top of the green vertical bars, and the ranges of background levels in U.S. soils are shown in the grey bars. What this figure shows is that all but one of the constituents are present in the Wyoming fly ash at concentrations that are below the USEPA residential soil screening levels; and for cobalt, the concentration range is only marginally above the screening level. As noted in detail in the report itself, the toxicity value upon which the USEPA soil screening level for cobalt is based is two levels of magnitude lower than what has been derived by other regulatory agencies; thus a much higher health protective soil screening level for cobalt exists. What the data also show is that constituent concentrations in coal ash are not that different from concentrations in soils in the U.S.

The results are similar for all of the coal ashes evaluated in the report (AECOM, 2012). The evaluation in the report included not only the simple comparison of constituent concentrations in coal ash to USEPA screening levels, but also provided a detailed cumulative risk screen for each coal ash data set to account for potential additive effects of combined exposures to the trace elements in coal ash. The results confirm the simple screening results, which indicate that no significant risk would be posed by direct exposure to coal ash in a residential setting.

Thus, by considering the levels of trace elements in coal ash in comparison to the background levels in soils in the U.S., and in comparison to the USEPA screening levels for these constituents in residential soil, screening levels that are protective of daily exposure to soils by children and adults, including sensitive subgroups, it is concluded that even daily direct contact to trace elements in coal ash would not pose a significant risk to human health.

A.6 Background Levels in Groundwater

Because these constituents are naturally present in soils and rocks, they are also naturally present in our groundwaters and surface waters. The USGS has published a report titled "Trace Elements and Radon in Groundwater Across the United States" (USGS, 2011b). Just as for soil, it is important to understand that there are background levels of constituents in groundwater. Constituent concentrations in groundwater that is upgradient of a source represent background conditions. To demonstrate a release to groundwater by a source, concentrations downgradient of the source must be greater than the background/upgradient concentrations at a statistically significant level for a consistent period of time.

The same concept applies to surface water. These same constituents are naturally present in surface water due to discharge of groundwater to surface water and the effect of erosion of soil into our surface waters. To demonstrate an effect of a source on surface water, the concentrations downgradient/downstream of the source must be greater than the background/upstream concentrations at a statistically significant level for a consistent period of time.

Constituents in groundwater and surface water can be in a dissolved form, or they can be adhered to or part of a soil or sediment particle. Movement of these particles in groundwater is generally more difficult because of the presence of the soil and rock that the groundwater must move through. Surface water is constantly impacted by erosion of soils, thus in surface water, it is much more common for constituents to be bound to particles rather than dissolved in the water. For this reason, it is important to evaluate both total concentrations of constituents in water (which represents constituents dissolved in the water and as part of a soil or sediment particle) and the dissolved component (by filtering out the soil/sediment particles).

A.7 Toxicity Evaluation for Cobalt and Chromium

A.7.1 Cobalt

Cobalt is the only constituent in the Powder River Basin coal ash (the coal that is used at the Rush Island Energy Center) with concentrations above the USEPA screening level for residential soils. There is much uncertainty associated with the USEPA dose-response value for cobalt, and with the resulting screening level for residential soil. The World Health Organization (WHO) indicates that "there are no suitable data with which to derive a tolerable intake for chronic ingestion of cobalt" (WHO, 2006). Agency for Toxic Substances and Disease Registry (ATSDR, 2004) states that "adequate chronic studies of the oral toxicity of cobalt or cobalt compounds in humans and animals are not presently available." However, using a short-term study in six human volunteers, ATSDR (2004) derived an intermediate-term (15–364 days) minimal risk level (MRL) of 0.05 mg/kg-day. The "adverse" effect was identified as increased red blood cell count, although it is also noted that cobalt is used as a treatment for anemia (low red blood cell count). ATSDR also notes that "Since cobalt is naturally found in the environment, people cannot avoid being exposed to it. However, the relatively low concentrations present do not warrant any immediate steps to reduce exposure." WHO notes that the largest source of exposure to cobalt for the general population is the food supply; the estimated intake from food is 5–40 ug/day, most of which is inorganic cobalt (WHO, 2006). Expressed on a mg/kg-day basis, this is 0.00007–0.0005 mg/kg-day from the diet.

USEPA however has derived a Provisional Peer-Reviewed Toxicity Value (PPRTV) for cobalt of 0.0003 mg/kg-day, this is two orders of magnitude lower than the ATSDR intermediate term MRL, and is higher that most dietary intake estimates. Thus the RSL for cobalt for residential soil is much lower than values derived by other regulatory bodies.

A.7.2 Hexavalent Chromium

The data provided by USGS (2011a) for chromium is for total chromium in the samples; the Ameren data for groundwater and surface water are also based on analysis of total chromium. Many metals can exist in different oxidation states; for some metals, the oxidation state can have different toxicities. This is the case for chromium. Chromium exists in two common oxidation states: trivalent chromium (chromium-3, Cr(III) or Cr+3), and hexavalent chromium (chromium-6, Cr(VI) or Cr+6). Trivalent chromium is essentially nontoxic, as evidenced by its RSL of 120,000 mg/kg. It can be bought over-the-counter as a supplement, and is included in most vitamins. Hexavalent chromium has been concluded to be a human carcinogen by the inhalation route of exposure (USEPA, 2014a).

Currently on USEPA's toxicity database, the Integrated Risk Information System (IRIS) (USEPA, 2014a), the primary source of dose-response information for risk assessment and for the RSL tables, an oral reference dose is available for trivalent chromium, and IRIS provides an inhalation IUR for potential inhalation carcinogenic effects and an oral reference dose and inhalation reference concentration for hexavalent chromium. The oral noncancer dose-response value for hexavalent chromium is based on a study where no adverse effects were reported; thus the target endpoint is identified as "none reported."

Recent studies by the National Toxicology Program (NTP) have shown that when present in high concentrations in drinking water, hexavalent chromium can cause gastrointestinal tract tumors in mice (NTP, 2008). IRIS does not present an oral CSF for hexavalent chromium; a value developed by the New Jersey Department of Environmental Protection (NJDEP, 2009) was used in the development of the RSLs. USEPA developed a draft oral cancer dose-response value for hexavalent chromium, based on the same study and was the same as the NJDEP value. However, it should be noted that USEPA's Science Advisory Board (SAB) provided comments in July 2011 on the draft USEPA derivation of the oral CSF for hexavalent chromium and indicated many reservations with the assumptions of mode of action, and in the derivation itself. The SAB review can be accessed at http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433. Thus, the value used to develop the RSLs for hexavalent chromium has been called into question by USEPA's peer review panel. Currently there is much scientific debate about whether the mode of action of hexavalent chromium in very high concentrations in drinking water is relevant to the low concentrations most likely to be encountered in environmental situations (Proctor, et al., 2012).

Therefore, for this evaluation of chromium in the Powder River Basin coal ash, total chromium is evaluated assuming the total concentration is hexavalent chromium and using RSLs calculated using USEPA's on-line RSL calculator (USEPA, 2014b), based on the primary dose-response values provided in the IRIS database (USEPA, 2014a) for both potential carcinogenic and noncarcinogenic endpoints.

The assumption that all chromium in CCPs is in the hexavalent form is very conservative, and in fact unrealistic. Data for the Alaska Power Plant indicate that hexavalent chromium comprises 0.25% of the total chromium concentration in the combined fly ash/bottom ash material from that facility. Literature data for analyses of CCPs from US coals (total CCPs) indicate that hexavalent chromium can comprise up to 5% of the total chromium (Huggins, et al., 1999); thus over 95% of the total chromium is present in the nontoxic trivalent form. This is consistent with data from USEPA, though there are some single higher results (USEPA, 2009).

A.8 Summary

Constituents present in coal ash are also present in our natural environment, and we are exposed to them every day, in the soils that we contact and the food that we eat. All of these constituents have USEPA-derived risk-based screening levels for residential soils. The constituent concentrations in coal ash from the Powder River Basin, the source of the coal used at the Rush Island Energy Center, are below risk-based screening levels for residential soils (with one exception) and the concentrations are similar to background levels in U.S. soils.

A.9 References

AECOM. 2012. Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants. Prepared for the American Coal Ash Association. Available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf

ATSDR. 2004. Toxicological Profile for Cobalt. Agency for Toxic Substances and Disease Registry. Available at: http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=373&tid=64

Huggins, FE, M Najih, and GP Huffman. 1999. Direct speciation of chromium in coal combustion by-products by X-ray absorption fine-structure spectroscopy. Fuel 78:233–242.

MDNR. 2006. Missouri Risk-Based Correction Action (MRBCA) Technical Guidance. April, 2006. Available at: http://www.dnr.mo.gov/env/hwp/mrbca/docs/mrbca-sections6-06.pdf

NJDEP. 2009. Derivation of Ingestion-Based Soil Remediation Criterion for Cr+6 Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate. Division of Science, Research and Technology New Jersey Department of Environmental Protection. Risk Assessment Subgroup of the NJDEP Chromium Workgroup. April 8, 2009.

NTP. 2008. NTP technical report on the toxicology and carcinogenesis studies of sodium dichromate dihydrate (CAS No. 7789-12-0) in F344/N rats and B6C3F1 mice (drinking water studies), NTP TR 546. NIH Publication No. 08-5887. National Toxicology Program.

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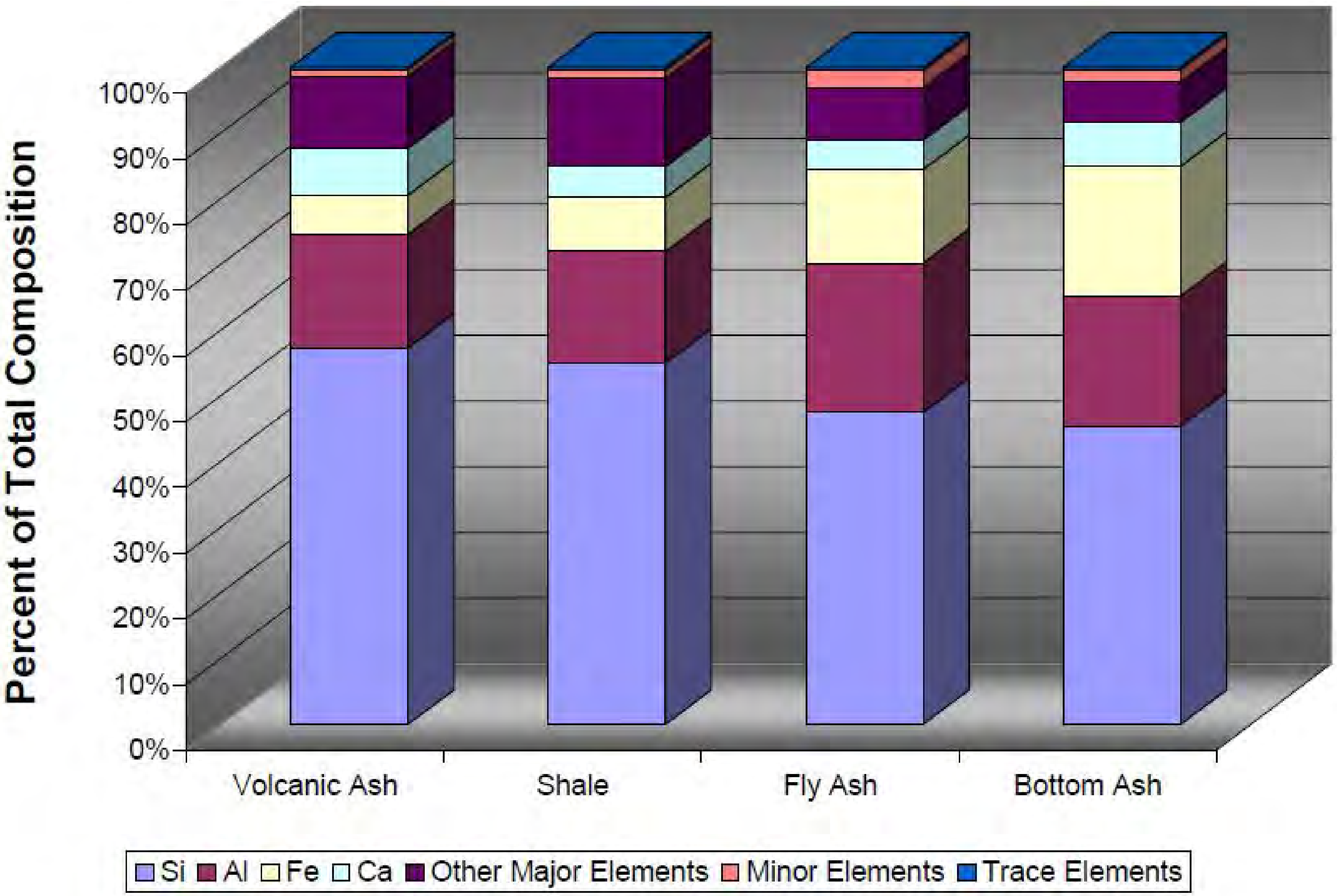
Attachment A – Figures

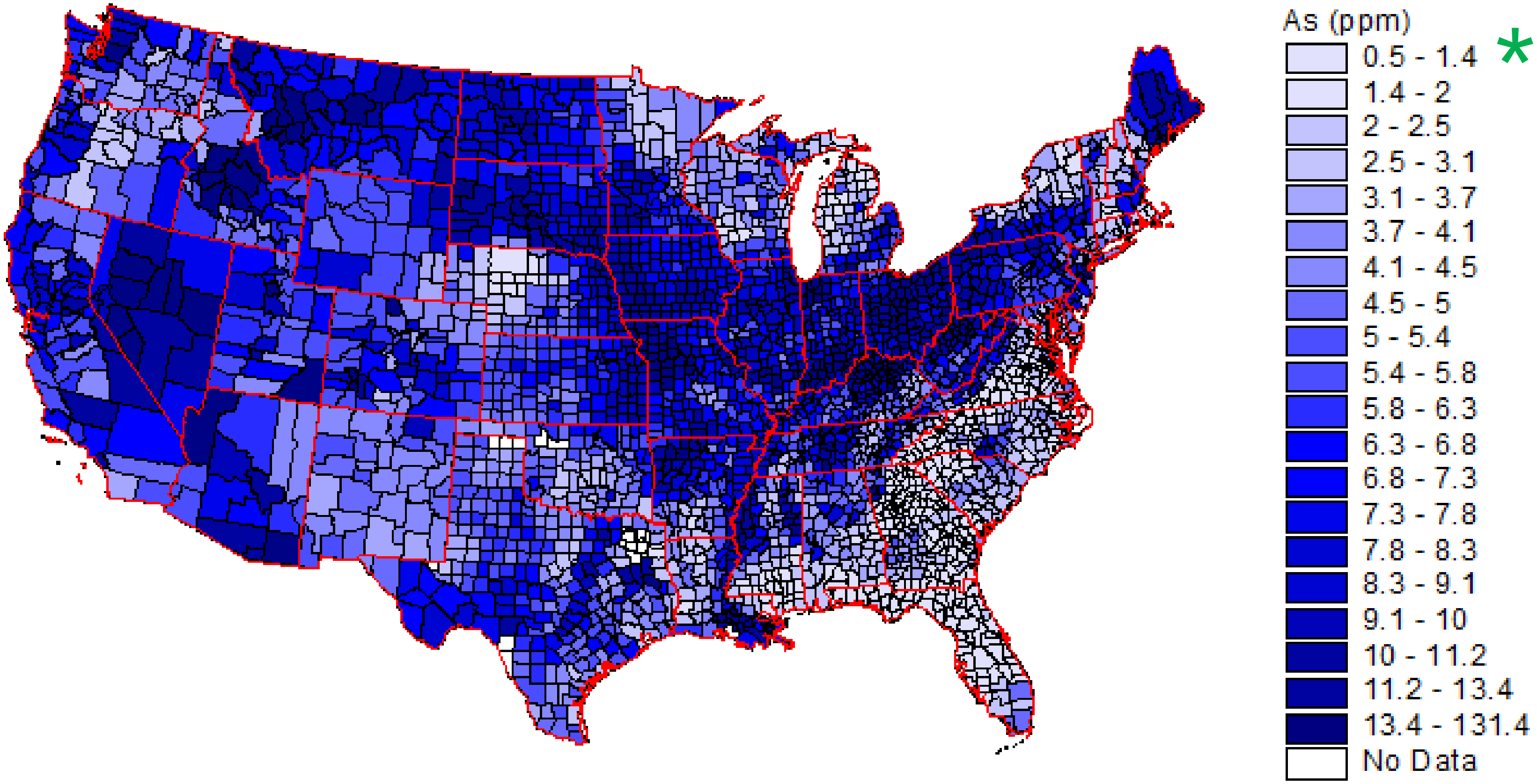
Figure A-1
Composition of Coal Ash and Other Natural Materials



Source: EPRI. 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.

Figure A-2

Arsenic is Present in our Natural Environment – Background Levels in Soils in the U.S.

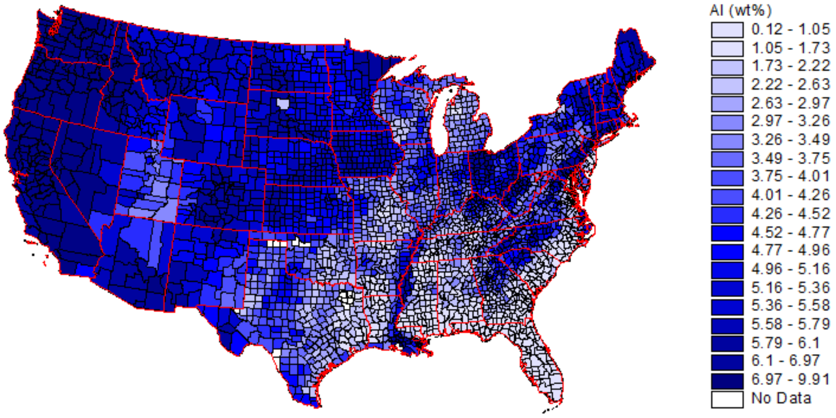


***The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.67 mg/kg. USEPA. 2014c.**
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

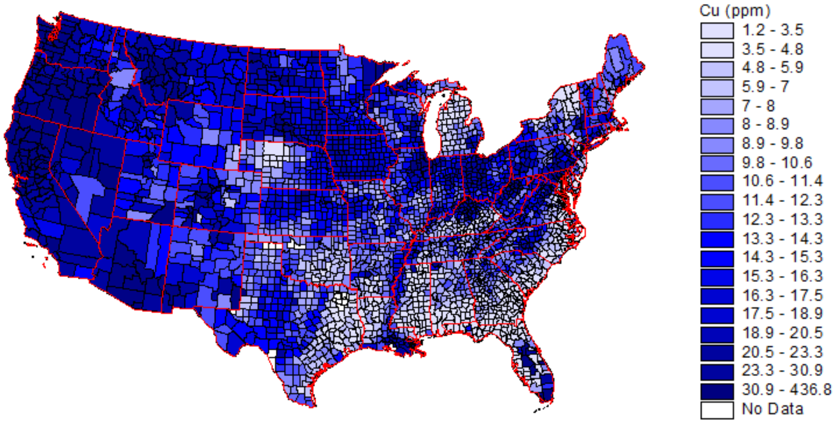
Figure A-3

Aluminum is Present in our Natural Environment –
Background Levels in Soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

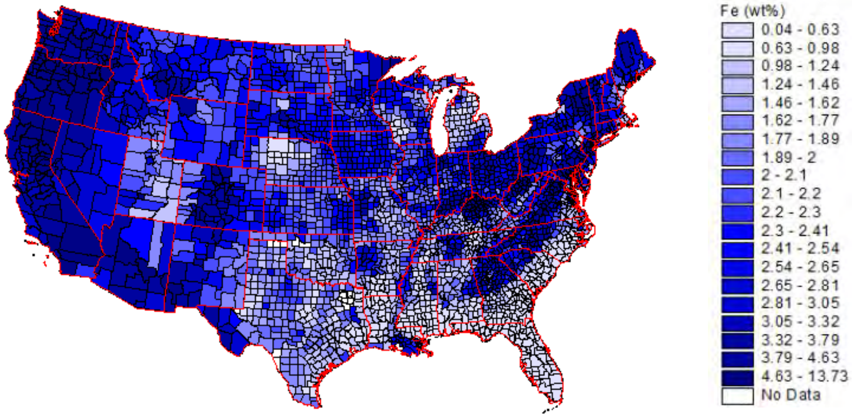
Copper is Present in our Natural Environment –
Background Levels in Soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

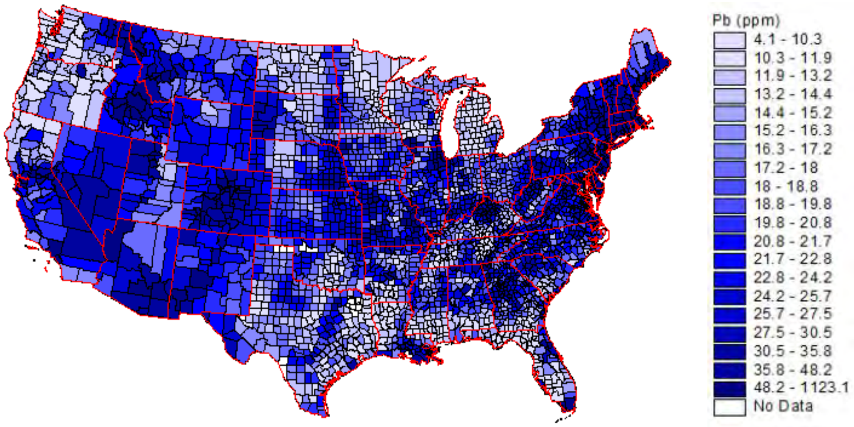
Figure A-4

Iron is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

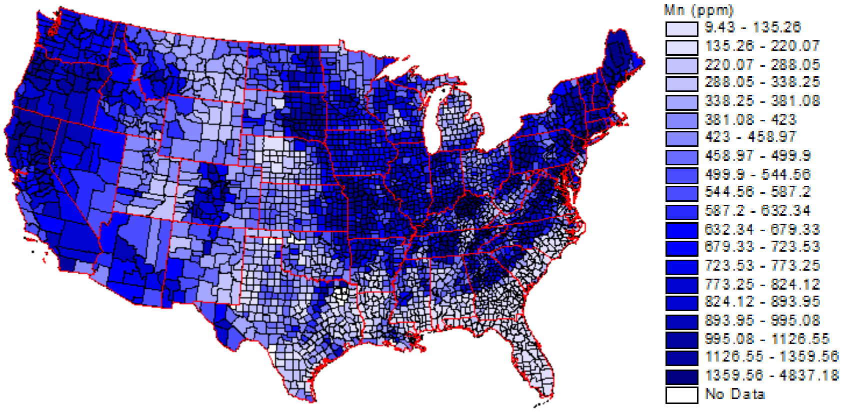
Lead is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

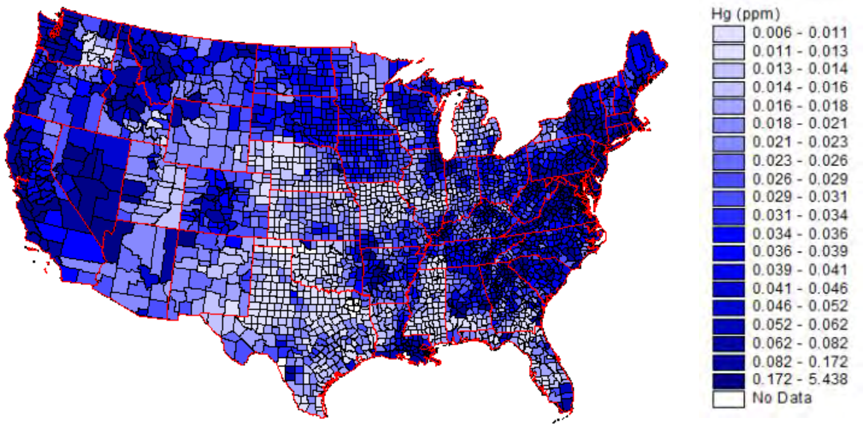
Figure A-5

Manganese is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

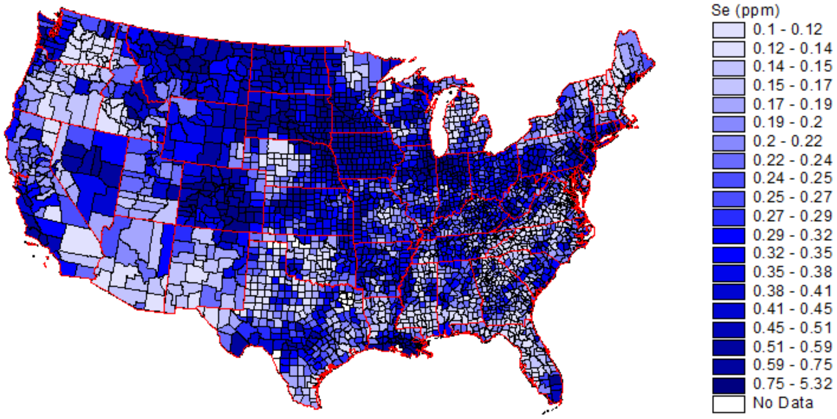
Mercury is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

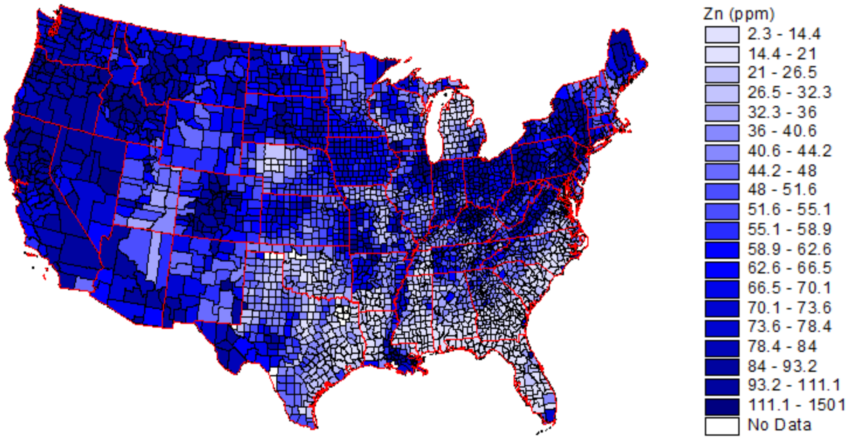
Figure A-6

Selenium is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

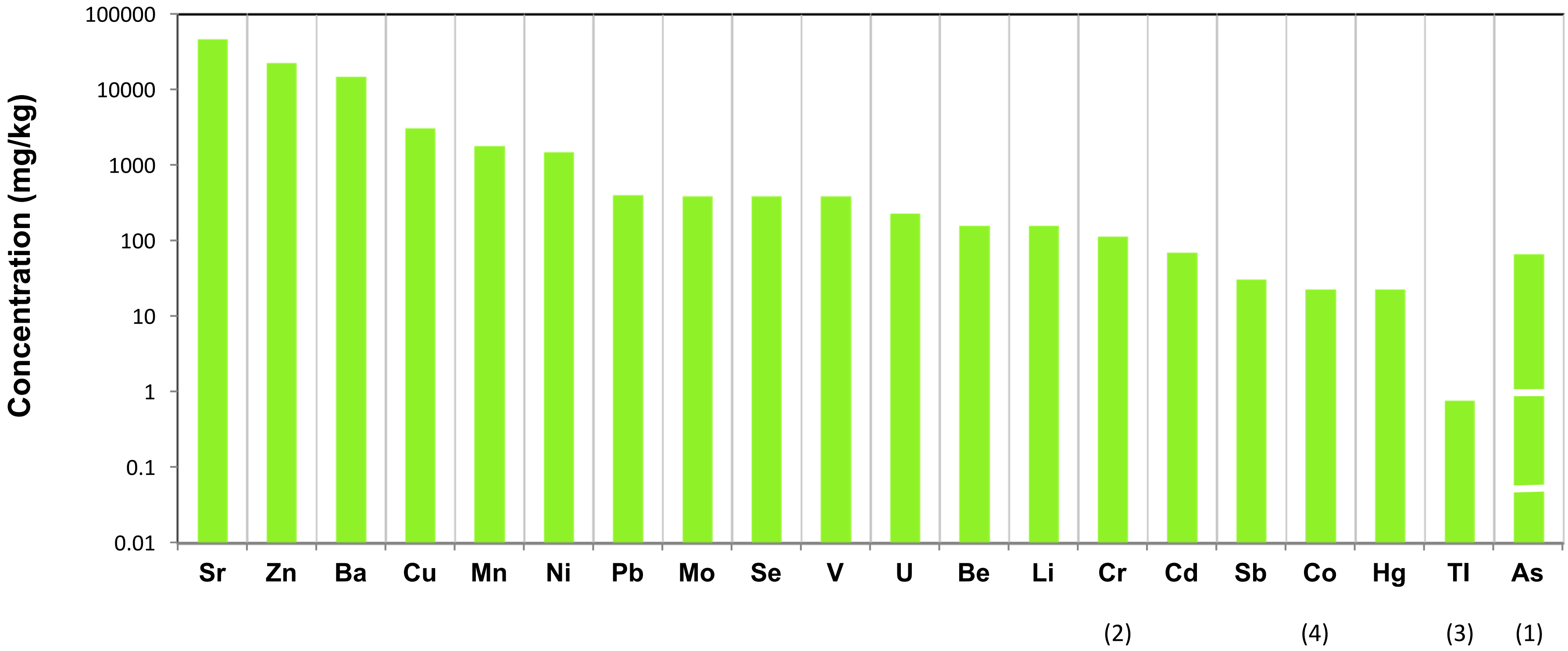
Zinc is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-7

USEPA Regional Screening Levels for Residential Soils - Coal Ash Constituents



🟩 Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2014)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:

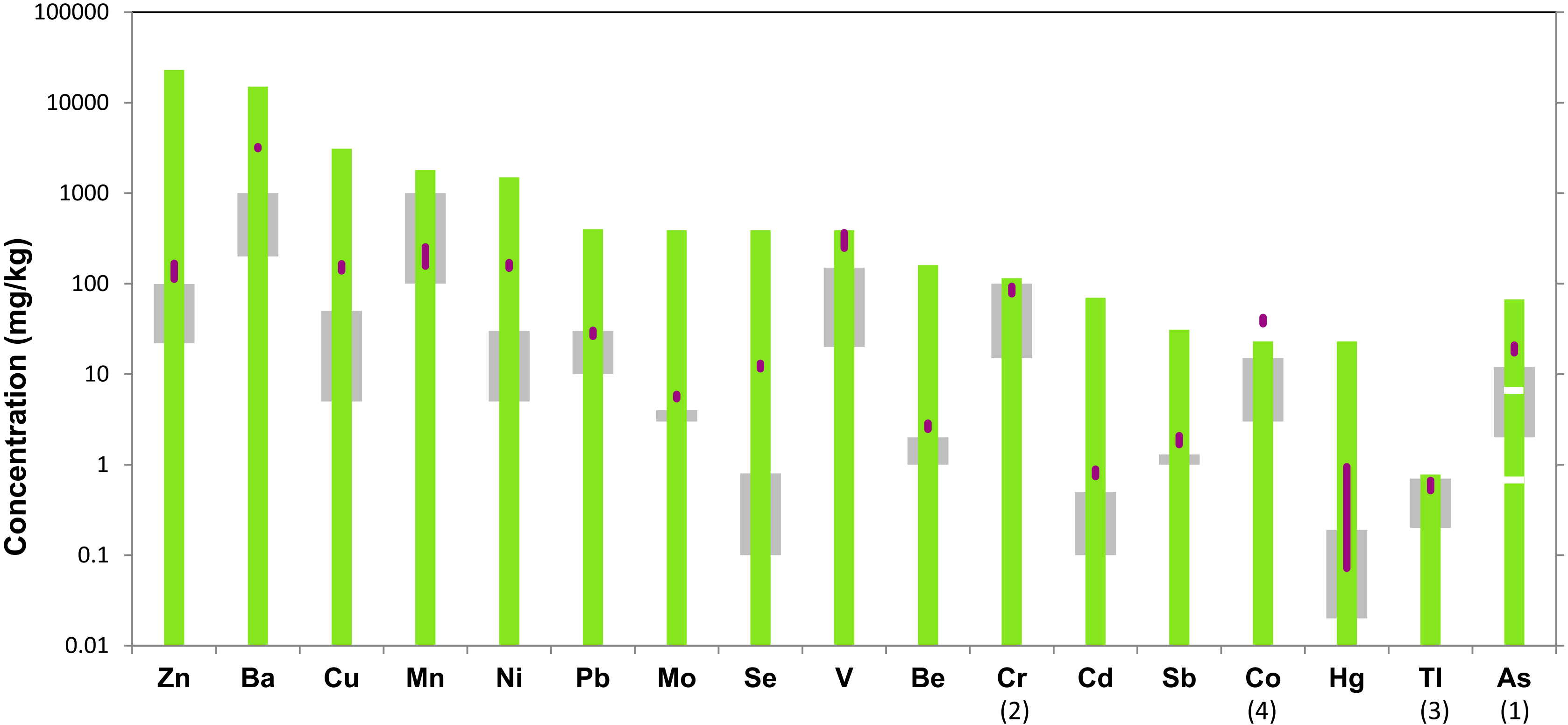
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.

(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.

(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]

(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

Figure A-8 **Comparison of 10th and 90th percentile USGS Database Constituent Concentrations in Fly Ash from the Wyoming Coal Power Plant and Background Levels in US Soils to the USEPA Regional Screening Levels for Residential Soils**



▬ Soil - EPRI, 2010. Report No.1020556. Available for download at www.epri.com.

🟩 USEPA Regional Screening Level (RSL) - Residential Soil (May 2014)

http://www.epa.gov/region9/superfund//prg/index.html

▬ Concentration Range (10th - 90th Percentile) in Wyoming Fly Ash; USGS, 2011.

http://pubs.usgs.gov/ds/635/

Notes:
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar).
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.
(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]
(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

ATTACHMENT B

Meramec Energy Center Dilution Factor Calculations

Golder Associates

CALCULATIONS

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Meramec Energy Center Dilution Factor Calculations - Mississippi River **Reviewed by:** M.Haddock

1.0 Introduction

The Mississippi River is a large, flowing water body and daily flow at the Meramec Energy Center (MEC) is estimated to range between 36 and 538 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 131.000 gallons or 0.0004%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low River Conditions

Date	St. Louis Gauge Height	St. Louis Gauge Elevation	Mississippi River Elevation at St. Louis Gauge	Chester Gauge Height	Chester Gauge Elevation	Mississippi River Elevation at Chester Gauge
Units	ft above gauge	ft MSL	ft MSL	ft above gauge	ft MSL	ft MSL
1/1/2013 12:00	-4.55	379.58	375.03	-1.12	341.05	339.93
1/2/2013 19:00	-4.35	379.58	375.23	-1.28	341.05	339.77

Notes:
1) ft - feet
2) ft MSL - feet above mean sea level
3) Information and Data for the St. Louis gauge available at https://waterdata.usgs.gov/usa/nwis/uv?07010000.
4) Information and Data for the Chester gauge available at https://waterdata.usgs.gov/nwis/uv?site_no=07020500.

Mississippi River Elevation at St. Louis Gauge	Mississippi River Elevation at Chester Gauge	Distance Between St. Louis and Chester Gauges	Calculated Mississippi River Gradient	Distance from St. Louis Gauge to MEC	Estimated Mississippi River Elevation at MEC
ft MSL	ft MSL	River Miles	foot/foot	River Miles	ft MSL
375.03	339.93	70.1	0.00009	18.5	366

Notes
1) Estimated Mississippi River Elevation at the MEC calculated by subtracting the gradient of the Mississippi River multiplied distance from the St. Louis gauge (in river feet) from the St. Louis gauge.

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Meramec Energy Center Dilution Factor Calculations - Mississippi River **Reviewed by:** M.Haddock

1.2 Aquifer Discharge Length and Area

Description	Value	Units
Estimated length of discharge zone	4,400	feet
Estimated top of discharge zone (1Q10 river level)	366	feet above mean sea level
Estimated bottom of discharge zone (Bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (Top - Bottom)	56	feet
Estimated area of discharge zone (length x thickness)	246,400	feet^2

1.3 Groundwater Properties

Description	Symbol	Value	Units
Average Hydraulic Conductivity (includes MW-6, MW-7, MW-8	K	31	feet/day
Average Groundwater Gradient (from GMP)	I	0.0023	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.2	feet/day

1.4 Groundwater Discharge

Description	*Symbol*	Value	Units
Average linear groundwater velocity	*V*	0.2	feet/day
Estimated Discharge zone area	*A*	246,400	feet^2
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	17,568	feet^3/day

1.5 Mississippi River Flow

Description	*Value*	Units
Estimated low Mississippi River Conditions (1/1/2013)	366	feet MSL
Corresponding STL Discharge (1/1/2013)	56,400	feet^3/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	4,872,960,000	feet^3/day

Date: February 8, 2018		**Made by:**	J. Ingram
Project No.: 130-1560		**Checked by:**	E. Kidner
Subject: Meramec Energy Center Dilution Factor Calculations - Mississippi River		**Reviewed by:**	M.Haddock

1.5 Dilution Factor

Description	Values	Units
Estimated Daily Groundwater Discharge	17,568	feet^3/day
Estimated Daily Groundwater Discharge	131,420	gallons/day
Estimated Daily River Flow	4,872,960,000	feet^3/day
Estimated Daily River Flow	36,452,274,739	gallons/day
Estimated Dilution Factor (River / GW)	**277,372 or >100,000**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates under low flow river conditions. As an example, low flow values used for Meramec are from January 1, 2013 which is the lowest value since 1989 and the 9th lowest in recorded history at the St. Louis Mississippi River gauge. Using river flow averages would greatly increase the dilution by an order of magnitude. Mississippi River data is available at http://water.weather.gov/ahps2/hydrograph.php?wfo=lsx&gage=EADM7.

2) To simplify the calculations, the alluvial aquifer was assumed to consist of higher permeability sands, resulting in conservative (higher) estimates of groundwater discharge.

3) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage. In addition, on a near continuous basis, groundwater flows from the bedrock aquifer into the shallow alluvial aquifer. All of these sources increase dilution within the alluvial aquifer.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.

Golder Associates

CALCULATIONS

Date: February 8, 2018 | **Made by:** J. Ingram

Project No.: 130-1560 | **Checked by:** E. Kidner

Subject: Meramec Energy Center Dilution Factor Calculations - Meramec River | **Reviewed by:** M. Haddock

1.0 Introduction

The Meramec River is a large, flowing water body and daily flow at the Meramec Energy Center (MEC) is estimated to range between 171 million and 103 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 231,000 gallons or 0.13%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low River Conditions

Date	Arnold Gauge Height	Arnold Gauge Elevation	Meramec River Elevation at Arnold Gauge	Valley Park Gauge Height	Valley Park Gauge Elevation	Meramec River Elevation at Valley Park Gauge
Units	**ft above gauge**	**ft MSL**	**ft MSL**	**ft above gauge**	**ft MSL**	**ft MSL**
7/28/2012 21:00	5.47	373.21	378.68	-3.88	391.22	387.34

Notes:
1) ft - feet
2) ft MSL - feet above mean sea level
3) Information and Data for the Arnold gauge available at https://waterdata.usgs.gov/nwis/uv?site_no=07019300,
4) Information and Data for the Valley Park gauge available at https://waterdata.usgs.gov/nwis/uv?site_no=07019130,

Meramec River Elevation at Arnold Gauge	Meramec River Elevation at Valley Park Gauge	Distance Between Arnold and Valley Park Gauges	Calculated Meramec River Gradient	Distance from Arnold Gauge to MEC	Estimated Meramec River Elevation at MEC
ft MSL	**ft MSL**	**River Miles**	**foot/foot**	**River Miles**	**ft MSL**
378.68	387.34	15.5	0.00011	5.6	376

Notes
1) Estimated Meramec River Elevation at the MEC calculated by subtracting the gradient of the Meramec River multiplied distance from the Arnold gauge (in river feet) from the Arnold gauge.

1.2 Alluvial Aquifer Geological Properties

Description	Value	Units
Estimated length of discharge zone	6,200	feet
Estimated top of discharge zone (low river level)	376	feet above mean sea level
Estimated bottom of discharge zone (Bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (Top - Bottom)	66	feet
Estimated area of discharge zone (length x thickness)	409,200	$feet^2$
Estimated percentage of discharge area that consists of channel deposits (mostly sands and gravels)	34	%
Estimated percentage of discharge area that consists of floodplain deposits (mostly Silty Clay, Silt or Clay)	66	%
Estimated channel deposits discharge area	139,128	$feet^2$
Estimated floodplain deposits discharge area	270,072	$feet^2$

1.3 Groundwater Properties

Description	Symbol	Value	Units
Channel Deposits (Sand, Silty Sand, Gravel)			
Average Hydraulic Conductivity (includes MW-3, MW-4, and MW-5)	K	96	feet/day
Average Groundwater Gradient (from GMP)	I	0.0023	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.6	feet/day
Floodplain Deposits (Silt, Clay, Sitly Clay)			
Estimated Average Hydraulic Conductivity (inorganic silts, Geotechdata.info (see below))	K	0.284	feet/day
Average Groundwater Gradient (from GMP)	I	0.0023	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.002	feet/day

Hydraulic Conductivity for floodplain deposits based on data for inorganic silts, silty or clayey fine sands, with slight plasticity available at http://www.geotechdata.info/parameter/permeability.html.

1.4 Groundwater Discharge

Description	*Symbol*	Value	Units
Channel Deposits (Sand, Silty Sand, Gravel)			
Average linear groundwater velocity	*V*	0.6	feet/day
Estimated Discharge zone area	*A*	139,128	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	30,719	$feet^3$/day
Floodplain Deposits (Silt, Clay, Sitly Clay)			
Average linear groundwater velocity	*V*	0.002	feet/day
Estimated Discharge zone area	*A*	270,072	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	176	$feet^3$/day

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Meramec Energy Center Dilution Factor Calculations - Meramec River **Reviewed by:** M. Haddock

1.4 Meramec River Flow

Description	***Value***	**Units**
Estimated low Meramec River Conditions (7/28/2012)	376	feet MSL
Corresponding Discharge for Eureka Gauge (7/28/2012)	265	feet^3/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	22,896,000	feet^3/day

Nearest upstream gauge with discharge data is the Eureka gauge. No discharge data is available for the Arnold, Fenton, or Valley Park gauges. Information and data for the Eureka gauge is available at https://waterdata.usgs.gov/nwis/uv?site_no=07019000.

1.5 Dilution Factor

Description	**Values**	**Units**
Estimated Daily Channel Deposit Groundwater Discharge	30,719	feet^3/day
Estimated Daily Floodplain Deposit Groundwater Discharge	176	feet^3/day
Estimated Daily Groundwater Discharge	30,896	feet^3/day
Estimated Daily Groundwater Discharge	231,117	gallons/day
Estimated Daily River Flow	22,896,000	feet^3/day
Estimated Daily River Flow	171,273,986	gallons/day
Estimated Dilution Factor (River / GW)	**741 or >700**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates under low flow river conditions. As an example, low flow values used for Meramec are from July 28, 2012 which is the lowest value since 2001 at the Meramec Arnold Gauge. Using river flow averages would greatly increase the dilution by an order of magnitude. Meramec River data is available at http://water.weather.gov/ahps2/hydrograph.php?gage=arnm7&wfo=lsx.
2) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage. In addition, on a near continuous basis, groundwater flows from the bedrock aquifer into the shallow alluvial aquifer. All of these sources increase dilution within the alluvial aquifer.
3) The nearest Meramec River gauge with discharge values for July 28, 2012 is the Eureka gauge, which is located approximately 34 river miles upstream. The discharge as the river flows downstream is greater as it approaches the Mississippi River. Additionally, under low Meramec conditions, the Mississippi River can also flow upstream, causing additional dilution of the area near the MEC, which was not accounted for in the calculation.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.

Attachment 9

Groundwater Monitoring Plan

REPORT

40 CFR PART 257 GROUNDWATER MONITORING PLAN

Meramec Energy Center

St. Louis County, Missouri, USA

Submitted To: Ameren Missouri
1901 Chouteau Avenue
St. Louis, Missouri 63103

Submitted By: Golder Associates Inc.
820 S. Main Street, Suite 100
St. Charles, MO 63301 USA

Distribution:		
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Date: October 16, 2017

Project No.153-1406

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1.0 INTRODUCTION

This Groundwater Monitoring Plan (GMP) presents information on the design of the groundwater monitoring system, groundwater sampling and analysis procedures, and groundwater statistical analysis methods for Ameren Missouri's (Ameren) Meramec Energy Center (Facility) in St. Louis County, Missouri (see location on **Figure 1**). The Meramec Energy Center currently manages and has historically managed Coal Combustion Residuals (CCR) generated from the facility at a number of surface impoundments. The surface impoundments onsite consist of:

- Active Surface Impoundments
  - Surface Impoundment 492 (MCPA), approximately 6 acres
  - Surface Impoundment 493 (MCPB), approximately 6 acres
  - Surface Impoundment 496 (MCPC), approximately 10 acres
  - Surface Impoundment 498 (MCPD), approximately 17 acres
  - Surface Impoundment 489 (MCPE), approximately 24 acres
- Excluded Surface Impoundments
  - Surface Impoundment 490 (MOPF), approximately 23 acres
  - Surface Impoundment 491 (MOPG), approximately 12 acres
  - Surface Impoundment 494 (MOPH), approximately 31 acres
  - Surface Impoundment 495 (MOPI), approximately 16 acres

According to the CCR Rule, all of the Meramec Surface Impoundments are unlined. However, Surface Impoundments 489 and 498 do have a liner in place. Since all the surface impoundments lie very close to one another and dividing berms were constructed with locally derived alluvial material and Coal Combustion Residuals (CCR), the monitoring network design monitors the Meramec Surface Impoundments as one multi-unit system.

This GMP was developed to meet the requirements of United States Environmental Protection Agency (USEPA) 40 CFR Part 257 "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule" (the CCR Rule). The CCR Rule requires owners or operators of an existing CCR Surface Impoundment to install a groundwater monitoring system and develop a sampling and analysis program (§§ 257.90 - 257.94). Ameren Missouri has determined that the CCR Surface Impoundments at the Meramec Energy Center are subject to the requirements of the CCR Rule. For this GMP, the Meramec Energy Center generating plant is referred to as the MEC and the MEC and its surrounding facilities, including the Meramec Surface Impoundment, are referred to as the Facility or Site.

2.0 SITE SETTING

Ameren owns and operates the Facility in St. Louis County, Missouri located approximately 18 miles southwest of downtown St. Louis. **Figure 1** depicts the location of the Facility and property boundaries referenced to local topographic features, the Mississippi River, and the Meramec River. **Figure 2** depicts Facility structures relative to site property boundaries and the two adjoining rivers. The Facility property encompasses approximately 480 acres and is primarily located in the topographically low area north of the confluence of the Mississippi and Meramec Rivers. The property is bounded to the northeast by wooded and partially developed land, to the southeast by the Mississippi River, to the southwest and west by the Meramec River and to the northwest by wooded and partially developed land.

The Facility is located in a topographically low area in a valley at the confluence of the Meramec and Mississippi Rivers, with a surface elevation of approximately 420 feet above mean sea level (MSL) at the plant area. Topographically higher terrain is located west of the Meramec River Valley. The terrain to the east of the Facility consists of topographically higher terrain, at elevations generally ranging from 450 MSL feet to as high as 550 feet MSL, as shown on **Figure 2** and **Appendix A**.

2.1 Coal Combustion Residuals (CCR) Surface Impoundments

The Facility includes a coal fired power plant as well as five (5) currently active CCR surface impoundments that are used for CCR management. Historically, CCR has also been stored in four (4) additional surface impoundments, which are no longer ponded and are excluded from the CCR Rule groundwater monitoring requirements. A list of the Meramec Surface Impoundments is provided above in Section 1.0.

The present Site grade is as much as 20 feet above the original ground surface. As part of the MEC plant construction project, the original grade of the plant was increased by using fill material. The ash ponds were reportedly made by excavating on-Site material silts and clays and using the materials as construction fill beneath the plant as well as for surface impoundment berms (CH2MHILL, 1997). Reportedly, the Meramec Surface Impoundments were excavated approximately 10-20 feet below the original grade and then were used to contain the CCR. Therefore, present day ash thickness is reported to be typically 20 to 30 feet below the present Site grade, which is considered to be nominally at approximately 420 feet MSL (CH2MHILL, 1997). Based on this information, the generalized elevation of the base of the coal ash is estimated to be approximately 390 feet MSL. A cross section drawn through Ash Ponds 489 and 491 indicate the elevation of the base of ash is 390 feet MSL and 395 feet, respectively (CH2MHILL 1997, **Appendix B**).

CCR thickness was directly measured at three locations in Surface Impoundment 494 to be at least 26.5 feet thick (Golder, 2008) and at an elevation as low as approximately 387 feet MSL. CCR thickness was measured at two locations in Surface Impoundment 489 (Woodward-Clyde Consultants, 1988). The bottom of ash elevations were estimated to be 387.3 and 389.1 feet MSL.

While according to the CCR Rule all of the Meramec Surface Impoundments are treated as unlined units, Surface Impoundment 498 has a geomembrane liner with a base elevation of approximately 395 feet MSL (Ameren drawing SK-005-R2, 2011) and Surface Impoundment 489 is lined with a geomembrane with a base at an elevation of approximately 408 feet MSL (Ameren drawing 8020-X-135358, 1994). See **Appendix B** for referenced drawings.

2.2 Geology

2.2.1 Physiographic Setting and Regional Geology

The Facility is located in the extreme southeastern corner of the Central Lowland Physiographic Province and the Dissected Till Plains (Miller et al., 1974). However, the Facility lies between two major river systems near their confluence and within the floodplain of the Mississippi and Meramec Rivers in an area that contains alluvial river deposits. Therefore, the local site landforms are characterized by alluvial flood plain landforms.

2.2.2 Local Geology

The geology immediately surrounding the Facility is comprised of two distinctly different geological terrains; (1) floodplain deposits of the Mississippi and Meramec River Valleys and (2) older sedimentary bedrock formations. Most of the Facility, including all of the plant infrastructure and the Meramec Surface Impoundments lie within these floodplain deposits. The river valley area is comprised of floodplain and alluvial deposits that are the result of the water flow and deposition of the Mississippi and Meramec Rivers.

Based on previous investigations, the alluvial materials on the east side of the Facility tend to have more clayey silts, silty clays, and fine sands (CH2MHILL, 1997). Alluvial materials to the west, closer to the Meramec River, include coarser materials, including fine- to medium-grained sand with clay, silt, and some gravels (CH2MHILL, 1997). The depth of the alluvial deposits near the MEC range from approximately 105 to 120 feet below ground surface (bgs) and become shallower towards the bluffs to the northeast.

Shannon and Wilson (1979) completed a geotechnical investigation in the area directly around the MEC. 16 geotechnical borings were completed as a part of this investigation. Based on borings and cross sections from this report, the local geology directly adjacent to the MEC is as follows:

- Approximately 420-410 feet MSL – Fill Materials
- Approximately 410-375 feet MSL – Clays, Clayey Silts, and Silty Clays
- Approximately 375-340 feet MSL – Silts, Sandy Silts, Silty Sands, and Sands that thicken to the southeast towards the Mississippi River
- Approximately 340-320 feet MSL – Clays and Silty Clays
- Approximately 320-310 feet MSL – Intermittent Sands, Gravels, and Clayey Gravels
- Approximately 310 feet MSL and below – Limestone and Shale Bedrock

Drilling completed as a part of installation of the monitoring well network used for this GMP show similar results to previous studies. Borings located to the southwest of the MEC (MW-5, MW-6 and MW-7) encounter poorly and well graded sands that are likely associated with past meanders of the adjacent Mississippi and Meramec Rivers. The sand in these wells becomes more prevalent at locations closer to the Mississippi River to the south/southeast. Drilling completed further from the Mississippi River to the northwest consisted of more fine-grained materials such as silts, clays and silty clays with occasional sandy/gravelly lens deposits. These deposits are typical for low energy floodplain deposits with occasional sandy/gravel units from historical Meramec River channel meanders.

Bedrock beneath the Facility consists of the Warsaw Formation, of the Mississippian aged Meramecian Series and consists of shales and fine-grained shaley limestone (CH2MHILL, 1997). The bluff area on the east side of the Facility consists of the Salem Formation at lower elevations and St. Louis Limestone at higher elevations (Middendorf and Brill, 2002).

2.3 Site Hydrogeology

Site hydrogelogy has been characterized based on data collected during several different investigations. In 1988, five (5) monitoring wells were installed around the MEC by Woodward-Clyde Consultants (Woodward-Clyde). A map of the monitoring wells is provided in **Appendix C**. Observations from these five groundwater monitoring wells is summarized below. CH2MHill (1997) also completed a hydrogeological assessment using the monitoring wells installed by Woodward Clyde.

Golder (2008) installed five (5) piezometers both in and directly adjacent to Surface Impoundment 494. This effort provides information on the depth of ash in the Meramec Surface Impoundments, geotechnical data of the soil in and around the Meramec Surface Impoundments, and water level information in and around the Meramec Surface Impoundments.

Golder also installed ten (10) monitoring wells and borings as a part of the installation of the CCR monitoring well network used for CCR monitoring. **Appendix A** provides cross section depictions of the subsurface geology. Boring logs and monitoring well construction diagrams are provided in **Appendix D** and **Appendix E**.

2.3.1 Uppermost Aquifer

The CCR Rule requires that a groundwater monitoring system be completed in the uppermost aquifer around each Active CCR Surface Impoundment (§257.91(a)). As shown on **Appendix A**, the uppermost aquifer is the alluvial silt, sand and gravel deposits associated with the Meramec and Mississippi River Valley alluvium (CH2MHILL, 1997; Shannon & Wilson, 1979; **Appendix C**). These channel deposits are intermixed with a wide variety of clay/silty clay floodplain deposits and, therefore, can appear at varying depths. However, sandy/gravelly units were encountered at many locations at approximately 360-370 feet MSL, likely deposited from a historic meander of the Meramec River. These alluvial deposits overlie Mississippian-age limestone and shale of the Meramecian Series. The depth of the alluvial aquifer typically ranges from approximately 105 to 120 feet bgs (approximately 255 to 331 feet MSL), but thins to the east toward the bluff (CH2MHILL, 1997), where it is not present at higher elevations above the floodplain.

2.3.2 Surface Water and Groundwater Elevations

2.3.2.1 CCR Surface Impoundment Water

Meramec pond gauge measurements were provided by Ameren for Surface Impoundments 498, 492, 493, and 496. These measurements were obtained during a similar timeframe as the groundwater measurements from each of the 8 initial background sampling events (baseline events). During this time, Surface Impoundment 498 had a pond level ranging from approximately 417 to 418 feet MSL. This pond has a liner system in place and does not connect with the underlying aquifer or surrounding surface impoundments. The pond level in Surface Impoundments 492, 493, and 496 ranged between approximately 408 and 412 feet MSL. These Surface Impoundments ranged between 9 to 30 feet above the natural groundwater elevations in the surrounding aquifer. The difference between the pond level and the natural groundwater elevation is greatest when the Mississippi River level is low. Data show water mounding within the Meramec Surface Impoundments without a liner regardless of the river level; however, the mounding is less pronounced at times of high river level.

2.3.2.2 Alluvial Aquifer

Groundwater elevations within the alluvial aquifer in the Facility area have been obtained in several different studies. Historical groundwater measurements come from five (5) monitoring wells installed in 1988 by Woodward-Clyde and then re-analyzed in 1997 by CH2MHILL. Three of the monitoring wells (B-4, B-5, and B-6) were installed with total depths ranging from 90 and 101 feet bgs. These three (3) monitoring wells were located near Surface Impoundment 489 at the southwest corner of the Facility, near the Meramec River. Groundwater elevations in the downgradient monitoring wells near Surface Impoundment 489 ranged between approximately 377 and 385 feet MSL and were similar to the concurrent Mississippi River level. Monitoring wells B-1 and B-2 were installed on the east (upgradient) side of the Facility with total depths ranging from 41 to 56 feet bgs. Groundwater elevations in these monitoring wells ranged from approximately 403 to 415 feet MSL and were typically 20 to 30 feet higher in elevation than the Mississippi River. Additionally, one monitoring well (B-7) was installed into the coal ash to a total depth of 389 feet MSL and was dry in all readings (Woodward-Clyde Consultants, 1988). Results from these groundwater elevation measurements are provided in **Appendix C**.

Golder obtained groundwater elevation measurements from March 2016 through June 2017 within the alluvial aquifer for the CCR monitoring wells. For each of the 8 baseline sampling events, groundwater elevations were measured at monitoring wells within a 24-hour timeframe and a potentiometric map was generated from these data (**Appendix F and Table 1)**. Groundwater elevations ranged from approximately 380 to 400 feet MSL throughout the baseline sampling events except at MW-1, which ranged from approximately 400 to 404 feet MSL.

2.3.3 Groundwater Flow Directions

Groundwater flow within the alluvial aquifer is dynamic and is influenced by seasonal changes in the water level in the adjacent Mississippi and Meramec Rivers. River water levels measured at the Facility display large seasonal changes in the elevation of the Mississippi River water surface. For example, from January 2010 to April 2017, river water levels fluctuated between approximately 365 to 413 feet MSL. Water flows into and out of the alluvial aquifer as a result of fluctuating river water levels that produce "bank recharge" and "bank discharge" conditions. Under normal aquifer conditions, groundwater flow in the alluvial aquifer would be expected to have a flow direction component toward the Mississippi and Meramec Rivers, with a net flow direction generally to the southwest.

Although the movement of groundwater within the alluvial aquifer at the Facility is complex, the movement has been characterized by groundwater elevation measurements and the generation of potentiometric surface maps generated by Woodward-Clyde and Golder (**Appendix C, Appendix F, and Table 1**). The potentiometric surface maps display minor variability in the groundwater flow direction. These changes in flow direction are related to the level within the adjacent Mississippi and Meramec Rivers.

Groundwater flow direction and hydraulic gradient were estimated for the CCR wells using the EPA's On-line Tool for Site Assessment (USEPA, 2016). Estimated results from this analysis using groundwater elevations within the CCR monitoring wells are provided in **Table 2**. These results indicate that while groundwater flow direction is somewhat variable, overall net groundwater flow during the baseline sampling period was generally toward the west/southwest, flowing from the bluffs toward the rivers.

Based on the potentiometric surface maps and groundwater calculations, a general flow direction from the northeast (bluffs) to the southwest (Mississippi and Meramec Rivers) under normal river conditions is expected. However, during periods of high river levels, groundwater flow can temporarily reverse in localized areas. During these times of high river stage and temporary flow direction changes, horizontal groundwater gradients generally decrease and little net movement of groundwater to the north and east occurs.

Horizontal and vertical groundwater flow within the uppermost aquifer has been locally influenced by operation of the Meramec Surface Impoundments. Ponding of water in the Meramec Surface Impoundments that do not have a liner in place at elevations greater than the static water levels in the underlying alluvial aquifer groundwater creates a localized mounding effect, resulting in localized downward gradients and localized radial groundwater flow downward and outward from these impoundments.

2.3.3.1 Horizontal Gradients

Horizontal groundwater gradients in the alluvial aquifer are very dependent on river water levels (bank recharge and bank discharge conditions described earlier). Site wide horizontal gradients were calculated for each of the CCR groundwater baseline sampling events and the results of these are displayed on **Table 2**. The horizontal groundwater gradients range from 0.001 to 0.003 feet/foot.

2.3.3.2 Vertical Gradients

A review of downward gradients that exist on site was completed by comparing groundwater elevations in the CCR monitoring wells to the Meramec Surface Impoundment pond gauges. On average, the groundwater elevation of the active ponds that do not have a liner (492, 493, and 496) is approximately 9 to 30 feet higher than the alluvial groundwater zone. However, this downward gradient also changes seasonally based on river levels. During high river level conditions, the difference in groundwater elevation between the surface impoundments and the alluvial groundwater zone is the smallest.

2.3.4 Hydraulic Conductivities

Golder performed in-situ rising head hydraulic conductivity tests on the 10 newly installed CCR monitoring wells used to monitor the Meramec Surface Impoundments in order to estimate the hydraulic conductivities. The tests were conducted using a pneumatic slug (Hi-K slug) and a downhole pressure transducer. The results of Golder's hydraulic conductivity testing estimated an average hydraulic conductivity of approximately 2.3 x 10^{-2} centimeters per second (cm/sec) and a geometric mean of 1.4 x 10 of $^{-2}$ cm/sec. Golder's findings for hydraulic conductivity values are summarized below in **Table 3** provided below in the text.

Estimated groundwater flow velocities were calculated using the CCR monitoring well hydraulic conductivity, hydraulic gradients and an estimated value for effective porosity (**Table 2**). Using these values, flow velocities are estimated to range between 0.13 and 0.34 feet per day, and approximately 87 feet per year.

Table 3: CCR Monitoring Well Hydraulic Conductivities

Well ID	Total Depth (feet BTOC)	Well Screen Interval (feet BTOC)	Well Screen interval (feet MSL)	Estimated Hydraulic Conductivity (feet/day)	Estimated Hydraulic Conductivity (cm/sec)
MW-1	41.4	36.2 - 41.0	365.4 - 370.2	85	3.00E-02
MW-2	36.8	31.6 - 36.4	362.2 - 367.0	92	3.26E-02
MW-3	33.1	27.9 - 32.7	364.4 - 369.2	185	6.52E-02
MW-4	45.2	40.0 - 44.8	359.3 - 364.1	46	1.63E-02
MW-5	62.7	52.5 - 62.3	340.6 - 350.4	56	1.98E-02
MW-6	54.9	44.7 - 54.5	363.6 - 373.4	37	1.32E-02
MW-7	54.9	44.7 - 54.5	363.4 - 373.2	49	1.74E-02
MW-8	77.8	67.6 - 77.4	346.0 - 355.8	5	1.89E-03
BMW-1	62.89	52.7 - 62.5	356.6 - 366.4	3	9.91E-04
BMW-2	44.9	39.7 - 44.5	364.5 - 369.3	106	3.75E-02

Notes:

1. feet BTOC – feet below top of casing ft BGS - feet below ground surface.
2. feet MSL - feet above mean sea level.
3. cm/sec - centimeters per second.
4. Slug tests were completed by Golder Associates using a Pneumatic Hi-K Slug®.

2.3.5 Porosity and Effective Porosity

Porosities were estimated based on the grain size distributions of aquifer soil samples collected during monitoring well drilling. Representative grain size distributions were collected from the screened intervals at MW-6 and MW-8 using the ASTM D6912 Method B and the results are provided in **Appendix G**. MW-6 represents monitoring wells that were located closer to the Mississippi River and had more sandy environments, whereas MW-8 represents wells that contained gravel/silty sand environments that were further from the Mississippi and are historical Meramec River channels. The results indicate that the screened intervals of the alluvial aquifer near the Mississippi River are mostly comprised of sand (at least 90%) with lesser amounts of gravel, silt and clay. Also, the typical grain size of the sand ranges from fine to medium sand. Textbook values of porosities for sands and sand/gravel mixes range from 25-50% (Fetter, 2000 and Freeze and Cherry, 1979) and fine sands typically range from 29-46%, whereas coarse sands typically range from 26-43% (Das, 2008). An average porosity of 35% is estimated for the alluvial aquifer based on the Site data.

Effective porosity is the porosity that is available for fluid flow. Studies completed in unconsolidated sediments have determined that water molecules pass through all pores and the effective porosity is approximately equal to the total porosity (Fetter, 2000). Therefore, the effective porosity of the alluvial aquifer is also estimated to be 35%.

3.0 GROUNDWATER MONITORING NETWORK

3.1 Monitoring Network Design Criteria

§257.91 of the CCR Rule sets out the requirements for development of a groundwater monitoring system for both new and existing CCR landfills and surface impoundments. The performance standard in the CCR Rule (§257.91(a)) states that the groundwater monitoring system must consist of a sufficient number of wells at appropriate locations to yield groundwater samples in the uppermost aquifer that accurately represent:

- The quality of background groundwater
- The quality of groundwater passing the waste boundary of the CCR unit

3.2 Design of the Groundwater Monitoring System

The detection monitoring well network for the Facility is depicted on **Figure 2**. The network consists of 10 monitoring wells screened in the uppermost aquifer for the purpose of monitoring the Meramec Surface Impoundments. The monitoring well network includes two (2) background groundwater monitoring wells (BMW-1 and BMW-2) that are located on the bluff side of the facility in areas upgradient and unaffected by CCR disposal. BMW-1 is located near the bluffs on the southeastern portion of the site and BMW-2 is located near the bluffs on the northeastern portion of the site. Eight (8) of the groundwater monitoring wells are placed ringing the Meramec Surface Impoundments and are downgradient wells. The groundwater monitoring well locations were selected based on site-specific technical information presented in Section 2.0 of this document, as well as the preferential migration pathway analysis below.

3.2.1 Preferential Migration Pathway Analysis

As discussed in Section 2.3, the movement of constituents in water from the ash within the Meramec Surface Impoundments will be downward and predominately in the downgradient direction toward the Meramec and Mississippi Rivers. Groundwater elevations are higher to the east and lower to the west/south, and fluctuate with river stages. CCR is known to be at least 28 feet thick, placing it at an approximate base elevation of 385 to 390 feet MSL. Groundwater levels onsite in downgradient wells typically range from 380 to 385 feet MSL under normal river conditions and can be as high as 395 feet MSL or higher during high river conditions. Upgradient wells range from 390 to 400 feet MSL. The potential exists for constituents to migrate from the Meramec Surface Impoundments into the alluvial aquifer from depths ranging from the water table surface down to the lowest depth of CCR, followed by lateral movement in the direction of groundwater flow. Geologically, the preferential pathway for groundwater is through zones with the highest conductivity and flow. The highest conductivity layers on-site are those comprised of coarse-grained particles such as sand, gravel and silty sands. Groundwater in these units will have higher dispersivity.

In order to place monitoring well screens within the migration pathway from the unit and to consistently have water for sampling, monitoring wells were installed with screen intervals below the seasonal groundwater lows and placed with screening levels that intercept water from the units with the greatest hydraulic conductivity and flow. The system of monitoring wells ringing the Meramec Surface Impoundments are screened in the uppermost unit and monitor groundwater quality passing the waste boundary.

3.3 Groundwater Monitoring Well Placement

3.3.1 Background/Upgradient Monitoring Well Locations

As described above, the flow of groundwater in the alluvial aquifer is generally from the bluff area located northeast of the site toward the Mississippi and Meramec Rivers to the south and west, however, alluvial aquifer flow is locally influenced by water levels in the active surface impoundments without a liner (492, 493, and 496) and the Mississippi and Meramec River levels. The CCR Rule (§257.91(a)(1)) requires that background groundwater samples from the uppermost aquifer *"Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit."*

As shown in **Figure 2**, the background monitoring wells BMW-1 and BMW-2 are located close to the bluff on the eastern side of the Facility. BMW-1 is located to the southeast of the Meramec Surface Impoundments and BMW-2 is located to the northeast of the Meramec Surface Impoundments. These wells provide background groundwater quality representative of upgradient groundwater that will pass through the Meramec Surface Impoundments.

3.3.2 Downgradient Monitoring Well Locations

As discussed above, downgradient monitoring wells are located ringing the Meramec Surface Impoundments to monitor potential migration pathways. **Figure 2** shows that the downgradient well network consists of eight (8) groundwater monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, and MW-8) around the Meramec Surface Impoundments at locations that are located as close to the waste boundary as practical.

3.3.3 Groundwater Monitoring Well Screen Intervals

The system of monitoring wells ringing the Meramec Surface Impoundments are screened in the alluvial aquifer zone near the base elevation of the CCR. Details on the construction of the groundwater monitoring wells are provided in **Table 4** and **Appendix E.**

Screen intervals were installed within the uppermost high conductivity unit within the alluvial aquifer at each location that was below the seasonal low for groundwater. Each well has an approximately 5- or 10-foot-long screen interval. Screen intervals for the CCR Wells range from approximately 341 to 374 feet MSL (approximately 25 to 75 feet bgs). Monitoring well construction information is shown in **Table 4** and **Appendix E**.

4.0 INSTALLATION OF THE GROUNDWATER MONITORING SYSTEM

The CCR Rule Groundwater Monitoring System for the Meramec Surface Impoundments was installed in January 2016 and April 2016 as described in the following subsections.

4.1 Drilling Methods and Monitoring Well Constructions

Cascade Drilling LP installed the monitoring wells using a rotosonic drill rig (Mini Sonic CDD 1415) under direct supervision of a Golder Geologist or Engineer. Continuous soil core samples were obtained at each well borehole location and were logged in the field by Golder. Soils were classified according to the Unified Soil Classification System. Boring logs and well construction diagrams are provided in **Appendix D** and **Appendix E** respectively.

Groundwater monitoring wells were installed in accordance with Missouri Department of Natural Resources (MDNR) Well Construction Rules (10 CSR 23-4.060 Construction Standards for Monitoring Wells). All groundwater monitoring wells were installed using 2-inch diameter PVC well riser pipe and 5 or 10-foot long, 0.010-inch machine slotted well screens. Wells were installed with a sand filter pack, bentonite seal, and annular space in accordance with MDNR Well Construction Rules. Details on the construction of the groundwater monitoring wells are provided in **Table 4** and **Appendix E**.

Monitoring wells were completed with an aluminum protective cover with a locking lid that extends approximately 2 to 3 feet above ground surface and a small concrete pad. Three yellow protective posts (concrete filled steel bollards) were installed around each monitoring well surface completion.

4.2 Groundwater Monitoring Well Development

After well construction, a Golder Geologist or Engineer developed groundwater monitoring wells using surging and purging techniques. During development, field parameters (pH, conductivity, temperature, and turbidity) were recorded and development was complete once a minimum of three well-bore volumes of water were purged, turbidity was typically less than 20 nephelometric turbidity units (NTU) or ± 10% and consecutive measurements of field parameter values were within 10 percent difference. Groundwater monitoring wells were developed using an inertial pump with a surge block ring attached to a foot valve to surge and purge the well. Well development forms are attached in **Appendix H**.

4.3 Dedicated Pump Installation

A dedicated pump was installed in each groundwater monitoring well after development and hydraulic conductivity testing. The dedicated pumps provide a consistent, repeatable sampling method to reduce likelihood of cross contamination, reduce water sample turbidity, and expedite sampling. For the purposes of this groundwater monitoring network, low-flow QED brand PVC MicroPurge bladder pumps with Dura-Flex Teflon bladders were installed in each well.

4.4 Surveying and Well Registration

Zahner and Associates, Inc., a Professional Land Surveyor licensed in Missouri, surveyed the location and top of casing elevation of the monitoring wells. A drawing showing the location of the groundwater monitoring wells is shown in **Figure 2** and a summary of survey information is provided in **Table 4**. Upon completion of monitoring well installation and surveying, MDNR Well Construction Registration Forms were prepared for each well and submitted to MDNR. Copies of these forms are provided in **Appendix I**.

5.0 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program for the Meramec Surface Impoundments is described in the following sections.

5.1 Baseline Sampling Events

In accordance with section 257.94(b) of the CCR Rule, before starting detection monitoring, eight baseline (or background) samples were collected for all Appendix III and Appendix IV parameters at all downgradient and upgradient/background monitoring wells prior to October 17, 2017. These samples establish initial baseline datasets that are used for the statistical evaluation of groundwater results.

5.2 Detection Monitoring

The Detection Monitoring Program is defined in the CCR Rule in section 257.94 and the following sections outline the procedures for the detection monitoring program.

5.2.1 Sampling Constituents and Monitoring Frequency

Detection monitoring should be completed at a minimum of semi-annually (approximately every 6 months) for all Appendix III constituents (**Table 5**) unless a demonstration that the need for an alternative monitoring schedule is required. **Table 6** lists the analytical methods and practical quantitation limits used for the monitoring program.

5.2.2 Data Evaluation and Response

As required in the CCR Rule, a statistical evaluation of the groundwater data must be completed within 90 days of receiving data from the laboratory. The data will be analyzed using the methods and procedures outlined in the statistical analysis plan (**Appendix J**).

5.3 Assessment Monitoring

Assessment monitoring is outlined in section 257.95 of the CCR Rule and is initiated after a confirmed SSI has been identified and no alternate source demonstration has been completed. In accordance with the CCR Rule, a notification must be prepared and placed within the Facility operating record and on the publically available website stating that an Assessment Monitoring program has been initiated. The purpose of Assessment Monitoring is to determine whether or not groundwater concentrations are at a Statistically Significant Level (SSL) compared to Groundwater Protection Standards (GWPS). Detection Monitoring sampling continues during Assessment Monitoring.

5.3.1 Sampling Constituents and Monitoring Frequency

As outlined in section 257.95 of the CCR rule, Assessment Monitoring groundwater sampling must begin within 90 days of a confirmed SSI determination. Sampling must be completed at all monitoring wells used in the detection monitoring program, for all Appendix IV analytes (**Table 5**). Within 90 days of receiving data from this initial Assessment Monitoring sampling event, a second sampling event must be completed analyzing the Appendix IV constituents detected in groundwater during the initial sampling event.

Following this initial phase of the Assessment Monitoring Program, the CCR Rule requires sampling of the full list of Appendix IV constituents on an annual basis (Annual Assessment Event). During the other semi-annual Assessment Sampling Event, only those Appendix IV constituents that are detected during the annual sampling event are to be analyzed and reported. Additionally, verification resampling will be performed within 90 days of receiving data from the laboratory for all detected Appendix IV constituents for each event.

5.3.2 Data Evaluation and Response

As required in the CCR Rule, a statistical evaluation of the groundwater data must be completed within 90 days of receiving data from the laboratory. The data will be analyzed using the methods and procedures outlined in the Statistical Analysis Plan (**Appendix J**).

A GWPS is required for each Appendix IV constituent and must be included in the annual report. The GWPS will be either the MCL or a value based on background data, whichever is higher. The generation of the GWPS is discussed in more detail in the Statistical Analysis Plan (**Appendix J**). Statistical analysis must be completed within 90 days of receiving data from the laboratory. The statistical analysis will determine if any constituents are SSLs greater than the GWPS.

In order to discontinue Assessment Monitoring and return to Detection Monitoring, the concentration of all Appendix III and Appendix IV constituents for all compliance wells must be at levels statistically lower than background levels for two consecutive sampling events (257.95(e)). If any constituent is present at a statistical level above background levels, but below the GWPS, then Assessment Monitoring continues.

5.3.2.1 Responding to a SSL

If the Assessment Monitoring statistical evaluations demonstrate that a SSL has been triggered, then the owner/operator of the CCR unit must complete the following four actions as described in 257.95(g):

1. Prepare a notification identifying the constituents in Appendix IV that have exceeded a CCR Unit specific GWPS. This notification must be placed in the facility operating record within 30 days of identifying the SSL (257.95(g)) and 257.105(h)). Additionally, within 30 days of placing the notification in the operating record, the notification must be posted to the internet site (257.107(h)).
2. Define the character and extent of the release and any relevant site conditions that may affect the corrective action remedy that is ultimately selected. The characterization must be sufficient to support a complete and accurate assessment of the corrective measures necessary to effectively clean up releases from the CCR Unit and must include at least the following: (No timeframe is specified in the CCR Rule for this action)

   A. Installation of additional monitoring wells that are necessary to define the contaminant plume
   B. Collect data on the nature and estimated quantity of the material released
   C. Install and sample at least one additional monitoring well at the facility boundary in the direction of the contaminant plume migration

3. Notify off-site property owners if the contamination plume has migrated offsite on to their property within 30 days of this determination.
4. If possible, provide an alternate source demonstration that determines that the SSL is not caused by a release at the facility within 90 days of completing the statistical evaluation. If no alternate source demonstration can be made and the plume is determined to have originated from the CCR Unit, then proceed to corrective action steps in the CCR Rule.
   D. If no alternate source demonstration is made, and the CCR Unit is an unlined surface impoundment, the closure or retrofit must be initiated.

Actions 1-3 must be completed regardless of whether or not an alternate source demonstration can be made.

5.3.3 Annual Reporting Requirements

In addition to the periodical reporting listed above, an annual groundwater monitoring report will be prepared according to the requirements of 40 CFR §257.90(e). At a minimum, the annual groundwater monitoring report will contain the following information:

- The current status of the groundwater monitoring program
- A projection of key activities planned for the upcoming year
- A map showing the CCR unit and all background (or upgradient) and downgradient monitoring wells included in this monitoring plan
- A discussion of any monitoring wells that were installed or decommissioned during the preceding year or any other changes made to the groundwater monitoring system
- Analytical results from groundwater sampling
- The monitoring data obtained under §§ 257.90 through 257.98, including a summary of the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs
- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels)
- If required, an alternate source demonstration that is certified by a professional engineer
- If required, a demonstration that an alternate sampling frequency is needed
- If assessment monitoring is required, a listing of GWPS for each Appendix IV constituent

6.0 GROUNDWATER SAMPLING METHODOLOGY

Sampling will be performed in accordance with generally accepted practices within the industry and with the provisions of Missouri regulations. The following sections provide details regarding procedures that will be used to collect groundwater samples. Although this section provides reference to specific forms, the use of other equivalent forms to record the necessary data is permissible.

6.1 Equipment Calibration

Equipment used to record field water quality parameters will be calibrated each day prior to use following manufacturers' recommendations. Calibration solutions for standardization materials will be freshly prepared or from non-expired stock. In the absence of manufacturer or regulatory guidance, field equipment should be calibrated to within +/- 10 percent of the standard (or 0.1 standard units for pH meters). Equipment that fails calibration may not be used. Calibration records will be maintained. A sample field Instrument Calibration Form is included in **Appendix K**.

6.2 Monitoring Well Inspection

Prior to performing any water purging or sampling, each monitoring well will be inspected to assess its integrity. The condition of each monitoring well will be evaluated for any physical damage or other breach of integrity. The security of each monitoring well will be assessed in order to confirm that no outside source constituents have been introduced to the monitoring well.

6.3 Water Level Measurement

To meet the requirements of §257.93(c), water level measurements will be taken at all monitoring wells and prior to the start of any groundwater purging. These measurements will be taken within a 24 hour period and will be recorded on the Record of Water Level Readings form or Groundwater Sample Collection Form (included in **Appendix I**). Static water levels will be measured in each monitoring well prior to purging using an electric meter accurate to 0.01 foot. The measuring probe will be rinsed with distilled or deionized water before and after use at each well.

6.4 Monitoring Well Purging

Prior to collecting samples, each monitoring well will be purged. Purging will be accomplished using either:

- Low-flow (a.k.a., minimal drawdown, or Micropurge) techniques
- Traditional purging techniques where at least three well volumes are evacuated before samples are collected

6.4.1 Low-Flow Sampling Technique

Low-flow groundwater sampling procedures will be used for purging and sampling monitoring wells that are equipped with dedicated pumps and will sustain a pumping rate of at least 100 milliliters per minute (ml/min).

Water will be purged from these wells at low rates in order to minimize drawdown in the well during purging and sampling. Depth to water measurements and field water quality parameters (temperature, pH, turbidity, and conductivity) recorded during purging will be used as criteria to determine when purging has been completed. Sample collection will be initiated immediately after purging at each well.

During water purging, wells will be pumped at rates that minimize drawdown in the well. Purging rates in the range of 100-500 ml/min typically will be used; however, higher rates may be used if sustained by the well. Stabilization of the water column will be considered achieved when three consecutive water level measurements vary by 0.3 foot or less at a pumping rate of no less than 100 ml/min.

At a minimum, field water quality parameter measurements of temperature, pH, turbidity, and conductivity, will be measured during purging at each well. Prior to collecting the initial set of field water quality parameters, the water in the sampling pump and discharge tubing (i.e., pump system volume) remaining from the previous sampling event will be removed.

After evacuating the water in the pump system, collecting field measurements will begin. Depth to water measurements and field water quality parameter measurements will be made during purging. If a field meter equipped with a flow cell is used, an amount of water equal to the volume of the flow cell should be allowed to pass through the flow cell between individual field stabilization measurements. Stabilization will be attained and purging considered complete when three consecutive measurements of each field parameter vary within the following limits:

- ± 0.2 for pH
- ± 3% for Conductivity
- ± 10% for Temperature
- Less than 10 nephelometric turbidity units (NTU) or ± 10% for Turbidity

All data gathered during monitoring well purging will be recorded on a form, an example of which is included in **Appendix K**.

6.4.2 Traditional Purge Techniques

If low-flow sampling is not performed, wells will be purged a minimum of 3 well volumes before collecting a sample. Purging procedures will generally follow those for low-flow sampling including measurement of the field parameters listed above with two exceptions:

- Higher flow rate may be used during purging
- Purging is completed after a minimum of 3 well volumes have been removed (see below)

Even where low-flow sampling is not performed, the sampling goals are to:

- Stabilize field parameters (listed in previous section) prior to collecting samples
- Minimize drawdown in the well

When traditional purge techniques are used, field stabilization measurements will be collected at the beginning of purging and between each well volume purged. The stability criteria will be those described above for low-flow sampling.

6.4.3 Low Yielding Wells

If a monitoring well purges dry, it will be allowed to recover up to 24 hours before samples are collected. No additional purging will be performed after initially purging the monitoring well dry. If recharge is insufficient to fill all necessary sample bottles, samplers will note this on the field form, and fill as many sample bottles as possible.

6.5 Sample Collection

Sampling should take place immediately after purging is complete. Samples will be transferred directly from field sampling equipment into containers supplied by the analytical laboratory appropriate for the constituents being monitored as listed in **Table 6**. Sample containers will be kept closed until the time each set of sample containers is filled.

6.6 Equipment Decontamination

All non-dedicated field equipment that is used for purging or sample collection shall be cleaned with a phosphate-free detergent and triple-rinsed, inside and out, with deionized or distilled water prior to use and between each monitoring well. Decontamination water shall be disposed of at an Ameren approved location. Any disposable tubing used with non-dedicated pumps should be discarded after use at each monitoring well. Clean latex gloves will be worn by sampling personnel during monitoring well purging and sample collection.

6.7 Sample Preservation and Handling

In accordance with §257.93 of the CCR Rule, groundwater samples collected as part of the monitoring program will not be filtered prior to analysis. Once groundwater samples have been collected and preserved in laboratory supplied containers, they will be packed into insulated, ice-filled coolers to be maintained at a temperature as close as possible to 4 degrees Celsius. Groundwater samples will be collected in the designated size and type of containers required for specific parameters. Sample containers will be filled in such a manner as not to lose preservatives by spilling or overfilling. Samples will be delivered to the laboratory or sent via overnight courier following chain-of-custody procedures.

6.8 Chain-of-Custody Program

The chain-of-custody (COC) program will allow for tracing sample possession and handling from the time of field collection through laboratory analysis. The COC program includes sample labels, sample seals, field Groundwater Sample Collection Forms, and COC record. A sample Chain-of-Custody (COC) form is provided in **Appendix K**.

Each sample will be assigned a unique sample identification number to be recorded on the sample label. The sample identification number for all samples will be designated differently based on the nature of the samples. Each sample identification number and description will be recorded on the field Groundwater Sample Collection Form and on the COC document.

6.8.1 Sample Labels

Sample labels sufficiently durable to remain legible when wet will contain the following information, written with indelible ink:

- Site and sample identification number
- Monitoring well number or other location
- Date and time of collection
- Name of collector
- Parameters to be analyzed
- Preservative, if applicable

6.8.2 Sample Seal

The shipping container will be sealed to prevent the samples from being disturbed during transport to the laboratory.

6.8.3 Field Forms

All field information must be completely and accurately documented to become part of the final report for the groundwater monitoring event. Example field forms are included in **Appendix J**. The field forms will document the following information:

- Identification of the monitoring well
- Sample identification number
- Field meter calibration information
- Static water level depth
- Purge volume
- Time monitoring well was purged
- Date and time of collection
- Parameters requested for analysis
- Preservative used
- Field water quality parameter measurements

- Field observations on sampling event
- Name of collector(s)
- Weather conditions including air temperature and precipitation

6.8.4 Chain-of-Custody Record

The COC record is required for tracing sample possession from time of collection to time of receipt at the laboratory. The National Enforcement Investigations Center (NEIC) of USEPA considers a sample to be in custody under any of the following conditions:

- It is in the individual's possession
- It is in the individual's view after being in his possession
- It was in the individual's possession and he locked it up
- It is in a designated secure area

All environmental samples will be handled under strict COC procedures beginning in the field. The field team leader will be the field sample custodian and will be responsible for ensuring that COC procedures are followed. A COC record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter
- Sample identification numbers
- Signature of collector
- Date and time of collection
- Sample type
- Identification of monitoring well
- Number of sample containers in shipping container
- Parameters requested for analysis
- Signature of person(s) involved in the chain of possession
- Inclusive dates of possession

A copy of the completed COC form will be placed in a water resistant bag and accompany the shipment and will be returned to the shipper after the shipping container reaches its destination. The COC record will also be used as the analysis request sheet. When shipping by courier, the courier does not sign the COC record: copies of shipping forms are retained to document custody.

6.9 Temperature Control and Sample Transportation

After collection, sample preservation, and labeling, sample containers will be placed in coolers containing water-ice with the goal of reducing the groundwater samples to a temperature of approximately 4°C or less.

All samples included in the shipping container will be packed in such a manner to minimize the potential for container breakage. Samples will be either hand-delivered or shipped via commercial carrier to the certified analytical laboratory. Custody seals will be placed on the shipping containers if a third party courier is used.

7.0 ANALYTICAL AND QUALITY CONTROL PROCEDURES

7.1 Data Quality Objectives

As part of the evaluation component of the Quality Assurance (QA) program, analytical results will be evaluated for precision, accuracy, representativeness, completeness, and comparability (PARCC). These are defined as follows:

- Precision is the agreement or reproducibility among individual measurements of the same property, usually made under the same conditions
- Accuracy is the degree of agreement of a measurement with the true or accepted value
- Representativeness is the degree to which a measurement accurately and precisely represents a characteristic of a population, parameter, or variations at a sampling point, a process condition, or an environmental condition
- Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions
- Comparability is an expression of the confidence with which one data set can be compared with another data set in regard to the same property

The accuracy, precision and representativeness of data will be functions of the sample origin, analytical procedures and the specific sample matrices. Quality Control (QC) practices for the evaluation of these data quality indicators include the use of accepted analytical procedures, adherence to hold time, and analysis of QC samples (e.g., blanks, replicates, spikes, calibration standards and reference standards).

Quantitative QA objectives for precision and accuracy, along with sensitivity (detection limits) are established in accordance with the specific analytical methodologies, historical data, laboratory method validation studies, and laboratory experience with similar samples. The Representativeness of the analytical data is a function of the procedures used to process the samples.

Completeness is a qualitative characteristic which is defined as the fraction of valid data obtained from a measurement system (e.g., sampling and analysis) compared to that which was planned. Completeness can be less than 100 percent due to poor sample recovery, sample damage, or disqualification of results which are outside of control limits due to laboratory error or matrix-specific interferences. Completeness is documented by including sufficient information in the laboratory reports to allow the data user to assess the quality of the results. The overall completeness goal for each task is difficult to determine prior to data acquisition. For this project, all reasonable attempts will be made to attain 90% completeness or better (laboratory).

Comparability is a qualitative characteristic which allows for comparison of analytical results with those obtained by other laboratories. This may be accomplished through the use of standard accepted methodologies, traceability of standards to the National Bureau of Standards (NBS) or USEPA sources, use of appropriate levels of quality control, reporting results in consistent, standard units of measure, and participation in inter-laboratory studies designed to evaluate laboratory performance.

Data quality and the standard commercial report package will be evaluated with respect to PARCC criteria using the laboratory's QA practices, use of standard analytical methods, certifications, participation in inter-laboratory studies, temperature control, adherence to hold times, and COC documentation (also called Data Validation).

7.2 Quality Assurance/Quality Control Samples

This section describes the various Quality Assurance/Quality Control (QA/QC) samples that will be collected in the field and analyzed in the laboratory and the frequency at which they will be performed.

7.2.1 Field Equipment Rinsate Blanks

In cases where sampling equipment is not dedicated or disposable, an equipment rinsate blank will be collected. The equipment rinsate blanks are prepared in the field using laboratory-supplied analyte-free water. The water is poured over and through each type of sampling equipment following decontamination and submitted to the laboratory for analysis of target constituents. **One rinsate blank will be collected for every 10 samples.**

7.2.2 Field Duplicates

Field duplicates are collected by sampling the same location twice, but the field duplicate is assigned a unique sample identification number. Samplers will document which location is used for the duplicate sample. **One field duplicate will be collected for every 10 samples.**

7.2.3 Field Blank

Field blanks are collected in the field using laboratory-supplied analyte-free water. The water is poured directly into the supplied sample containers in the field and submitted to the laboratory for analysis of target constituents. **One field blank will be collected for every 10 samples.**

7.2.4 Laboratory Quality Control Samples

The laboratory will have an established QC check program using procedural (method) blanks, laboratory control spikes, matrix spikes, and duplicates. Details of the internal QC checks used by the laboratory will be found in the laboratory QAP and the published analytical methods. These QC samples will be used to determine if results may have been affected by field activities or procedures used in sample transportation or if matrix interferences are an issue. **One (1) Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) set** (i.e. one sample plus one MS, and one MSD sample at one location) **will be collected per 20 samples.** MS/MSD samples will have a naming convention as follows:

- Sample: M-MW-1
- MS: M-MW-1-MS
- MSD: M-MW-1-MSD

8.0 DATA EVALUATION AND STATISTICAL ANALYSIS

The following sections describe the evaluation and analysis procedures that are followed upon receipt of the analytical report.

8.1 Evaluation of Rate and Direction of Groundwater Flow

Groundwater elevations will be determined for each sampling event and will be used to develop a groundwater elevation contour map that will be submitted with reports. The direction of groundwater flow will be determined from up-and downgradient relationships as depicted on the potentiometric surface map. Based on these maps, groundwater flow velocities will be estimated for each event.

8.2 Data Validation

Before the data are used for statistical analysis, they will be evaluated by examining the quality control data accompanying the data report from the laboratory. Relevant quality control data could include measures of accuracy (percent recovery), precision (relative percent difference, RPD), and sample contamination (blank determinations). Data that fail any of these checks will be flagged for further evaluation. A Data Quality Review (DQR) may be initiated with the laboratory for any anomalous data.

8.3 Statistical Analysis

Upon completion of the data validation, the data will be submitted for statistical analysis in compliance with 40 CFR §257.93. The detailed statistical analysis plan for the Facility will be included in **Appendix J**.

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TABLES

Table 1
Groundwater Level Data
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

	Location[4]		Top of Casing[7]	Ground Surface[7]	Background Event 1 3/28/2016		Background Event 2 5/13/2016		Background Event 3 7/18/2016		Background Event 4 9/7/2016		Background Event 5 11/10/2016		Background Event 6 1/6/2017		Background Event 7 3/7/2017		Background Event 8 6/14/2017	
Well ID	Northing	Easting	Feet MSL[5]	Feet MSL[5]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]	DTW[3]	GWE[4]
MW-1	937676.9	865954.1	406.43	404.1	4.83	401.60	2.61	403.82	5.57	400.86	4.72	401.71	5.36	401.07	7.08	399.35	5.55	400.88	2.46	403.97
MW-2	937325.1	864864.5	398.62	396.1	12.76	385.86	3.54	395.08	14.79	383.83	11.69	386.93	16.42	382.20	19.10	379.52	13.25	385.37	7.72	390.90
MW-3	936750.8	864447.2	397.12	394.6	11.30	385.82	2.07	395.05	13.27	383.85	10.15	386.97	14.93	382.19	17.62	379.50	11.81	385.31	6.23	390.89
MW-4	935618.0	864629.8	404.10	402.0	18.17	385.93	9.13	394.97	20.02	384.08	16.48	387.62	21.65	382.45	24.43	379.67	18.93	385.17	13.08	391.02
MW-5	934874.4	864781.0	402.93	400.8	16.94	385.99	7.93	395.00	18.67	384.26	15.65	387.28	20.27	382.66	23.14	379.79	17.83	385.10	11.69	391.24
MW-6	933905.2	865153.5	418.12	415.8	32.26	385.86	23.33	394.79	33.56	384.56	30.56	387.56	35.11	383.01	38.29	379.83	33.64	384.48	26.49	391.63
MW-7	934334.4	866242.5	417.94	415.7	32.01	385.93	23.04	394.90	33.32	384.62	30.37	387.57	34.68	383.26	37.79	380.15	33.52	384.42	26.39	391.55
MW-8	935303.6	866797.8	423.37	421.0	36.68	386.69	27.46	395.91	38.07	385.30	35.14	388.23	39.60	383.77	42.59	380.78	37.57	385.80	31.27	392.10
BMW-1	935220.4	867989.4	419.08	416.8	24.40[8]	396.72[8]	19.78	399.30	28.16	390.92	24.96	394.12	27.41	391.67	32.64	386.44	28.51	390.57	22.49	396.59
BMW-2	937927.1	866342.2	409.02	406.8	14.21	394.81	11.22	397.80	15.45	393.57	14.58	394.44	15.36	393.66	17.29	391.73	15.71	393.31	11.39	397.63
Mississippi River	934893.52[2]	868520.62[2]	NA	NA	NA	386.59	NA	395.52	NA	384.25	NA	387.53	NA	382.37	NA	380.70	NA	385.77	NA	390.10

Notes:

1.) Groundwater monitoring wells surveyed by Zahner & Associates, Inc. on February 4, 2016 and April 28, 2016.

2.) * - Mississippi River gauge location is estimated.

3.) DTW - Depth to water measured in feet below top of casing.

4.) GWE - Groundwater elevation measured in feet above mean sea level.

5.) MSL - Feet above mean sea level.

6.) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone feet.

7.) Vertical Datum: NAVD88 feet.

8.) Groundwater elevation data based on orginal BMW-1 location that has been abandoned.

9.) NA - Not Applicable.

10.) Mississippi River Level is provided by Ameren.

Prepared	JSI
Check	JS/RJF
Reviewed	MNH

Table 2
Generalized Hydraulic Properties of Uppermost Aquifer
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Meramec Monitoring Wells

(MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, BMW-1, BMW-2)

Baseline Sampling Event	Baseline Sampling Event Date	Average Groundwater Flow Direction (Azimuth)	Estimated Hydraulic Gradient (Feet/Foot)	Mean Hydraulic Conductivity (Feet/Day)	Mean Hydraulic Conductivity (cm/sec)	Estimated Effective Porosity	Estimated Groundwater Velocity (Feet/Day)
1	3/28/2016	232.5	0.0022	37.02	1.3E-02	0.35	0.23
2	5/13/2016	249.1	0.0012	37.02	1.3E-02	0.35	0.13
3	7/18/2016	240.1	0.0025	37.02	1.3E-02	0.35	0.27
4	9/7/2016	244.8	0.0022	37.02	1.3E-02	0.35	0.23
5	11/10/2016	242.3	0.0032	37.02	1.3E-02	0.35	0.34
6	1/6/2017	233.9	0.0030	37.02	1.3E-02	0.35	0.31
7	3/7/2017	230.9	0.0023	37.02	1.3E-02	0.35	0.24
8	6/14/2017	244.0	0.0019	37.02	1.3E-02	0.35	0.20

Estimated Results (USEPA Tool)	
Resultant Groundwater Flow Direction (Azimuth)	239
Estimated Annual Net Groundwater Movement (Feet/Year)	87

Prepared By: JSI
Checked By: JS/RJF
Reviewed By:

Notes:

1. Azimuth and Hydraulic Gradient calculated using the United States Environmental protection agency (USEPA) On-Line Tools for Site Assessment Calculation for Hydraulic Gradient (magnitude and direction) available at https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/gradient4plus-ns.html
2. Hydraulic conductivity value is the geometric mean of slug test results for the Meramec monitoring wells (except MW-1).
3. An effective porosity of 0.35 was used based on grain size distributions and published values (Fetter 2000, Cohen 1953, and Johnson 1967) .
4. Azimuth is measured clockwise in degrees from north.
5. cm/sec - Centimeters per second.

Table 4
Monitoring Well Construction Details
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Well ID	Date Installed	Location[4]		Top of Casing Elevation	Ground Surface Elevation	Top of Screen	Bottom of Screen	Base of Well	Total Depth
		Northing	Easting	(FT MSL)[5]	(FT MSL)[5]	(FT MSL)[5]	(FT MSL)[5]	(FT MSL)[5]	(FT BGS)[5]
MW-1	1/23/2016	937676.9	865954.1	406.43	404.1	370.2	365.4	365.0	39.1
MW-2	1/23/2016	937325.1	864864.5	398.62	396.1	367.0	362.2	361.8	34.3
MW-3	1/22/2016	936750.8	864447.2	397.12	394.6	369.2	364.4	364.0	30.6
MW-4	1/22/2016	935618.0	864629.8	404.10	402.0	364.1	359.3	358.9	43.1
MW-5	1/22/2016	934874.4	864781.0	402.93	400.8	350.4	340.6	340.2	60.6
MW-6	1/21/2016	933905.2	865153.5	418.12	415.8	373.4	363.6	363.2	52.7
MW-7	1/24/2016	934334.4	866242.5	417.94	415.7	373.2	363.4	363.0	52.7
MW-8	1/24/2016	935303.6	866797.8	423.37	421.0	355.8	346.0	345.6	75.4
BMW-1	4/7/2016	935220.4	867989.4	419.08	416.8	366.4	356.6	356.2	60.6
BMW-2	1/25/2016	937927.1	866342.2	409.02	406.8	369.3	364.5	364.1	42.7

Notes:
1.) All elevations and coordinates were surveyed on January 14, and April 28th, 2016 by Zahner and Associates, Inc.
2.) FT MSL = Feet Above Mean Sea Level.
3.) FT BGS = Feet Below Ground Surface.
4.) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone Feet.
5.) Vertical Datum: NAVD88 Feet.

Prepared By: JSI
Checked By: JS
Reviewed By: MNH

Table 5
Groundwater Quality Monitoring Parameters
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Monitoring Parameter		Background[2]	Detection[3]	Assessment[4]
Field Parameters	Temperature, pH, Conductivity and Dissolved Oxygen	X	X	X
Appendix III[1]	Boron	X	X	X
	Calcium	X	X	X
	Chloride	X	X	X
	Fluoride	X	X	X
	Sulfate	X	X	X
	pH	X	X	X
	Total Dissolved Solids (TDS)	X	X	X
Appendix IV[1]	Antimony	X		X
	Arsenic	X		X
	Barium	X		X
	Beryllium	X		X
	Cadmium	X		X
	Chromium	X		X
	Cobalt	X		X
	Fluoride	X		X
	Lead	X		X
	Lithium	X		X
	Mercury	X		X
	Molybdenum	X		X
	Selenium	X		X
	Thallium	X		X
	Radium 226 & 228	X		X

Notes:

1.) Analyte lists match requirements for monitoring from USEPA Rule 40 CFR parts 257 and 261.

2.) Background will be performed through October 2017 until at least 8 samples are collected.

3.) Approximately 6 months will separate each semi-annual sampling event.

4.) If necessary, assessment monitoring will be performed in accordance with USEPA Rule.

Prepared By: JS
Checked By: MWD
Reviewed By: MNH

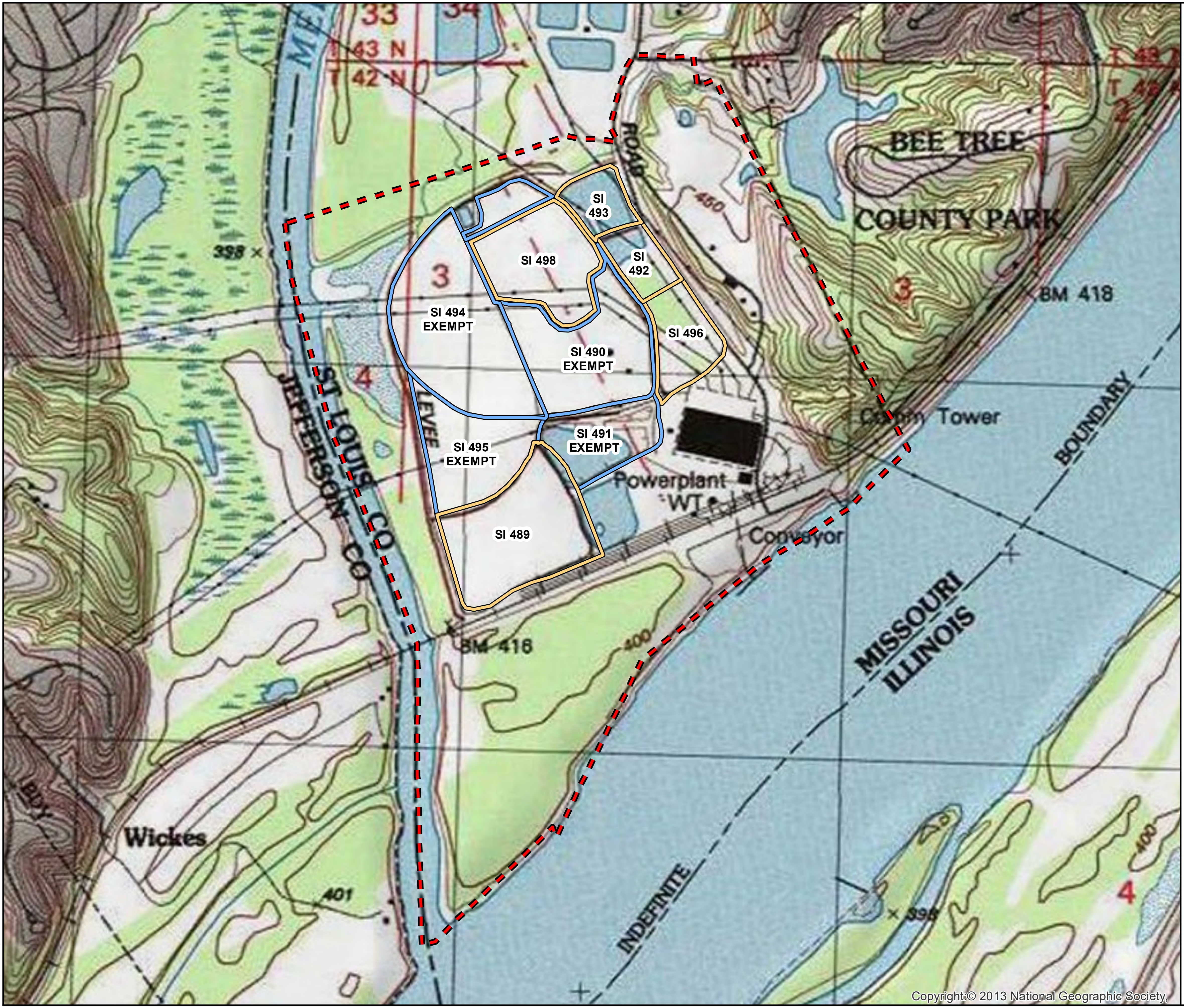
Table 6
Analytical Methods and Practical Quantitation Limits
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Analyte	Method Reference	Preservative	Hold Times	PQL (µg/L)	MCL (mg/L)
Appendix III - Detection Monitoring					
Boron	SW-846 6010/MCAWW 200.7	HNO3	6 months	20.0	NA
Calcium	SW-846 6010/MCAWW 200.7	HNO3	6 months	500.0	NA
Chloride	EPA 300.0/325.5/MCAWW 300/SW846 9251/9056	NA	28 days	500.0	NA
Fluoride	EPA 300.0, 300.1	NA	28 days	-	4
pH	4500 H+B-2000	NA	NA	-	NA
Sulfate	EPA 300.0/SW846 300	NA	28 days	2000.0	NA
Total Dissolved Solids (TDS)	2540 C-1997/SM18-20 2540 C	NA	7 days	10000.0	NA
Appendix IV - Assessment Monitoring					
Antimony	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	1.0	0.006
Arsenic	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	1.0	0.01
Barium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	2.0	2
Beryllium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	1.0	0.004
Cadmium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	0.5	0.005
Chromium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	1.5	0.1
Cobalt	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	4.0	NP
Fluoride	EPA 300.0	N/A	28 days	-	4
Lead	SW-846 6020	HNO3	6 months	0.005	0.015
Lithium	SW-846 6010	HNO3	6 months	-	NA
Mercury	SW-846 7470	HNO3	28 days	-	0.002
Molybdenum	SW-846 6010	HNO3	6 months	-	NP
Selenium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	1.0	0.05
Thallium	SW-846 6010/6020/MCAWW 200.7/200.8	HNO3	6 months	0.2	0.002
Radium 226 & 228	SW-846 903.1/SM 6500 904	-	-	1.0 (pCi/L)	5.0 (pCi/L)

Notes:
1.) NA - not applicable.
2.) Analyte lists matches requirements for detection and assesment monitoring from United States Environmental Protection Agency (USEPA) Rule 40 CFR parts 257 and 261.
3.) SW-846 denotes Test Methods for Evaluating Solid Waste, Physical- Chemical Methods, EPA publication SW-846, 3rd edition, and subsequent updates.
4.) MCAWW denotes Methods for the Chemical Analysis of Water and Wastes (MCAWW), United States Environmental Protection Agency (USEPA) published in the 1983.
5.) EPA 300 denotes Methods for the Determination of Organic Compounds in Drinking Water Environmental Monitoring Systems Laboratory, Office of Research and Development, USEPA, Cincinnati, Ohio 45268. EPA-300/4-88/039, December 1988 (Revised July 1991).
6.) SM18-20 denotes Standard Methods for the Examination of Water and Wastewater, 18th, 19th, and 20th Editions, published by the American Public Health Association, Water Environment Federation, and the American Water Works Association.
7.) Other industry-used or agency-approved methods may be used provided that they produce the necessary level of precision and accuracy for data use and reporting.
8.) Updates to the methods listed here are approved for use.
9.) PQL - Practical Quantitation Limit.
10.) MCL - Maximum Contaminant Level from USEPA 2014 Edition of the Drinking Water Standards and Health Advisories. October 2014. http://water.epa.gov/drink/contaminants/index.cfm.
11.) Dash (-) - Indicates no information available.
12.) µg/L - Micrograms per liter.
13.) pCi/L - Picocuries per liter.
14.) NP - Not Promulgated.
15.) mg/L - Milligrams per liter.

Prepared By: JS
Checked By: JSI
Reviewed By: MNH

FIGURES

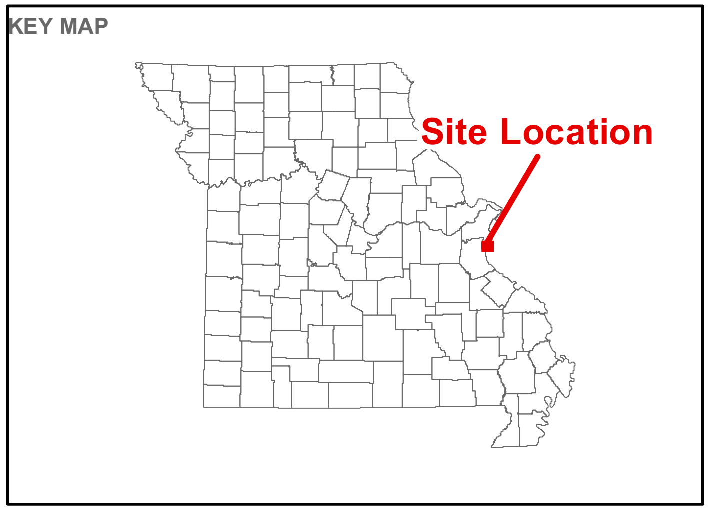


Copyright:© 2013 National Geographic Society,

LEGEND

- ▨ Meramec Energy Center Property Boundary
- 🟨 Active Surface Impoundment
- 🟦 Exempt Surface Impoundment

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. SI - SURFACE IMPOUNDMENT.
3. EXEMPT SURFACE IMPOUNDMENTS ARE EXCLUDED FROM COAL COMBUSTION RESIDUALS MONITORING.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 2,000 2,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION TOPOGRAPHIC MAP

CONSULTANT

YYYY-MM-DD	12-10-2015
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

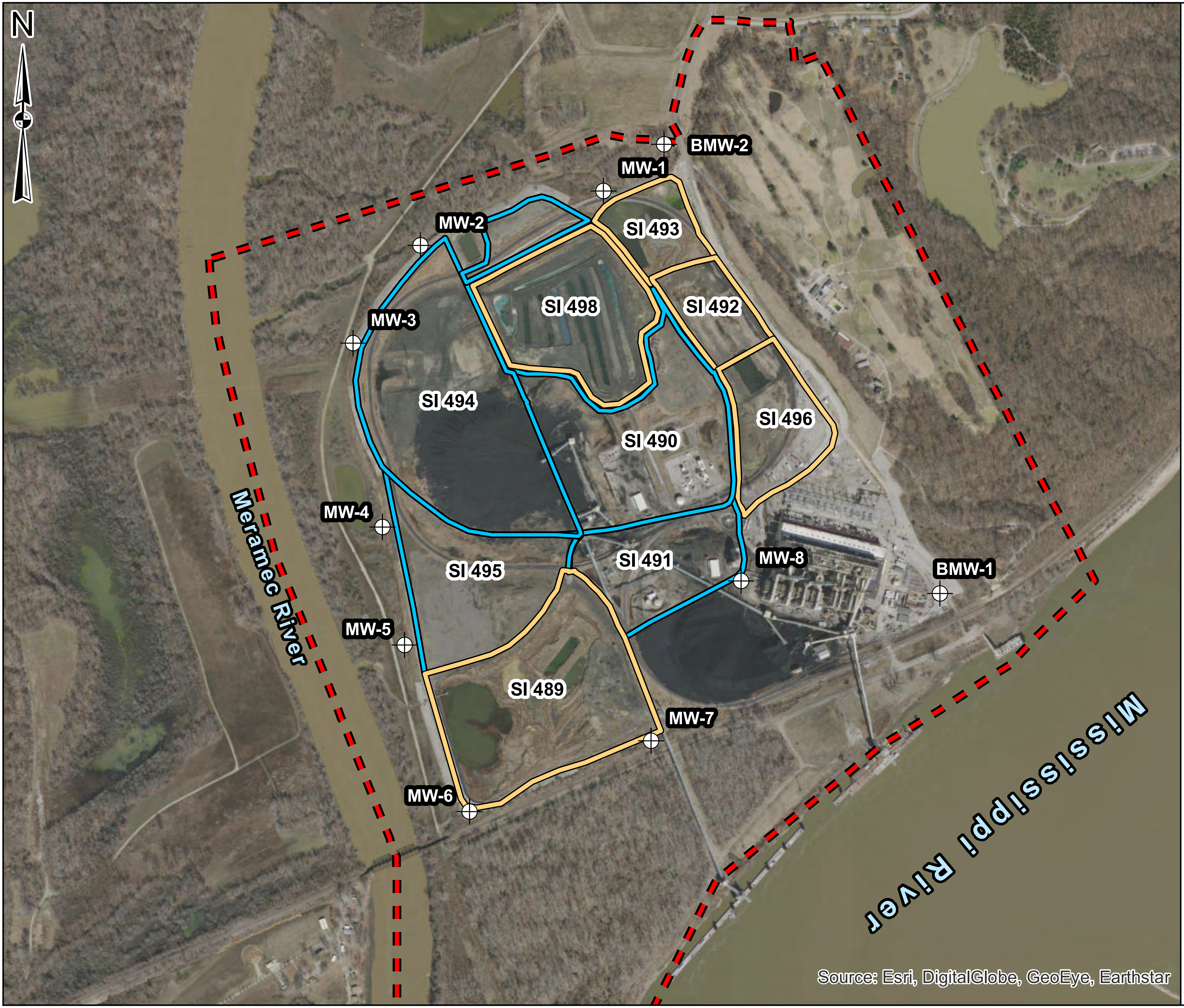
PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004	1.0	**1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

1 in

0

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Figure 1 - Topo Map.mxd

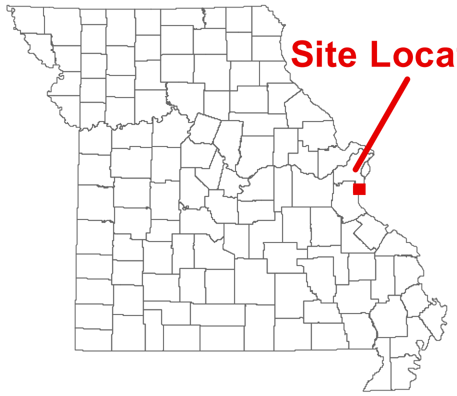


Source: Esri, DigitalGlobe, GeoEye, Earthstar

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ Active Surface Impoundment
- ▭ Exempt Surface Impoundment
- ⊕ Monitoring Well Location

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. SI - SURFACE IMPOUNDMENT.
3. EXEMPT SURFACE IMPOUNDMENTS ARE EXCLUDED FROM COAL COMBUSTION RESIDUALS MONITORING.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.

2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION AERIAL MAP AND MONITORING WELL LOCATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-03-18
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	1.0	**2**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Figure 2 - Site Location Aerial Map and Monitoring Well Locations.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0 1 in

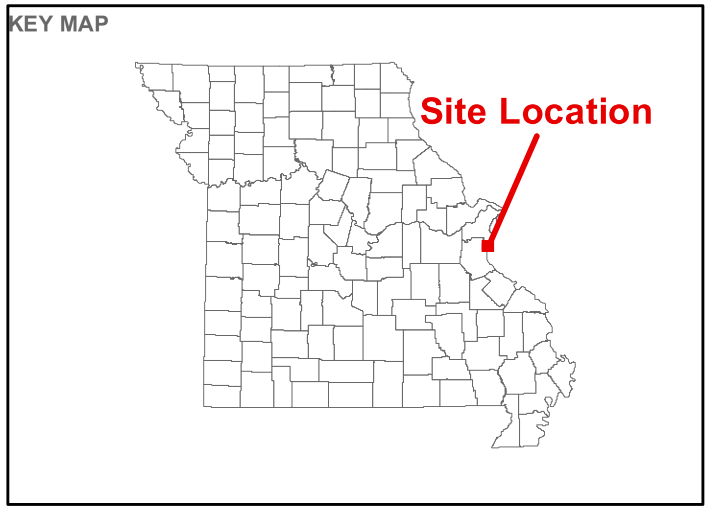
APPENDIX A
CROSS SECTIONS

Source: Esri, DigitalGlobe, GeoEye, Earthstar

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ Active Surface Impoundment
- ▭ Exempt Surface Impoundment
- ⊕ Monitoring Well Location
- ⊗ Site Investigation Boring Location
- ═ Cross Section Line

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. SI - SURFACE IMPOUNDMENT.
3. EXEMPT SURFACE IMPOUNDMENTS ARE EXCLUDED FROM COAL COMBUSTION RESIDUALS MONITORING.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
CROSS SECTION LOCATIONS

CONSULTANT

YYYY-MM-DD	2017-08-21
PREPARED	JS
DESIGN	JS
REVIEW	JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

0 1 in

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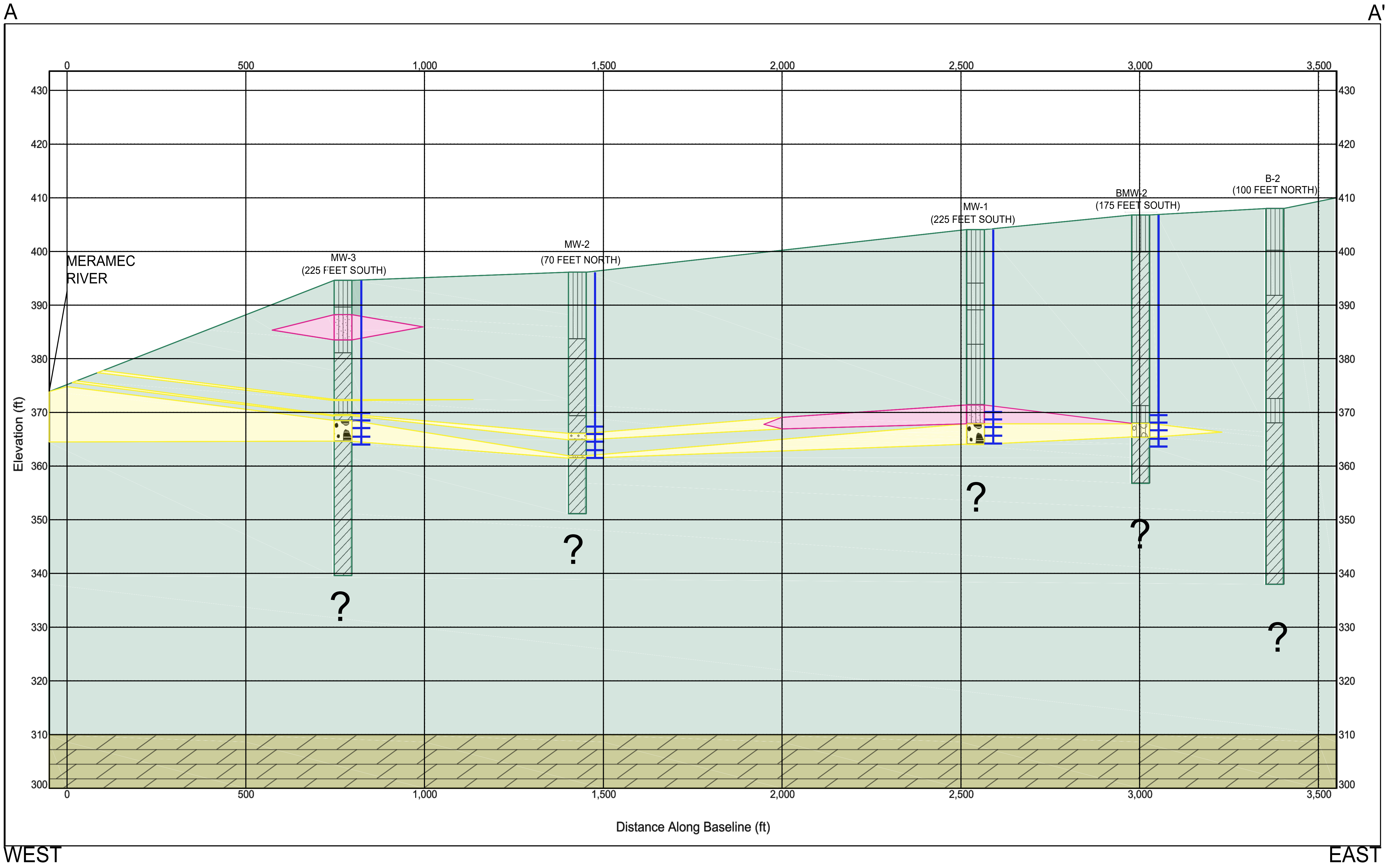

LEGEND

🟪	SILTY SANDS	🟨	SANDS AND GRAVELS
🟩	SILTY CLAYS & SILTS	▨	BEDROCK

MONITORING WELL

SCREENING INTERVAL

NOTE(S)

1. SEE APPENDIX D OF THE GMP FOR SOIL BORING LOGS.
2. SEE APPENDIX E OF THE GMP FOR MONITORING WELL CONSTRUCTION DETAILS.
3. BOREHOLES SHOWN ARE PROJECTED ONTO CROSS SECTION.
4. VERTICAL EXAGGERATION: 15:1.
5. ELEVATION IN FEET ABOVE MEAN SEA LEVEL.
6. BEDROCK ELEVATIONS BASED ON B-8, B-9 AND SHANNON AND WILSON, 1979.
7. FT - FEET

CLIENT
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MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-08-21
DESIGNED	JS
PREPARED	JS
REVIEWED	JAP
APPROVED	MNH

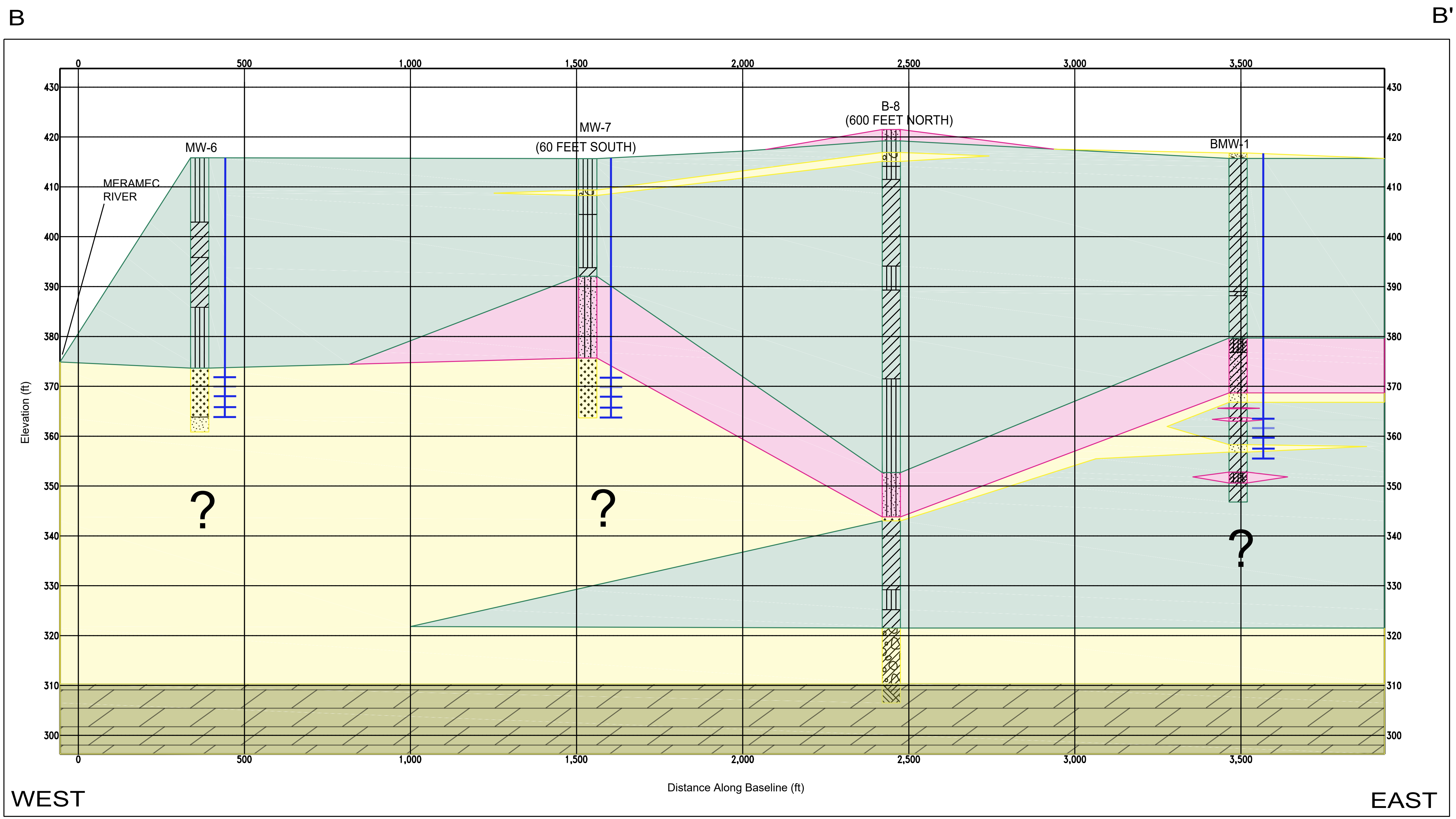
PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
CROSS SECTION A TO A'

PROJECT NO.	PHASE	REV.	FIGURE
153-1406	0004A	0.0	A2

Path: \\stlouis\common\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\X-Sections\ | File Name: MEC - Cross Sections.dwg

0 1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

🟪	SILTY SANDS	🟨	SANDS AND GRAVELS
🟩	SILTY CLAYS & SILTS	▨	BEDROCK

MONITORING WELL

SCREENING INTERVAL

NOTE(S)

1. SEE APPENDIX D OF THE GMP FOR SOIL BORING LOGS.
2. SEE APPENDIX E OF THE GMP FOR MONITORING WELL CONSTRUCTION DETAILS.
3. BOREHOLES SHOWN ARE PROJECTED ONTO CROSS SECTION.
4. VERTICAL EXAGGERATION: 15:1.
5. ELEVATION IN FEET ABOVE MEAN SEA LEVEL.
6. FT - FEET

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MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-08-21
DESIGNED	JS
PREPARED	JS
REVIEWED	JAP
APPROVED	MNH

PROJECT
GROUNDWATER MONITORING PROGRAM

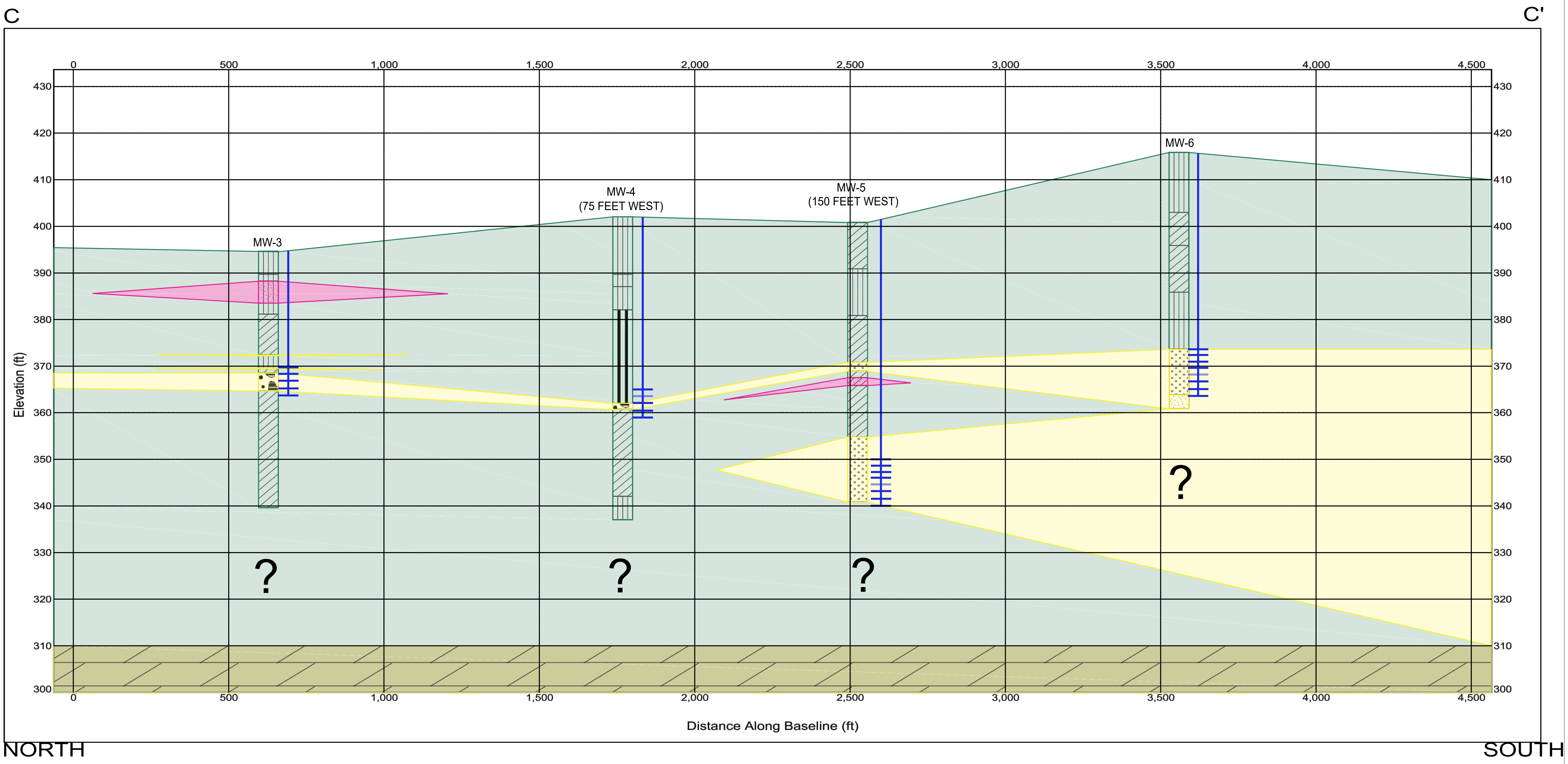
TITLE
CROSS SECTION B TO B'

PROJECT NO.	PHASE	REV.	FIGURE
153-1406	0004A	0.0	A3

Path: \\stlouis\common\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\X-Sections\ | File Name: MEC - Cross Sections.dwg

1 in

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

🟪	SILTY SANDS	🟨	SANDS AND GRAVELS
🟩	SILTY CLAYS & SILTS	▨	BEDROCK

MONITORING WELL

SCREENING INTERVAL

NOTE(S)

1. SEE APPENDIX D OF THE GMP FOR SOIL BORING LOGS.
2. SEE APPENDIX E OF THE GMP FOR MONITORING WELL CONSTRUCTION DETAILS.
3. BOREHOLES SHOWN ARE PROJECTED ONTO CROSS SECTION.
4. VERTICAL EXAGGERATION: 15:1.
5. ELEVATION IN FEET ABOVE MEAN SEA LEVEL.
6. BEDROCK ELEVATION BASED ON B-8, B-9, AND SHANNON AND WILSON, 1979.
7. FT - FEET

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MERAMEC ENERGY CENTER
ST. LOUIS COUNTY, MISSOURI

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-08-21
DESIGNED	JS
PREPARED	JS
REVIEWED	JAP
APPROVED	MNH

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
CROSS SECTION C TO C'

PROJECT NO.	PHASE	REV.	FIGURE
153-1406	0004A	0.0	A4

Path: \\stlouis\common\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\X-Sections\ | File Name: MEC - Cross Sections.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in

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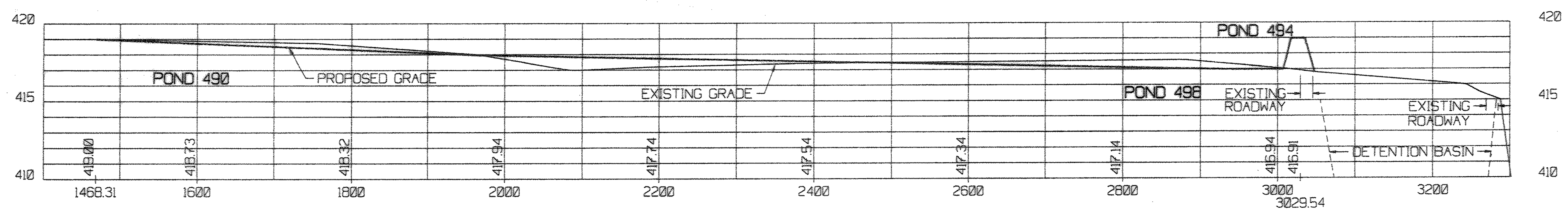
APPENDIX B
EXISTING AMEREN SURFACE IMPOUNDMENT DRAWINGS

PRINT
DIST. 8/15/94

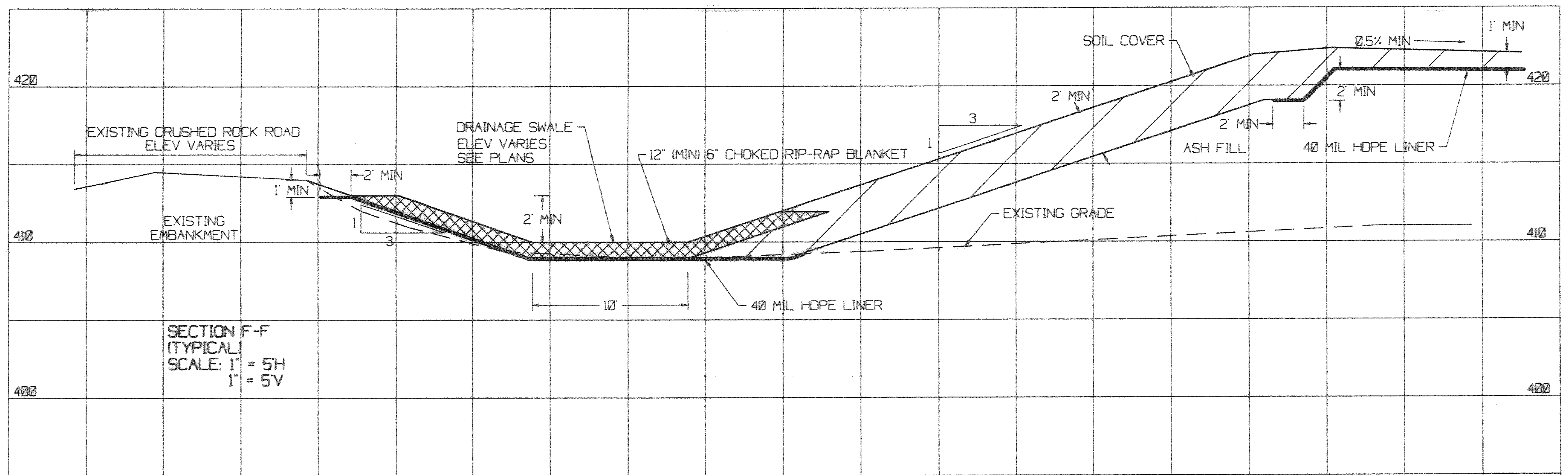
REVISIONS

REV.	W.O.

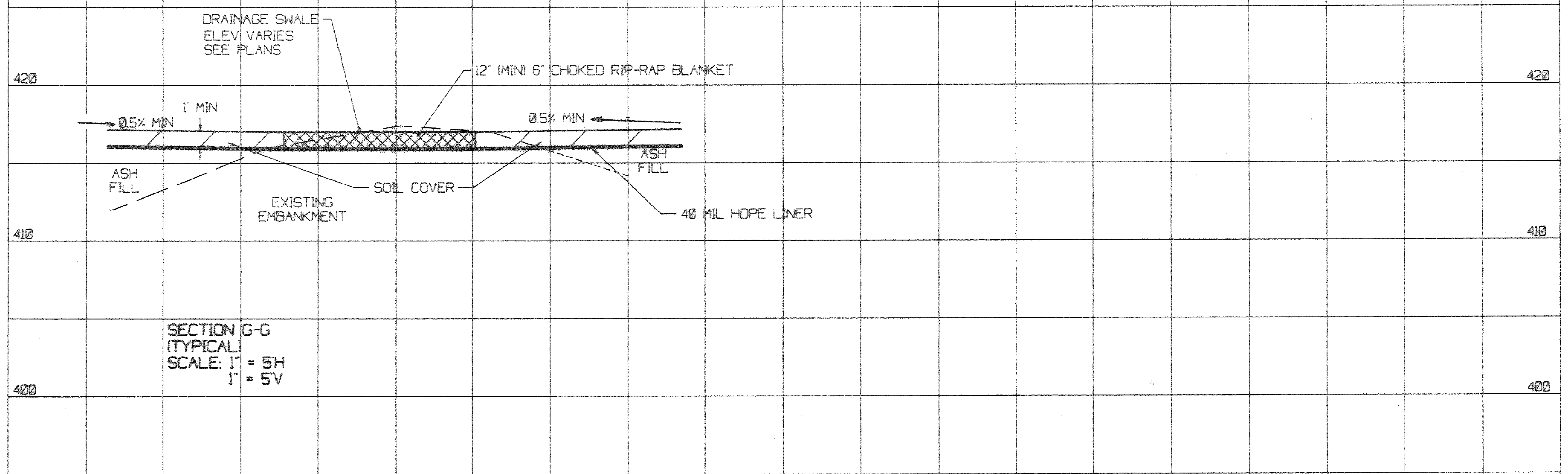
8020-X-135358



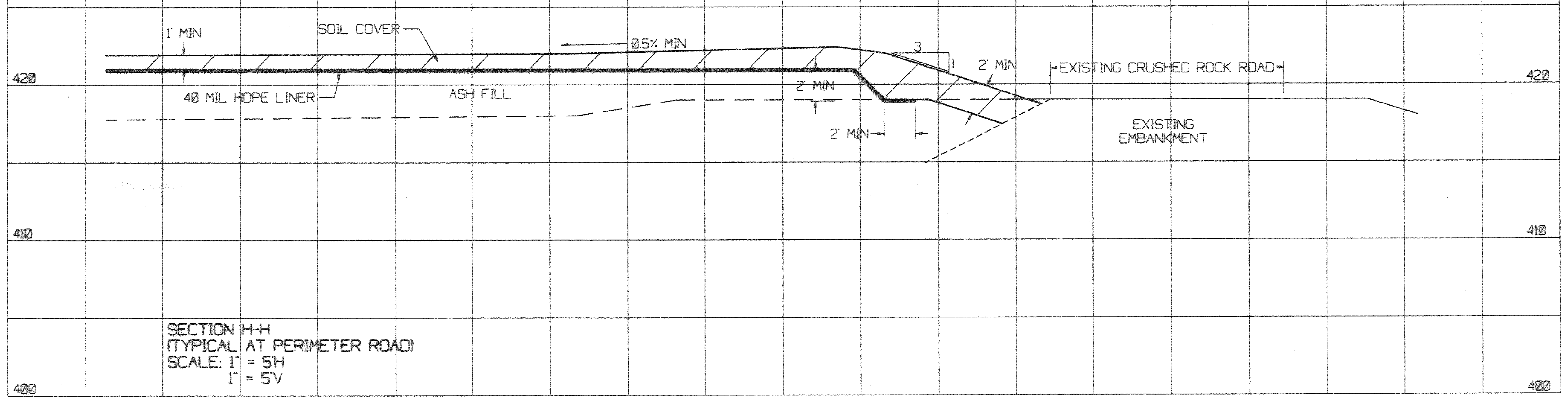
SECTION E-E (ROAD PROFILE)
SCALE 1" = 100H
1" = 5'V



SECTION F-F
(TYPICAL)
SCALE: 1" = 5'H
1" = 5'V



SECTION G-G
(TYPICAL)
SCALE: 1" = 5'H
1" = 5'V



SECTION H-H
(TYPICAL AT PERIMETER ROAD)
SCALE: 1" = 5'H
1" = 5'V

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THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT DRAWINGS AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

SEPTEMBER 14, 1994

PAUL HENRY
REITZ
E-22353

DRAWN	MRF
CHKD.	PHR
SUPV.	
APPD.	

FLYASH POND 489
RECLAMATION

LOCATION		CLASS
001005	MERAMEC POWER PLANT	02010

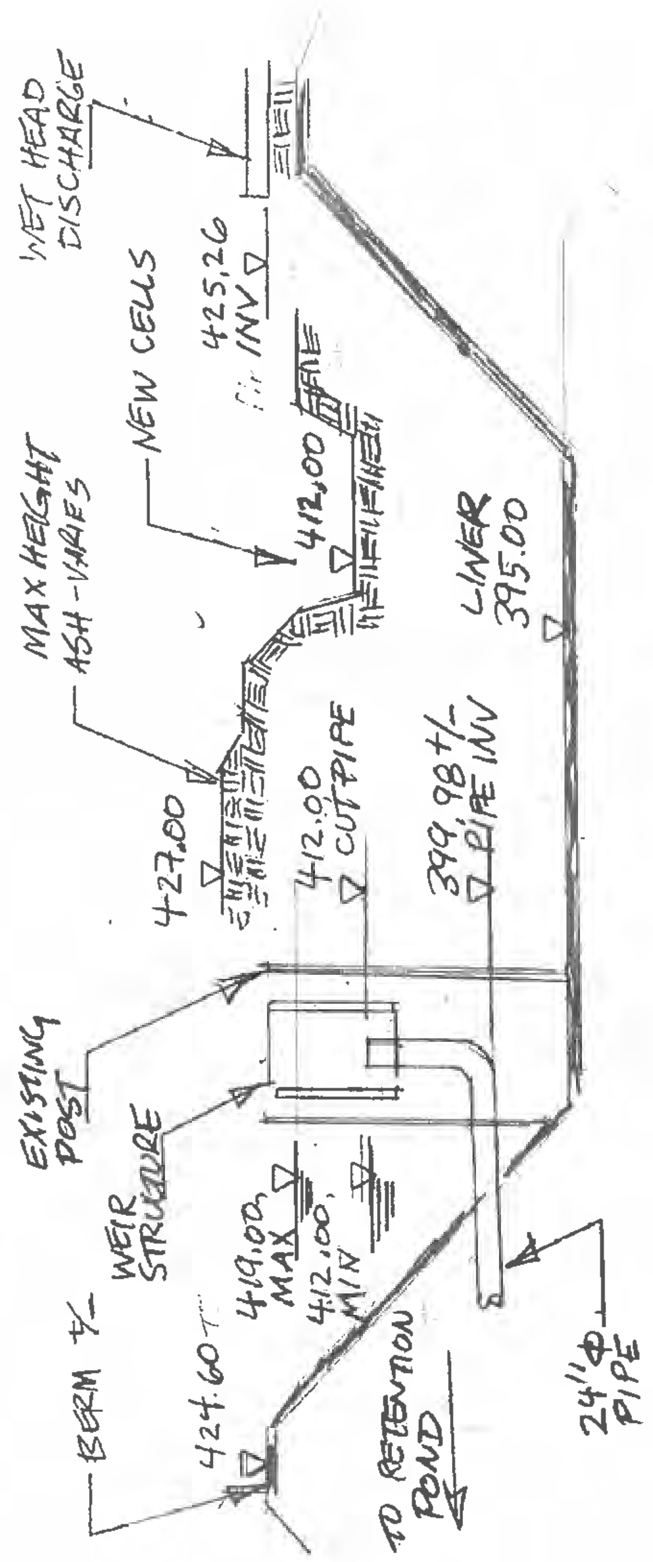
UNION ELECTRIC COMPANY
ST. LOUIS, MO.

8020-X-135358

REV.
0

SHEET 3 OF 3

SK-005-R2



00	21-Oct-11	Release for AMS review
01	21-Oct-11	Release for Ameren review
02	07-Nov-11	Revised

Meramec Power Station
8200 Fine Road
St. Louis, Missouri 63129

AMS
Ash Management Services

Ash Pond No. 498
Hydraulic profile

SK-005-R2

APPENDIX C
HISTORICAL HYDROGEOLOGICAL AND RIVER LEVEL INFORMATION

Excerpts From
Woodward-Clyde Consultants, 1988

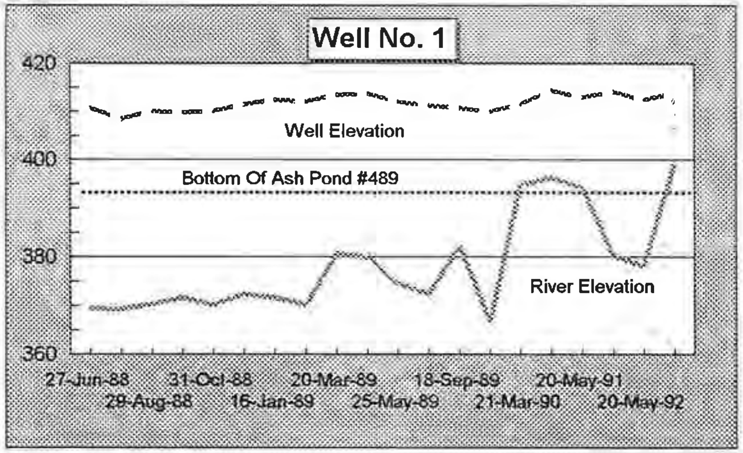
TABLE 1
WATER LEVEL ELEVATIONS (FT MSL)

Date (1988)	Boring B-1	Boring B-2	Boring B-3	Boring B-4	Boring B-5	Boring B-6	Boring B-7	Mississippi River Level
1/11	413.3 (ATD)							376.7
1/12								376.9
1/13								377.2
1/14			376.5 (ATD)					376.9
1/15								377.1
1/16								376.1
1/17								375.9
1/18				381.7 (ATD)				376.5
1/19					390.1 (ATD)			377.1
1/20					377.1			379.3
1/21					381.1			382.2
1/22				380.7		390.3 (ATD)	DRY (ATD)	381.9
1/23								382.9
1/24								382.5
1/25								381.4
1/26								380.7
1/27								379.2
1/28			379.8	380.2	380.5	379.3	DRY	379.4
1/29								379.4
1/30								379.8
1/31	412.8	403.5	379.4	379.7	379.8	379.8	DRY	379.7
2/1								381.8

TABLE 1 (continued)
WATER LEVEL ELEVATIONS (FT MSL)

Date (1988)	Boring B-1	Boring B-2	Boring B-3	Boring B-4	Boring B-5	Boring B-6	Boring B-7	Mississippi River Level
2/2								385.3
2/3								385.3
2/4								384.7
2/5	414.8	404.3	385.1	385.0	384.9	384.8	DRY	383.7
2/6								382.7
2/7								380.6
2/8								379.8
2/9	413.9			380.7	380.6	380.6	DRY	380.2
2/10								379.0
2/11								379.3
2/12								378.7
2/13								377.9
2/14								378.0
2/15								378.4
2/16								377.7
2/17	413.4	403.7		379.2	379.1	379.1	DRY	377.8

NOTES:
1. ATD = at time of drilling
2. Mississippi River elevation for site is approximate; value was calculated by linear interpolation between measured reiver levels at Jefferson Barracks, which is approximately 7.2 miles upstream from the site; and Waters Point which is approximately 3.0 river miles downstream from the site (U.S. Army Corps of Engineers data). There was generally about a four to five foot difference in elevation between the river level at Jefferson Barracks and the river level at Waters Point.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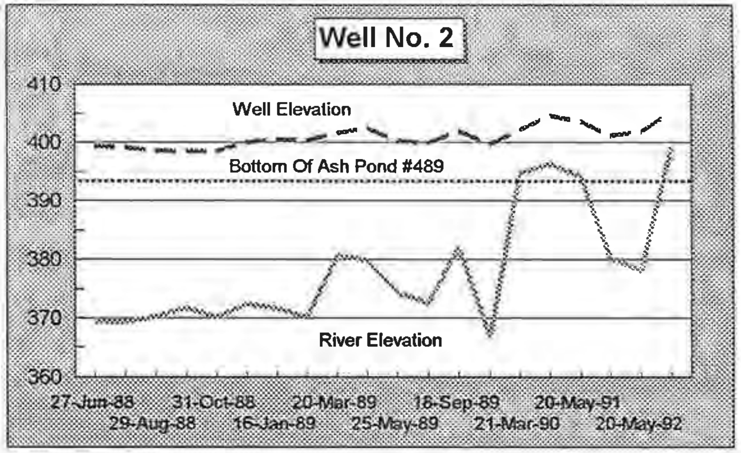
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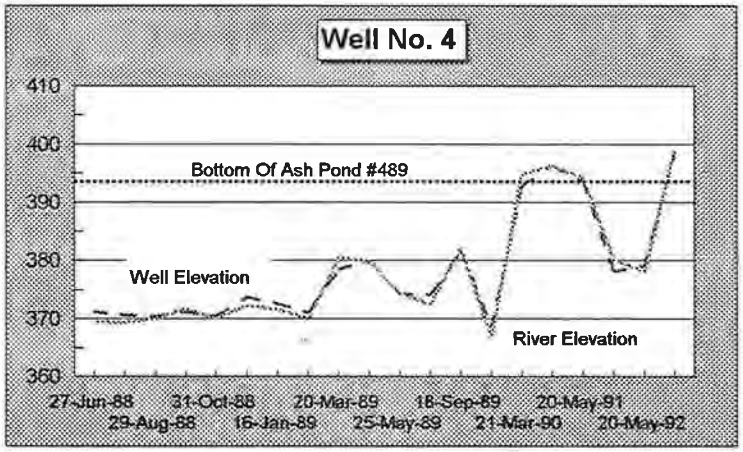
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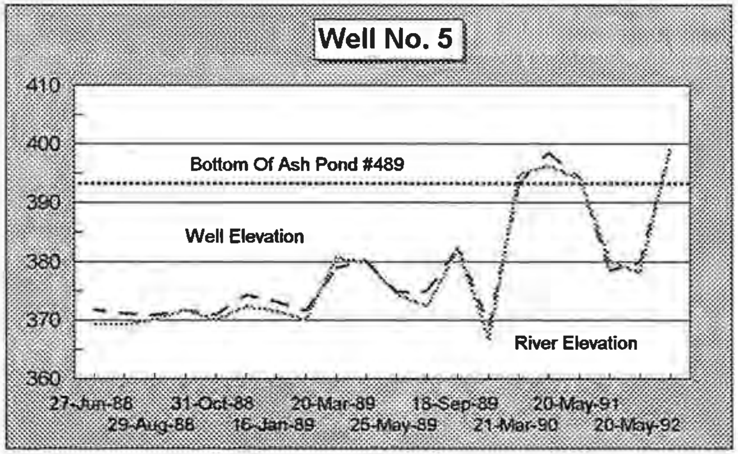
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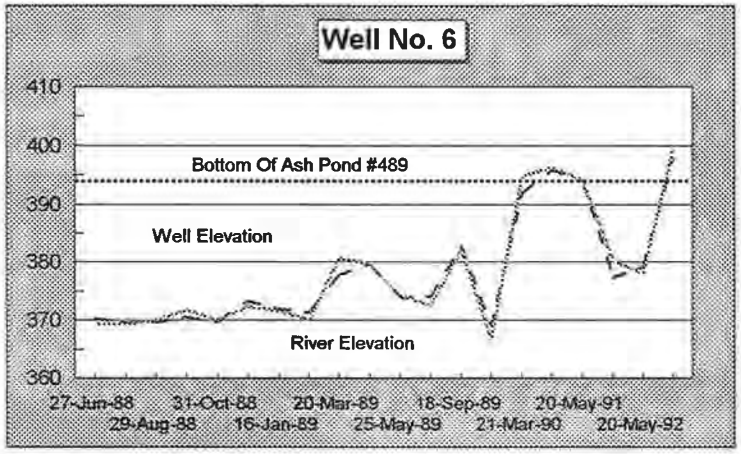
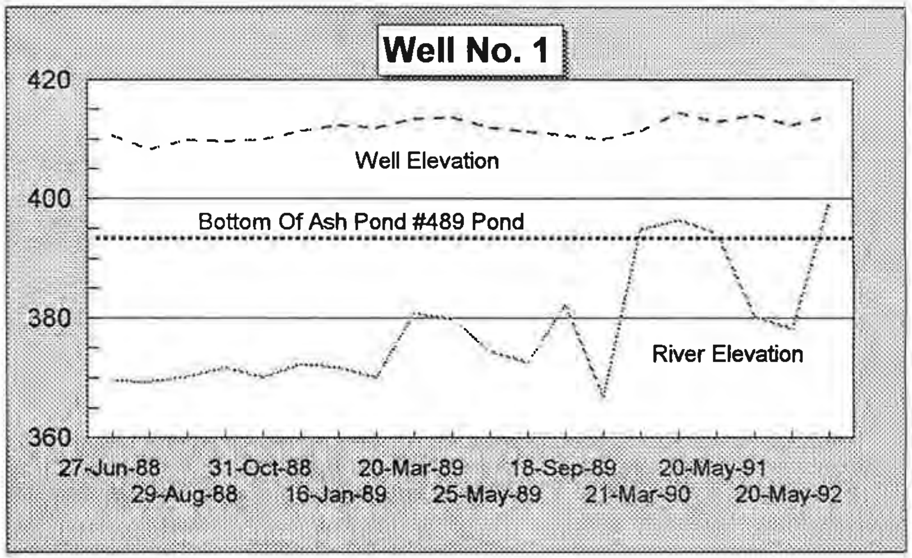

Well No. 6

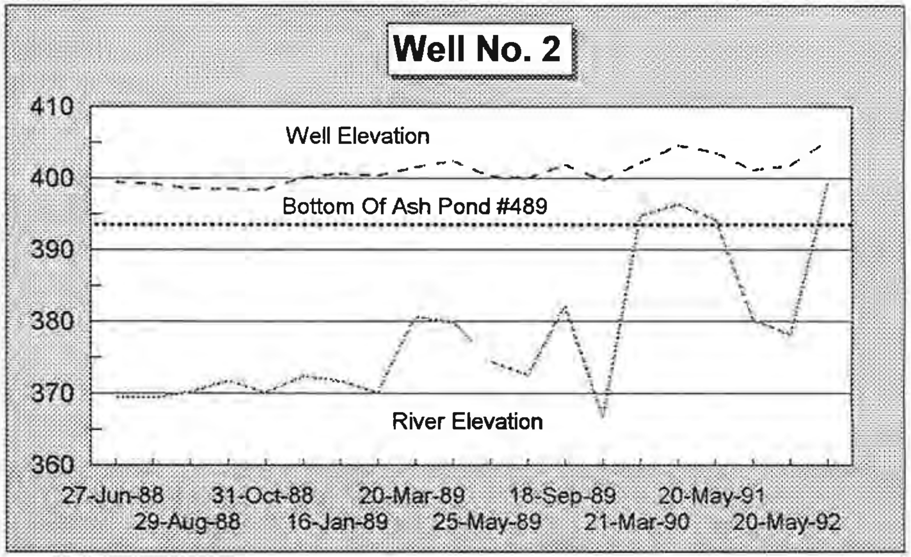
MERAMEC PLANT QUARTERLY GROUND WATER MONITORING DATA

Date	Time	Well Number	Well Water Level	River Water Level
27-Jun-88	1110	1	410.63	369.48
25-Jul-88	1100	1	408.31	369.36
29-Aug-88	1125	1	409.92	370.18
26-Sep-88	1055	1	409.69	371.74
31-Oct-88	950	1	409.96	370.14
05-Dec-88	920	1	411.39	372.38
16-Jan-89	925	1	412.37	371.68
13-Feb-89	930	1	411.96	370.08
20-Mar-89	820	1	413.46	380.68
17-Apr-89	1030	1	413.63	379.85
25-May-89	1230	1	411.89	374.43
26-Jun-89	1030	1	411.22	372.53
18-Sep-89	1042	1	410.57	382.13
12-Dec-89	1000	1	410.03	366.74
21-Mar-90	1008	1	411.39	394.78
13-Jun-90	1022	1	414.34	396.33
20-May-91	1007	1	412.84	394.18
21-Nov-91	857	1	414.06	380.23
20-May-92	840	1	412.36	378.15
14-Jun-93	853	1	413.87	399.28



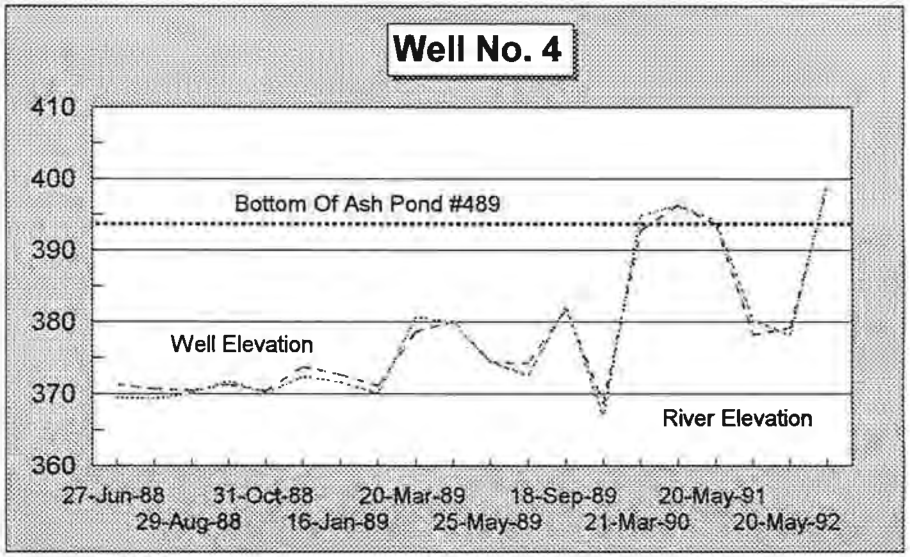
MERAMEC PLANT QUARTERLY GROUND WATER MONITORING DATA

Date	Time	Well Number	Well Water Level	River Water Level
27-Jun-88	1350	2	399.43	369.48
25-Jul-88	1310	2	399.16	369.36
29-Aug-88	1305	2	398.55	370.18
26-Sep-88	1310	2	398.53	371.74
31-Oct-88	1040	2	398.44	370.14
05-Dec-88	1100	2	400.08	372.38
16-Jan-89	1040	2	400.59	371.68
13-Feb-89	1015	2	400.37	370.08
20-Mar-89	915	2	401.54	380.68
17-Apr-89	1220	2	402.41	379.85
25-May-89	1300	2	400.30	374.43
26-Jun-89	1115	2	399.97	372.53
18-Sep-89	1110	2	401.90	382.13
12-Dec-89	1036	2	399.71	366.74
21-Mar-90	1040	2	402.17	394.78
13-Jun-90	1050	2	404.58	396.33
20-May-91	1041	2	403.60	394.18
21-Nov-91	1022	2	401.12	380.23
20-May-92	940	2	401.78	378.15
14-Jun-93	927	2	405.22	399.28



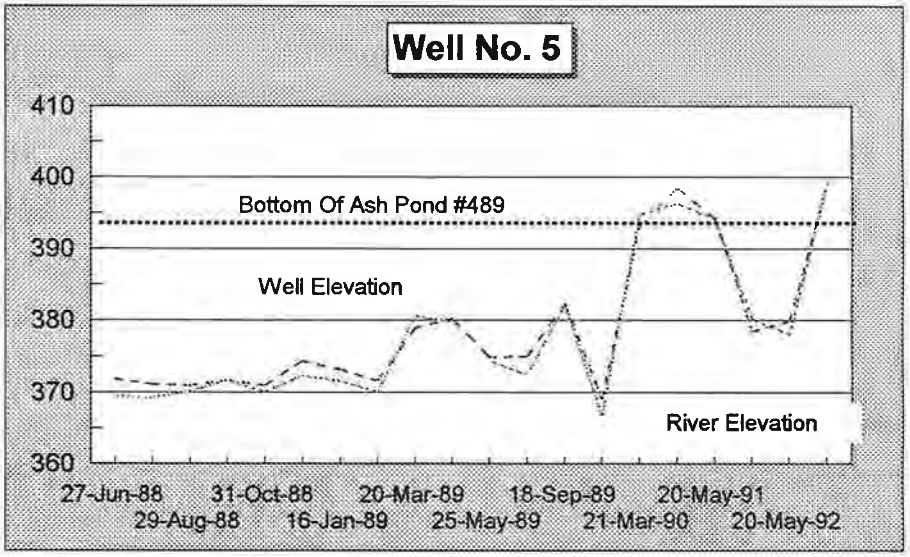
MERAMEC PLANT QUARTERLY
GROUND WATER MONITORING DATA

Date	Time	Well Number	Well Water Level	River Water Level
27-Jun-88	1500	4	371.28	369.48
25-Jul-88	1505	4	370.67	369.36
29-Aug-88	1455	4	370.48	370.18
26-Sep-88	1440	4	371.28	371.74
31-Oct-88	1305	4	370.46	370.14
05-Dec-88	1300	4	373.73	372.38
16-Jan-89	1330	4	372.66	371.68
13-Feb-89	1230	4	371.14	370.08
20-Mar-89	1215	4	378.63	380.68
17-Apr-89	1305	4	380.08	379.85
25-May-89	1400	4	374.37	374.43
26-Jun-89	1300	4	374.22	372.53
18-Sep-89	1304	4	381.73	382.13
12-Dec-89	1214	4	368.62	366.74
21-Mar-90	1120	4	392.72	394.78
13-Jun-90	1244	4	396.28	396.33
20-May-91	1242	4	393.61	394.18
21-Nov-91	1317	4	378.22	380.23
20-May-92	1243	4	379.17	378.15
14-Jun-93	1007	4	398.67	399.28



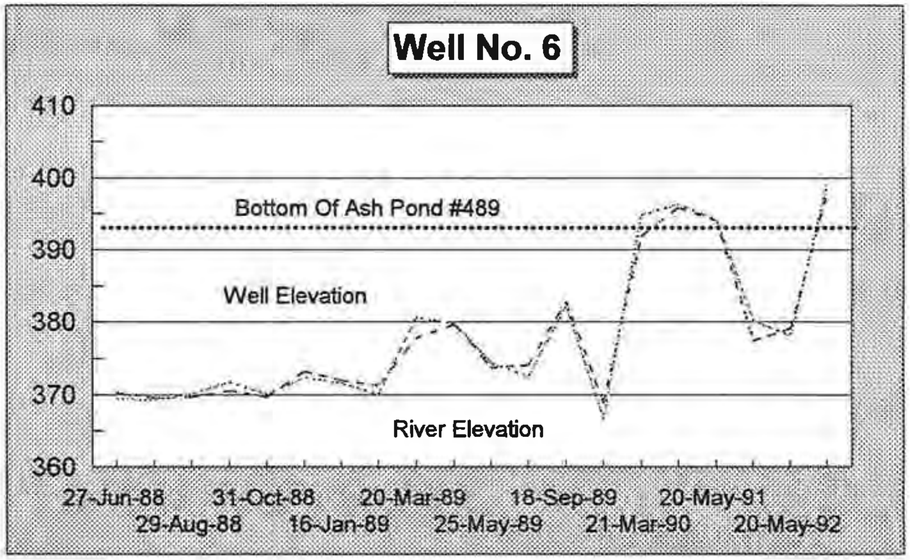
MERAMEC PLANT QUARTERLY GROUND WATER MONITORING DATA

Date	Time	Well Number	Well Water Level	River Water Level
27-Jun-88	1610	5	371.89	369.48
25-Jul-88	1550	5	371.16	369.36
29-Aug-88	1550	5	370.99	370.18
26-Sep-88	1605	5	371.78	371.74
31-Oct-88	1350	5	370.98	370.14
05-Dec-88	1320	5	374.41	372.38
16-Jan-89	1415	5	373.25	371.68
13-Feb-89	1415	5	371.68	370.08
20-Mar-89	1305	5	378.98	380.68
17-Apr-89	1545	5	380.26	379.85
25-May-89	1430	5	374.96	374.43
26-Jun-89	1340	5	375.06	372.53
18-Sep-89	1334	5	382.33	382.13
12-Dec-89	1253	5	369.12	366.74
21-Mar-90	1143	5	393.14	394.78
13-Jun-90	1305	5	398.52	396.33
20-May-91	1317	5	394.24	394.18
21-Nov-91	1354	5	378.55	380.23
20-May-92	1336	5	379.91	378.15
14-Jun-93	1035	5	399.21	399.28



MERAMEC PLANT QUARTERLY
GROUND WATER MONITORING DATA

Date	Time	Well Number	Well Water Level	River Water Level
27-Jun-88	1705	6	370.38	369.48
25-Jul-88	1705	6	369.62	369.36
29-Aug-88	1705	6	369.73	370.18
26-Sep-88	1705	6	370.61	371.74
31-Oct-88	1515	6	369.75	370.14
05-Dec-88	1400	6	373.29	372.38
16-Jan-89	1600	6	371.99	371.68
13-Feb-89	1505	6	371.36	370.08
20-Mar-89	1400	6	377.84	380.68
17-Apr-89	1625	6	379.70	379.85
25-May-89	1600	6	373.84	374.43
26-Jun-89	1500	6	374.07	372.53
18-Sep-89	1356	6	382.77	382.13
12-Dec-89	1323	6	368.92	366.74
21-Mar-90	1208	6	391.89	394.78
13-Jun-90	1326	6	395.88	396.33
20-May-91	1338	6	394.14	394.18
21-Nov-91	1336	6	377.41	380.23
20-May-92	1045	6	379.12	378.15
14-Jun-93	1107	6	398.06	399.28



Excerpt From
CH2MHILL, 1997

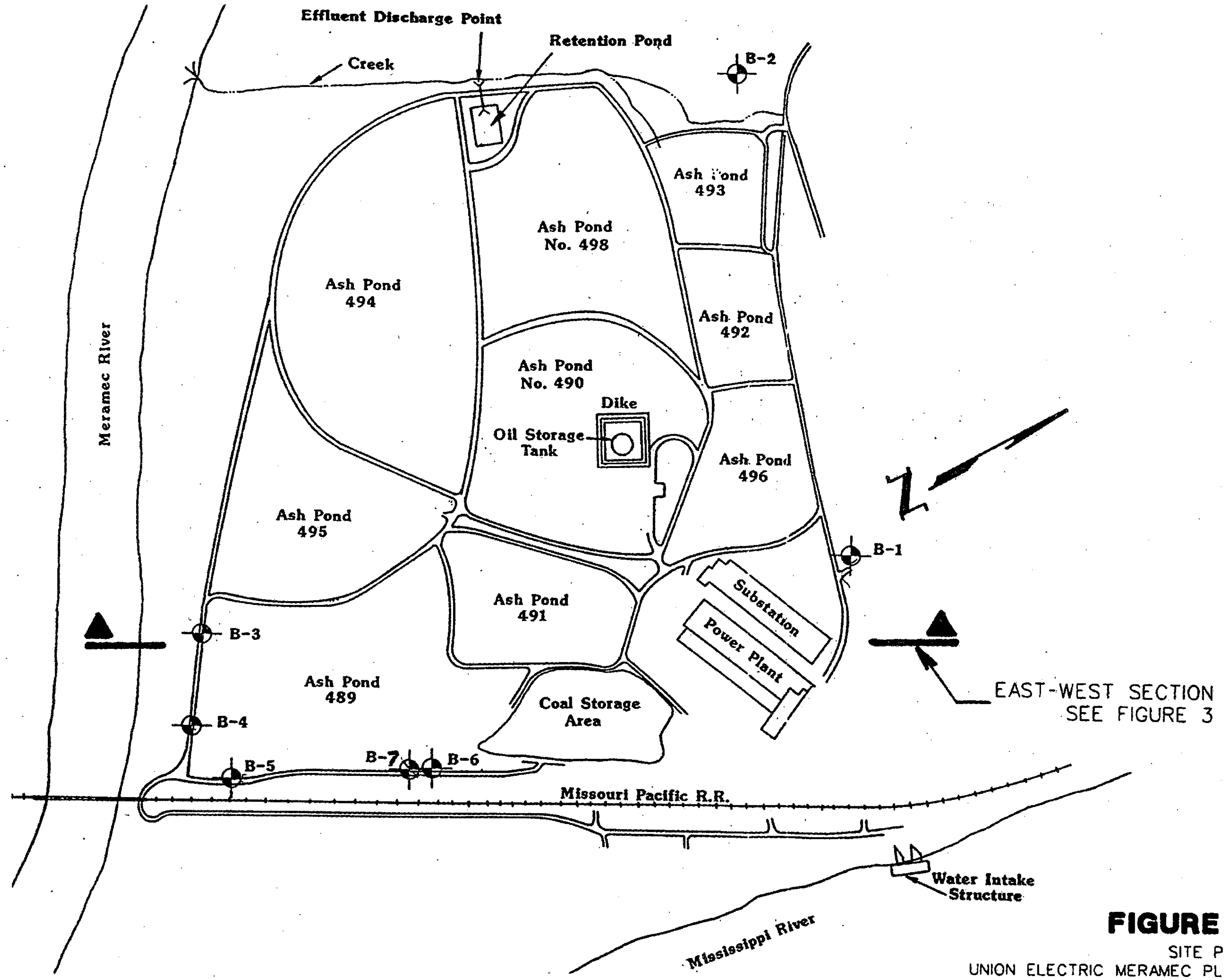
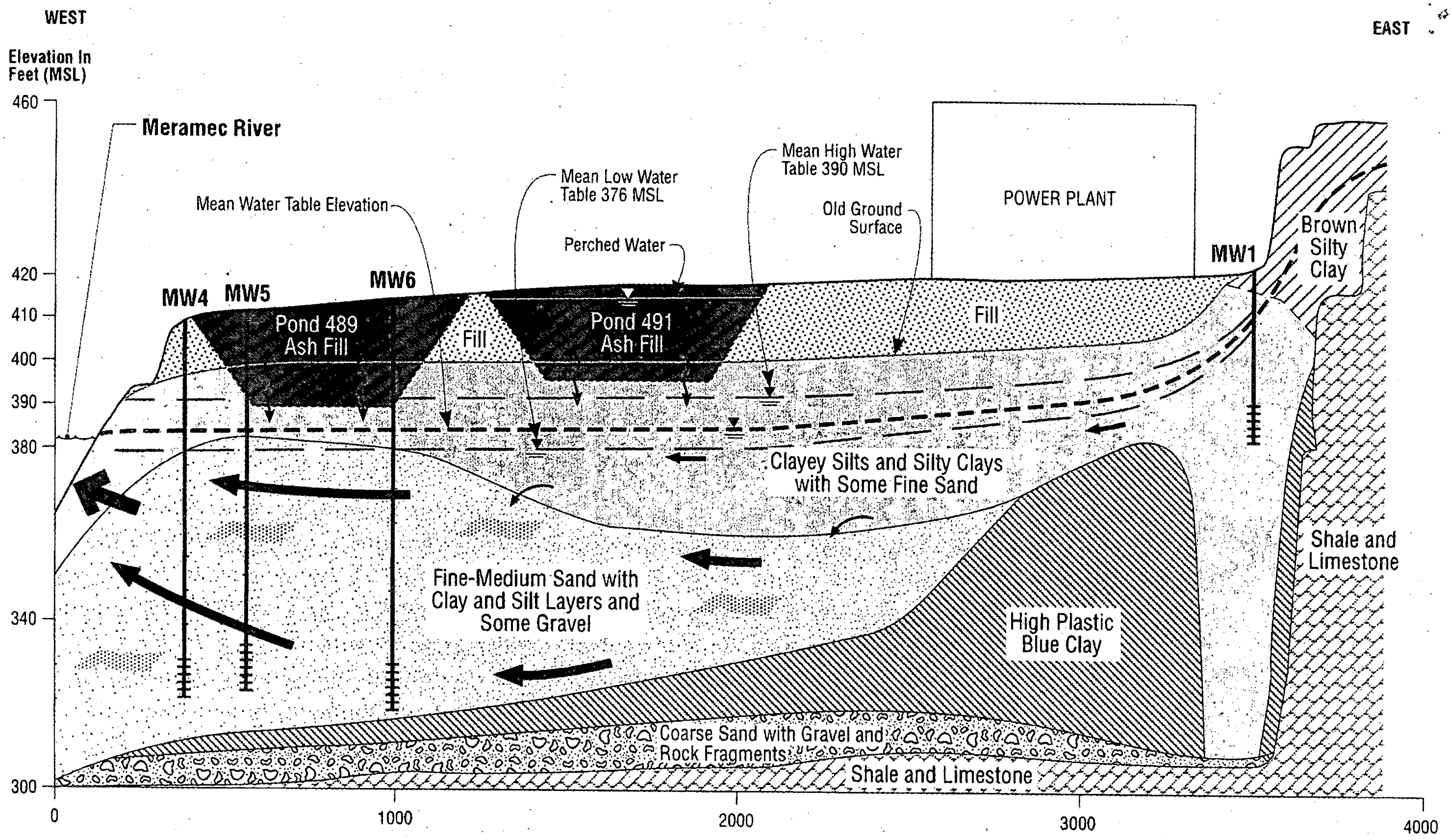


FIGURE 2

SITE PLAN
UNION ELECTRIC MERAMEC PLANT
ST. LOUIS COUNTY, MISSOURI

CH2MHILL



Not To Scale

FIGURE 3

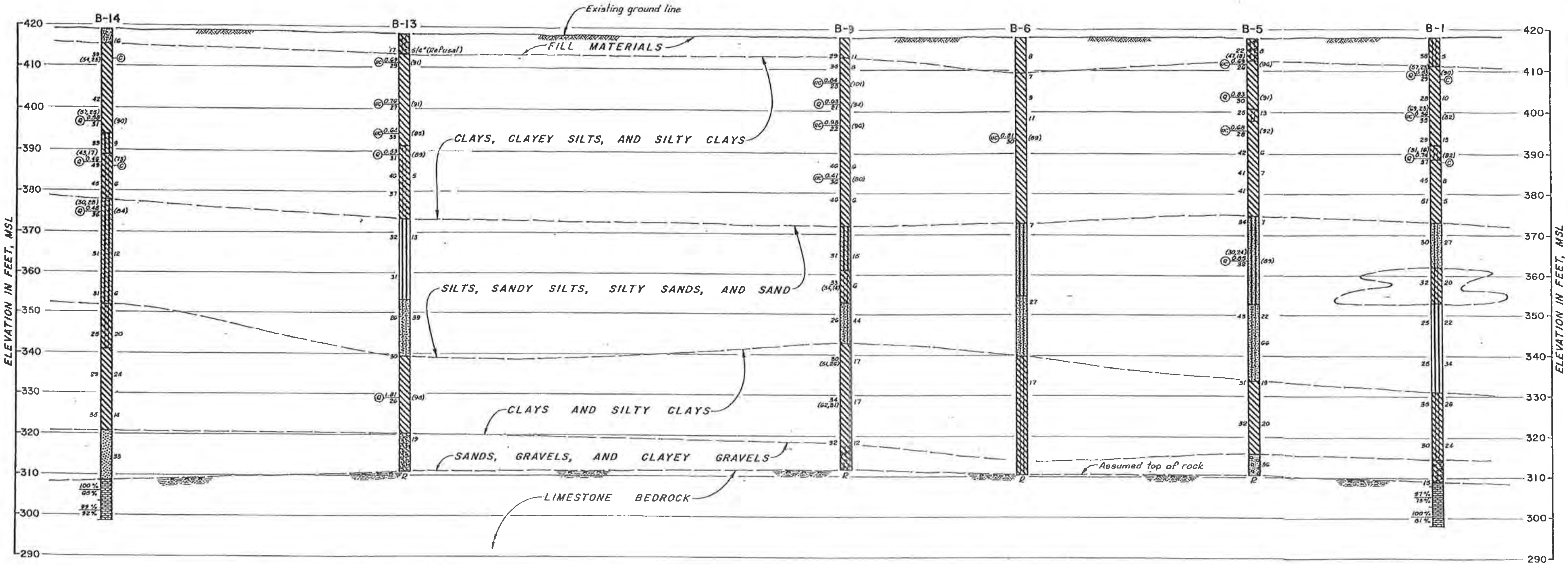
Conceptual Site Model

Union Electric Meramec Plant, St. Louis County, MO

E143874.SR.ZZ Cross-Section 12-3-97 mjl

CH2MHILL

Excerpt From
Shannon & Wilson, Inc., 1979



SECTION A-A

20 15 10 5 0 20 40 60
SCALE IN FEET

NOTES:
1. See Plate 2 for location of section
2. See Plate 5 for legend.

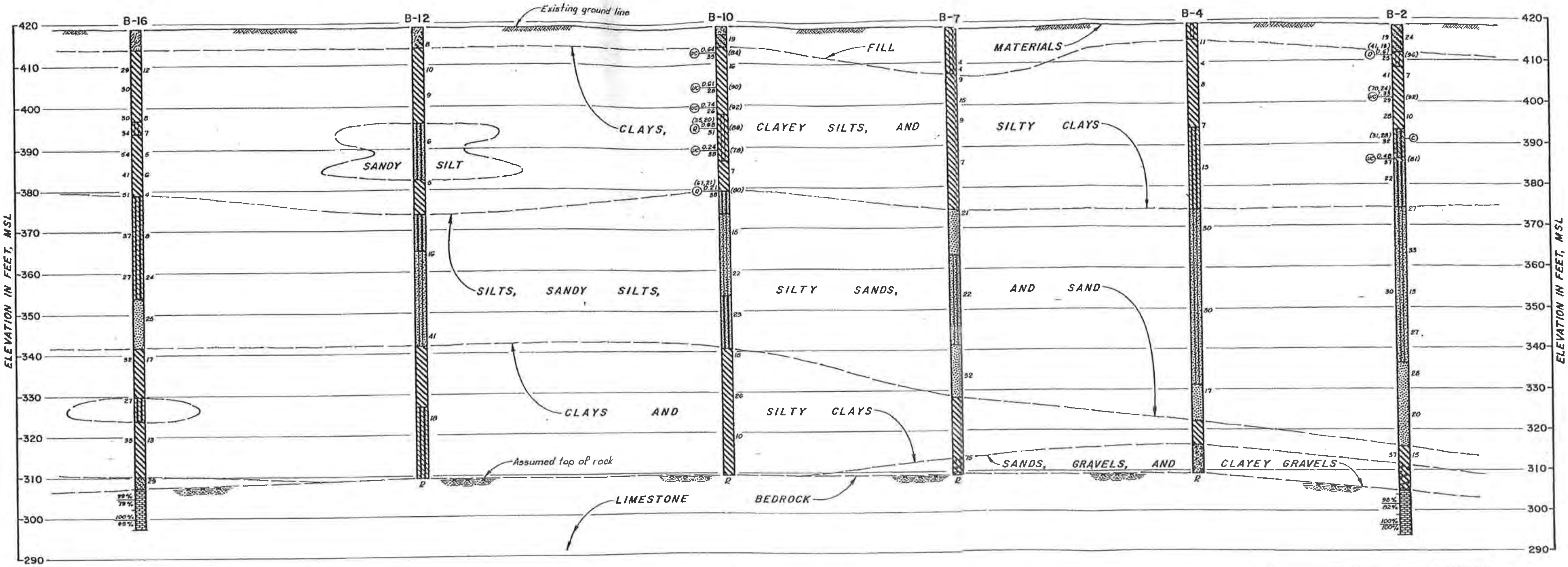
General Note:
Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.

GENERALIZED SOIL AND ROCK PROFILE ALONG SECTION A-A

SHANNON & WILSON, INC.
GEOTECHNICAL CONSULTANTS

M-256

PLATE 3



SECTION B-B

20 15 10 5 0 20 40 60
SCALE IN FEET

NOTES:
1. See Plate 2 for location of section.
2. See Plate 5 for legend.

General Note:
Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.

GENERALIZED SOIL AND ROCK PROFILE
ALONG SECTION B–B

SHANNON & WILSON, INC.
GEOTECHNICAL CONSULTANTS

PLATE

APPENDIX D
CCR MONITORING WELL BORING LOGS

RECORD OF BOREHOLE BMW-1

SHEET 1 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 4/7/2016
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: N/A E: N/A

ELEVATION: 416.79
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	ELEVATION DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC/ATT	REMARKS
0	6" Sonic	(0-1.1) CONCRETE			1	SO	1.9/5.0	
		(1.1-27.8) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; greenish black (5GY 2/1); cohesive, w~PL, firm	CL	415.9 1.1				
5		(5.0) SAA (Same As Above), medium gray (N5) mottled with moderate yellowish brown (10YR 5/4)		412.0 5.0	2	SO	2.9/5.0	
10		(10.0) SAA, stiff		407.0 10.0	3	SO	5.0/5.0	
		(13.6) SAA, dark gray (N3)		403.4 13.6				
15		(15.0) SAA, trace organic fragments (wood)		402.0 15.0	4	SO	5.0/5.0	
20		(20.0) SAA, some non-plastic fines; firm		397.0 20.0	5	SO	5.0/5.0	Run #4, Silty clay in sample appears to be swelling when brought to the surface resulting in recovery over 100%. Measured field recovery: 6.0/5.0. Estimated actual recovery: 5.0/5.0
25		(25.0) SAA, medium gray (N5) mottled with moderate yellowish brown (10YR 5/4)		392.0 25.0	6	SO	5.0/5.0	▽ Water Level 25.23 ft bgs 4/11/2016 Run #5, Silty clay in sample appears to be swelling when brought to the surface resulting in recovery over 100%. Measured field recovery: 5.3/5.0. Estimated actual recovery: 5.0/5.0
		(27.8-28.6) (ML) CLAYEY SILT, low plasticity fines, trace fine sand; light brownish gray (5YR 6/1) mottled moderate yellowish brown (10YR 5/4); cohesive, w<PL, soft	ML	389.2 27.8				
			CL	388.4 28.6				
30		Log continued on next page						

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JSI/JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE BMW-1

SHEET 2 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 4/7/2016
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: N/A E: N/A

ELEVATION: 416.79
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30 35	6" Sonic	(28.6-37.1) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; medium gray (N5) to light brownish gray (5YR 6/1) mottled with moderate yellowish brown (10YR 5/4); cohesive, w<PL, soft *(Continued)*	CL		379.9	7	SO	10.0 / 10.0	Run #6, Silty clay in sample appears to be swelling when brought to the surface resulting in recovery over 100%. Measured field recovery: 5.7/5.0. Estimated actual recovery: 5.0/5.0
		(37.1-40.0) (ML) sandy CLAYEY SILT, medium plasticity fines, some fine sand; medium gray (N5); cohesive, w<PL, soft	MH		37.1 377.0				
40 45		(40.0-48.1) (SC) CLAYEY SAND, fine sand, low plasticity fines; medium gray (N5); non-cohesive, wet, loose	SC		40.0 368.9	8	SO	10.0 / 10.0	
		(48.1-50.0) (SP) SAND, fine sand, trace non-plastic fines; brownish gray (5YR 4/1); non-cohesive, wet, loose	SP		48.1 367.0				
50		(50.0-51.1) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; medium gray (N5); cohesive, w>PL, firm	CL		50.0 365.9	10	SO	9.2 / 10.0	
		(51.1-51.3) (SC) CLAYEY SAND, fine sand, medium plasticity fines; medium gray (N5); cohesive, w<PL, firm	SC		51.1 365.7				
		(51.3-53.1) (CL) SILTY CLAY, medium to high plasticity, trace fine sand; medium gray (N5); cohesive, w<PL, firm	CL		51.3 363.9				
		(53.1-53.8) (SC) CLAYEY SAND, fine sand, medium plasticity fines; medium gray (N5); cohesive, w<PL, firm	SC		53.1 363.2				
55		(53.8-58.5) (CL) SILTY CLAY, low to medium plasticity, some fine sand; medium gray (N5); cohesive, w~PL, firm	CL		53.8 358.5				
60		(58.5-60.0) (SP) SAND, fine sand, trace non-plastic fines; brownish gray (5YR 4/1); non-cohesive, wet, compact	SP		58.5 357.0				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JSI/JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE BMW-1

SHEET 3 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 4/7/2016
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: N/A E: N/A

ELEVATION: 416.79
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC/ATT	
60	6" Sonic	(60.0-64.0) (CL) SILTY CLAY, medium plasticity fines, some fine sand; medium gray (N5); cohesive, w~PL, firm	CL	▨	60.0 353.0				
65		(64.0-66.2) (ML) sandy CLAYEY SILT, low plasticity fines, fine sand; medium gray (N5); non-cohesive, wet, compact	ML	▦	64.0 350.8	9	SO	10.0/10.0	
		(66.2-70.0) (CL) SILTY CLAY, medium to high plasticity, trace fine sand; medium gray (N5) to brownish gray (5YR 4/1); cohesive, w>PL, stiff	CL	▨	66.2 347.0				
70		END OF BORING AT 70.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG BMW-1.			70.0				
75									
80									
85									
90									

GOLDER STL RECORD OF BOREHOLE MWD MEC LOGS.GPJ GLDR_CO.GDT 10/10/17

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JSI/JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE BMW-2

SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/25/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 937,927.10 E: 866,342.24

ELEVATION: 406.80
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6" Sonic	(0.0-6.9) (ML) CLAYEY SILT, medium plasticity fines, some organics (roots), trace fine sand; dark yellowish brown (10YR 4/2) to dusky yellowish brown (10YR 2/2); cohesive, w~PL, firm	ML	▨		1	SO	4.6 / 5.0	
5						2	SO	3.6 / 5.0	
		(6.9-35.6) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm	CL	▨	399.9 / 6.9				
10						3	SO	4.9 / 5.0	∇ Water Level 11.89 ft bgs 2/16/2016
		(12.5) SAA (Same As Above) except, stiff			394.3 / 12.5				
15		(15.0) SAA except, firm			391.8 / 15.0	4	SO	5.0 / 5.0	
20						5	SO	10.0 / 10.0	
		(21.8) SAA except, low plasticity fines; medium dark gray (N4); w<PL			385.0 / 21.8				
30									

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE BMW-2

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring	DRILLING METHOD: 6" Sonic	DATUM: NAVD88	ELEVATION: 406.80
PROJECT NUMBER: 153-1406.0004A	DRILLING DATE: 1/25/16	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Meramec Energy Center	DRILL RIG: Mini Sonic (CDD1415)	COORDINATES: N: 937,927.10 E: 866,342.24	

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC/ATT	
30	6" Sonic	(6.9-35.6) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm *(Continued)*	CL		371.2 35.6	6	SO	10.0/10.0	
35		(35.6-38.8) (ML) CLAYEY SILT, low plasticity fines, some sub-angular fine to coarse gravel; dark gray (N3); cohesive, w<PL, firm	ML		368.0 38.8				
		(38.8-41.4) (GM) SILTY GRAVEL, fine to coarse sub-angular gravel, non-plastic fines, trace fine sand; brownish gray (5YR 4/1); non-cohesive, wet, compact (40.0) SAA except, some fine to coarse sub-rounded sand	GM		366.8 40.0 365.4 41.4				
40 45		(41.4-50.0) (CL) SILTY CLAY, high plasticity fines; dark gray (N3); cohesive, w>PL, stiff	CL		356.8 50.0	7	SO	7.7/10.0	
50 55 60		END OF BORING AT 50.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG BMW-2.							

SCALE: 1 in = 3.8 ft	LOGGED: JS
DRILLING CONTRACTOR: Cascade	CHECKED: JSI
DRILLER: J. Drabek	REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-1

SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/23/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 937,676.92 E: 865,954.06

ELEVATION: 404.10
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6" Sonic	(0.0-10.0) (ML) SILT, non-plastic fines, some fine sand, some organics (roots); dark yellowish brown (10YR 4/2); cohesive, w<PL, soft	ML			1	SO	2.7 / 5.0	∇ Water Level 2.23 ft bgs 2/16/2016
5		(5.0) SAA (Same As Above) except, firm			399.1 / 5.0	2	SO	5.0 / 5.0	
10		(10.0-15.0) (ML) CLAYEY SILT, low to medium plasticity fines, some fine sand; moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR4/2); cohesive, w~PL, soft to firm	ML		394.1 / 10.0	3	SO	5.0 / 5.0	
15		(15.0-21.4) (ML) SILT, non-plastic fines, trace fine sand; moderate yellowish brown (10YR 5/4); cohesive, w<PL, soft	ML		389.1 / 15.0	4	SO	5.0 / 5.0	
20									
		(21.4-32.7) (ML) SILT, non-plastic to low plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w<PL, soft	ML		382.7 / 21.4	5	SO	10.0 / 10.0	
25									
30		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD MEC LOGS.GPJ GLDR_CO.GDT 10/10/17

RECORD OF BOREHOLE MW-1

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/23/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 937,676.92 E: 865,954.06

ELEVATION: 404.10
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	SAMPLES NUMBER	TYPE	REC/ATT	REMARKS
30	6" Sonic	(21.4-32.7) (ML) SILT, non-plastic to low plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w<PL, soft *(Continued)*	ML		371.4 32.7				
35		(32.7-36.2) (SM) SILTY SAND, fine to coarse well graded sand, non-plastic to low plasticity fines, trace sub-rounded gravel; brownish gray (5YR 4/1); non-cohesive, wet, compact	SM		367.9 36.2	6	SO	10.0/10.0	
		(36.2-40.0) (GW) sandy GRAVEL, fine to coarse sub-rounded gravel, fine to coarse sub-rounded sand, some non-plastic to low plasticity fines; brownish gray (5YR 4/1); non-cohesive, wet, compact	GW		364.1 40.0				
40		END OF BORING AT 40.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-1.							
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-2

SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/23/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 937,325.09 E: 864,864.51

ELEVATION: 396.13
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	SAMPLES NUMBER	TYPE	REC/ATT	REMARKS
0	6" Sonic	(0.0-12.4) (ML) SILT, non-plastic fines, trace fine sand, some organics (roots); dark yellowish brown (10YR 4/2); non-cohesive, moist, compact	ML			1	SO	3.2/5.0	
5		(5.0) SAA (Same As Above) except, dark yellowish brown (10YR 4/2) to brownish black (5YR 2/1)			391.1 5.0	2	SO	3.6/5.0	
10						3	SO	4.7/5.0	
		(12.4-26.8) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sand; medium dark gray (N4) mottled dark yellowish brown (10YR 4/2); cohesive, w~PL, stiff	CL		383.7 12.4				∇ Water Level 12.57 ft bgs 2/16/2016
15		(15.0) SAA except, firm to stiff			381.1 15.0	4	SO	8.8/10.0	
20									
25		(25.0) SAA except, firm			371.1 25.0	5	SO	10.0/10.0	
		(26.8-30.0) (CL) SILTY CLAY, medium plasticity fines, some fine sand; medium dark gray (N4); cohesive, w~PL, soft	CL		369.3 26.8				
30					366.1				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

RECORD OF BOREHOLE MW-2

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/23/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 937,325.09 E: 864,864.51

ELEVATION: 396.13
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC / ATT	
30	6" Sonic	(30.0-31.2) (SW) SAND, fine to coarse sub-rounded sand, trace low plasticity fines; brownish gray (5YR 4/1); non-cohesive, wet, compact	SW	⁘	30.0				
		(31.2-34.2) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w~PL, firm	CL	▨	364.9 31.2	5	SO	10.0 / 10.0	
		(34.2-34.6) (GM) SILTY GRAVEL, fine to coarse sub-rounded gravel, low plasticity fines, trace fine to coarse sub-rounded sand; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	GM	○	361.9 34.2				
35		(34.6-45.0) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w~PL, firm (35.0) SAA except, stiff	CL	▨	361.5 34.6 361.1 35.0	6	SO	10.0 / 10.0	
40									
45		END OF BORING AT 45.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-2.			351.1 45.0				
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-3

SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring	DRILLING METHOD: 6" Sonic	DATUM: NAVD88	ELEVATION: 394.63
PROJECT NUMBER: 153-1406.0004A	DRILLING DATE: 1/22/16	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Meramec Energy Center	DRILL RIG: Mini Sonic (CDD1415)	COORDINATES: N: 936,750.84 E: 864,447.17	

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC ATT	
0	6" Sonic	(0.0-5.0) (ML) SILT, non-plastic to low plasticity fines, some fine sand; dark yellowish brown (10YR 4/2); cohesive, w<PL, firm	ML			1	SO	2.9 5.0	
5		(5.0-6.4) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2) to dusky yellowish brown (10YR 2/2); cohesive, w~PL, firm	ML		389.6 5.0	2	SO	4.2 5.0	
		(6.4-11.1) (SM) SILTY SAND, fine poorly graded sand, non-plastic fines; dark gray (N3); non-cohesive, wet, compact	SM		388.2 6.4				
10						3	SO	4.9 5.0	
		(11.1-13.5) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; brownish black (5YR 2/1); cohesive, w<PL, firm	ML		383.5 11.1				∇ Water Level 11.07 ft bgs 2/16/2016
		(13.5-22.2) (CL) SILTY CLAY, medium to high plasticity fines; dark yellowish brown (10YR 4/2); cohesive, w>PL, stiff	CL		381.1 13.5				
15		(15.0) SAA (Same As Above) except, w~PL, firm			379.6 15.0	4	SO	5.0 5.0	
20						5	SO	9.1 10.0	
		(22.2-22.4) (SP) SAND, fine sand, some non-plastic fines; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	SP		372.4 22.2				
		(22.4-25.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; dark gray (N3); cohesive, w<PL, soft	ML		372.2 22.4				
25		(25.0-25.2) (SP) SAND, fine sand, some non-plastic fines; moderate yellowish brown (10YR 5/4); non-cohesive, wet, compact	SP		369.6 25.0				
		(25.2-26.1) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2); cohesive, w<PL, firm	CL		369.4 25.2				
		(26.1-30.0) (GW) sandy GRAVEL, fine to coarse sub-rounded gravel, fine sand, trace non-plastic fines; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	GW		368.5 26.1				
30					364.6				

Log continued on next page

SCALE: 1 in = 3.8 ft	LOGGED: JS
DRILLING CONTRACTOR: Cascade	CHECKED: JSI
DRILLER: J. Drabek	REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-3

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/22/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 936,750.84 E: 864,447.17

ELEVATION: 394.63
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC ATT	
30	6" Sonic	(30.0-55.0) (CL) SILTY CLAY, medium to high plasticity fines, trace sub-rounded gravels; moderate brown (5YR3/4); cohesive, w~PL, stiff	CL	▨	30.0				
35		(34.8) SAA except, olive gray (5Y 4/1)			359.8 34.8	6	SO	10.0 10.0	
40		(40.0) SAA except, less gravel			354.6 40.0				(40.0) Run #7, Driller adds 5 feet of sample rod to the sampler in order to sample a 15 feet run to total depth.
45						7	SO	10.7 15.0	
50									
55		END OF BORING AT 55.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-3.			339.6 55.0				
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD MEC LOGS.GPJ GLDR_CO.GDT 10/10/17

RECORD OF BOREHOLE MW-4

SHEET 1 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center
DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/22/16
DRILL RIG: Mini Sonic (CDD1415)
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 935,618.00 E: 864,629.82
ELEVATION: 402.03
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	ELEVATION DEPTH (ft)	SAMPLES NUMBER	TYPE	REC/ATT	REMARKS
0	6" Sonic	(0.0-12.4) (ML) CLAYEY SILT, low to medium plasticity fines, some fine sand; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm	ML		1	SO	3.5/5.0	
5		(5.0) SAA (Same As Above) except, trace fine sub-angular gravel; w<PL		397.0 5.0	2	SO	1.8/5.0	
10					3	SO	4.6/5.0	
		(12.4-15.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2) to dark gray (N3); cohesive, w<PL, firm	ML	389.6 12.4				
15		(15.0-20.0) NO RECOVERY	ML	387.0 15.0	4	SO	0.0/5.0	(15.0-20.0) Run # 4, No recovery from 15-20 ft. Driller says sample slipped through the retaining bit. Some CLAYEY SILT found in bit, 15-20 is likely same as above but very soft. ▽ Water Level 18.18 ft bgs 2/16/2016
20		(20.0-40.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; brownish gray (5YR 4/1); cohesive, w~PL, stiff	ML	382.0 20.0	5	SO	9.4/10.0	
25		(26.3) SAA except, soft, w<PL		375.7 26.3				
30		Log continued on next page		372.0				

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek
LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-4

SHEET 2 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center
DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/22/16
DRILL RIG: Mini Sonic (CDD1415)
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 935,618.00 E: 864,629.82
ELEVATION: 402.03
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic	(20.0-40.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sand; brownish gray (5YR 4/1); cohesive, w~PL, stiff *(Continued)* (30.0) SAA except, some fine sand; w~PL, firm	ML		30.0	6	SO	10.0 / 10.0	
40		(40.0-41.3) (GW) GRAVEL, sub-rounded gravel, some medium plasticity fines, trace fine to coarse sub-rounded sand; moderate yellowish brown (10YR 5/4); non-cohesive, wet, compact	GW		362.0 40.0	7	SO	10.0 / 10.0	
		(41.3-60.0) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; dark gray (N3); cohesive, w~PL, firm	CL		360.7 41.3				
50		(50.0) SAA except, trace coarse sub-rounded gravel; medium dark gray (N4)			352.0 50.0	8	SO	9.8 / 10.0	
		(54.3) SAA except, no gravel, some fine sand; stiff			347.7 54.3				
60					342.0				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek
LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-4

SHEET 3 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/22/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 935,618.00 E: 864,629.82

ELEVATION: 402.03
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
60	6" Sonic	(60.0-65.0) (ML) SILT, low plasticity fines, trace sub-angular gravel, trace fine sand; brownish gray (5YR 4/1); cohesive, w<PL, firm	ML		60.0	9	SO	5.0 / 5.0	
65		END OF BORING AT 65.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-4.			337.0 65.0				
70									
75									
80									
85									
90									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-5

SHEET 1 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/21/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 934,874.35 E: 864,780.96

ELEVATION: 400.83
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	SAMPLES NUMBER	TYPE	REC ATT	REMARKS
0	6" Sonic	(0.0-10.0) FILL - (CL) SILTY CLAY, medium plasticity fines, trace fine sand, some organics (tree and grass roots); dark yellowish brown (10YR 4/2); cohesive, w~PL, firm	CL	▨		1	SO	4.5 5.0	
5		(5.0) SAA (Same As Above) except, greenish black (5GY 2/1); stiff		▨	395.8 5.0	2	SO	4.9 5.0	
10		(10.0-20.0) FILL - (ML) CLAYEY SILT, non-plastic to low plasticity fines, trace fine sand; brownish black (5YR 2/1) to grayish black (N2), ASH; cohesive, w<PL, soft	ML	▤	390.8 10.0	3	SO	5.0 5.0	
15		(15.0) SAA except, medium dark gray (N4) mottled moderate yellowish brown (10YR 5/4)		▤	385.8 15.0	4	SO	4.9 5.0	▽ Water Level 16.79 ft bgs 2/16/2016
20		(20.0-30.0) (CL) SILTY CLAY, low plasticity fines; dusky yellowish brown (10YR 2/2) to dark gray (N3); cohesive, w<PL, firm	CL	▨	380.8 20.0	5	SO	10.0 10.0	
30					370.8				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-5

SHEET 2 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/21/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 934,874.35 E: 864,780.96

ELEVATION: 400.83
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic	(30.0-31.9) (SW) SAND, fine to coarse sub-rounded sand, fine sub-rounded gravel; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	SW	30.0 368.9				
		(31.9-33.3) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w~PL, firm	CL	31.9 367.5				
		(33.3-35.0) (SC) CLAYEY SAND, fine to coarse sub-rounded sand, low to medium plasticity fines; medium dark gray (N4); non-cohesive, wet, compact	SC	33.3 365.8				
35		(35.0-46.0) (CL) SILTY CLAY, low to medium plasticity fines; dark gray (N3); cohesive, w~PL firm	CL	35.0 354.8	6	SO	10.0 / 10.0	
40					7	SO	5.0 / 5.0	
45		(46.0-60.6) (SW) SAND, fine to coarse sub-rounded sand, some sub-rounded gravel; dark gray (N3); non-cohesive, wet, compact	SW	46.0				
50					8	SO	8.8 / 10.0	
55					9	SO	2.4 / 5.6	
60		Log continued on next page						

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-5

SHEET 3 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/21/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 934,874.35 E: 864,780.96

ELEVATION: 400.83
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC/ATT	
60			SW	∴	340.2 60.6	9	SO		
		END OF BORING AT 60.6 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-5.							
65									
70									
75									
80									
85									
90									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-6

SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/21/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 933,905.19 E: 865,153.48

ELEVATION: 415.84
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC/ATT	REMARKS
0	6" Sonic	(0.0-12.9) FILL - (ML) sandy SILT, non-plastic fines, fine sand; dusky yellowish brown (10YR 2.2); non-cohesive, dry, loose	ML			1	SO	5.0/5.0	
5		(5.0) SAA (Same As Above) except, some organics (tree and grass roots)			410.8 5.0	2	SO	3.8/5.0	
10		(10.0) SAA except, wet			405.8 10.0	3	SO	4.9/5.0	
		(12.9-15.0) FILL - (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; moderate brown (5YR 3/4); cohesive, w<PL, soft	CL		402.9 12.9				
15		(15.0-20.0) NO RECOVERY	CL		400.8 15.0	4	SO	0.0/5.0	(15.0-20.0) Run # 4, No recovery from 15-20 ft. Driller says sample slipped through the retaining bit. Some SILTY CLAY found in bit, 15-20 is likely same as above but very soft.
20		(20.0-30.0) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sand; duskly yellowish brown (10YR 2/2); cohesive, w~PL, firm	CL		395.8 20.0	5	SO	3.0/10.0	(20.0-30.0) Run # 5, poor recovery because driller dropped contents of bag on ground
30					385.8				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-6

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/21/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 933,905.19 E: 865,153.48

ELEVATION: 415.84
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic	(30.0-42.2) (ML) sandy SILT, non-plastic fines, fine sand; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	ML		30.0	6	SO	6.8 / 15.0	(30.0) Run 6, (40.0) Driller adds 5 feet of sample rod to the sampler in order to sample a 15 feet run. ∇ Water Level 31.32 ft bgs 2/16/2016
		(42.2-52.0) (SW) SAND, fine to coarse sub-rounded sand, trace non-plastic fines; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	SW		373.6 42.2				
45		(45.0) SAA except, no fines; medium gray (N5)			370.8 45.0	7	SO	9.8 / 10.0	
		(52.0-55.0) (SP) SAND, fine sand; medium gray (N5); non-cohesive, wet, compact	SP		363.8 52.0				
55		END OF BORING AT 55.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-6.			360.8 55.0				
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-7

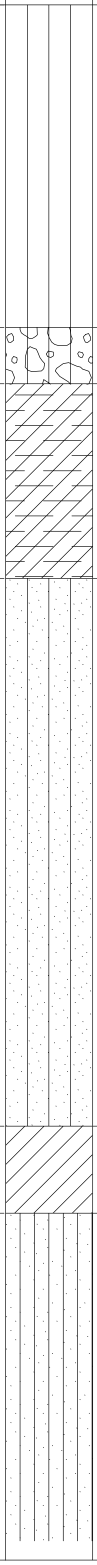
SHEET 1 of 2

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/23/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 934,334.40 E: 866,242.50

ELEVATION: 415.67
INCLINATION: -90



DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	NUMBER	TYPE	REC / ATT	
0	6" Sonic	(0.0-6.3) (ML) SILT, non-plastic to low plasticity fines, trace sub-angular gravel in upper 0.5 ft; dusky brown (5YR 2/2); cohesive, w<PL, stiff	ML			1	SO	3.0 / 5.0	
5		(5.0) SAA (Same As Above) except, firm			410.7 5.0	2	SO	5.0 / 5.0	
		(6.3-7.4) (GM) SILTY GRAVEL, fine to coarse sub-angular gravel, non-plastic fines, trace fine to coarse sub-rounded sand; dusky yellowish brown (10YR 2/2); non-cohesive, wet, compact	GM		409.4 6.3				
		(7.4-11.2) (ML) CLAYEY SILT, low plasticity fines, some fine sand; dark yellowish brown (10YR 4/2); cohesive, w<PL, firm	ML		408.3 7.4				
10						3	SO	4.0 / 5.0	
		(11.2-21.9) (ML) sandy SILT, non-plastic to low plasticity fines, fine sand, trace sub-rounded gravel; dusky yellowish brown (10YR 2/2); cohesive, w<PL, soft	ML		404.5 11.2				
15						4	SO	2.7 / 5.0	
20						5	SO	4.9 / 10.0	
		(21.9-23.6) (CL) SILTY CLAY, medium to high plasticity fines; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm	CL		393.8 21.9				
		(23.6-40.0) (SP & ML) SAND & SILT, fine sand, non-plastic fines; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	SP & ML		392.1 23.6				
25									
30									

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-7

SHEET 2 of 2

PROJECT: Ameren CCR GW Monitoring	DRILLING METHOD: 6" Sonic	DATUM: NAVD88	ELEVATION: 415.67
PROJECT NUMBER: 153-1406.0004A	DRILLING DATE: 1/23/16	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Meramec Energy Center	DRILL RIG: Mini Sonic (CDD1415)	COORDINATES: N: 934,334.40 E: 866,242.50	

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	ELEVATION / DEPTH (ft)	SAMPLES NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic	(23.6-40.0) (SP & ML) SAND & SILT, fine sand, non-plastic fines; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact *(Continued)*						∇ Water Level 30.99 ft bgs 2/16/2016
35			SP & ML		6	SO	6.5 / 10.0	
40		(40.0-52.7) (SW) SAND, fine to coarse sub-rounded sand, trace sub-rounded fine gravel; dusky yellowish brown (10YR 4/2); non-cohesive, wet, compact		375.7 / 40.0				
45			SW		7	SO	6.4 / 10.0	
50		(50.0) SAA except, no gravel		365.7 / 50.0	8	SO	2.0 / 2.7	
		END OF BORING AT 52.7 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-7.		363.0 / 52.7				
55								
60								

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-8

SHEET 1 of 3

PROJECT: Ameren CCR GW Monitoring	DRILLING METHOD: 6" Sonic	DATUM: NAVD88	ELEVATION: 421.03
PROJECT NUMBER: 153-1406.0004A	DRILLING DATE: 1/24/16	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Meramec Energy Center	DRILL RIG: Mini Sonic (CDD1415)	COORDINATES: N: 935,303.55 E: 866,797.84	

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES NUMBER	TYPE	REC / ATT	REMARKS
0		(0.0-0.9) FILL - (GW) sandy GRAVEL, fine to coarse sub-angular gravel, fine sand; dark gray (N3); non-cohesive, dry, loose	GW		420.1 0.9	1	SO	4.8 / 5.0	
		(0.9-1.2) FILL - (SW) SAND, fine to coarse sub-rounded sand; moderate yellowish brown (10YR 5/4); non-cohesive, dry, loose	SW		419.8 1.2				
		(1.2-7.1) (ML) sandy SILT, non-plastic fines, fine sand, trace sub-rounded gravel; dusky yellowish brown (10YR 2/2); non-cohesive, dry, compact	ML		416.0 5.0				
5		(5.0) SAA (Same As Above) except, some sand, some gravel; moist			413.9 7.1	2	SO	3.9 / 5.0	
		(7.1-10.0) (ML) CLAYEY SILT, low plasticity fines, trace fine sand; dark yellowish brown (10YR 4/2); cohesive, w<PL, stiff	ML		411.0 10.0				
10	6" Sonic	(10.0-20.0) (CL) SILTY CLAY, high plasticity fines; brownish gray (5YR 4/1); cohesive, w~PL, stiff	CL		401.0 20.0	3	SO	9.6 / 10.0	
20		(20.0-21.7) (SC) CLAYEY SAND, fine to coarse sub-rounded sand, medium plasticity fines; brownish gray (5YR 4/1); non-cohesive, wet, compact	SC		399.3 21.7	4	SO	4.7 / 10.0	
		(21.7-30.0) (CL) SILTY CLAY, high plasticity fines, trace fine sand; medium dark gray (N3); cohesive, w>PL, very stiff	CL		391.0				
30									

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-8

SHEET 2 of 3

PROJECT: Ameren CCR GW Monitoring
PROJECT NUMBER: 153-1406.0004A
LOCATION: Meramec Energy Center

DRILLING METHOD: 6" Sonic
DRILLING DATE: 1/24/16
DRILL RIG: Mini Sonic (CDD1415)

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 935,303.55 E: 866,797.84

ELEVATION: 421.03
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30		(30.0-32.8) (ML) sandy SILT, non-plastic fines, fine sand; dark yellowish brown (10YR 4/2); non-cohesive, wet, compact	ML	░	30.0				
		(32.8-40.0) (CL) SILTY CLAY, low plasticity fines; brownish gray (5YR 4/1); cohesive, w<PL, stiff	CL	▨	388.2 32.8				
35						5	SO	9.2 / 10.0	∇ Water Level 35.86 ft bgs 2/16/2016
40		(40.0-50.0) (CL) SILTY CLAY, medium plasticity fines; medium dark gray (N3); cohesive, w~PL, firm	CL	▨	381.0 40.0				
45	6" Sonic					6	SO	10.0 / 10.0	
		(48.8) SAA except, soft			372.5 48.5				
		(49.2) SAA except, firm			371.8 49.2				
50		(50.0-68.0) (ML) sandy SILT, non-plastic fines, fine sand; medium dark gray (N4); non-cohesive, wet, compact	ML	░	371.0 50.0				
55						7	SO	10.0 / 10.0	
60		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

Golder Associates

RECORD OF BOREHOLE MW-8

SHEET 3 of 3

PROJECT: Ameren CCR GW Monitoring	DRILLING METHOD: 6" Sonic	DATUM: NAVD88	ELEVATION: 421.03
PROJECT NUMBER: 153-1406.0004A	DRILLING DATE: 1/24/16	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Meramec Energy Center	DRILL RIG: Mini Sonic (CDD1415)	COORDINATES: N: 935,303.55 E: 866,797.84	

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE				SAMPLES			REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	NUMBER	TYPE	REC / ATT	
60	6" Sonic	(50.0-68.0) (ML) sandy SILT, non-plastic fines, fine sand; medium dark gray (N4); non-cohesive, wet, compact *(Continued)*	ML		353.0 68.0				
65						8	SO	10.0 10.0	
		(68.0-75.5) (SM) SILTY SAND, fine poorly graded sand, non-plastic fines; medium dark gray (N4); non-cohesive, wet, compact	SM		345.5 75.5				
70									
75						9	SO	10.0 10.0	
		(75.5-75.9) (SW) SAND, fine to coarse sub-rounded sand, trace coarse sub-rounded gravel; brownish gray (5YR 4/1); non-cohesive, wet, compact	SW		345.1 75.9				
		(75.9-80.0) (CL) SILTY CLAY, low plasticity fines, trace fine sand; medium dark gray (N4); cohesive, w~PL, stiff	CL		341.0 80.0				
80		END OF BORING AT 80.0 FEET BELOW GROUND SURFACE. FOR WELL DETAILS, SEE WELL CONSTRUCTION LOG MW-8.							
85									
90									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade
DRILLER: J. Drabek

LOGGED: JS
CHECKED: JSI
REVIEWED: PJJ/MNH

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APPENDIX E
CCR MONITORING WELL CONSTRUCTION DIAGRAMS

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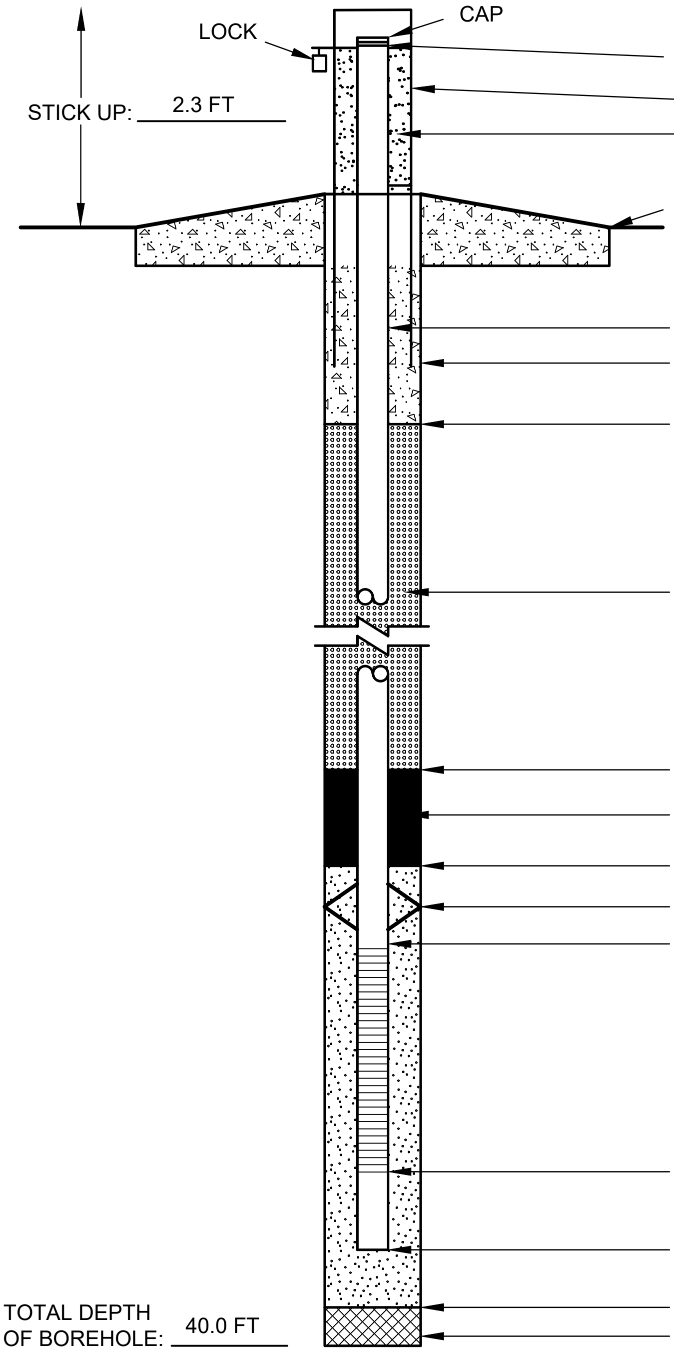
ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-1

PROJECT NAME: AMEREN CCR GW MONITORING	PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER	LOCATION: MW-1
CLIENT: AMEREN MISSOURI	SURFACE ELEVATION: 404.1 FT MSL

GEOLOGIST: J. SUOZZI	NORTHING: 937676.9	EASTING: 865954.1
DRILLER: J. DRABEK	STATIC WATER LEVEL: 4.56 FT BTOC	COMPLETION DATE: 1/23/2016

DRILLING COMPANY: CASCADE	DRILLING METHODS: SONIC



STICK UP: 2.3 FT

TOP OF CASING ELEVATION: 406.43 FT MSL

PROTECTIVE CASING ([✓ yes]/ no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 404.1 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 5 $\frac{1}{2}$ BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 31.5 FINE: 30.0

CENTRALIZER (yes/[✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 33.9

TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 38.7

BOTTOM OF WELL DEPTH (ft. bgs): 39.1

TOTAL DEPTH OF BOREHOLE: 40.0 FT

BOTTOM OF FILTER PACK (ft. bgs): 39.1

TYPE AND AMOUNT OF BACKFILL: 0.9 FT - NATURAL CAVE IN

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
125 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

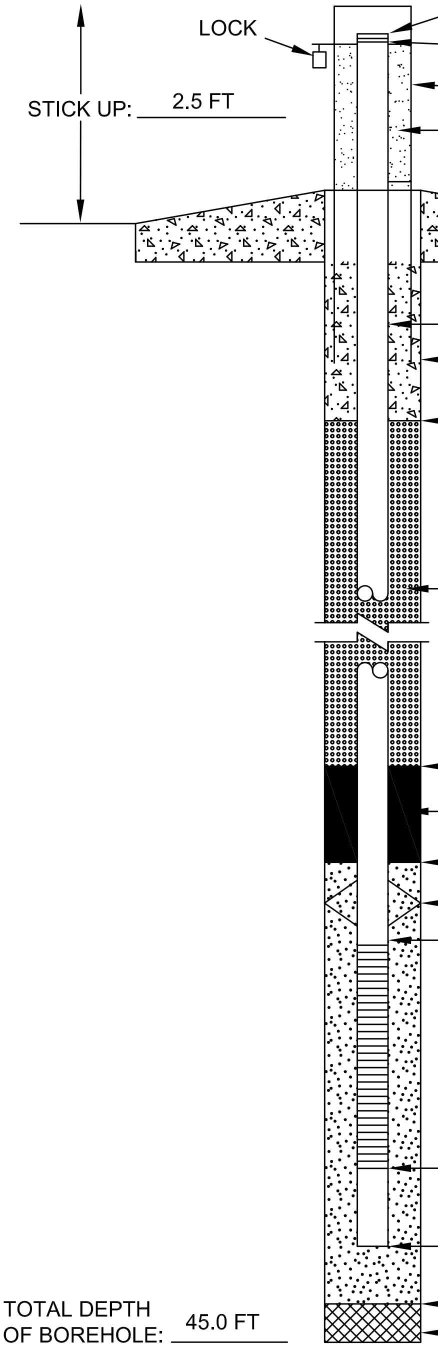
CHECKED BY: J. INGRAM

DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-2

PROJECT NAME: AMEREN CCR GW MONITORING		PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER		LOCATION: MW-2
CLIENT: AMEREN MISSOURI		SURFACE ELEVATION: 396.1 FT MSL
GEOLOGIST: J. SUOZZI	NORTHING: 937325.1	EASTING: 864864.5
DRILLER: J. DRABEK	STATIC WATER LEVEL: 15.06 FT BTOC	COMPLETION DATE: 1/23/2016
DRILLING COMPANY: CASCADE		DRILLING METHODS: SONIC



STICK UP: 2.5 FT

TOP OF CASING ELEVATION: 398.62 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 396.1 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 4 $\frac{1}{2}$ BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 27.0 FINE: 26.0

CENTRALIZER (yes [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 29.12

TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 33.9

BOTTOM OF WELL DEPTH (ft. bgs): 34.3

BOTTOM OF FILTER PACK (ft. bgs): 35.0

TYPE AND AMOUNT OF BACKFILL: 10.0 FT - 1.5 BAGS BENTONITE CHIPS

TOTAL DEPTH OF BOREHOLE: 45.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
150 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

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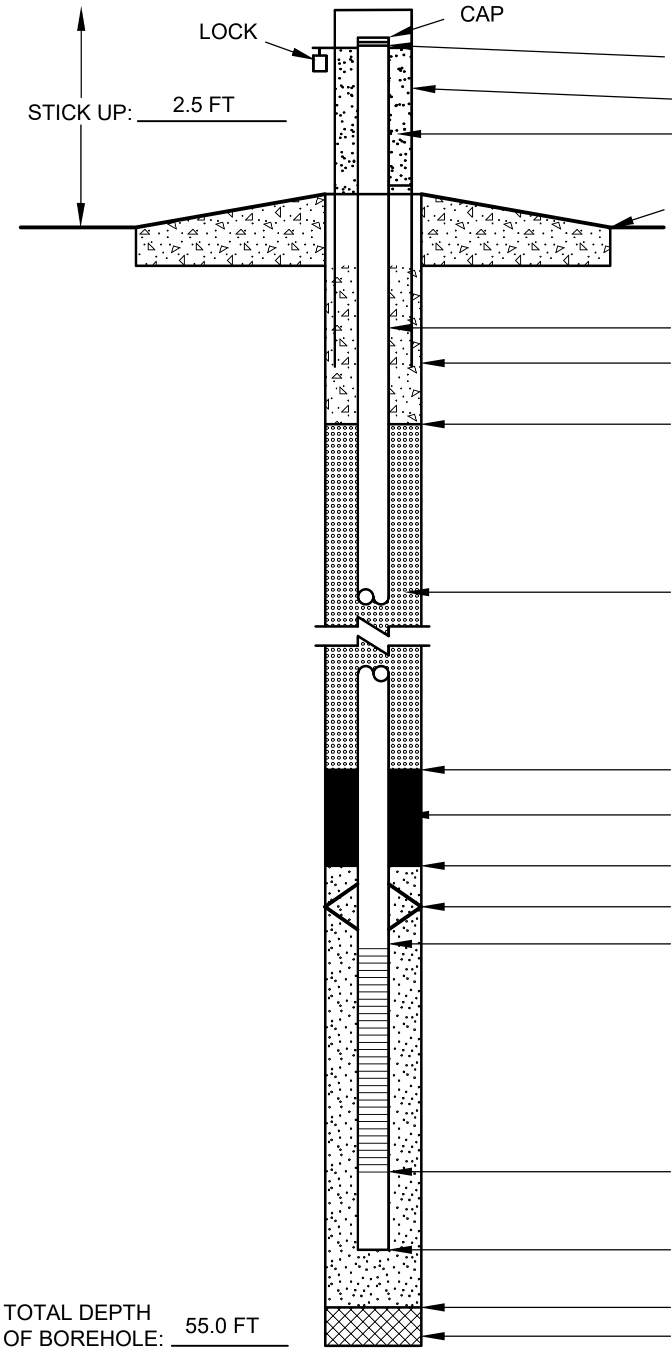
ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-3

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-3
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 394.6 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 936750.8
EASTING: 864447.2
DRILLER: J. DRABEK
STATIC WATER LEVEL: 13.56 FT BTOC
COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.5 FT

TOP OF CASING ELEVATION: 397.12 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 394.6 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 5 BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 23.0 FINE: 22.0
CENTRALIZER (yes / [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (ft. bgs): 25.4
TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 30.2
BOTTOM OF WELL DEPTH (ft. bgs): 30.6
BOTTOM OF FILTER PACK (ft. bgs): 31.5
TYPE AND AMOUNT OF BACKFILL: 23.5 FEET - 3 BAGS BENTONITE CHIPS

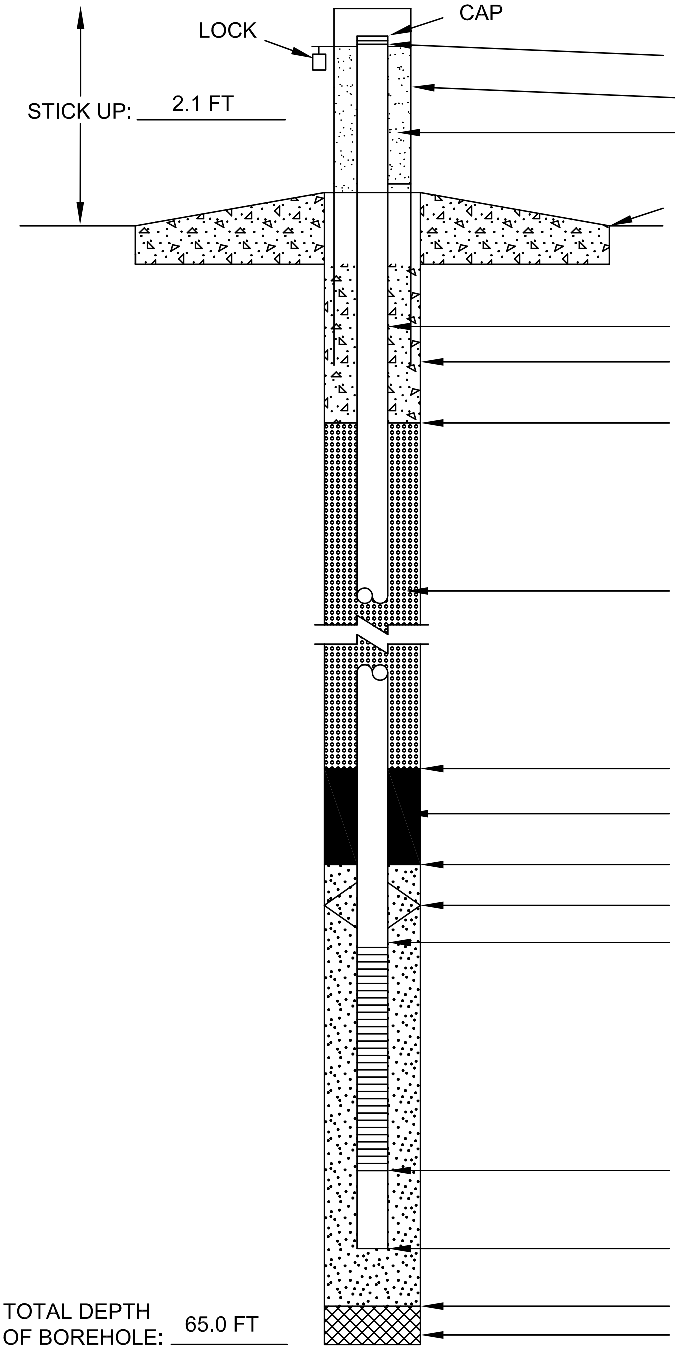
TOTAL DEPTH OF BOREHOLE: 55.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 150 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-4

PROJECT NAME: AMEREN CCR GW MONITORING	PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER	LOCATION: MW-4
CLIENT: AMEREN MISSOURI	SURFACE ELEVATION: 402.0 FT MSL
GEOLOGIST: J. SUOZZI	NORTHING: 935618.0
	EASTING: 864629.8
DRILLER: J. DRABEK	STATIC WATER LEVEL: 20.25 FT BTOC
	COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE	DRILLING METHODS: SONIC



STICK UP: 2.1 FT

TOP OF CASING ELEVATION: 404.10 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 402.0 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 6 $\frac{1}{2}$ BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 35.7 FINE: 34.0

CENTRALIZER (yes / [✓ no]) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 37.9

TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 42.7

BOTTOM OF WELL DEPTH (ft. bgs): 43.1

BOTTOM OF FILTER PACK (ft. bgs): 45.0

TYPE AND AMOUNT OF BACKFILL: 20.0 FT - 3 $\frac{1}{3}$ BAGS BENTONITE CHIPS

TOTAL DEPTH OF BOREHOLE: 65.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

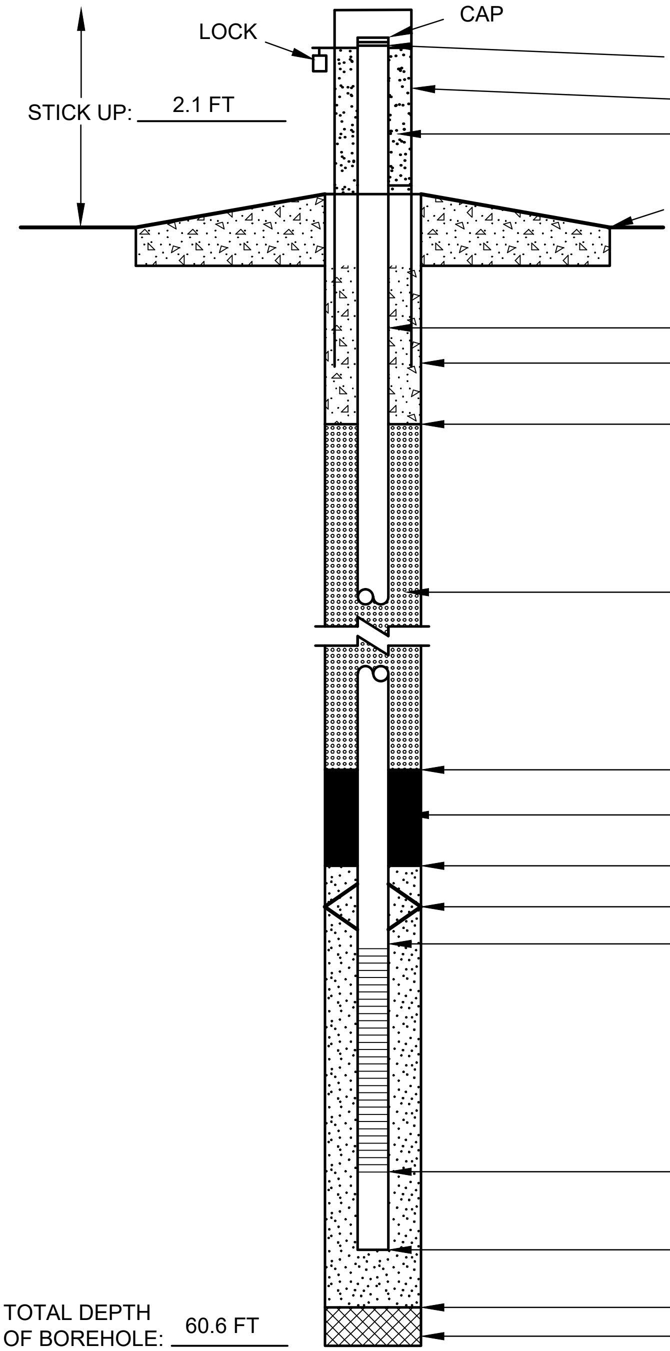
CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-5

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-5
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 400.8 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 934874.4
EASTING: 864781.0
DRILLER: J. DRABEK
STATIC WATER LEVEL: 18.89 FT BTOC
COMPLETION DATE: 1/22/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.1 FT

TOP OF CASING ELEVATION: 402.93 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 400.8 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 8 BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 47.5 FINE: 46.0
CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 50.4
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 3 $\frac{1}{4}$ BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 60.2
BOTTOM OF WELL DEPTH (ft. bgs): 60.6
BOTTOM OF FILTER PACK (ft. bgs): 60.6
TYPE AND AMOUNT OF BACKFILL: NONE

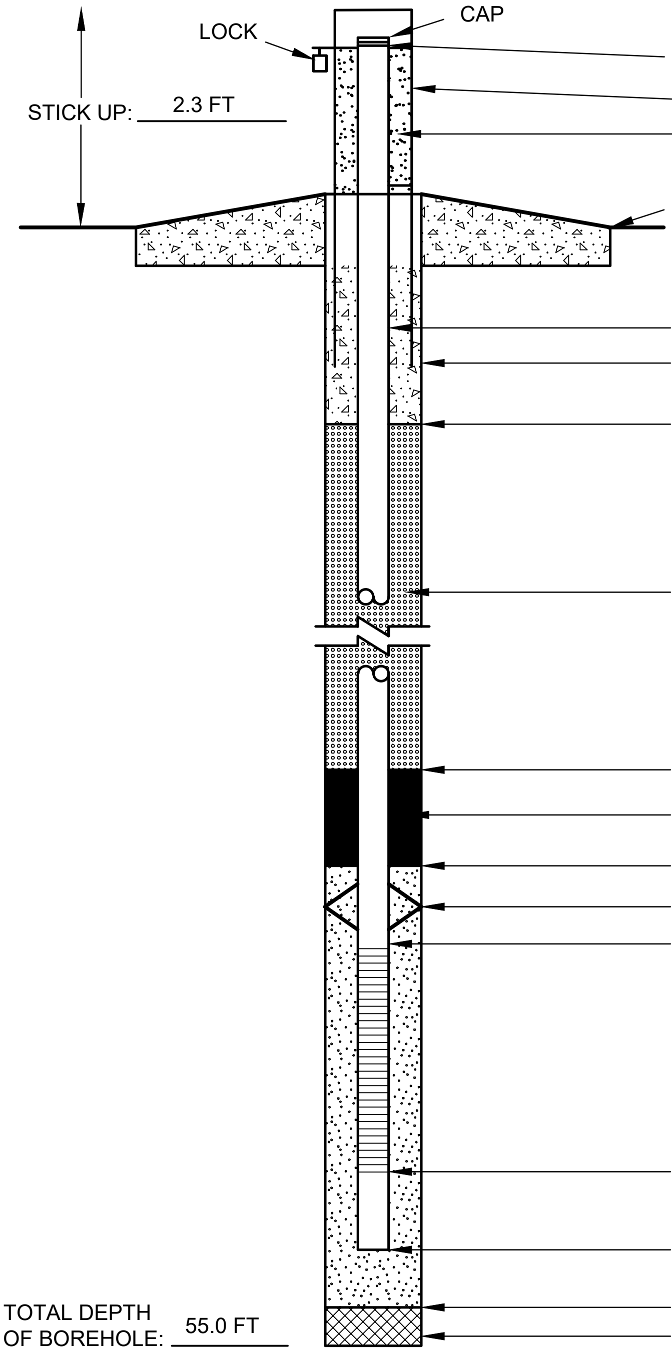
TOTAL DEPTH OF BOREHOLE: 60.6 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
250 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-6

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-6
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 415.8 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 933905.2
EASTING: 865153.5
DRILLER: J. DRABEK
STATIC WATER LEVEL: 33.60 FT BTOC
COMPLETION DATE: 1/21/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.3 FT
TOP OF CASING ELEVATION: 418.12 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
GROUND SURFACE ELEVATION: 415.8 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 7 BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 39.7 FINE: 39.0
CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 42.5
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 3.5 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 52.3
BOTTOM OF WELL DEPTH (ft. bgs): 52.7
BOTTOM OF FILTER PACK (ft. bgs): 52.7
TOTAL DEPTH OF BOREHOLE: 55.0 FT
TYPE AND AMOUNT OF BACKFILL: 2.3 FEET -NATURAL BACKFILL

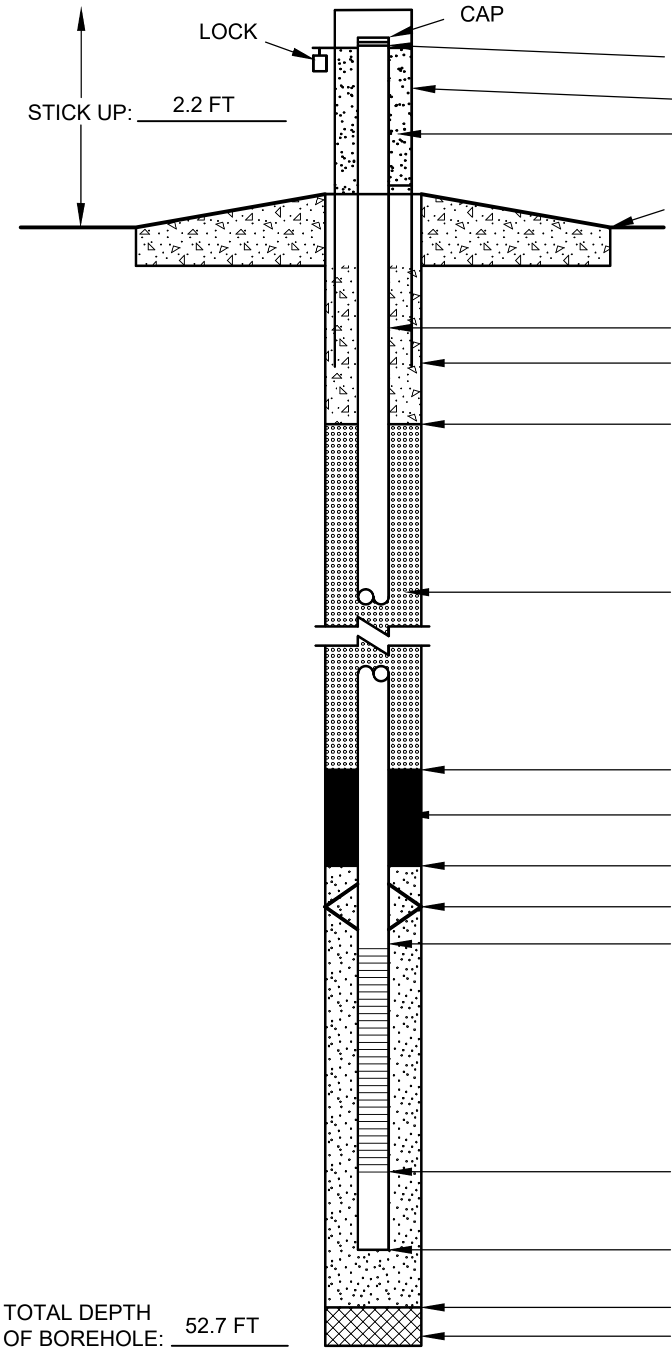
ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 300 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-7

PROJECT NAME: AMEREN CCR GW MONITORING		PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER		LOCATION: MW-7
CLIENT: AMEREN MISSOURI		SURFACE ELEVATION: 415.7 FT MSL
GEOLOGIST: J. SUOZZI	NORTHING: 934334.4	EASTING: 866242.5
DRILLER: J. DRABEK	STATIC WATER LEVEL: 33.26 FT BTOC	COMPLETION DATE: 1/24/2016
DRILLING COMPANY: CASCADE		DRILLING METHODS: SONIC



STICK UP: 2.2 FT

TOP OF CASING ELEVATION: 417.94 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

GROUND SURFACE ELEVATION: 415.7 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: NONE

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 8 BAGS

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 38.5 FINE: 37.0

CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)

TOP OF SCREEN DEPTH (ft. bgs): 42.5

TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 2.5 BAGS FINE: $\frac{1}{3}$ BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 52.3

BOTTOM OF WELL DEPTH (ft. bgs): 52.7

TOTAL DEPTH OF BOREHOLE: 52.7 FT

BOTTOM OF FILTER PACK (ft. bgs): 52.7

TYPE AND AMOUNT OF BACKFILL: NONE

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

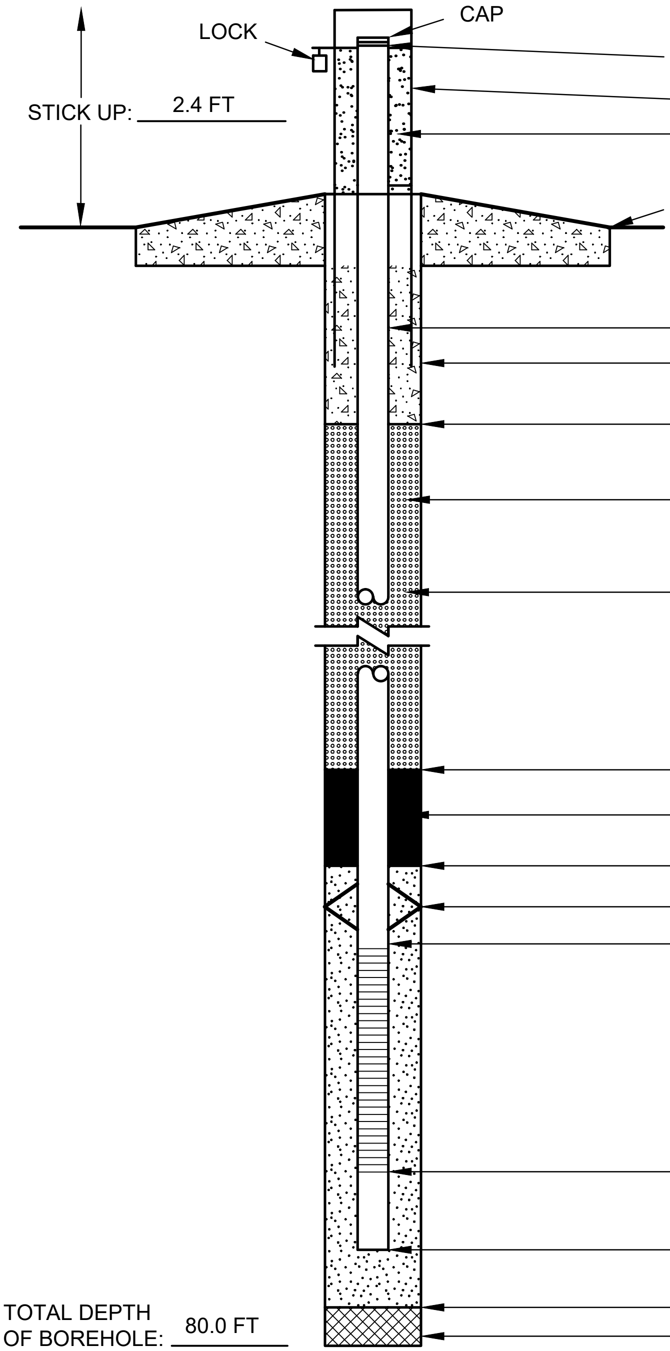
DATE CHECKED: 4/25/2016

PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG MW-8

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: MW-8
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 421.0 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 935303.6
EASTING: 866797.8
DRILLER: J. DRABEK
STATIC WATER LEVEL: 38.20 FT BTOC
COMPLETION DATE: 1/24/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.4 FT

TOP OF CASING ELEVATION: 423.37 FT MSL
PROTECTIVE CASING ([✓ yes]/ no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 421.0 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 3.5 BAGS
TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 4 BAGS
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 58.0
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 1 BAG
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 63.0 FINE: 62.5
CENTRALIZER ([✓ yes]/ no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)
TOP OF SCREEN DEPTH (ft. bgs): 65.2
TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 2.5 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 75.0
BOTTOM OF WELL DEPTH (ft. bgs): 75.4
BOTTOM OF FILTER PACK (ft. bgs): 80.0
TYPE AND AMOUNT OF BACKFILL: NONE

TOTAL DEPTH OF BOREHOLE: 80.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
250 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG BMW-1

PROJECT NAME: AMEREN CCR GW MONITORING

PROJECT NUMBER: 153-1406.0004A

SITE NAME: MERAMEC ENERGY CENTER

LOCATION: BMW-1

CLIENT: AMEREN MISSOURI

SURFACE ELEVATION: 416.8 FT MSL

GEOLOGIST: J. INGRAM

NORTHING: 935220.4

EASTING: 867989.4

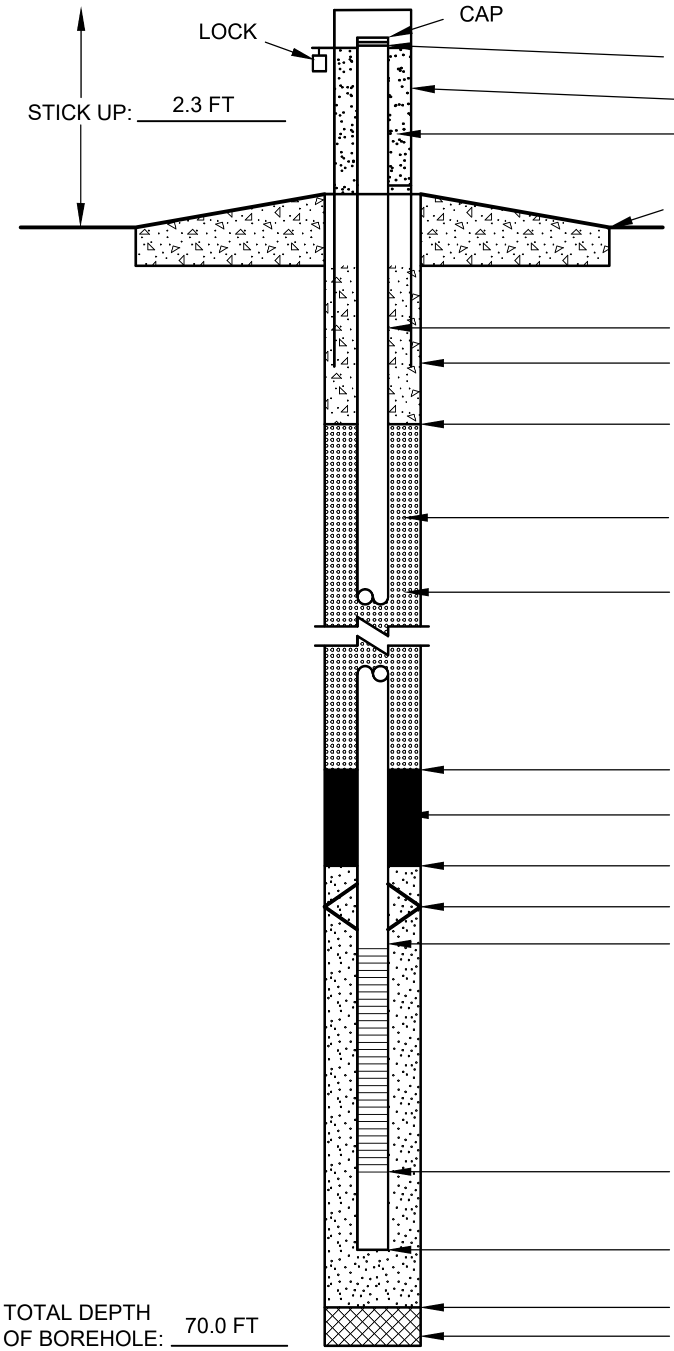
DRILLER: J. DRABEK

STATIC WATER LEVEL: 25.42 FT BTOC

COMPLETION DATE: 4/7/2016

DRILLING COMPANY: CASCADE

DRILLING METHODS: SONIC



STICK UP: 2.3 FT

TOP OF CASING ELEVATION: 419.08 FT MSL

PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

GROUND SURFACE ELEVATION: 416.8 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 2.5

TYPE AND AMOUNT OF ANNULAR SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 2 BAGS

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE 3 BAGS

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 40.0

TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 1 BAG

TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 46.5 FINE: 45.0

CENTRALIZER ([✓ yes] / no) - TYPE: STAINLESS STEEL (TOP + BOTTOM)

TOP OF SCREEN DEPTH (ft. bgs): 50.4

TYPE OF SCREEN: 2" X 9.8' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010 IN

SIZE OF SAND PACK: COARSE: #1 FINE: #0

AMOUNT OF SAND: COARSE: 4 BAGS FINE: 0.5 BAG

BOTTOM OF SCREEN DEPTH (ft. bgs): 60.2

BOTTOM OF WELL DEPTH (ft. bgs): 60.6

BOTTOM OF FILTER PACK (ft. bgs): 62.0

TOTAL DEPTH OF BOREHOLE: 70.0 FT

TYPE AND AMOUNT OF BACKFILL: $\frac{3}{8}$" CHIPS: 62.0-68.0 ft. bgs
CAVE IN: 68.0-70.0 ft. bgs

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. 200 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000) MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON APRIL 28, 2016. FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM

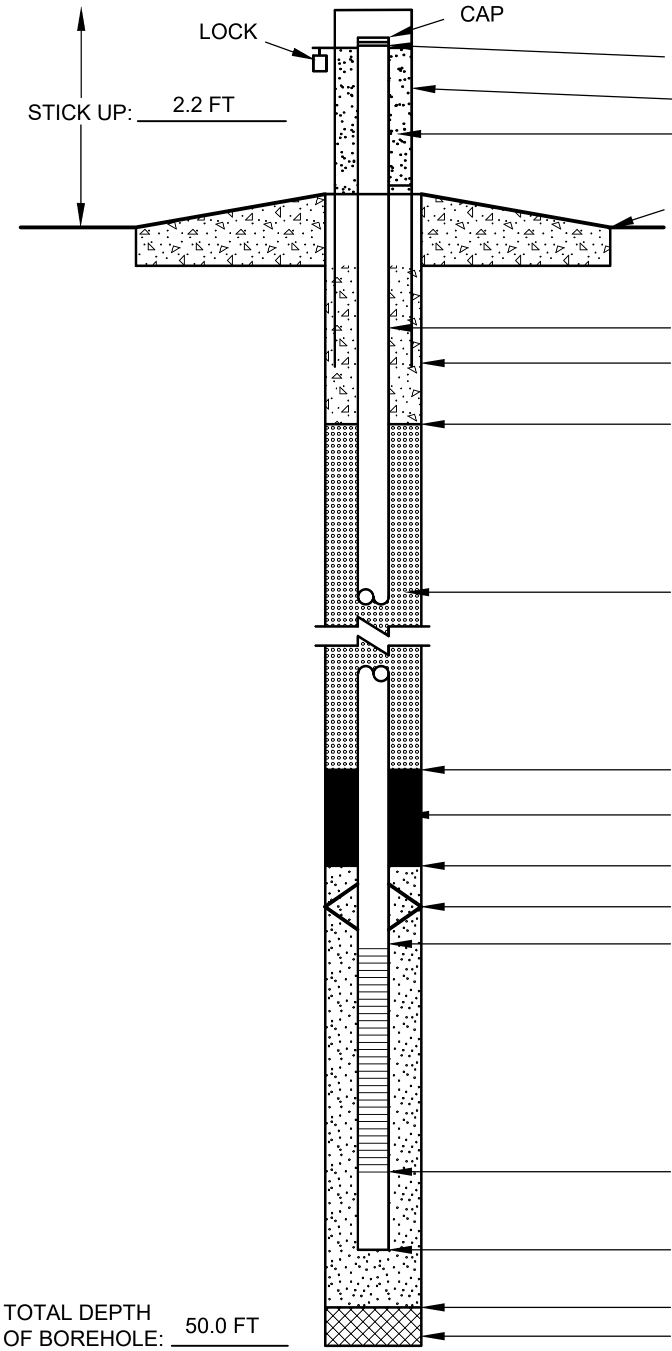
DATE CHECKED: 6/2/2016

PREPARED BY: J. SUOZZI

Golder Associates

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG BMW-2

PROJECT NAME: AMEREN CCR GW MONITORING
PROJECT NUMBER: 153-1406.0004A
SITE NAME: MERAMEC ENERGY CENTER
LOCATION: BMW-2
CLIENT: AMEREN MISSOURI
SURFACE ELEVATION: 406.8 FT MSL
GEOLOGIST: J. SUOZZI
NORTHING: 937927.1
EASTING: 866342.2
DRILLER: J. DRABEK
STATIC WATER LEVEL: 14.11 FT BTOC
COMPLETION DATE: 1/25/2016
DRILLING COMPANY: CASCADE
DRILLING METHODS: SONIC



STICK UP: 2.2 FT

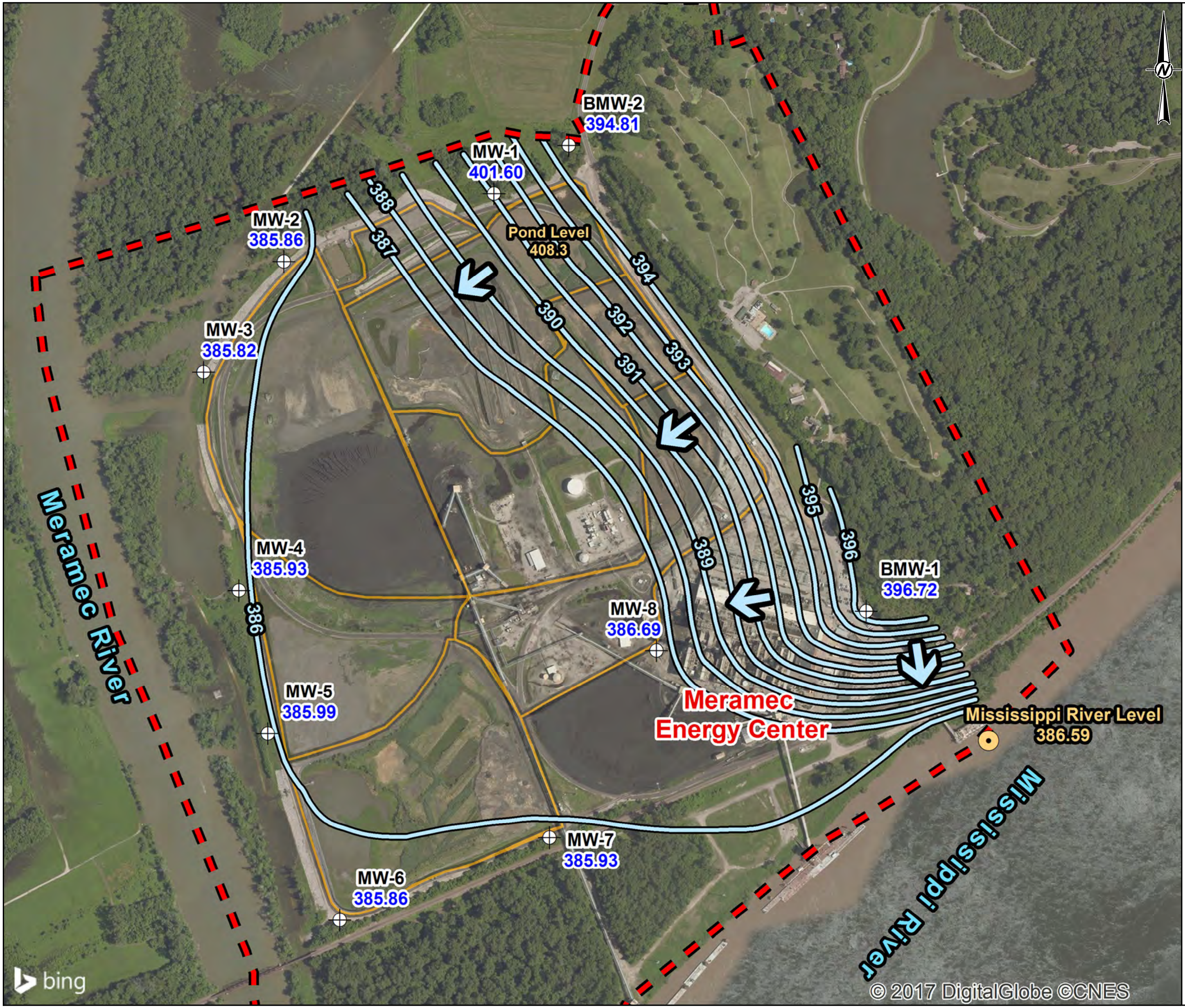
TOP OF CASING ELEVATION: 409.02 FT MSL
PROTECTIVE CASING ([✓ yes] / no): 4" X 5' ALUMINUM
PEA GRAVEL OR SAND
GROUND SURFACE ELEVATION: 406.8 FT MSL
DIAMETER OF RISER PIPE (in.): 2.0
DIAMETER OF BOREHOLE (in.): 6.0
CONCRETE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF ANNULAR SEAL: NONE
TOP OF BENTONITE SEAL DEPTH (ft. bgs): 2.5
TYPE AND AMOUNT OF BENTONITE SEAL: $\frac{3}{8}$" BENTONITE CHIPS - 6 $\frac{1}{2}$ BAGS
TOP OF SAND PACK DEPTH (ft. bgs): COARSE: 34.7 FINE: 34.0
CENTRALIZER (yes / [✓ no]) - TYPE: NONE
TOP OF SCREEN DEPTH (ft. bgs): 37.5
TYPE OF SCREEN: 2" X 4.8' SCHEDULE 40 PVC
SCREEN SLOT SIZE (in.): 0.010 IN
SIZE OF SAND PACK: COARSE: #1 FINE: #0
AMOUNT OF SAND: COARSE: 1.75 BAGS FINE: $\frac{1}{3}$ BAG
BOTTOM OF SCREEN DEPTH (ft. bgs): 42.3
BOTTOM OF WELL DEPTH (ft. bgs): 42.7
BOTTOM OF FILTER PACK (ft. bgs): 44.0
TYPE AND AMOUNT OF BACKFILL: BENTONITE CHIPS - 1 BAG - 6.0 FT

TOTAL DEPTH OF BOREHOLE: 50.0 FT

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL.
120 GALLONS OF H2O USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FT (2000)
MISSOURI EAST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY ZAHNER AND ASSOCIATES, INC ON FEBRUARY 4, 2016.
FT BTOC = FEET BELOW TOP OF CASING. SAND AND BENTONITE BAGS WEIGH 50 LBS EACH.

CHECKED BY: J. INGRAM
DATE CHECKED: 4/25/2016
PREPARED BY: J. SUOZZI

APPENDIX F
POTENTIOMETRIC SURFACE MAPS FROM BACKGROUND CCR SAMPLING EVENTS



LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

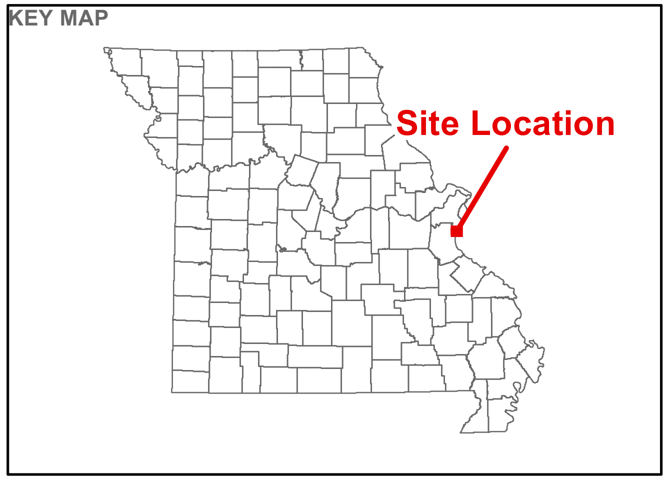
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

↖ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 1 - MARCH 28, 2016

CONSULTANT

YYYY-MM-DD	2016-03-31
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P1**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E1.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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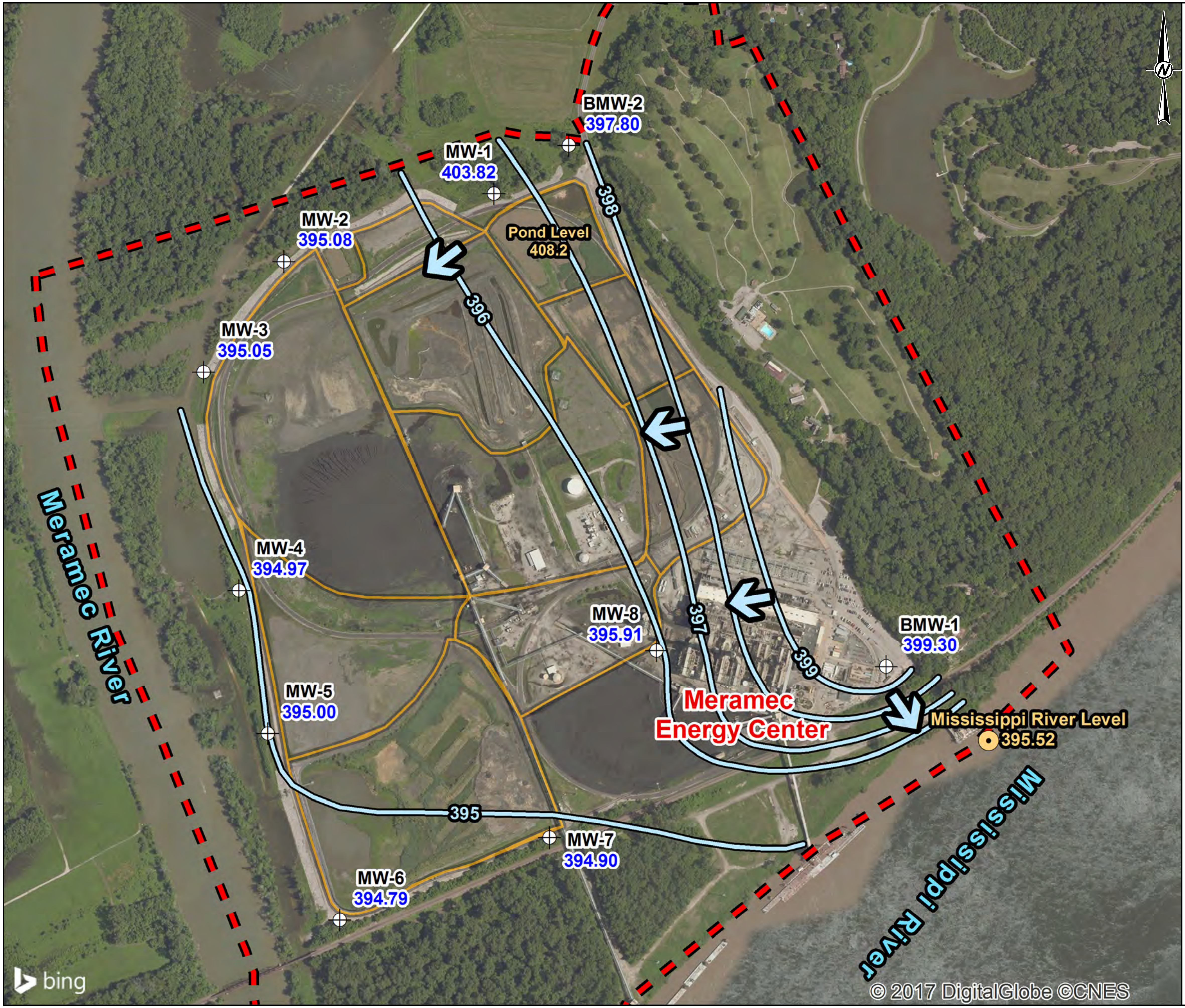


LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

▭ Groundwater Elevation Contour (FT MSL)

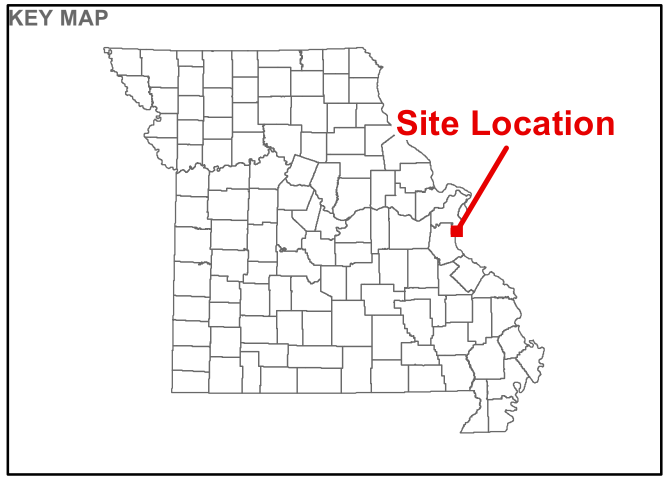
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 2 - MAY 13, 2016

CONSULTANT

YYYY-MM-DD	2016-05-24
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	P2

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E2.mxd

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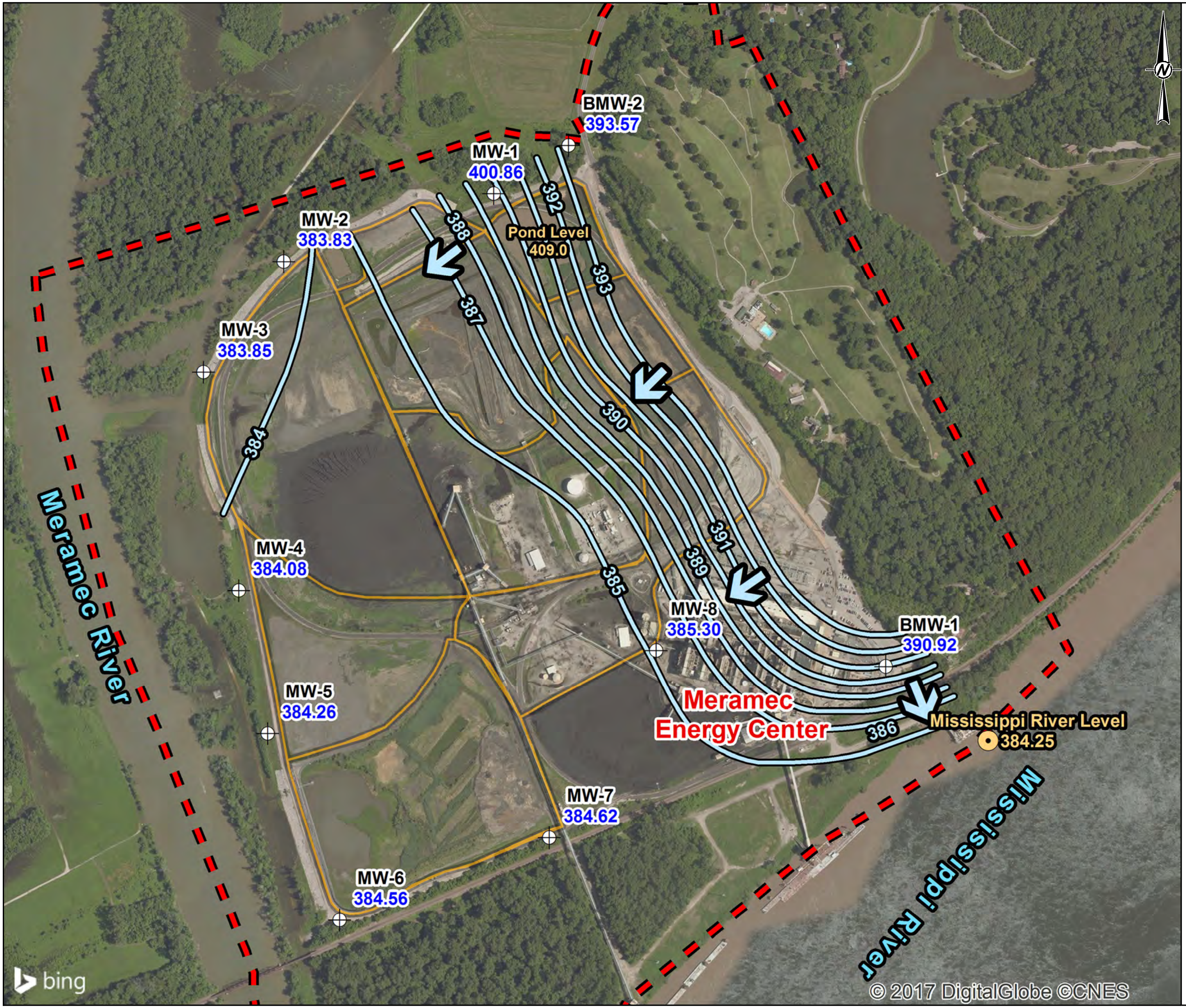
1 in



LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

═ Groundwater Elevation Contour (FT MSL)

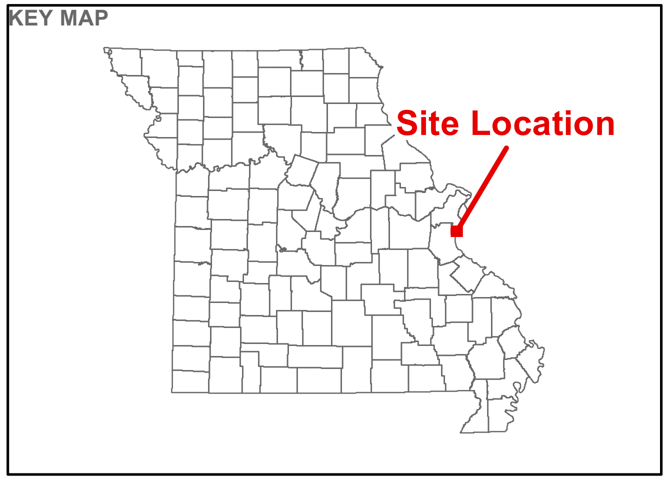
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

⬉ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 3 - JULY 18, 2016

CONSULTANT

YYYY-MM-DD	2016-08-16
PREPARED	JS
DESIGN	JS
REVIEW	JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P3**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E3.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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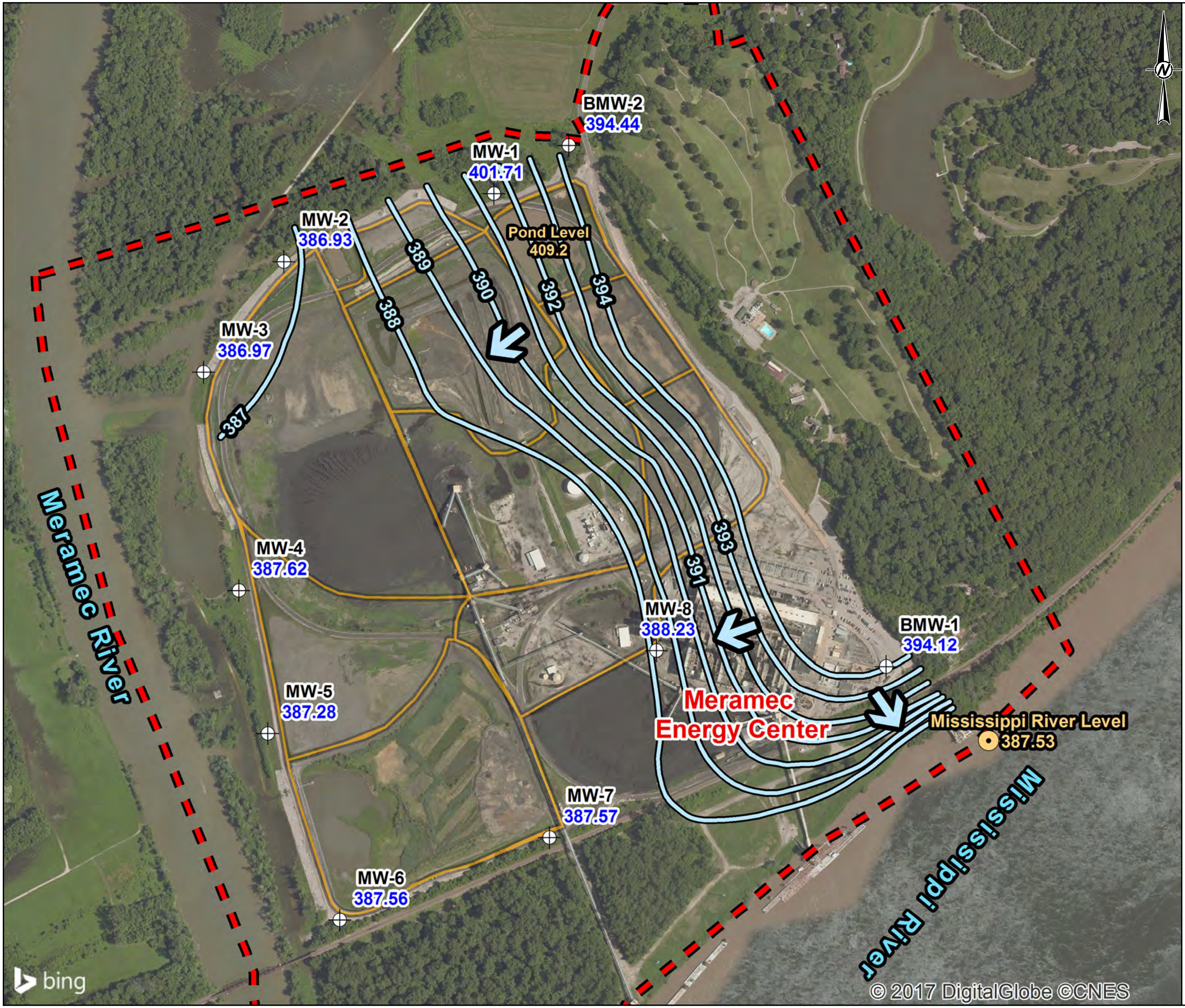


LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

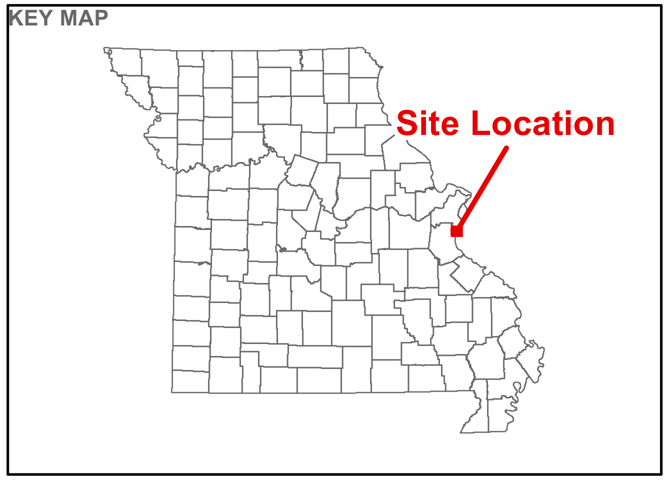
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➘ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 4 - SEPTEMBER 7, 2016

CONSULTANT

YYYY-MM-DD	2017-09-27
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P4**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E4.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
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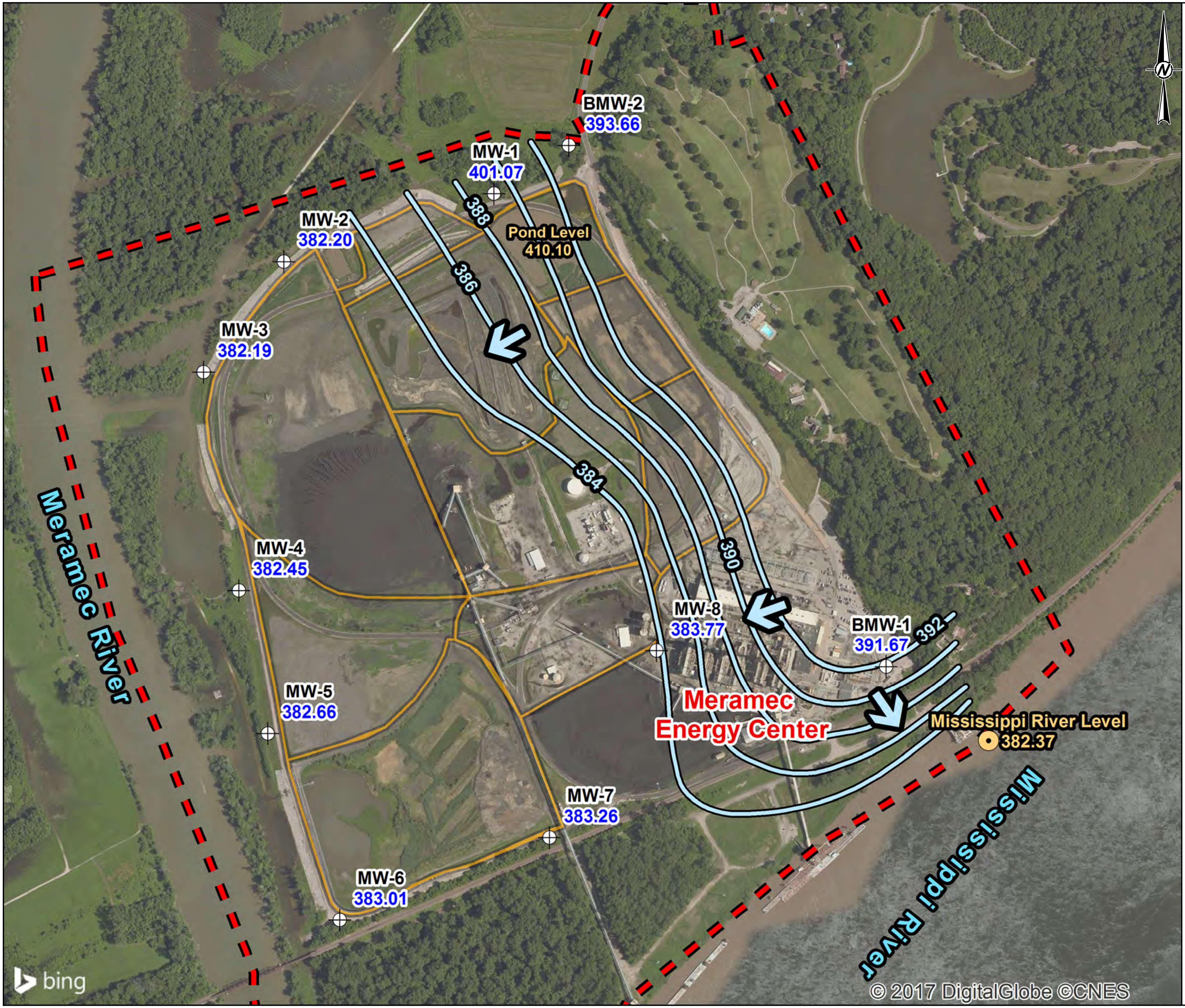


LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

═ Groundwater Elevation Contour (FT MSL)

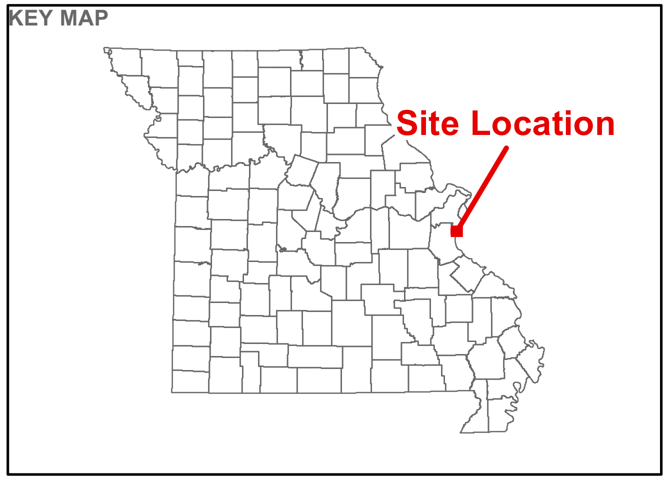
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➘ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 5 - NOVEMBER 10, 2016

CONSULTANT

YYYY-MM-DD	2017-11-21
PREPARED	JSI
DESIGN	JSI
REVIEW	MSG
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P5**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E5.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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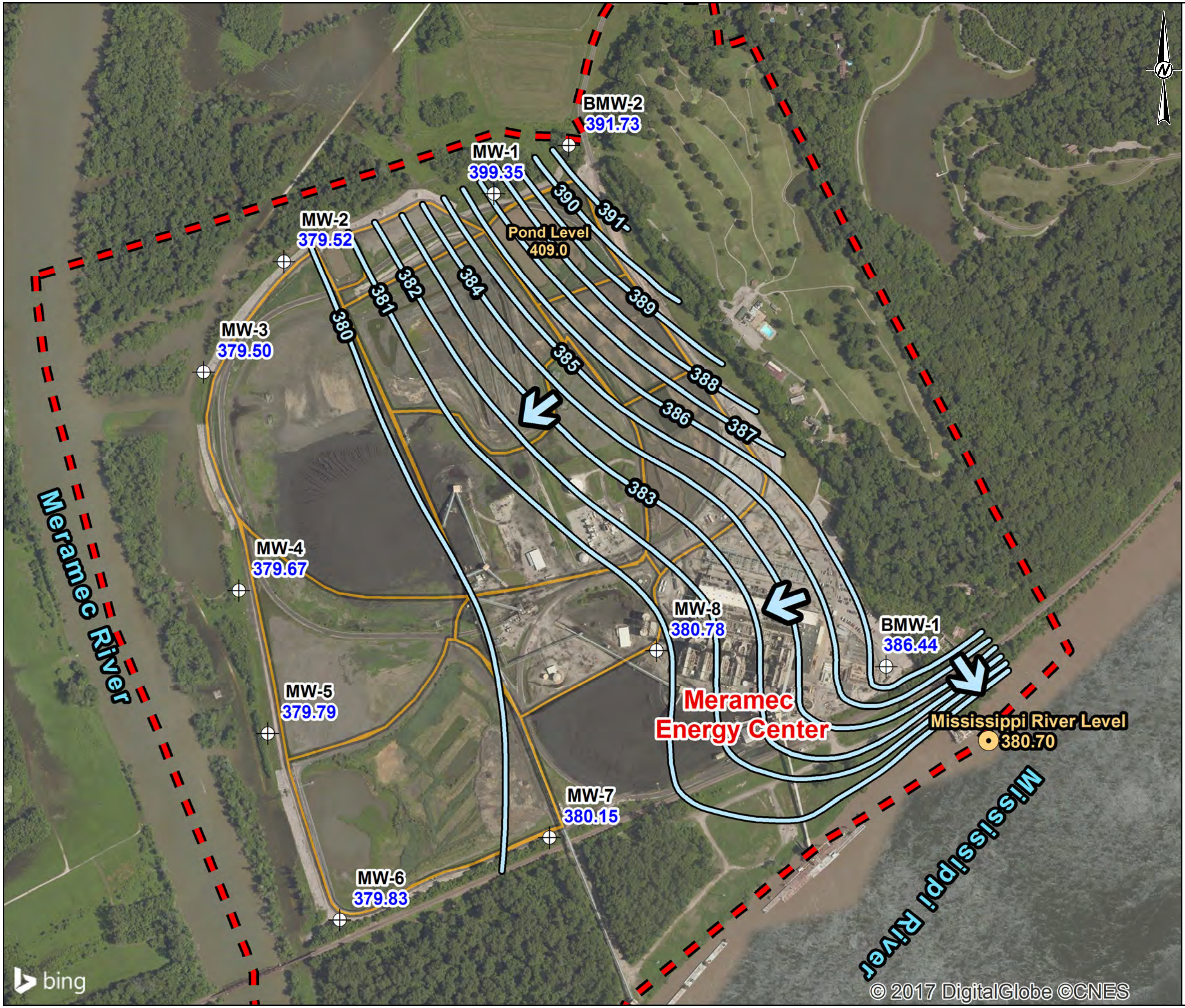


LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

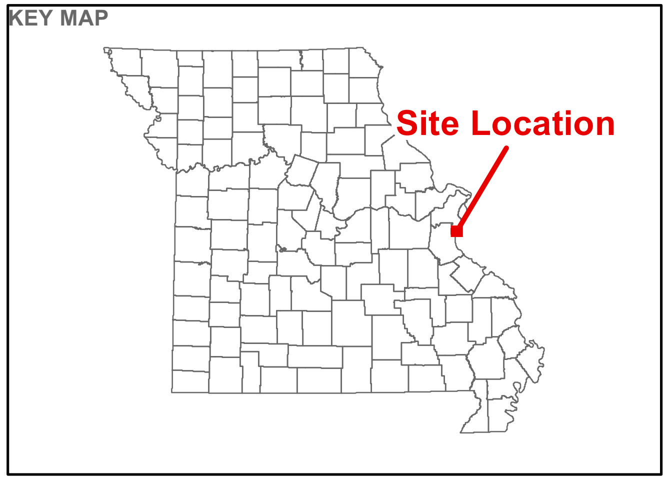
═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

⇖ Groundwater Flow Direction



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 6 - JANUARY 6, 2017

CONSULTANT

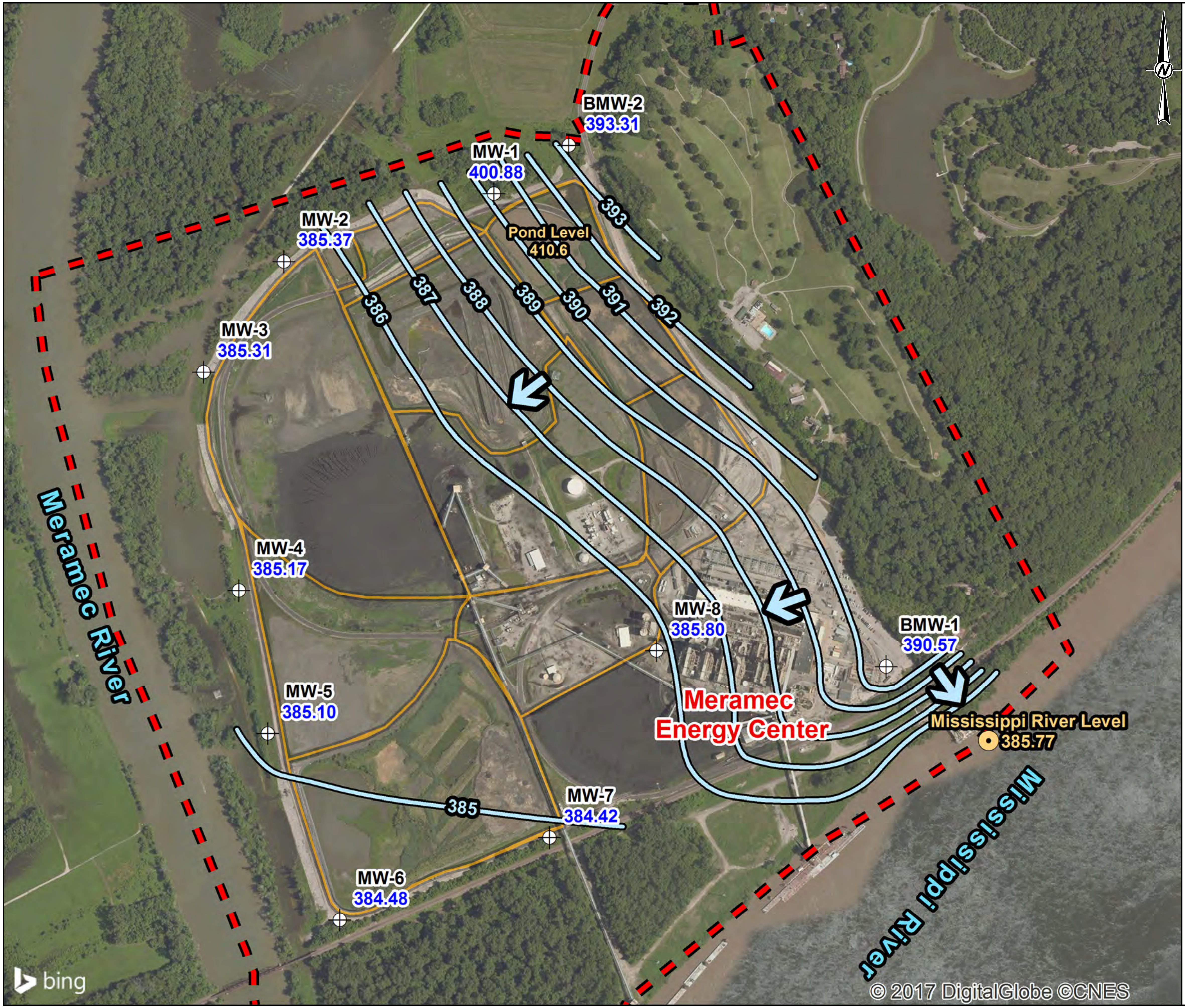
Golder Associates

YYYY-MM-DD	2017-01-23
PREPARED	JS
DESIGN	JSI
REVIEW	BEF
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	P6

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E6.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in



LEGEND

- ▭ Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

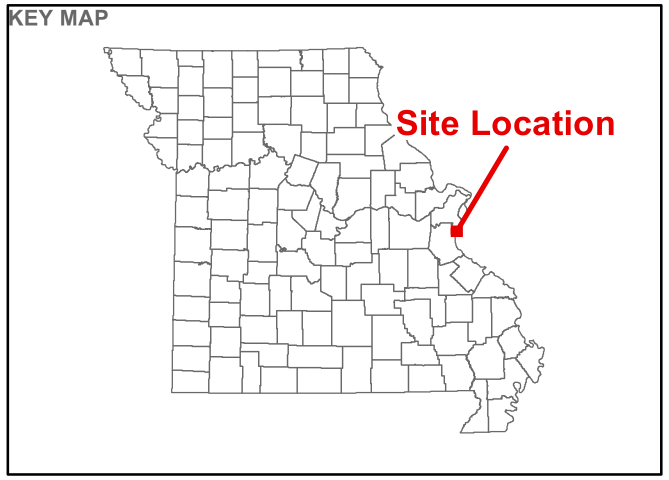
Groundwater Elevation Contours

- ═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- ⬉ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 7 - MARCH 7, 2017

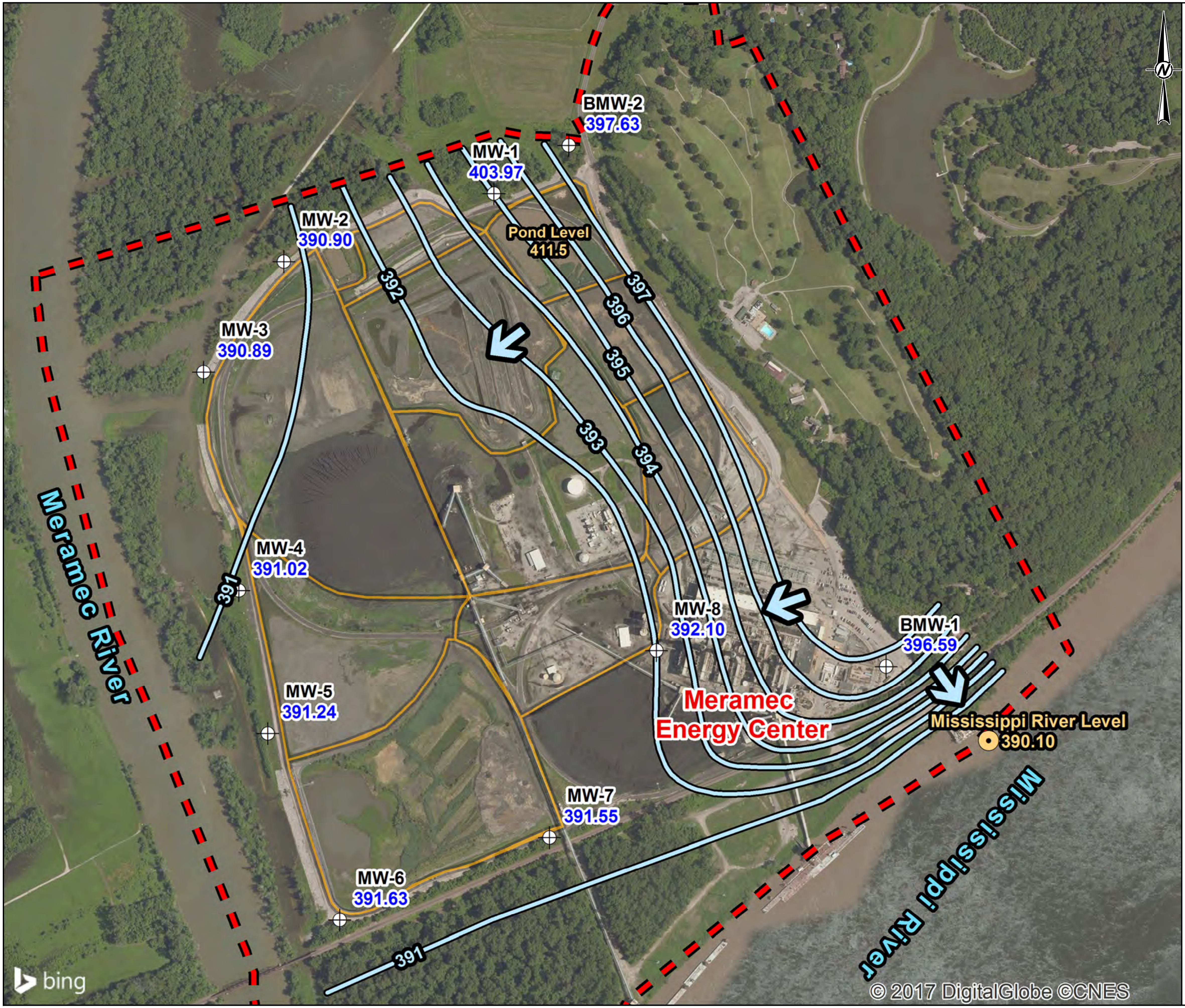
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-03-14
PREPARED	JS
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P7**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E7.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in



LEGEND

▨ Meramec Energy Center Property Boundary

☐ All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

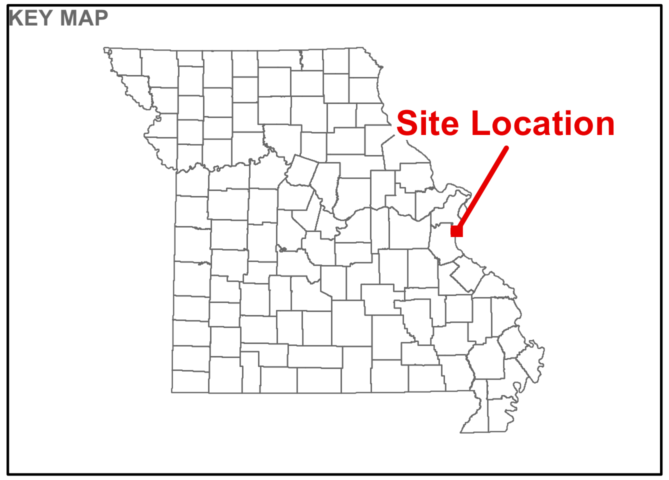
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 8 - JUNE 14, 2017

CONSULTANT

YYYY-MM-DD	2017-07-06
PREPARED	JS
DESIGN	JSI
REVIEW	RJF
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**P8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

0 1 in

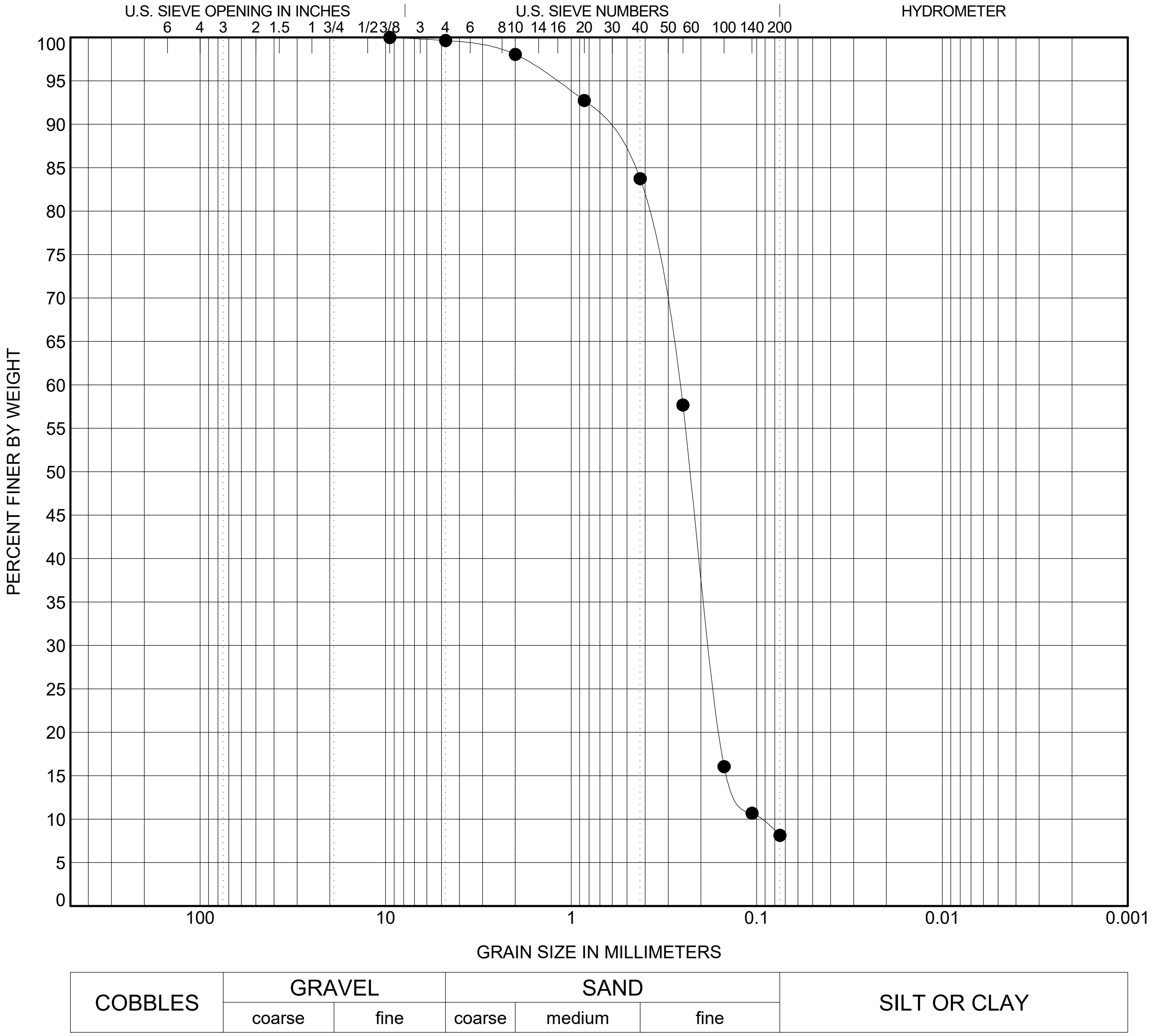
Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E8.mxd

APPENDIX G
GRAIN SIZE DISTRUBUTION

Golder Associates
500 Century Plaza Drive, Suite 190
Houston, Texas 77073
Telephone: (281) 821-6868
Fax: (281) 821-6870

GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT Ameren Services
PROJECT NAME Ameren/GW Monitoring Program/MO
PROJECT NUMBER 1531406
PROJECT LOCATION Missouri



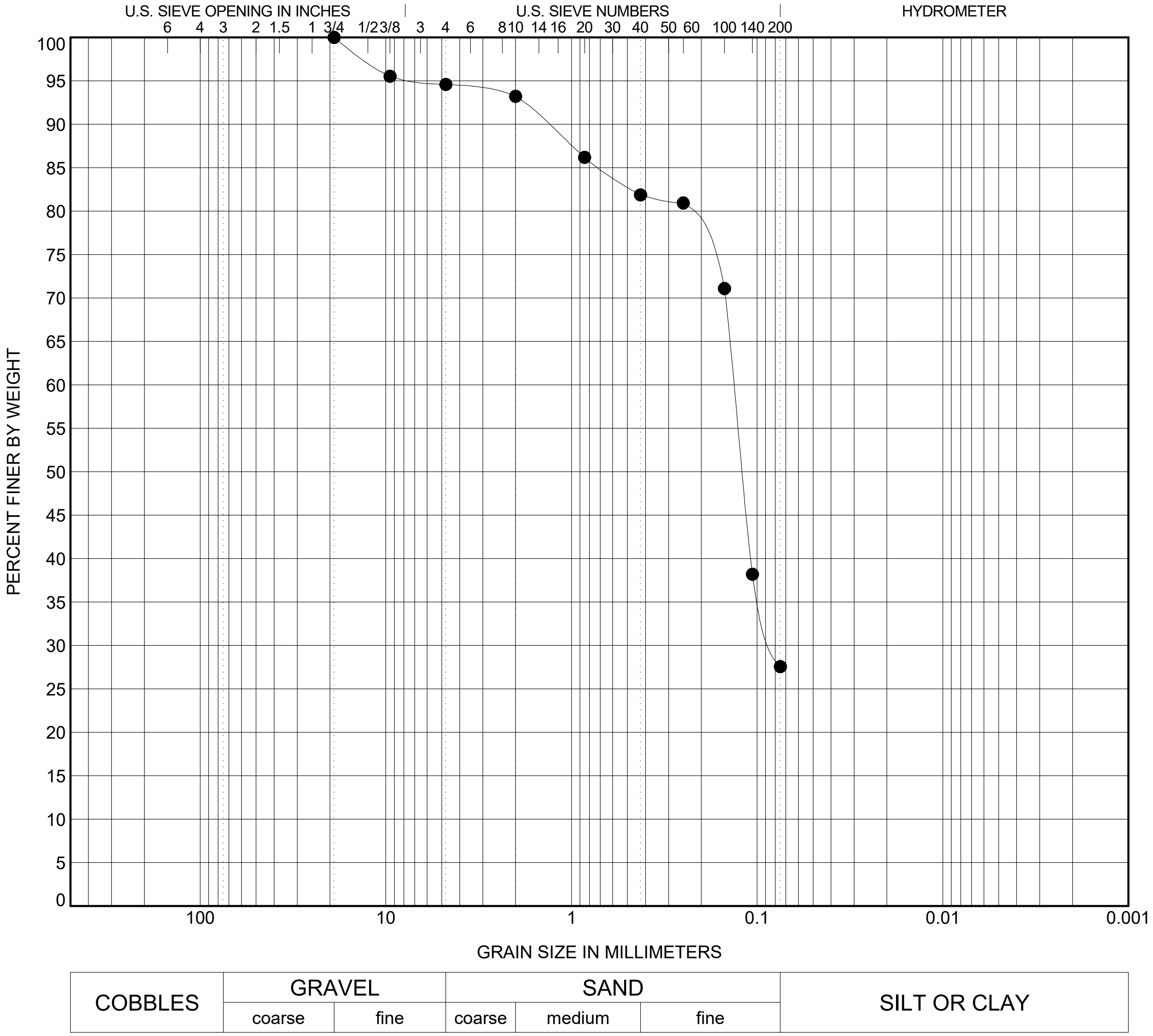
	BOREHOLE	DEPTH	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test.?	Test Date	Description	Tech.	Review	Notes
●	MW-6	45-55 ft		B	Moist	No		1 hr.	No	3/4/16		MR	VK	

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	MW-6	45-55 ft	9.5	0.262	0.178	0.097	0.4	91.5	8	

Golder Associates
500 Century Plaza Drive, Suite 190
Houston, Texas 77073
Telephone: (281) 821-6868
Fax: (281) 821-6870

GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT Ameren Services
PROJECT NAME Ameren/GW Monitoring Program/MO
PROJECT NUMBER 1531406
PROJECT LOCATION Missouri



	BOREHOLE	DEPTH	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test.?	Test Date	Description	Tech.	Review	Notes
●	MW-8	66-76 ft		B	Moist	No		1 hr.	No	3/4/16		MR	VK	

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	MW-8	66-76 ft	19	0.133	0.081		5.4	67.0	28	

APPENDIX H
WELL DEVELOPMENT FORMS

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring **Project No.:** 153-1406.0004

Location

MW-1

Monitored By: JS Date 2/5/16 Time 0722

Well Piezometer Data

(circle one)

Depth of Well (from [✓ top of PVC] or ground) 41.25 feet

Depth of Water (from [✓ top of PVC] or ground) 4.45 feet

Radius of Casing inches

2 feet

Casing Volume cubic feet

8.45 · 3 = 25.4 gallons

+ 125 gal H_2O from drilling

150.4 gal total

Development / Purging Discharge Data

Purging Method Waterra

Start Purging Date 2/5/16 Time 0835

Stop Purging Date 2/5/16 Time 1135

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/5/16	1017	75	13.46	7.20	1.065	126	1.02	-62.7	4.63	Remove surge block, cloudy
	1030	95	13.88	7.61	1.062	28.8	0.86	-73.8	4.78	clear
	1045	115	13.97	7.46	1.057	13.8	0.82	-78.0	4.67	clear
	1100	135	13.79	7.37	1.057	9.11	0.76	-79.1	4.75	clear
	1115	155	13.78	7.35	1.061	7.37	0.83	-83.1	4.79	clear
	1130	175	13.88	7.32	1.062	7.43	0.81	-77.5	4.78	clear

TD post Dev't - 41.36

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

Location: MW-2

Monitored By: JS

Date: 2/1/16

Time: 0840

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground): 36.75 / 36.84 feet (Final TD)

Depth of Water (from top of PVC or ground): 13.92 feet

Radius of Casing: 2 inches

Radius of Casing: — feet

Casing Volume: 8.3 = 2.4 cubic feet

Casing Volume: gallons

+150 gal H_2O from drilling
175 gal total

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging: Date 2/1/16 Time 0930

Stop Purging: Date 2/1/16 Time 1440

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°C)	pH	Spec.Cond. (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/1/16	1202	60	–	–	–	–	–	–	13.98	Remove surge block
	1222	70	14.04	9.01	1.142	85.4	5.01	-93.8	13.95	Cloudy
	1240	80	13.75	8.80	1.144	14.5	0.86	-128.1	14.09	clear
	1300	110	13.82	8.74	1.145	8.30	0.69	-120.9	14.11	clear
	1315	125	13.89	8.50	1.145	7.96	0.64	-127.4	14.13	Clear
	1330	140	13.85	8.34	1.146	6.81	0.66	-101.9	14.12	clear
	1345	155	13.72	8.21	1.149	6.97	0.56	-86.2	14.14	clear
	1400	170	13.78	8.00	1.151	6.85	0.65	-123.3	14.13	Clear
	1415	185	13.69	7.85	1.148	5.96	0.71	-117.4	14.13	clear
	1430	200	13.80	7.84	1.150	6.81	0.73	-109.9	14.12	clear
	1440	210	13.87	7.79	1.149	6.61	0.78	-110.1	14.12	clear

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location MW-3

Monitored By: JS Date 2/4/16 Time 0744

Well Piezometer Data

(*circle one*)

Depth of Well (from top of PVC or ground)	33.03	feet
Depth of Water (from top of PVC or ground)	12.08	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	5.7×3 = 17.1	gallons

+ 150 gal H_2O from drilling
= 168 gal H_2O

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date 2/4/16 Time 0802

Stop Purging Date 2/4/16 Time 1330

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/4/16	0935	75	12.20	7.12	1.144	>1000	1.65	12.1	12.10	slightly muddy
	1030	83	11.39	6.95	1.152	>1000	0.54	-53.4	12.00	very muddy
	1045	90	11.90	6.95	1.160	>1000	0.62	-58.6	12.01	very muddy
	1100	97	12.21	6.86	1.148	>1000	0.68	-45.1	12.09	muddy
	1115	120	13.02	6.75	1.148	141	0.72	-40.0	12.06	cloudy
	1130	129	13.20	6.73	1.156	>1000	4.06	-38.7	12.02	Remove surge block, muddy ☆
	1145	155	12.33	6.69	1.155	>1000	1.23	-31.7	12.00	slightly muddy
	1200	165	12.80	6.78	1.154	239	1.05	-53.4	12.01	slightly muddy
	1225	175	12.95	6.69	1.158	58.4	0.85	-57.3	11.96	cloudy
	1240	190	13.66	6.67	1.150	291	0.62	-62.7	12.01	very cloudy
	1255	205	13.43	6.68	1.152	25.0	0.70	-69.3	11.91	clear
	1310	215	13.80	6.71	1.154	9.93	0.73	-68.1	11.90	clear
	1325	225	13.80	6.70	1.152	8.15	0.68	-65.6	11.86	clear

post dev't TD: 33.09

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring **Project No.:** 153-1406.0004

Location MW-4

Monitored By: JS Date 2/8/16 Time 0729

Well Piezometer Data

(*circle one*)

Depth of Well (from top of PVC or ground)	45.25	feet
Depth of Water (from top of PVC or ground)	17.94	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	7 • 3 = 21 gal	gallons

+200 gal H_2O from drilling = 221 gal H_2O total

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date 2/8/16 Time 0828

Stop Purging Date 2/8/16 Time 1700

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/8/16	1021	85	13.11	7.66	1.320	71000	0.99	-69.6	18.20	muddy
	1036	90	11.36	7.61	1.318	71000	1.54	-84.2	18.36	muddy
	1050	95	5.86	7.41	1.312	71000	2.04	-73.3	18.82	muddy
	1105	97	6.68	7.29	1.307	71000	1.57	-48.2	18.39	muddy
	1120	98	11.75	7.36	1.327	71000	2.08	-69.0	18.40	muddy
	1135	103	11.32	7.18	1.334	71000	3.20	-46.4	18.36	slightly muddy, Remove surge block
	1150	120	11.46	7.30	1.342	124	1.93	-62.8	18.37	very cloudy
	1210	165	11.03	7.08	1.340	139	1.50	-61.2	18.40	very cloudy
	1225	190	11.47	7.24	1.323	104	1.24	-69.0	18.40	cloudy, dump purge water
	1310	193	4.29	6.99	1.327	124	1.98	-36.4	17.98	cloudy
	1330	220	9.64	7.29	1.333	217	1.73	-51.0	18.16	very cloudy
	1345	230	9.56	7.29	1.316	—	0.86	-59.1	18.21	very cloudy
	1400	245	10.34	7.25	1.316	163	0.91	-72.2	18.25	very cloudy, low flow
	1415	255	10.28	7.23	1.325	51.1	0.66	-73.7	18.24	cloudy
	1430	270	9.20	7.18	1.354	48.6	1.13	-76.5	18.26	slightly cloudy
	1456	275	2.82	7.20	1.342	42.4	2.53	-44.5	18.19	slightly cloudy
	1515	279	6.25	7.20	1.340	70.2	2.01	-59.2	18.25	slightly cloudy
	1530	290	9.50	7.19	1.338	30.8	0.63	-68.4	18.27	Clear
	1545	300	9.98	7.26	1.327	48.5	1.02	-71.2	18.28	slightly cloudy
	1600	307	10.05	7.24	1.332	64.1	0.76	-71.5	18.31	slightly cloudy
	1615	317	9.68	7.25	1.340	70.5	1.06	-79.0	18.32	cloudy
	1630	335	9.41	7.24	1.320	38.0	1.30	-73.5	18.35	slightly cloudy
	1645	345	8.66	7.24	1.325	24.5	1.35	-71.4	18.36	Clear
	1650	350	8.43	7.24	1.328	23.6	1.18	-69.2	18.36	clear

post Dev't TD: 45.17

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring **Project No.:** 153-1406.0004

Location MW-5

Monitored By: JS Date 2/9/16 Time 0800

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground) 62.70 feet

Depth of Water (from top of PVC or ground) 17.98 feet

Radius of Casing 2 inches

feet

Casing Volume cubic feet

11.2.3 gallons + 250 gal H₂O from drilling

284 gal total

Development / Purging Discharge Data

Purging Method Waterra

Start Purging Date 2/9/16 Time 0840

Stop Purging Date 2/9/16 Time 1240

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/9/16	0945	160	13.18	8.77	1.270	71000	0.64	-105.6	18.89	muddy
	1000	195	13.21	8.51	1.263	39.2	1.12	-109.4	18.61	slightly cloudy, Remove surge block
	1010	225	13.40	8.28	1.270	21.8	0.92	-124.8	18.60	clear
	1045	240	12.18	8.44	1.297	78.1	1.08	-124.7	18.45	cloudy
	1055	260	12.91	8.60	1.267	76.7	0.82	-125.8	18.45	cloudy
	1105	285	13.23	8.32	1.272	43.7	0.76	-130.9	18.45	Slightly cloudy
	1115	300	12.40	8.13	1.261	55.3	1.33	-124.4	18.29	slight cloudy
	1125	303	12.50	8.01	1.265	52.8	1.28	-108.6	18.29	slightly cloudy, low flow
	1135	306	12.38	8.03	1.270	25.0	1.27	-103.7	18.26	clear
	1145	310	12.55	7.90	1.266	20.0	1.26	-92.2	18.25	clear
	1205	320	12.31	7.38	1.268	14.4	1.13	-86.2	18.29	Clear
	1215	325	12.36	7.37	1.270	14.4	1.10	-84.9	18.30	clear
	1225	330	12.33	7.38	1.273	13.5	1.08	-91.1	18.29	clear
	1235	337	12.41	7.37	1.277	13.0	1.05	-89.4	18.29	clear

post Dev't TD: 62.72

★ D.I. water reads 8.07

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

MW-6

Monitored By: JS   Date 2/3/16   Time 1308

Well Piezometer Data

(*circle one*)

Depth of Well (from top of PVC or ground)	55.42	feet
Depth of Water (from top of PVC or ground)	33.36	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	7.3 · 3 = 21.9	gallons

+300 gal H_2O from drilling

322 gal total

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging   Date 2/3/16   Time 1322

Stop Purging   Date 2/3/16   Time 1630

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/3/16	1340	50	13.45	7.58	1.474	>1000	1.48	-41.2	34.39	muddy
	1355	95	14.46	7.24	1.607	>1000	1.13	-54.2	34.30	muddy
	1410	130	13.80	7.08	1.666	>1000	1.30	-47.5	34.19	muddy
	1425	175	14.30	7.07	1.690	>1000	1.61	-50.7	34.02	muddy
	1440	220	14.10	6.96	1.686	74.1	1.22	-50.1	34.41	cloudy
	1515	255	14.08	7.06	1.723	48.7	1.87	-63.7	34.20	cloudy, remove surge block
	1520	305	14.42	7.03	1.693	13.9	1.27	-60.3	34.17	clear
	1540	335	14.06	6.98	1.688	11.5	1.33	-43.6	33.56	clear, low flow
	1550	346	13.70	6.98	1.702	19.8	1.28	-40.9	33.52	clear
	1600	343	13.47	6.99	1.701	19.5	1.23	-46.1	33.50	clear
	1610	352	13.71	6.96	1.699	15.4	1.08	-42.4	33.51	clear
	1620	360	13.75	6.99	1.699	14.1	1.26	-49.1	33.46	clear
	1630	367	13.77	6.99	1.699	13.4	1.23	-49.3	33.44	clear

post TD: 55.45

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

MW-7

Monitored By: JS

Date: 1/29/16

Time: 1028

Well Piezometer Data

(circle one)

D[illegible] of Well (from top of PVC or ground): 53.13 feet

Depth of Water (from top of PVC or ground): 31.66 feet

Radius of Casing: 2 inches

feet

Casing Volume: 7.4.3 = 22.5 cubic feet

gallons

+200 gal H_2O used

total 222.5

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date: 1/29/16 Time: 1026

Stop Purging Date: 1/29/16 Time: 1517

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
1/29/16	1037	38	14.60	9.16	1.462	>1000	1.31	-262.3	32.11	muddy
	1050	75	15.00	8.81	1.706	>1000	1.61	-260.2	32.05	muddy
	1105	92	14.86	8.70	1.848	>1000	1.50	-260.1	31.92	muddy
	1120	107	14.65	8.32	1.851	>1000	1.42	-264.1	31.69	muddy
	1134	125	14.90	8.06	2.004	>1000	1.06	-225.4	32.20	muddy, surge block removed
	1155	175	14.95	7.73	2.083	17.6	0.89	-257.1	32.21	clear
	1210	—	—	—	—	—	—	—	—	pause dev't
	1305	175	14.25	8.50	2.148	33.3	2.81	-224.4	31.81	clear, resume purge
	1325	215	14.74	8.10	2.182	12.4	1.31	-243.7	32.14	clear
	1335	235	15.12	7.96	2.200	11.3	0.98	-261.1	32.02	clear
	1345	242	15.00	7.72	2.200	12.3	1.01	-256.7	32.05	clear, low flow
	1355	255	15.01	7.67	2.209	10.2	0.92	-209.4	31.90	clear, low flow
	1405	260	15.02	7.71	2.217	10.3	1.14	-227.7	32.07	clear, low flow
	1415	265	15.00	7.84	2.220	8.45	1.03	-261.5	31.90	clear, low flow
	1425	265	14.77	7.74	2.217	7.76	1.32	-241.8	31.81	clear, low flow
	1440	268	14.14	7.33	2.219	9.12	1.61	-200.0	31.80	clear, low flow
	1455	270	14.19	7.11	2.212	9.22	1.26	-165.2	31.78	clear, low flow
	1510	273	14.17	7.17	2.210	9.10	1.30	-197.4	31.75	clear, low flow
	1515	274	14.17	7.14	2.217	9.08	1.18	-183.6	31.73	clear, low flow

post TD= 52.92

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location MW-8b

Monitored By: JS Date 2/3/16 Time 0735

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground)	78.80	feet
Depth of Water (from top of PVC or ground)	87.78	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	10.5 x 3 = 31.5	gallons

+250 gal H_2O from drilling

282 gal H_2O total

Development / Purging Discharge Data

Purging Method Waterra

Start Purging Date 2/3/16 Time 0754

Stop Purging Date 2/10/16 Time 1336

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/3/16	0833	90	13.47	8.03	1.181	>1000	0.56	-15.4	40.98	Very muddy, gray
	0845	110	13.72	7.89	1.183	>1000	0.54	-32.6	41.32	very muddy/silty, gray
	0855	145	13.54	7.77	1.191	>1000	0.63	54.9	40.84	very muddy, gray
	0910	175	13.67	7.65	1.189	>1000	0.72	-77.1	40.97	very muddy, gray
	0925	210	13.42	7.60	1.191	>1000	0.80	-94.6	41.65	very muddy, gray
	0940	235	13.49	7.53	1.194	>1000	0.66	-98.1	41.44	Remove surge block, v. muddy ☆
	1005	250	13.55	7.36	1.190	>1000	0.67	-100.1	41.19	very muddy, gray
	1020	310	13.16	7.56	1.202	>1000	1.23	-89.0	41.20	very muddy, gray
	1035	340	13.24	7.47	1.200	>1000	0.90	-93.4	39.41	very muddy, gray
	1650	355	14.07	7.44	1.194	>1000	0.70	-93.3	41.14	very muddy, gray
	1105	375	13.65	7.45	1.198	>1000	1.00	-96.3	41.00	very muddy, gray
	1120	415	13.40	7.38	1.196	>1000	0.69	-89.2	41.09	very muddy, gray
	1145	435	11.43	7.37	1.196	>1000	0.72	-90.4	38.46	very muddy, gray, low flow
	1200	440	10.33	7.42	1.142	>1000	0.65	-86.6	38.39	very muddy, dark gray
	1215	443	10.12	7.46	1.168	>1000	1.77	-87.8	38.40	very muddy, dark gray
2/4/16	1539	443	—	—	—	—	—	—	17.10	TD: 78.25, start purge
2/4/16	1616	448	—	—	—	—	—	—	17.36	TD: 77.77, Finish purge
2/10/16	1110	448	—	—	—	>1000	—	—	38.22	Start purge
2/10/16	1336	530	—	—	—	>1000	—	—	39.19	Finish purge, TD: 71.66

Sheet 1 of 1

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring **Project No.:** 153-1406.0004

Location

BMW-26

Monitored By: JS Date 2/5/16 Time 1247

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground)	[illegible] 43.99	feet
Depth of Water (from top of PVC or ground)	13.99	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	7.3 • 3 = 21.9	gallons

+120 gal H_2O from drilling

142 gal H_2O total

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date 2/5/16 Time 1300

Stop Purging Date 2/5/16 Time 1544

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
2/5/16	1320	30	13.48	7.59	0.877	71000	0.81	-49.2	14.66	muddy
	1335	45	13.57	7.43	0.876	71000	0.64	-50.8	14.80	muddy
	1350	60	13.41	7.49	0.816	71000	0.83	-75.4	14.92	muddy
	1405	75	13.40	7.46	0.834	71000	0.80	-68.0	14.79	muddy
	1420	90	13.32	7.41	0.839	294	0.78	-53.6	14.99	clear
	1435	105	13.02	7.60	0.841	237	0.97	-59.3	14.89	clear
	1450	120	13.12	7.52	0.841	27.5	0.89	-63.3	14.71	Clear
	1505	135	12.87	7.44	0.857	34.7	0.92	-65.9	15.50	Remove surge block ★, clear
	1520	150	13.50	7.41	0.863	16.0	0.96	-60.4	15.60	clear
	1535	165	13.32	7.35	0.870	13.1	0.97	-58.4	15.59	clear

Post Dev't TD: [illegible] 44.00

Sheet 1 of 3

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

BMW-1a

Monitored By: JS Date 4/8/16 Time 0900

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground)	62.90	feet
Depth of Water (from top of PVC or ground)	25.23	feet
Radius of Casing	2	inches
	—	feet
Casing Volume	—	cubic feet
	10.4 · 3 = 31.2	gallons

+200 gal from drilling

232 gal total

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date 4/8/16 Time 0931

Stop Purging Date 4/8/16 Time 1630

Monitoring

Q (L/min)

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
	0953	5	12.58	7.26	1.468	>1000	5.54	212.0	39.30	very muddy/gray, Q: 1L/min
	0943	8	13.24	7.05	1.521	>1000	4.49	63.2	32.52	" " " ": 1L/min
	0953	10	13.42	6.96	1.521	>1000	4.07	8.5	32.59	" " " Q: 1L/min
	1003	12	13.04	7.00	1.540	>1000	3.77	-20.0	32.67	" " " Q: 0.9L/min
	1013	15	14.94	6.99	1.552	>1000	2.87	-26.1	31.46	" " " Q: 1L/min
	1033	20	13.68	6.33	1.616	>1000	3.61	9.6	35.95	" " " Q: 2L/min
	1053	30	14.42	6.83	1.657	>1000	2.32	-29.6	35.10	muddy/gray, Q: 2L/min
	1113	40	14.17	6.92	1.665	>1000	2.35	-37.8	44.93	muddy/gray, Q: 2.4
	1133	58	14.33	6.23	1.627	>1000	2.31	9.1	44.52	muddy/gray, Q = 2.4
	1153	75	12.77	6.94	1.729	>1000	2.17	-12.6	46.63	muddy/gray, Q = 3.0
	1213	95	15.18	6.34	1.629	>1000	1.81	-15.2	46.95	muddy/gray, Q = 3.0
	1245	110	13.74	7.11	1.645	>1000	3.12	-145.8	38.11	Remove surge block, Q = 5.0 ☆
	1300	130	14.04	6.93	1.700	948	4.14	-29.4	58.32	~~slightly~~ cloudy Q = 5.0
	1320	140	14.90	6.56	1.678	659	2.43	-15.9	42.72	cloudy Q = 2.5
	1335	150	15.20	6.54	1.668	614	3.08	-34.7	39.34	cloudy Q = 3.0
	1355	167	15.17	6.46	1.662	790	1.12	-16.4	45.19	cloudy Q = 3.0
	1415	186	15.06	6.84	1.686	836	1.75	-30.4	49.52	cloudy Q = 3.0
	1435	205	13.41	6.83	1.740	>1000	2.11	-39.4	50.11	cloudy/gray Q = 4.0
	1525	230	14.60	6.52	1.725	>1000	1.47	-11.9	51.13	cloudy/gray, Q = 3.0
	1540	245	15.76	6.83	1.711	>1000	1.10	-42.4	47.0	cloudy/silty, Q = 3.0
	1555	263	14.39	6.62	1.730	>1000	1.42	-28.5	47.52	cloudy/gray, Q = 3.0
	1610	280	15.25	6.59	1.697	>1000	1.13	-27.8	47.65	cloudy/gray, Q = 3.0
	1625	—	—	—	—	—	—	—		pause purge

Sheet 2 of 3

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

Location: BMW-1a

Monitored By: JS Date 4/13/16 Time 0820

Well Piezometer Data

(*circle one*)

Depth of Well (from top of PVC or ground) 62.90 feet

Depth of Water (from top of PVC or ground) 24.74 feet

Radius of Casing 2 inches

feet

Casing Volume cubic feet

gallons

Development / Purging Discharge Data

Purging Method Waterra

Start Purging Date 4/14/16 Time 0838

Stop Purging Date Time

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
4/14/16	0840	5	15.87	6.52	1.493	>1000	1.88	159.3	34.15	muddy
	0850	20	16.36	6.95	1.504	>1000	0.90	17.3	43.90	muddy
	0900	37	16.45	6.97	1.504	>1000	0.97	-28.0	47.10	muddy
	0910	46	16.53	6.97	1.503	>1000	1.30	-46.8	48.79	muddy
	0920	60	16.57	6.94	1.513	>1000	1.05	-55.1	54.01	muddy
	0930	80	16.51	6.92	1.528	>1000	1.80	-50.2	55.41	muddy
	0940	96	16.36	6.93	1.551	>1000	1.70	-49.7	55.95	muddy
	0950	107	16.23	6.85	1.593	>1000	1.78	-42.4	56.40	muddy
	1000	125	16.15	6.90	1.604	>1000	1.19	-44.7	57.11	muddy
	1010	145	15.99	6.73	1.657	>1000	2.37	-34.1	60.44	muddy purged dry
	1108	155	17.26	7.13	1.635	172	2.61	-52.1	36.81	cloudy
	1118	165	17.28	7.12	1.683	729	2.25	-62.7	57.51	Muddy
	1128	185	16.99	6.99	1.692	70.3	1.57	-51.1	61.00	Slightly cloudy
	1138	190	—	—	—	—	—	—	61.40	Stop purge, dry
	1156	195	17.13	7.24	1.780	>1000	1.44	-20.0	35.42	muddy/sandy
	1206	215	17.07	6.86	1.711	70.5	1.42	-48.9	50.15	cloudy
	1216	230	16.92	6.89	1.706	114	1.37	-53.7	51.62	cloudy
	1226	255	16.86	6.79	1.701	169	1.23	-50.9	52.81	cloudy
	1236	265	16.79	6.83	1.715	184	1.61	-52.7	48.61	cloudy
	1250	280	16.74	6.80	1.723	226	1.51	-50.3	57.95	cloudy
	1305	290	—	—	—	—	—	—	60.14	purged dry
	1338	295	16.75	7.11	1.588	45.8	4.96	-4.3	33.47	cloudy
	1348	300	17.03	6.86	1.679	303	2.94	-26.9	34.40	cloudy
	1358	305	17.01	6.93	1.690	236	2.88	-40.8	35.75	cloudy
	1408	309	17.02	6.96	1.697	176	2.27	-48.5	36.24	cloudy
	1418	313	17.04	6.99	1.700	138	2.27	-54.5	36.56	cloudy
	1428	317	17.04	6.99	1.702	130	2.01	-44.8	37.10	cloudy

Sheet 3 of 3

Golder Associates WELL DEVELOPMENT/PURGING FORM

Project Ref: Ameren GW Monitoring

Project No.: 153-1406.0004

Location

BMW-1a

Monitored By: JS

Date: 4/13/16

Time: 1421

Well Piezometer Data

(circle one)

Depth of Well (from top of PVC or ground): ____ feet

Depth of Water (from top of PVC or ground): ____ feet

Radius of Casing: ____ inches / ____ feet

Casing Volume: ____ cubic feet / ____ gallons

See page 1

Development / Purging Discharge Data

Purging Method: Waterra

Start Purging Date: 4/13/16 Time: 0838

Stop Purging Date: ____ Time: 1603

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
4/13/16	1448	320	17.07	6.96	1.705	126	1.66	-57.6	37.15	cloudy
	1508	325	17.04	6.95	1.701	115	1.43	-57.3	36.75	cloudy
	1528	330	17.00	6.91	1.701	150	1.31	-57.0	36.92	cloudy
	1548	335	17.00	6.89	1.698	151	1.41	-56.8	36.81	cloudy

APPENDIX I
CCR MDNR WELL CERTIFICATION FORMS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304699	DATE RECEIVED 03/14/2016	
CR NO	CHECK NO. 170083	
STATE WELL NO A206420 03/15/2016	REVENUE NO. 031416	
ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR NUMBER ________________
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW1		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 4.6 FT

SURFACE COMPLETION

TYPE
☒ ABOVE GROUND
☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION
LENGTH _5.0 FT.
DIAMETER _4.0 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
DIAMETER 12.0 IN.
LENGTH _2.5 FT.

COPY

SURFACE COMPLETION GROUT
☒ CONCRETE
☐ OTHER

LOCATION OF WELL
LAT. ___38 ° ___24' 31.23"
LONG. ___90 ° ___20' 25.26"

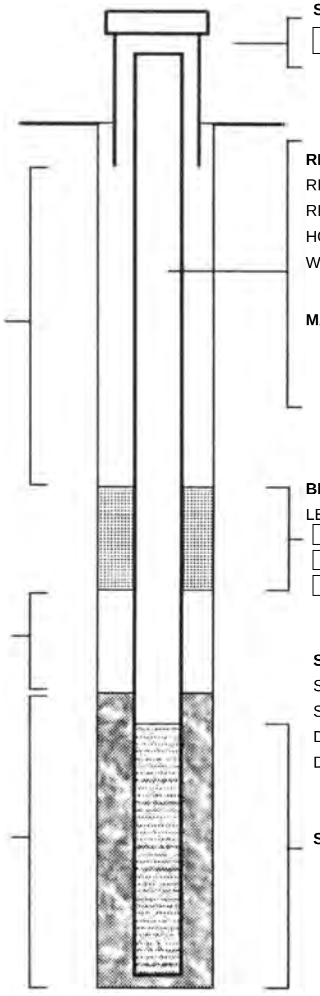
SMALLEST LARGEST
________ 1/4 ________ 1/4 ________ 1/4

SEC. LG000050 TWN. ________ NORTH
RANGE ________ Direction E

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDESS

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

ELEVATION ________FT.

ANNULAR SEAL
LENGTH _______0.0FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☒ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

RISER
RISER PIPE DIAMETER _______2.0IN.
RISER PIPE LENGTH ______36.2FT.
HOLE DIAMETER ________6.0IN.
WEIGHT OR SDR# _____SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER _______

BENTONITE SEAL
LENGTH: __27.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: _______0.5FT.

SCREEN
SCREEN DIAMETER: _______2.0IN.
SCREEN LENGTH: _______4.8FT.
DIAMETER OF DRILL HOLE: _6.0IN.
DEPTH TO TOP ______35.2FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: ______32.4FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER
PACK: _______7.6FT.

DEPTH		FORMATION
FROM	TO	DESCRIPTION
0.0	10.0	SLT
10.0	15.0	CLY SLT
15.0	21.4	SILT
21.4	32.7	SLT
32.7	36.2	SLT SND
36.2	40.0	SDY GRVL

TOTAL DEPTH: ______40.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284____	DATE WELL DRILLING WAS COMPLETED 01/23/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484____	SIGNATURE (APPRENTICE) x ________________________	APPRENTICE PERMIT NUMBER __________

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304700	DATE RECEIVED 03/14/2016		
CR NO	CHECK NO. 170083		
STATE WELL NO A206421 03/15/2016	REVENUE NO. 031416		
ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE	

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW2		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 15.1 FT

COPY

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT
☒ ABOVE GROUND	LENGTH 5.0 FT.	DIAMETER 12.0 IN.	☒ CONCRETE
☐ FLUSH MOUNT	DIAMETER 4.0 IN.	LENGTH 2.5 FT.	☐ OTHER

LOCATION OF WELL
LAT. 38 ° 24' 27.77"
LONG. 90 ° 20' 38.95"

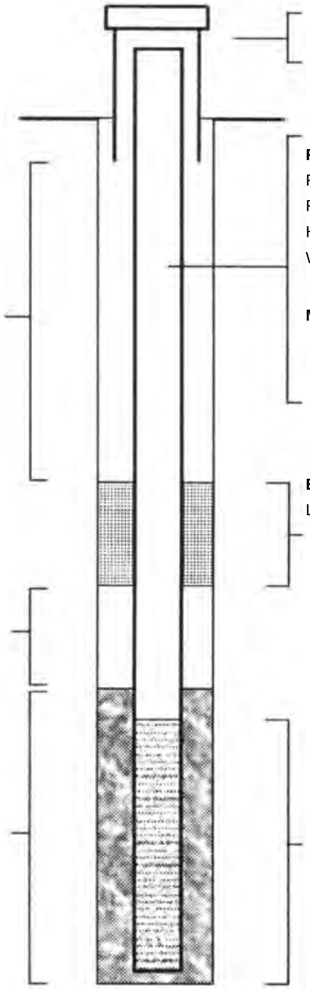
SMALLEST LARGEST
_______ 1/4 _______ 1/4 _______ 1/4

SEC. LG003051 TWN. ________ NORTH
RANGE ________ Direction E

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

ELEVATION ________FT.

ANNULAR SEAL
LENGTH 0.0FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 31.6FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ______

BENTONITE SEAL
LENGTH: 23.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: 1.0FT.

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 4.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 40.2FT.

DEPTH TO TOP OF PRIMARY FILTER PACK: 37.7FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER PACK: 7.3FT.

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0.0	12.4	SLT
12.4	30.0	STY CLY
30.0	31.2	SND
31.2	34.2	STY CLY
34.2	34.6	STY GRVL
34.6	45.0	STY CLY

TOTAL DEPTH: 45.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284		DATE WELL DRILLING WAS COMPLETED 01/23/2016
I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS			☐ PUMP INSTALLED
SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ________	APPRENTICE PERMIT NUMBER ________

MISSOURI DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF
GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304701	DATE RECEIVED 03/14/2016
CR NO	CHECK NO. 170083
STATE WELL NO A206422 03/15/2016	REVENUE NO. 031416

ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW3		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 13.6 FT

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT
☒ ABOVE GROUND	LENGTH 5.0 FT.	DIAMETER 12.0 IN.	☒ CONCRETE
☐ FLUSH MOUNT	DIAMETER 4.0 IN.	LENGTH 2.5 FT.	☐ OTHER

COPY

LOCATION OF WELL

LAT. 38 ° 24' 7.2"
LONG. 90 ° 20' 44.21"

SMALLEST LARGEST
________ 1/4 ________ 1/4 ________ 1/4

SEC. LG003052 TWN. ________ NORTH
RANGE ________ Direction

☐ LOCKING CAP
☐ WEEP HOLE

ELEVATION ________FT.

ANNULAR SEAL
LENGTH 0.0FT.

☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

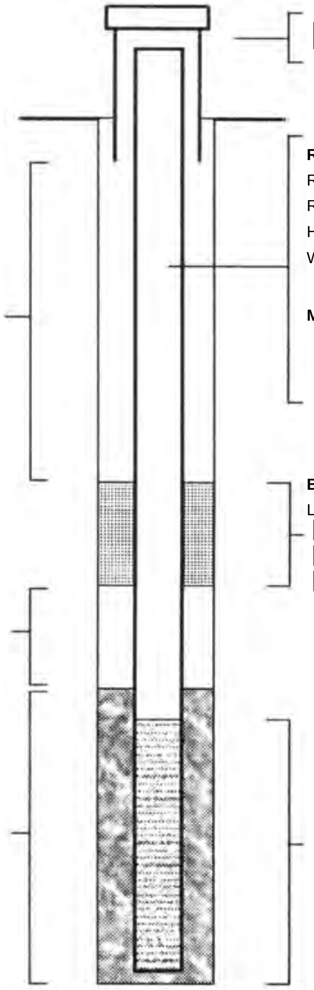
IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

SECONDARY FILTER PACK
LENGTH: 0.5FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: 47.4FT.

LENGTH OF PRIMARY FILTER
PACK: 7.6FT.



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 27.9FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ________

BENTONITE SEAL
LENGTH: 20.0
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 4.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 50.2FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

DEPTH		FORMATION DESCRIPTION
FROM	TO	
0.0	5.0	SLT
5.0	6.4	CLY SLT
6.4	11.1	STY SND
11.1	13.5	CLY SLT
13.5	22.2	STY CLY
22.2	25.0	CLY SLT
25.0	25.2	SND
25.2	26.1	STY CLY
26.1	30.0	SDY GRVL
30.0	55.0	STY CLY

TOTAL DEPTH: 55.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284	DATE WELL DRILLING WAS COMPLETED 01/22/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ________	APPRENTICE PERMIT NUMBER ________

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304702	DATE RECEIVED 03/14/2016
CR NO	CHECK NO. 170083
STATE WELL NO A206423 03/15/2016	REVENUE NO. 031416
ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY
ROUTE	

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY		VARIANCE GRANTED BY DNR NUMBER ________
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127
SITE NAME MERAMEC ENERGY CENTER	WELL NUMBER MW4	COUNTY ST LOUIS CITY	
SITE ADDRESS 8200 FINE ROAD	CITY ST LOUIS	STATIC WATER LEVEL 20.25 FT	

SURFACE COMPLETION

TYPE
☒ ABOVE GROUND
☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION
LENGTH 5.0 FT.
DIAMETER 4.0 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
DIAMETER 12.0 IN.
LENGTH 2.5 FT.

SURFACE COMPLETION GROUT
☒ CONCRETE
☐ OTHER

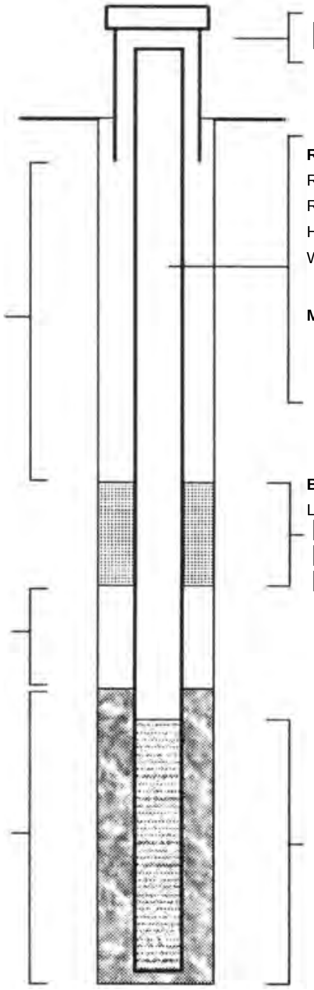
COPY

LOCATION OF WELL
LAT. 38 ° 24' 10.9"
LONG. 90 ° 20' 41.94"

SMALLEST LARGEST
________ 1/4 ________ 1/4 ________ 1/4

SEC. LG003051 TWN. ________ NORTH
RANGE ________ Direction E

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDESS

ELEVATION ________FT.

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 40.0FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

ANNULAR SEAL
LENGTH 0.0FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED:

%OF BENTONITE USED:

WATER USED/BAG: GAL.

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ______

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0.0	12.4	CLY SLT
12.4	15.0	CLY SLT
15.0	20.0	STY CLY
20.0	40.0	CLY SLT
40.0	41.3	GRVL
41.3	60.0	STY CLY
60.0	65.0	SLT

TOTAL DEPTH: 65.0 FEET

BENTONITE SEAL
LENGTH: 31.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: 1.7FT.

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 4.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 60.2FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: 57.6FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER PACK: 7.4FT.

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284		DATE WELL DRILLING WAS COMPLETED 01/22/2016
I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS			☐ PUMP INSTALLED
SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ________	APPRENTICE PERMIT NUMBER ________

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304703	DATE RECEIVED 03/14/2016
CR NO	CHECK NO. 170083
STATE WELL NO A206424 03/15/2016	REVENUE NO. 031416

ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW5		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 18.4 FT

COPY

SURFACE COMPLETION

TYPE
☒ ABOVE GROUND
☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION
LENGTH 5.0 FT.
DIAMETER 4.0 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
DIAMETER 12.0 IN.
LENGTH 2.5 FT.

SURFACE COMPLETION GROUT
☒ CONCRETE
☐ OTHER

LOCATION OF WELL
LAT. 38 ° 24' 3.54"
LONG. 90 ° 20' 40.05"

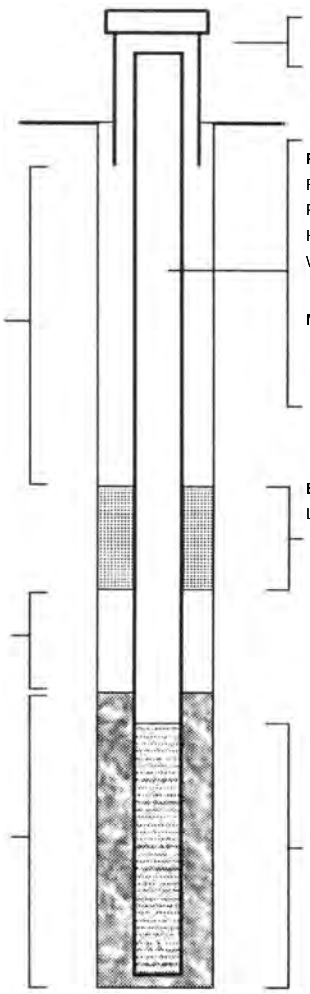
SMALLEST LARGEST
_______ 1/4 _______ 1/4 _______ 1/4

SEC. LG003051 TWN. ________ NORTH
RANGE ________ Direction E

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

ELEVATION ________FT.

ANNULAR SEAL
LENGTH 0.0FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 52.5FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ______

BENTONITE SEAL
LENGTH: 43.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: 1.5FT.

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 9.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 50.2FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: 46.9FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER PACK: 13.1FT.

DEPTH		FORMATION
FROM	TO	DESCRIPTION
0.0	10.0	STY CLY
10.0	20.0	CLY SLT
20.0	30.0	STY CLY
30.0	31.9	SND
31.9	35.0	CLY SND
35.0	46.0	STY CLY
46.0	60.0	SND

TOTAL DEPTH: 60.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284	DATE WELL DRILLING WAS COMPLETED 01/22/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ________________	APPRENTICE PERMIT NUMBER ________

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304704	DATE RECEIVED 03/14/2016
CR NO	CHECK NO. 170083
STATE WELL NO A206425 03/15/2016	REVENUE NO. 031416

ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE

COPY

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW6		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 33.6 FT

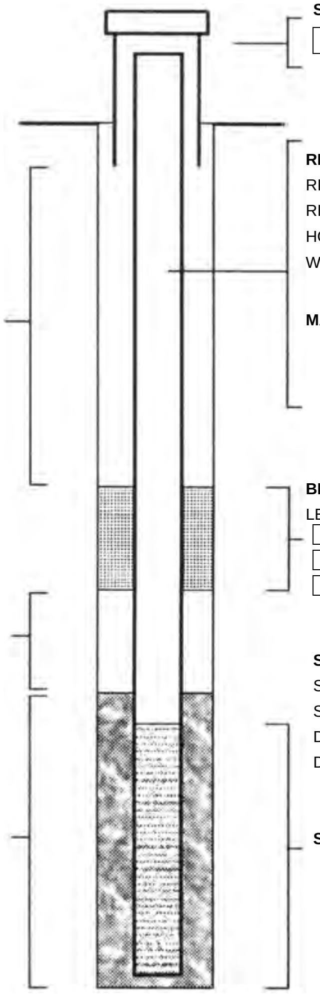
SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT	LOCATION OF WELL
☒ ABOVE GROUND	LENGTH 5.0 FT.	DIAMETER 12.0 IN.	☒ CONCRETE	LAT. 38 ° 23' 53.96"
☐ FLUSH MOUNT	DIAMETER 4.0 IN.	LENGTH 2.5 FT.	☐ OTHER	LONG. 90 ° 20' 35.4"

SMALLEST LARGEST
________ 1/4 ________ 1/4 ________ 1/4

SEC. LG003051 TWN. ________ NORTH
RANGE ________ Direction E

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

MONITORING FOR:
☐ RADIONUCLIDES
☐ EXPLOSIVES
☐ SVOCS
☐ PETROLEUM PRODUCTS ONLY
☒ METALS
☐ VOC
☐ PESTICIDES/HERBICIDESS

ELEVATION ________FT.

ANNULAR SEAL
LENGTH ________0.0FT.

☐ SLURRY
☐ PELLETS
☐ CEMENT/SLURRY
☐ CHIPS
☐ GRANULAR

IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED:

%OF BENTONITE USED:

WATER USED/BAG: GAL.

RISER
RISER PIPE DIAMETER ________2.0IN.
RISER PIPE LENGTH ________44.7FT.
HOLE DIAMETER ________6.0IN.
WEIGHT OR SDR# ________SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ________

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL
☐ EXTRACTION WELL
☐ PIEZOMETERS
☐ DIRECT PUSH
☒ OBSERVATION
☐ OPEN HOLE

BENTONITE SEAL
LENGTH: 39.2
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: ________0.7FT.

SCREEN
SCREEN DIAMETER: ________2.0IN.
SCREEN LENGTH: ________9.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP ________45.2FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: ________42.0FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER PACK: ________13.0FT.

DEPTH		FORMATION
FROM	TO	DESCRIPTION
0.0	12.9	SDY SLT
12.9	30.0	STY CLY
30.0	42.2	SDY SLT
42.2	52.0	SND
52.0	55.0	SND

TOTAL DEPTH: ______55.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284____		DATE WELL DRILLING WAS COMPLETED 01/21/2016
I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS			☐ PUMP INSTALLED
SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484____	SIGNATURE (APPRENTICE) x ________________________	APPRENTICE PERMIT NUMBER __________

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF
GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304705	DATE RECEIVED 03/14/2016	
CR NO	CHECK NO. 170083	
STATE WELL NO A206426 03/15/2016	REVENUE NO. 031416	
ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016 03/14/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW7		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 33.3 FT

COPY

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT	LOCATION OF WELL
☒ ABOVE GROUND	LENGTH 5.0 FT.	DIAMETER 12.0 IN.	☒ CONCRETE	LAT. 38 ° 23' 58.18"
☐ FLUSH MOUNT	DIAMETER 4.0 IN.	LENGTH 2.5 FT.	☐ OTHER	LONG. 90 ° 20' 21.71"

☐ LOCKING CAP
☐ WEEP HOLE

ELEVATION ________FT.

ANNULAR SEAL
LENGTH 0.0FT.

☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED:

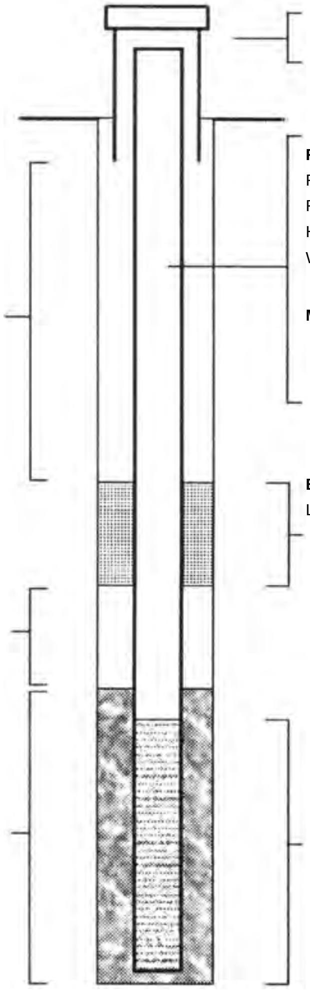
%OF BENTONITE USED:

WATER USED/BAG: GAL.

SECONDARY FILTER PACK
LENGTH: 1.5FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: 37.8FT.

LENGTH OF PRIMARY FILTER
PACK: 14.2FT.



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 44.7FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ______

BENTONITE SEAL
LENGTH: 34.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 9.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 42.2FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

SMALLEST LARGEST
_______ 1/4 _______ 1/4 _______ 1/4

SEC. LG003051 TWN. ________ NORTH
RANGE ________ Direction E

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDESS

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

DEPTH		FORMATION
FROM	TO	DESCRIPTION
0.0	6.3	SLT
6.3	7.4	STY GRVL
7.4	11.2	CLY SLT
11.2	21.9	SDY SLT
21.9	23.6	STY CLY
23.6	40.0	SND SLT
40.0	52.0	SND

TOTAL DEPTH: 52.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284	DATE WELL DRILLING WAS COMPLETED 01/24/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ______________________	APPRENTICE PERMIT NUMBER __________

MISSOURI DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF
GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304706	DATE RECEIVED 03/14/2016
CR NO	CHECK NO. 170083
STATE WELL NO A206427 03/15/2016	REVENUE NO. 031416

ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/14/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER MW8		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 38.2 FT

SURFACE COMPLETION

TYPE
☐ ABOVE GROUND
☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION
LENGTH ____ FT.
DIAMETER ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
DIAMETER ____ IN.
LENGTH ____ FT.

SURFACE COMPLETION GROUT
☐ CONCRETE
☐ OTHER

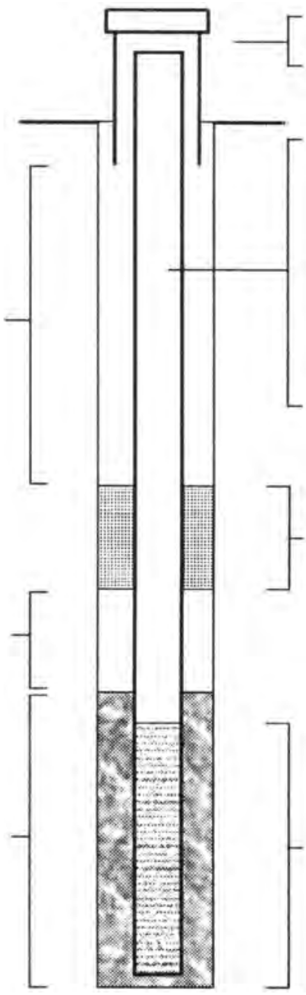
COPY

LOCATION OF WELL
LAT. ___38 ° ___24' _7.75"
LONG. ___90 ° ___20' 14.71"

SMALLEST LARGEST
_______ 1/4 _______ 1/4 _______ 1/4

SEC. LG000050 TWN. ________ NORTH
RANGE ________ Direction E

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☐ ALUMINUM ☐ PLASTIC

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☐ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDESS

ELEVATION ________FT.

RISER
RISER PIPE DIAMETER _______0.0IN.
RISER PIPE LENGTH _______0.0FT.
HOLE DIAMETER _______0.0IN.
WEIGHT OR SDR# _______0.0

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

ANNULAR SEAL
LENGTH __________FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

MATERIAL
☐ STEEL ☐ THERMOPLASTIC (PVC)
☐ OTHER _______

BENTONITE SEAL
LENGTH: ______
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: _______0.0FT.

SCREEN
SCREEN DIAMETER: _______0.0IN.
SCREEN LENGTH: _______0.0FT.
DIAMETER OF DRILL HOLE: _0.0IN.
DEPTH TO TOP ______80.0FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: ______80.0FT.

SCREEN MATERIAL
☐ STEEL ☐ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER
PACK: _______0.0FT.

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0.0	0.9	GRVL
0.9	1.2	SND
1.2	7.1	SDY SLT
7.1	10.0	CLY SLT
10.0	20.0	STY CLY
20.0	21.7	CLY SND
21.7	30.0	STY CLY
30.0	32.8	SDY SLT
32.8	50.0	STY CLY
50.0	68.0	SDY SLT
68.0	75.5	STY SND
75.5	75.9	SND
75.9	80.0	STY CLY

TOTAL DEPTH: ______80.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284____	DATE WELL DRILLING WAS COMPLETED 01/24/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484____	SIGNATURE (APPRENTICE) x ________________________	APPRENTICE PERMIT NUMBER __________

MISSOURI DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF
GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00305960	DATE RECEIVED 05/26/2016
CR NO	CHECK NO. 170099
STATE WELL NO A206734 05/31/2016	REVENUE NO. 052616
ENTERED NRBASSM PH1 PH2 PH3 05/26/2016 05/26/2016 05/26/2016	APPROVED BY
ROUTE	

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY		VARIANCE GRANTED BY DNR
OWNER ADDRESS 370 S LINDBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127
NUMBER ________			
SITE NAME MERAMEC ENERGY CENTER	WELL NUMBER BMW1	COUNTY ST LOUIS CITY	
SITE ADDRESS 8200 FINE RD	CITY ST LOUIS	STATIC WATER LEVEL 25.42 FT	

COPY

SURFACE COMPLETION

TYPE
☒ ABOVE GROUND
☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION
LENGTH 5.0 FT.
DIAMETER 4.0 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
DIAMETER 12.0 IN.
LENGTH 2.5 FT.

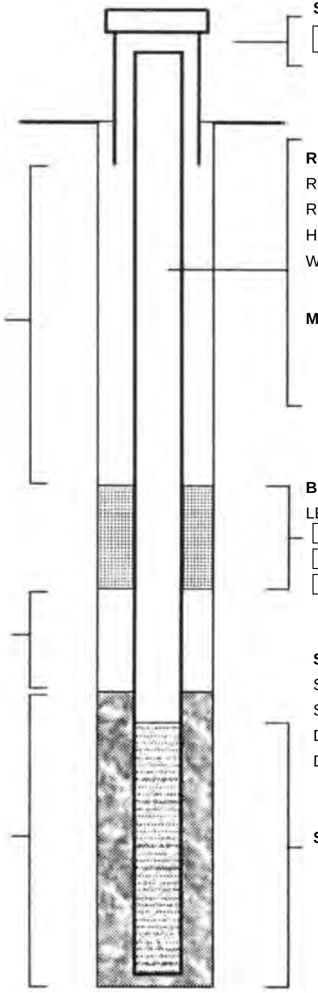
SURFACE COMPLETION GROUT
☒ CONCRETE
☐ OTHER

LOCATION OF WELL
LAT. 38 ° 24' 6.91"
LONG. 90 ° 19' 59.74"

SMALLEST LARGEST
______ 1/4 ______ 1/4 ______ 1/4

SEC. LG000050 TWN. ______ NORTH
RANGE ______ Direction

☐ LOCKING CAP
☐ WEEP HOLE



SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☐ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

ELEVATION ______FT.

RISER
RISER PIPE DIAMETER 2.0IN.
RISER PIPE LENGTH 52.7FT.
HOLE DIAMETER 6.0IN.
WEIGHT OR SDR# SCH40

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

ANNULAR SEAL
LENGTH 37.5FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER ______

IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED:

%OF BENTONITE USED:

WATER USED/BAG: GAL.

BENTONITE SEAL
LENGTH: 5.0
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH: 0.0FT.

SCREEN
SCREEN DIAMETER: 2.0IN.
SCREEN LENGTH: 9.8FT.
DIAMETER OF DRILL HOLE: 6.0IN.
DEPTH TO TOP 60.2FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: 55.9FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER
PACK: 14.1FT.

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION
0.0	1.1	CON
1.1	27.8	STY CLY
27.8	28.6	STY CLY
28.6	37.1	STY CLY
37.1	40.0	CLY SLT
40.0	48.1	CLY SND
48.1	50.0	SND
50.0	51.1	STY CLY
51.1	51.3	CLY SND
51.3	53.8	CLY SND
53.8	60.0	SND
60.0	64.0	STY CLY
64.0	66.2	CLY SLT
66.2	70.0	STY CLY

TOTAL DEPTH: 70.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JEFFREY INGRAM	PERMIT NUMBER 006124	DATE WELL DRILLING WAS COMPLETED 04/08/2016

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS

☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484	SIGNATURE (APPRENTICE) x ________	APPRENTICE PERMIT NUMBER ________

MISSOURI DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF
GEOLOGY AND LAND SURVEY
(573) 368-2165

MONITORING WELL CERTIFICATION RECORD

REF NO 00304708	DATE RECEIVED 03/14/2016	
CR NO	CHECK NO. 170083	
STATE WELL NO A206429 03/15/2016	REVENUE NO. 031416	
ENTERED NRBASSM PH1 PH2 PH3 03/14/2016 03/15/2016 03/15/2016	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME AMEREN MISSOURI C/O BILL KUTOSKY	CONTACT NAME AMEREN MISSOURI C/O BILL KUTOSKY			VARIANCE GRANTED BY DNR
OWNER ADDRESS 3750 S LINDEBERGH BLVD	CITY ST LOUIS	STATE MO	ZIP 63127	NUMBER ________________
SITE NAME MERAMEC ENERGY CENTER		WELL NUMBER BMW2		COUNTY ST LOUIS CITY
SITE ADDRESS 8200 FINE ROAD		CITY ST LOUIS		STATIC WATER LEVEL 14.11 FT

COPY

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT
☒ ABOVE GROUND	LENGTH _5.0 FT.	DIAMETER 12.0 IN.	☒ CONCRETE
☐ FLUSH MOUNT	DIAMETER _4.0 IN.	LENGTH _2.5 FT.	☐ OTHER

LOCATION OF WELL

LAT. ___38 ° ___24' _33.7"
LONG. ___90 ° ___20' 20.37"

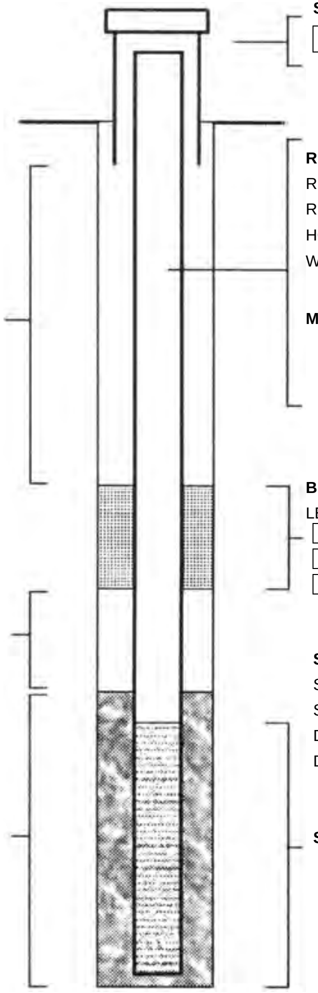
SMALLEST LARGEST
_______ 1/4 _______ 1/4 _______ 1/4

SEC. LG000050 TWN. ________ NORTH
RANGE ________ Direction E

MONITORING FOR:
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☒ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☒ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☐ PIEZOMETERS
☐ DIRECT PUSH

☐ LOCKING CAP
☐ WEEP HOLE



ELEVATION _______FT.

ANNULAR SEAL
LENGTH _______0.0FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED:
%OF BENTONITE USED:
WATER USED/BAG: GAL.

SECONDARY FILTER PACK
LENGTH: _______0.7FT.

DEPTH TO TOP OF PRIMARY
FILTER PACK: ______42.0FT.

LENGTH OF PRIMARY FILTER
PACK: _______8.0FT.

SURFACE COMPLETTION
☐ STEEL ☒ ALUMINUM ☐ PLASTIC

RISER
RISER PIPE DIAMETER _______2.0IN.
RISER PIPE LENGTH ______39.7FT.
HOLE DIAMETER _______6.0IN.
WEIGHT OR SDR# _____SCH40

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER _______

BENTONITE SEAL
LENGTH: __31.5
☐ CHIPS ☐ PELLETS ☐ GRANULAR
☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SCREEN
SCREEN DIAMETER: _______2.0IN.
SCREEN LENGTH: _______4.8FT.
DIAMETER OF DRILL HOLE: _6.0IN.
DEPTH TO TOP ______45.2FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

DEPTH		FORMATION
FROM	TO	DESCRIPTION
0.0	6.9	CLY SLT
6.9	35.6	STY CLY
35.6	38.8	CLY SLT
38.8	41.4	STY GRVL
41.4	50.0	STY CLY
TOTAL DEPTH:		______50.0 FEET

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETER AND GROUT USED.

SIGNATURE (PRIMARY COUNTRACTOR) x JOHN SUOZZI	PERMIT NUMBER 006284____		DATE WELL DRILLING WAS COMPLETED 01/25/2016
I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS			☐ PUMP INSTALLED
SIGNATURE (WELL DRILLER) x JASON DRABEK	PERMIT NUMBER 004484____	SIGNATURE (APPRENTICE) x ________________________	APPRENTICE PERMIT NUMBER _________

APPENDIX J
STATISTICAL ANALYSIS PLAN

Statistical Analysis Plan

STATISTICAL ANALYSIS PLAN

Prepared in accordance with the United States Environmental Protection Agencies Coal Combustion Rule, part 40 CFR 257.93 for Ameren Missouri's Surface Impoundment at the Meramec Energy Center, St. Louis County, Missouri

Submitted To: Ameren Missouri
1901 Chouteau Avenue
St. Louis, Missouri 63103

Submitted By: Golder Associates Inc.
820 S. Main Street, Suite 100
St. Charles, MO 63301 USA

Date: October 16, 2017

Project No.153-1406

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EXECUTIVE SUMMARY

This Statistical Analysis Plan (SAP) was developed to meet the requirements of United States Environmental Protection Agency (USEPA) 40 CFR Part 257 “Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule” (the Rule or CCR Rule). The Rule requires owners or operators of an existing Coal Combustion Residuals (CCR) Surface Impoundment to install a groundwater monitoring system and develop a sampling and analysis program (§§ 257.90 - 257.94). Ameren Missouri has determined that the Surface Impoundments at the Meramec Energy Center in St. Louis County, Missouri is subject to the requirements of the CCR Rule.

As a part of the groundwater sampling and analysis requirements of the Rule, statistical methods as described in Section §257.93(f) of the Rule need to be implemented to statistically evaluate groundwater quality. The selected statistical method must then be certified by a qualified professional engineer stating that the statistical method is appropriate for evaluating the groundwater monitoring data for the CCR Unit. Detailed descriptions of the acceptable statistical data methods are provided in the USEPA’s *Statistical Analysis of Groundwater Data at RCRA Facilities, Unified Guidance* (USEPA, 2009) (Unified Guidance). The Unified Guidance is also recommended in the CCR Rule to be used for guidance in the selection of the appropriate statistical evaluation method.

This SAP details the statistical procedures to be used to establish background conditions, to implement detection monitoring, and to implement assessment monitoring (if needed) for Ameren Missouri at the above mentioned CCR Unit. Detailed information on collection, sampling techniques, preservation, etc. are provided in the Groundwater Monitoring Plan (GMP) for the CCR Unit specified above. This SAP is a companion documents to the GMP and assumes that data analyzed by the procedures described in this SAP are from samples that were collected in accordance with the GMP.

This SAP was prepared by Golder Associates, Inc. (Golder) on behalf of Ameren in order to document appropriate method of groundwater data evaluation in compliance with CCR Rules. The methods and groundwater data evaluation techniques used in this SAP are appropriate for evaluation of the groundwater monitoring data for the above mentioned CCR Unit and are in compliance with performance standards outlined in Section §257.93(g) of the CCR Rule.

Table of Contents

List of Tables

1.0 BASELINE STATISTICS

This section discusses the procedures, methods, and processes that will be implemented as part of the Detection Monitoring statistical evaluation. Detection Monitoring will begin after eight rounds of sampling are completed at each monitoring well for each of the Appendix III and Appendix IV parameters. This background monitoring period provides baseline data for each monitoring well which can be used as the basis of the statistical evaluation. Detection monitoring will be completed on a semiannual basis unless adequate groundwater flow is not available for semiannual sampling and proper documentation as outlined in §257.94(d) is completed. Detection monitoring will analyze for Appendix III analytes as outlined in the Groundwater Monitoring Plan for this CCR Unit.

1.1 STATISTICAL DATA PREPARATION AND INITIAL REVIEW

Many of the statistical comparison tests used in detection, and assessment monitoring require various analyses to be completed prior to the data being used for the calculation of statistical limits. This section discusses the methods and procedures for completing this initial review of the data. The analyses required include testing for statistical independence, physical independence, and procedures to evaluate potential outliers.

1.1.1 Physical and Statistical Independence of Groundwater Samples

Detection, and Assessment Monitoring statistical evaluations assume that background and downgradient sampling results are statistically independent. The Unified Guidance states that *"Physical independence of samples does not guarantee statistical independence, but it increases the likelihood of statistical independence."* (Section 14.1, Unified Guidance). Physical independence is most likely achieved when consecutive groundwater samples are collected from independent volumes of water within a given aquifer zone. Using the Darcy Equation, minimum time intervals between sampling events can be calculated in order to confirm the minimum time interval for groundwater to travel through the borehole is less than the time between sampling events (**Table 1, Physical Independence**). This minimum time can be calculated as displayed in Section *14.3.2* of the Unified Guidance.

Table 1: Physical Independence

Well ID	Hydraulic Conductivity	Average Hydraulic Gradient	Effective Porosity	Well Bore Volume	Minimum Time
Symbol	K	I	n	D	T_{min}
Units	Feet/Day	Feet/Foot	%	Feet	Days
MW-1	85.14	0.0023	0.35	0.5	0.9
MW-2	92.34	0.0023	0.35	0.5	0.8
MW-3	184.68	0.0023	0.35	0.5	0.4
MW-4	46.17	0.0023	0.35	0.5	1.6
MW-5	56.15	0.0023	0.35	0.5	1.4
MW-6	37.44	0.0023	0.35	0.5	2.0
MW-7	49.40	0.0023	0.35	0.5	1.5
MW-8	5.35	0.0023	0.35	0.5	14.2
MW-B1	2.81	0.0023	0.35	0.5	27.1
MW-B2	106.19	0.0023	0.35	0.5	0.7

Notes:
1. Average hydraulic gradient and effective porosity taken from table 2 in the Groundwater Monitoring Plan (GMP)
2. Hydraulic Conductivity taken from table 3 of the Groundwater Monitoring Plan (GMP)
3. Calculation completed using the Darcy Equation as outlined in section 14.3.2 of the Unified Guidance.

1.1.2 Data Review – Testing For Outliers

Careful review of the data is critical for verifying that there is an accurate representation of the groundwater conditions. Early identification of anomalous data (outliers) helps play a key role in a successful SAP. Possible causes for outliers include:

- Sampling error or field contamination;
- Analytical errors or laboratory contamination;
- Recording or transcription errors;
- Faulty sample preparation, preservation, or shelf-life exceedance; or
- Extreme, but accurately detected environmental conditions (e.g., spills, migration from the facility).

The following sections outline a few graphical and statistical tests that should be completed prior to the data being used to calculate statistical limits.

1.1.2.1 Time Series Plots

Time Series plots are a quick and simple method to check for possible outliers. Time series plots should be generated with the concentration of the analyte on the Y-axis and the sample date (time) on the X-axis. If any data points look to be potential outliers, the data should be flagged and further evaluated as described in Section 1.1.2.2 below.

1.1.2.2 Dixon’s and Rosner’s Tests

If graphical methods demonstrate that potential outliers exist, further investigation of these data points can be completed using Dixon’s test for datasets with fewer than 25 samples and Rosner’s test with datasets greater than 20 samples. Formal testing should only be performed if an observation seems particularly high compared to the rest of the dataset. If statistical testing is to be completed to whether an outlier exists, it should be cautioned that these outlier tests assume that the rest of the data (other than the outlier) are normally distributed. Additionally, because log-normally distributed data often contain one or more values that appear high relative to the rest, it is recommended that the outlier test be run on the transformed values instead of their original observations. This way, one can avoid classifying a high log-normal measurement as an outlier just because the test assumptions were violated. Most groundwater statistical packages can complete Dixon’s and Rosner’s tests and more information about Dixon’s and Rosner’s tests is provided in Sections 12.3 and 12.4 of the Unified Guidance. If the test designates an observation as a statistical outlier, the source of the abnormal measurement should be investigated. In general, if a data point is found to be a statistical outlier, it should not be used for statistical evaluation. However, outlier removal should be performed carefully, and typically only when a specific cause for the outlier can be identified.

In some cases where a specific cause for an outlier cannot be identified, professional judgment can be used to determine whether the outlier significantly affects the statistical results to the extent that removal is deemed necessary. If an outlier value with much higher concentration than other background observations is not removed from background prior to statistical testing, it will tend to increase both the background sample mean and standard deviation. In turn, this may substantially raise the magnitude of the prediction limit or control limit calculated from that data set. Thus, experience shows that it is a good practice to remove obvious outliers from the database even when independent evidence of the source of the outlier does not exist. The removal of outliers tends to normalize the data and therefore produce a more robust statistical limit. Outlier removal also tends to produces a more conservative statistical limit, since the data variability is decreased, thereby decreasing the standard deviation.

1.2 Upgradient Monitoring Wells

Following the identification and removal of outliers, the upgradient data are further reviewed to determine appropriate methods for statistical evaluation to maintain adequate statistical power while minimizing the chance of false positives. The following sections describe the procedures and methods that should be used, based on the background dataset, to compare the background datasets, to calculate the data distribution, to handle non-detect (ND) data, and to select appropriate statistical evaluation methods (interwell vs intrawell).

1.2.1 Calculate for Mean and Standard Deviation

Following outlier removal, initial summary statistics including mean and standard deviation should be calculated for the background monitoring well datasets. While these summary statistics are easily completed in many groundwater statistical software packages, it is important to account for values that have low or zero values as described below.

1.2.1.1 Reporting of Low and Zero Values

1.2.1.1.1 Estimated Values (J Flag)

Estimated values are values that have a concentration between the method detection limit (MDL[1]) and the practical quantitation limit (PQL[2]) for any given compound. These values are typically displayed with a J flag in laboratory report packages and are often referred to as "J-values". In most cases, The Unified Guidance recommends using the estimated value provided for statistical evaluation. Estimated values are typically used because the accuracy and power of most statistical evaluations lose power as the percentage of non-detects increases. While they are below the PQL, estimated values are considered detectable concentrations for statistical calculations, which has the effect of lowering the percentage of non-detects.

This "rule" should be applied with care, as there is an exception. Estimated values are not considered detectable concentrations if all values for a single constituent are less than the PQL. This is discussed in more detail in Section 1.3.5 of this document.

1.2.1.1.2 Non-Detects Values (ND)

Non-Detect Values (ND) are concentrations that were not detected at a concentration above the MDL. ND values are typically displayed with a "U" or "ND" flag in laboratory data report packages. The following approaches for managing ND values are based on recommendations in the Unified Guidance and are applicable for use with the statistical evaluation procedures that will be further discussed and used in this SAP (prediction intervals, confidence intervals, and tolerance intervals):

- If <15% ND, substitute ½ the PQL;
- If between 15% to 50% ND, use the Kaplan-Meier or robust regression on ordered statistics to estimate the mean and standard deviation;
- If >50% but less than 100% ND, use a non-parametric test; or
- If 100% of values are less than the PQL, use the Double Quantification Rule.

1.2.2 Data Distribution

Statistical evaluations of groundwater data require an understanding of the data distribution for each analyte in each monitoring well. Data typically fall into one of the following distributions:

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[1] MDL = lowest level of an analyte (substance) that the laboratory can reliably detect with calibrated instrumentation; generally based on results of an annual "MDL study" performed in accordance with 40 CFR Part 136, Appendix B; MDLs are generally set using laboratory grade deionized water spiked with a known concentration and thus do not account for effects of matrix interference inherent in typical groundwaters.

[2] PQL = minimum concentration of an analyte (substance) that can be measured with a high degree of confidence that the analyte is present at or above that concentration (typically 5-10x higher than the MDL).

- Normal distribution – Sometimes referred to as Gaussian distribution, a normal distribution is a common continuous distribution where data form a symmetrical bell-shaped curve around a mean. Normally distributed data are tested using parametric methods.
- Transformed-normal distribution – Similar to a normal distribution, however, data are asymmetrical until transformation is applied to all data which then causes it to form a bell-curve. Transformed-normal data distributions are also tested use parametric methods.
- Non-Normal Distribution – When the data are not or cannot be transformed into a symmetrical distribution. Non-normal data distributions are tested using Non-parametric methods.

Testing for data distributions can be completed in several different ways including the skewness coefficient, probability plots with Filliben's test, or the Shapiro-Wilk/Shapiro-Francia Test. All of these methods may be employed, however, the Shapiro-Wilk and Shapiro-Francia tests are generally considered the best method according to the Unified Guidance. The Shapiro-Wilk test is best for sample sizes under 50 while the Shapiro-Francia test is best with larger datasets of 50 or more observations. Most groundwater statistical software packages can complete both Shapiro-Wilk and Shapiro-Francia tests and a detailed discussion of the testing procedures is provided in Section *10.5.1* of the Unified Guidance.

Based on the outcome of the data distribution testing, data will use either Parametric or Non-parametric tests. It is important to note that non-parametric testing usually requires larger datasets in order to minimize the Site Wide False Positive Rate (SWFPR) therefore when the raw data are not normally distributed, a transformed-normal distribution is preferred when possible.

1.2.3 Temporal Trend

Most statistical tests assume that the sample data are statistically independent and identically distributed. Therefore, samples collected over a period of time should not exhibit a time dependence. A time dependence could include the presence of trends or cyclical patterns when observations are graphed on a time series plot. Trend analysis methodologies test to see whether the dataset displays an increasing, decreasing, or seasonal trend. A statistically significant increasing or decreasing trend could indicate a release from the CCR unit (or alternative source) and further investigation of the cause of the trend may be necessary.

If a trend is suspected, a Theil-Sen trend line should be used to estimate slope and the Mann-Kendall Trend Test should be used to evaluate the slope significance (Chapter 14, Unified Guidance). If a statistically significant trend is reported, based on a Sen's slope/Mann-Kendall trend test, the source of the trend should be investigated. If the trend can be shown to be a result of an upgradient or off-site source, the data can be de-trended and used to calculated statistical limits. De-trending can be accomplished by computing a linear regression on the data (see Section 17.3.1 of the Unified Guidance) and then using the regression residuals instead of the original measurements in subsequent statistical analysis.

1.2.4 Comparing Background Datasets (Spatial Variation)

After physical independence, outlier, trend, and summary statistical testing is completed, the datasets from the background monitoring wells should be compared to one another for each individual constituent. The comparison of these background datasets is useful for determining whether spatial variability exists in the background dataset, and can also be used to decide whether an interwell or intrawell approach is more appropriate for statistical evaluation.

Box and whisker plots can be used to perform side by side comparison for each well and can be completed for each individual analyte to determine if the variance is equal across the background datasets. If the box plots appear to be staggered and do not appear to be from the same population (same variance) then a Lavene's test using an α of 0.01 should be used as a check to determine if the background datasets have spatial variation. Testing methods and procedures are provided in Section 11.2 of the Unified Guidance.

The preferred method for comparing background datasets is a Mann-Whitney (or Wilcoxon Rank Sum) Test, which evaluates the ranked medians of both the historical and new dataset populations. An α of 0.05 should be used for this evaluation. After calculation, if the Mann-Whitney statistic does not exceed the critical point, the test assumes that the two data populations have equal medians, and therefore are likely from the same statistical distribution. The testing methods and procedures for this analysis are provided in Section 16.2 of the Unified Guidance.

If spatial variability is identified within the background dataset, an additional investigation may be needed in order to confirm that the variability is not caused by impacts from the CCR unit. If there is spatial variability and it is not caused by impacts from the CCR Unit, then an intrawell approach to statistical evaluation may be appropriate.

1.3 Compliance Monitoring Wells and Statistically Significant Increases

After completing the previously described analyses of the background data, a statistical evaluation of the compliance monitoring data should be completed to determine if there are any Statistically Significant Increases[3] (SSIs) that could trigger assessment monitoring. Section §257.93(F) of the CCR Rule specifies the list of methods that can be used for statistical evaluation. These specific methods to be used for statistical evaluation of data from the RMSGS are detailed below. Further, the Unified Guidance is recommended in the CCR Rule to be used for guidance in the selection of the appropriate statistical evaluation method. This section provides a guide to choosing the correct statistical evaluation to analyze the compliance wells for SSIs, the basic principles of each method, and response activities for identified SSIs.

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[3] SSI = a verified statistical exceedance; under compliance monitoring programs, the first time an exceedance is reported it is an initial statistical exceedance and is only considered an SSI if a confirmatory result verifies the initial exceedance.

1.3.1 Interwell vs Intrawell Statistical Analysis

1.3.1.1 Interwell Statistical Analysis

An interwell statistical evaluation compares the groundwater results from the compliance (downgradient) monitoring wells to a pool of background (typically upgradient) monitoring well results. If results from the downgradient wells are statistically higher (or significant) than the background dataset then an exceedance is triggered. This upgradient verses downgradient method typically assumes that:

- Naturally, un-impacted groundwater characteristics in the compliance monitoring wells is comparable and equal on average to the background monitoring wells.
- Upgradient and downgradient monitoring well samples are drawn from the same aquifer and are screened in essentially the same hydrostratigraphic position.
- The aquifer unit is homogeneous and isotropic.
- Groundwater flow is in a definable pathway from upgradient to downgradient wells beneath the CCR Unit.

An interwell approach is preferable for statistical evaluation because it compares data to a background dataset that is not influenced by the CCR Unit. Interwell methods should be used with two exceptions: (1) there are significant differences in the datasets of the background wells (as indicated by methods described in Section 1.2.4) or (2) it can be demonstrated that groundwater geochemistry at all wells (background and compliance) is not impacted by the CCR Unit.

1.3.1.2 Intrawell Statistical Analysis

An intrawell statistical evaluation compares the groundwater results from a compliance monitoring well to historical data collected from that same compliance monitoring well. This method can be used for CCR monitoring when groundwater data from the background monitoring wells is statistically different than that of the compliance monitoring wells or when it can be shown that there is no impact from the CCR Unit in either upgradient or downgradient/compliance wells.

1.3.2 Statistical Power

As discussed above, one of the primary goals of the selection of a proper statistical evaluation method is to limit the potential for results to falsely trigger a SSI while also maintaining sufficient statistical power to detect a true SSI. Falsely triggering a SSI when no release from the CCR unit has occurred is referred to as a false positive. The False Positive Rate (FPR), typically denoted by the Greek letter α, is also known as the “significance level”. The FPR is the probability that a future compliance observation will be declared to be from a different statistical distribution than the background data. If the FPR is set too high, it can lead to the conclusion that there is evidence of impact when none exists. Conversely, if the FPR is set too low, it can lead to a false conclusion that no contamination exists, when it actually does exist (also known as a “false negative”). Ultimately, the ability to accurately identify SSIs depends on the selection of an appropriate FPR, which is referred to as the statistical power. FPRs are set for each parameter (or for each parameter in each well for intrawell analysis). However, statistical analysis programs and the resulting decision making do not depend on each individual measurement/comparison error rates, but are dependent on the collective error rate from all of the individual comparisons. When the individual FPRs are integrated over the entire statistical monitoring program, it is referred to as the site-wide false positive rate (SWFPR), which is a better measure of the ability of the entire statistical program to detect false positive observations.

1.3.2.1 Site-Wide False Positive Rate

For CCR monitoring, detection monitoring events are based on multiple comparisons, which include the seven (7) Appendix III parameters, at each compliance monitoring well. The SWFPR can be calculated based on several input parameters, including the assumed FPR, the number of downgradient monitoring wells (n), the number of parameters, and the number of statistical comparisons events in a given year for the CCR Unit. The Unified Guidance recommends that a statistical evaluation program be designed with an annual, cumulative SWFPR of approximately 10%.

The Unified Guidance recommends measuring statistical power using power curves which display the probability that an individual comparison will detect a concentration increase relative to background results. After determining the statistical method based on the background data, a power curve can be generated in order to determine the statistical power of the compliance monitoring program. The methods and procedures for calculating the SWFPR are described in Section 6.2.2 of the Unified Guidance.

1.3.2.2 Verification Sampling

Verification Sampling is an important aspect of the SAP as it improves statistical power while maintaining the SWFPR. Most statistical evaluations incorporate verification sampling mathematically into their determination of the SWFPR. Verification sampling is typically completed at a 1 of 2 pass strategy. As described above if an initial statistical exceedance is reported, then verification sampling will be performed to confirm the initial exceedance. Verification samples should be collected on a schedule that allows for physical independence of the samples. In a 1 of 2 pass strategy, if the concentration of the verification sample is less than the calculated compliance limit, then no SSI is triggered. If the initial and subsequent verification observation are above the calculated compliance limit, a SSI is triggered.

Due to the time constraints for reporting put forth in the CCR rule, it is suggested that verification sampling not be completed at the next regularly scheduled sampling event, but instead be collected prior to the next sampling event. Verification sampling within 90 days (assuming a 1 of 2 pass verification sampling strategy) will typically allow sufficient time to complete laboratory and statistical analysis in accordance with the timeframes set forth in the CCR Rules.

1.3.3 Statistical Evaluation Methods

As outlined above, the CCR rule list 5 possible methods for statistical evaluation. The different methods that can be employed for CCR monitoring as outlined in §257.93(F) are:

- ***§257.93(F)(1)*** *"A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent."*
- ***§257.93(F)(2)*** *"An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent."*
- ***§257.93(F)(3)*** *"A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit."*
- ***§257.93(F)(4)*** *"A control chart approach that gives control limits for each constituent."*
- ***§257.93(F)(5)*** *"Another statistical test method that meets the performance standards of paragraph (g) of this section."*

1.3.4 Prediction Intervals

Section §257.93(F)(3) outlines using prediction intervals or tolerance intervals for statistical evaluation. Based on recommendation from the Unified Guidance, prediction limits are the preferred method for calculating detection monitoring compliance limits and will be used to calculate compliance limits for the seven Appendix III constituents. In addition, the Unified Guidance suggests using prediction limits with verification sampling (Chapter 19 of the Unified Guidance), because prediction limits help to maintain low SWFPR while still providing high statistical power. Tolerance intervals, which are a backward looking procedure, should not be used for detection monitoring, but will likely be used in assessment monitoring, as further described in Section 2.0 below. If, at any point in the future, a different statistical method becomes more applicable to the site conditions, this document may be modified to include that method as recommended by the Unified Guidance.

Prediction interval methods can be used for parametric and non-parametric datasets as well as for intrawell or interwell statistical analysis. Prediction limits use background data from either background monitoring wells for interwell analysis or from historical data for intrawell analysis calculate a concentration that represents an upper limit of expected future concentrations for a particular population. In contrast to tolerance limits, prediction intervals are a forward looking, predictive analysis, which incorporate uncertainty in future measurements, and are thus the most appropriate method for detection monitoring programs. Typically, a one-sided upper prediction limit is used to evaluate detection monitoring observations. Observations must be lower than the prediction limit (or within the upper and lower prediction limits for pH) to be considered "in control". Parametric methods are generally preferred over non-parametric methods, because they result in lower SWFPRs and higher statistical power.

For detection monitoring, if parametric testing is required, the procedures outlined in Section 19.3.1 of the Unified Guidance should be used to calculate prediction limits for the statistical analysis. If non-parametric testing is required, the procedures outlined in Section 19.4.1 of the Unified Guidance should be used to calculate prediction limits. Most groundwater statistical software includes algorithms for calculating either parametric or non-parametric prediction limits.

1.3.5 Double Quantification Rule

In situations where the entire background dataset is reported as ND or Estimated (J-flag), the Double Quantification Rule (DQR) will be used to supplement the prediction limit analyses. Generally, the Appendix III constituents occur at detectable concentrations in natural groundwater; however, if ND results are encountered for a given constituent, the DQR can be implemented. A demonstration that this statistical evaluation is as least as effective as any other test and results as described in §257.93(f)(5) can be made. The DQR is recommended by the Unified Guidance as a supplement to prediction limits because it reduces the number of non-detects used for statistical analysis and provides a lower SWFPR while maintaining statistical power.

Under the DQR, a SSI is triggered if a compliance well observation is higher than the reporting limit (RL)/PQL in either (1) both a detection monitoring sample and its verification resample, or (2) two consecutive sampling events in a program were resampling is not utilized.

1.4 Responding to SSIs

If the statistical evaluation for an Appendix III analyte triggers a SSI, the data must be evaluated to determine if the cause of the SSI is due to a release from the CCR Unit or from an alternative source. Possible alternative sources may include laboratory causes, sampling causes, statistical evaluation causes, or natural variation. If the SSI can be attributed to one of these sources and the SSI was not caused by the CCR Unit, an alternate source demonstration (ASD) can be completed. An ASD must be certified by a qualified professional engineer and completed in writing within 90 days of completing the statistical evaluation for a particular sampling event. If the SSI cannot be attributed to an alternative source and is from the CCR Unit, then Assessment Monitoring is triggered.

1.5 Updating Background Values

The Unified Guidance suggests that updating statistical limits should only be completed after a minimum of 4 to 8 new measurements are available (i.e., every 2 to 4 years of semiannual monitoring, assuming no verification sampling). The periodic update of background, during which additional data are incorporated into the background, improves statistical power and accuracy by providing a more conservative estimate of the true background population. Prior to incorporating new data into the background dataset, a test should be performed to demonstrate that the "new data" are from the same statistical population as the existing background results. Below are three methods that can be used in determining if the “new” data should be included in the background:

- Time Series Graphs – As described in Section 1.1.2.1, time series graphs can be used as a qualitative test to assist with the determination whether a new group of data match the historical data or if there is a concentration trend that could be indicative of a release or evolving groundwater conditions.
- Box-Whisker plots can also be used to determine whether or not the datasets are similar.
- Mann-Whitney (or Wilcoxon Rank) Test – Used to evaluate the ranked medians of both the historical and new dataset populations. An α of 0.05 should be used for this evaluation. After calculation, if the Mann-Whitney statistic does not exceed the critical point, the test assumes that the two data populations have equal medians, and therefore are likely similar.

Ultimately, the Mann-Whitney (Wilcoxon Rank Sum) Test is the statistical test that is used to determine whether new observations should be included in the background dataset. It is important to note that a difference in background datasets does not automatically prevent the new data from being used; however, if differences are noted, a review of the new data will be conducted to determine if the noted difference is a result of a change in the natural conditions of the groundwater or if it is the result of a potential release from the CCR Unit. If the new data are included in the background dataset, the prediction limits will be recalculated, as described in Section 1.3.4 above.

2.0 ASSESSMENT MONITORING STATISTICAL EVALUATION

This section discusses the procedures, methods, and processes that will be implemented as part of the assessment monitoring statistical evaluation, if required. Assessment monitoring will be initiated if a SSI is triggered during detection monitoring. As per the CCR Rule in Section §257.95(b), assessment monitoring must be initiated within 90 days of identifying an SSI (not the sample event which provided the data that resulted in the SSI). This 90-day period includes sampling the groundwater monitoring network for the Appendix IV constituents. Following the initial sampling event for all Appendix IV constituents, the monitoring network is then sampled again within 90 days of receiving the results from the initial Appendix IV sampling event. Following these initial assessment monitoring events, assessment monitoring is performed on a semiannual basis. During one of the two semiannual events, the full list of Appendix IV constituents must be tested. During the second assessment monitoring event of each year, only the Appendix IV constituents that are detected during the previous semiannual event are required to be monitored. Assessment monitoring is terminated if concentrations for all Appendix III and Appendix IV constituents in all compliance wells are statistically lower than background for two consecutive sampling events (§257.95(e)). The following sections discuss the procedures, methods, and processes that will be implemented as part of the assessment monitoring statistical evaluation. As discussed in Section 1.1 of this document, many of the statistical comparisons used in assessment monitoring require various analyses to be completed prior to the data being accepted into the statistical evaluation. Before using the results from assessment monitoring, the steps outlined in Sections 1.1 and 1.2 will be completed. Please refer to those sections for descriptions on the methods and techniques required to complete these analyses.

2.1 Establishing a Ground Water Protection Standard (GWPS)

Following the removal of outliers and the performance of general statistics described in Sections 1.1 and 1.2, GWPS will be developed for use in the assessment monitoring program. The GWPS is a key element to the assessment monitoring process. GWPS must be generated for each of the detected Appendix IV analytes. If interwell methods are utilized (preferred method), a site-wide GWPS will be generated for each analyte based on Appendix IV results reported for background/hydraulically upgradient wells. If intrawell methods are utilized, a well specific GWPS will be generated for each analyte.

For Appendix IV parameters that have a maximum contaminant level (MCL), as established by the United States Environmental Protection Agency, the GWPS is set equal to the MCL. For those constituents whose background concentration are greater than the MCL, the GWPS will be calculated from the background data. Finally, for those constituents that do not have an established MCL, the GWPS will be calculated. Several analytes (cobalt, lead, lithium, and molybdenum) do not have MCLs established and therefore the GWPS must be calculated based on their background concentrations.

2.1.1 Maximum Contaminant Level (MCL) Based GWPS

Many of the Appendix IV analytes have USEPA MCL levels. As specified in the CCR Rule in Section §257.95(b), the GWPS must either be the MCL, or a limit based on background data, whichever is greater. This section describes the methods to be used for statistical analysis when the MCL is to be used as the GWPS.

For Assessment Monitoring, the Unified Guidance recommends the confidence interval method to evaluate for potential exceedances, which are referred to as "statistically significant levels" (SSLs) (Chapter 21, Unified Guidance). Using confidence intervals, SSLs are identified by comparing the calculated confidence interval against the GWPS. A confidence interval statistically defines the upper and lower bounds of a specified population within a stipulated level of significance. Confidence intervals are required to be calculated based on a minimum of 4 independent observations, but a more representative confidence interval can be developed when all of the available data are utilized.

The specific type of confidence interval should be based the attributes of the data being analyzed, including: (1) the data distribution, (2) the detection frequency, and (3) potential trends in the data. Table 1 below is based on Table 4-4 from the Electric Power Research Institute's *Groundwater Monitoring Guidance for the Coal Combustion Residual Rule* (2015), which displays the criteria for selecting an appropriate confidence interval. The method and procedure for calculating the Upper Confidence Limit (UCL) and Lower Confidence Limit (LCL) is provided in the section reference from the Unified Guidance, which is listed in the last column of Table 1, below.

Table 2- Confidence Interval Method Selection

Data Distribution	Non-detect Frequency	Data Trend	Confidence Interval Method
Normal	Low	Stable	Confidence Interval Around Normal Mean (Section 21.1.1)
Transformed Normal (Log-Normal)	Low	Stable	Confidence Interval Around Lognormal Arithmetic Mean (Section 21.1.3)
Non-normal	N/A	Stable	Nonparametric Confidence Interval Around Median (Section 21.2)
Cannot Be Determined	High	Stable	Nonparametric Confidence Interval Around Median (Section 21.2)
Residuals After Subtracting Trend are Normal (with equal variance)	Low	Trend	Confidence Band Around Linear Regression (Section 21.3.1)
Residuals after Subtracting Trend are Non-Normal	Low	Trend	Confidence Band Around Theil-Sen Line (Section 21.3.2)

In an assessment monitoring program the LCL is of prime interest. If the LCL exceeds the GWPS, there is statistical evidence that a SSL has been triggered. An initial SSL should be confirmed by verification sampling. If only the UCL exceeds the GWPS while the LCL is below the GWPS, the test is considered inconclusive and the Unified Guidance recommends that this situation be interpreted as ”in compliance”. If both the UCL and the LCL are below the GPWS, the data are also “in compliance” with the GWPS.

It is important to note that a slightly different set of criteria are used to determine whether assessment monitoring can be terminated. Additional discussion of the criteria used for exiting assessment monitoring and returning to detection monitoring is provided below in Section 2.2.

During Assessment Monitoring, a per test FPR (α) of 0.05 will be used as an initial error level for calculating the two-tailed confidence intervals for the compliance wells (which actually means 2.5% FPR per tail). In some cases based on recommendations from the Unified Guidance, it is appropriate to adjust the FPR of the confidence interval based on the number of data points available as well as the distribution of the data being evaluated. If deemed necessary based on recommendations from the Unified Guidance, an approach is provided in Section 22 of the Unified Guidance for determining an appropriate per test FPR based on the data characteristics.

When performing assessment monitoring statistical evaluations, it is important to evaluate the compliance data for shifts. If no shifts have occurred, then all of the available Appendix IV data for a particular constituent can be used in the statistical evaluation. If shifts are noted (typically based on qualitative evaluation of a time series plot), only the data collected after the shift should be used in the statistical evaluation.

2.1.2 Non-MCL Based GWPS

Background or historical concentration limits should be assessed using the following techniques for all Appendix IV analytes. These concentration limits should then be compared with the MCL, if available, and the higher of these two values will be used as the GWPS.

The Unified Guidance provides two acceptable approaches for establishing a non-MCL based GWPS (unless all values are ND, in which case the Double Quantification Rule as described above in Section 1.3.5 should be used). The two methods include the tolerance interval approach or the prediction interval approach.

2.1.2.1 Tolerance Interval Approach

If the background dataset is normally or transformed normally distributed, the Unified Guidance recommends Tolerance Intervals over the Prediction Intervals for establishing a GWPS. The GWPS should be based on a 95 percent coverage/95 percent confidence tolerance interval. If the background data are non-normal (even after transformation), then a large number of background observations are required to calculate a non-parametric tolerance interval (typically a minimum of 60 background observations are required to meet these requirements). If there is an insufficient number of background observations to calculate a non-parametric tolerance interval, then a non-parametric Prediction Interval approach should be used, as described in Section 2.1.2.2 below.

The Upper Tolerance Limit (UTL) is calculated for each detected Appendix VI constituent. Tolerance Limits, as outlined in the Unified Guidance (Section 17.2), are a concentration limit that is designed to contain a pre-specified percentage of the dataset population. Two coefficients associated tolerance intervals are (1) the specified population proportion and (2) the statistical confidence. The coverage coefficient (γ), which is used to contain the population portion, and the tolerance coefficient (or confidence level ($1-\alpha$)), which is used to set the confidence of the test. Typically, the UTL is calculated to have a coverage and confidence of 95%. When an MCL does not exist or the background concentrations are greater than the MCL, the calculated UTL for each constituent is used as the GWPS. The confidence interval for each compliance well is then compared with the GWPS.

In order to calculate a valid confidence interval, a minimum of four data points are necessary for each of the detected Appendix IV constituents in each compliance monitoring well (or four “new” assessment monitoring observations in each well when intrawell statistical methods are employed). Using the Tolerance Interval Approach, a statistically significant level (SSL) is triggered when calculated lower confidence limit (LCL) for each compliance well is greater than the GWPS.

Tolerance limits can be completed using both parametric (Section 17.2.1 of Unified Guidance) or non-parametric methods (Section 17.2.2 of Unified Guidance). However, as described above, the non-parametric method requires at least 60 background (or historical) measurements in order to achieve 95% confidence with 95% coverage. Tolerance Intervals can be calculated using most groundwater statistical software packages.

2.1.2.2 Prediction Interval Approach

If Tolerance Intervals cannot be used to calculate the GWPS (based on recommendation from the Unified Guidance, such as non-parametric datasets, ect.), then a Prediction Interval method should be used. This method is very similar to Section 1.3.4 of this document, however, for assessment monitoring, the Unified Guidance suggests using a prediction interval about a future mean for normally/transfomred-normally distributed datasets or a prediction interval about a future median for datasets with a high percent of ND or non-normally distributed data.

When using prediction intervals to calculate for a GWPS, a one-sided prediction interval is calculated using background (or historical) datasets based on a specified number of future comparisons - four future comparisons is typical. The Upper Prediction Limit that is calculated as a product of this method then becomes the GWPS, and is compared against the confidence interval for the compliance data, as described in Section 2.1.2.1, above. As also described above, if the LCL is greater than the calculated prediction limit then an SSL is triggered.

2.2 Returning to Background Detection Monitoring

As specified in 257.95(e) of the CCR Rule, in order to return to detection monitoring, the concentration of all constituents listed in Appendix III and Appendix IV must be shown to be at or below calculated "background (or historical) values" for two consecutive semiannual sampling events. This determination of background values is based on the statistical evaluation procedure established for detection monitoring. Therefore, if prediction limits (with the double quantification rule for analytes with all non-detects) are used for detection monitoring, prediction limits should be calculated and used for all Appendix III and IV analytes to determine when the monitoring program can return to Detection Monitoring. It is important to remember that Appendix IV constituents are only required to be sampled annually with only those Appendix IV constituents that are detected during the previous semiannual event being required to be analyzed during the second semiannual event of a given year. If statistical results demonstrate that concentrations for all constituents are below background levels for a particular event, all Appendix IV constituents should be sampled during the next event in order to achieve this goal of returning to Detection Monitoring. If this statistical evaluation demonstrates that any of the Appendix III or Appendix IV are at a concentration above background levels, but no SSLs have been triggered, then the CCR unit will remain in assessment monitoring (257.95(f)).

2.3 Response to a SSL

If the assessment monitoring statistical evaluation demonstrates that a SSL has been triggered, then the owner/operator of the CCR unit must complete the following four actions as described in 257.95(g):

1. Prepare a notification identifying the constituents in Appendix IV that have exceeded a CCR Unit specific GWPS. This notification must be placed in the facilities operating record within 30 days of identifying the SSL
2. Define the nature and extent of the release and any relevant site conditions that may affect the corrective action remedy that is ultimately selected. The characterization must be sufficient to support a complete and accurate assessment of the corrective measures necessary to effectively clean up releases from the CCR Unit and must include at least the following;
   A. Installation of additional monitoring wells that are necessary to define the contaminant plume,
   B. Collect data on the nature and estimated quantity of the material released,
   C. Install and sample at least one additional monitoring well at the facility boundary in the direction of the contaminant plume migration,
3. Notify off-site property owners if the contamination plume has migrated offsite on to their property, and
4. If possible, provide an alternative source demonstration that determines that the SSL is not caused by a release at the facility within 90 days of completing the statistical evaluation. If no alternative source demonstration can be made and the plume is determined to have come from the CCR Unit then initiate corrective action.

Actions 1-3 must be completed regardless of whether or not an alternate source demonstration can be made.

2.4 Updating Background Values

The background for Assessment Monitoring Parameters should be updated using the same methods and techniques described in Section 1.5 for updating detection monitoring background data.

3.0 REFERENCES

EPRI. 2015. Groundwater Monitoring Guidance for the Coal Combustion Residual Rule. Electric Power Research Institute. November.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery – Program Implementation and Information Division. March

USEPA. 2015. Federal Register. Volume 80. No. 74. Friday April 17, 2015. Part II. Environmental Protection Agency. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule/ [EPA-HQ-RCRA-2009-0640; FRL-9919-44-OSWER]. RIN-2050-AE81. April.

APPENDIX K
EXAMPLE FIELD FORMS

Sheet ___ of ___

Golder Associates

WELL DEVELOPMENT/PURGING FORM

Project Ref: ____________________

Project No.: ____________________

Location

Monitored By: Date Time

Well Piezometer Data

(*circle one*)

Depth of Well (from top of PVC or ground) feet

Depth of Water (from top of PVC or ground) feet

Radius of Casing inches

feet

Casing Volume cubic feet

gallons

Development / Purging Discharge Data

Purging Method

Start Purging Date Time

Stop Purging Date Time

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft TOC)	Appearance of Water and Comments

Golder Associates

GROUNDWATER SAMPLE COLLECTION FORM

Project Ref: ____ **Project No. :**_______________

WEATHER CONDITIONS

Temperature _________________________ Weather ______________________________________

SAMPLE INFORMATION

Sample Location ___________________________________ Sample No. ________________________
Sample Date ___________________ Time _____________ Sample By___________________________
Sample Method ____________________________________ Sample Type__________________________

Water Level Before Purging: ___________________________________
Well Volume: ____
Volume Water Removed Before Sampling: _______________________
Water Level Before Sampling: _________________________________
Water Level After Sampling: __________________________________
Appearance of Sample: ______________________________________

FIELD MEASUREMENTS

Parameter	Units	Measurement	Measurement	Measurement	Measurement	Sample
Time	hhmm					
Volume Discharge	gals					
pH	Standard					
Spec. Cond.	___S/CM					
Turbidity	NTU					
Temperature	°___					
Dissolved Oxygen	mg/l					
Redox Potential	+/- mV					

LABORATORY CONTAINERS

Sub-Sample	Analysis Requested	Type and Size of Sample Container	Filtered (Yes or No)	Type of Preservative
1				
2				
3				
4				
5				
6				
7				
8				

REMARKS: ____

NA = Not applicable

SAMPLING METHODS:

Bailer:	PVC/PE	Peristaltic Pump	Air-Lift Pump
	Stainless Steel	Submersible Pump	Other___________
	Teflon	Hand Pump	

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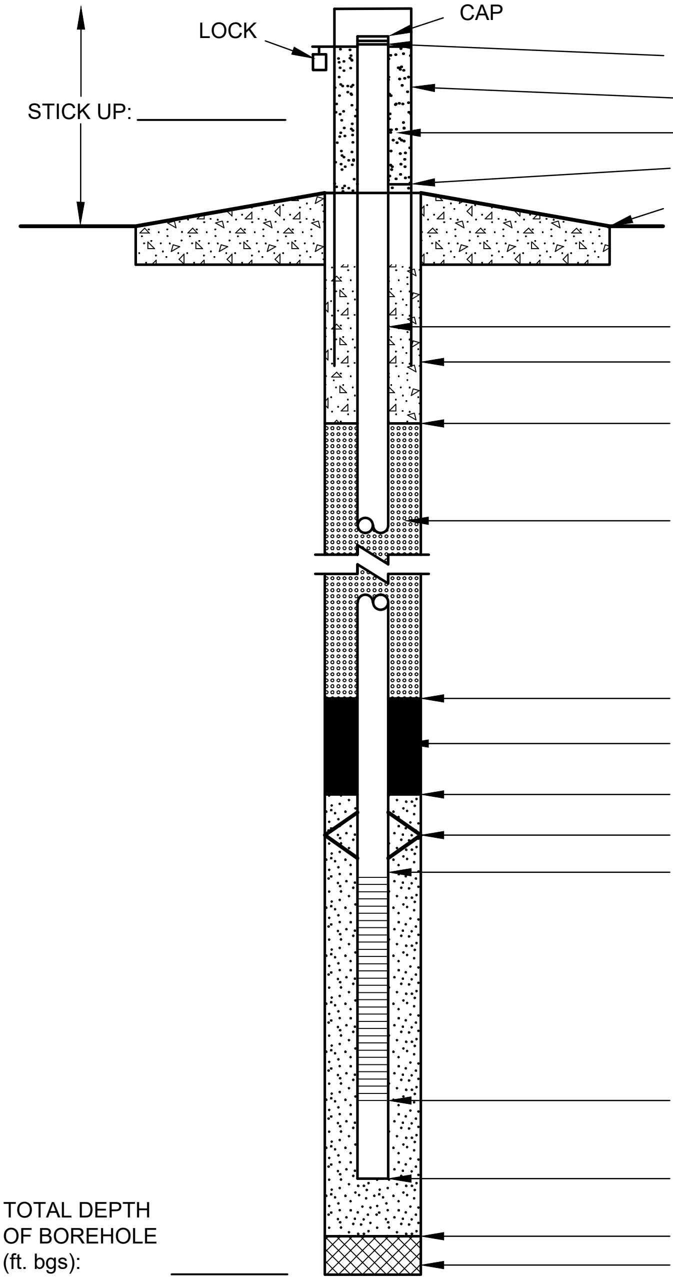
ABOVE GROUND MONITORING WELL CONSTRUCTION LOG ______________

PROJECT NAME:
PROJECT NUMBER:
SITE NAME:
LOCATION:
CLIENT:
SURFACE ELEVATION:
GEOLOGIST:
NORTHING:
EASTING:
DRILLER:
STATIC WATER LEVEL:
COMPLETION DATE:
DRILLING COMPANY:
DRILLING METHODS:



TOP OF CASING ELEVATION: ______________

PROTECTIVE CASING (yes / no): ______________

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: ______________

DIAMETER OF RISER PIPE (in.): ______________

DIAMETER OF BOREHOLE (in.): ______________

CONCRETE SEAL DEPTH (ft. bgs): ______________

TYPE AND AMOUNT OF ANNULAR SEAL: ______________

TOP OF BENTONITE SEAL DEPTH (ft. bgs): ______________

TYPE AND AMOUNT OF BENTONITE SEAL: ______________

TOP OF SAND PACK DEPTH (ft. bgs): ______________

CENTRALIZER (yes / no) - TYPE: ______________

TOP OF SCREEN DEPTH (ft. bgs): ______________

TYPE OF SCREEN: ______________

SCREEN SLOT SIZE (in.): ______________

SIZE OF SAND PACK: ______________

AMOUNT OF SAND: ______________

BOTTOM OF SCREEN DEPTH (ft. bgs): ______________

BOTTOM OF WELL DEPTH (ft. bgs): ______________

BOTTOM OF FILTER PACK (ft. bgs): ______________

TYPE AND AMOUNT OF BACKFILL: ______________

ADDITIONAL NOTES: ______________

CHECKED BY: ______________

DATE CHECKED: ______________

PREPARED BY: ______________

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RECORD OF WATER LEVEL READINGS

Project Name: ____________________________ **Location:** _____________________________________ **Project No.:** ______________________________

Borehole No.	Date	Time	Measuring Device / Serial No.	Measurement Point (M.P)	Water Level Below M.P.	Correction To Survey Mark	Survey Mark Elevation	Water Level Elevation	By	Comments

Sheet ___ of ___

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INSTRUMENT CALIBRATION FORM

Project Name: ____________________________ **Project No:** ______________________

Calibration By:

Instrument Details

Instrument Name	
Serial No.	
Model No.	

Calibration Details

Required Calibration Frequency/Last Calibration	
Calibration Standard	
Calibration Standard(s) Expiration Date	

Calibration:

Date	Time	**Calibration Standard** Units: ___________	**Instrument Reading** Units: _________

Comments:

>>> Select a Laboratory <<<

Chain of Custody Record

#N/A
#N/A
#N/A
#N/A

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_______ of ______ COCs
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below _________			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)																		Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____________

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for__________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No

Custody Seal No.:

Cooler Temp. (^{o}C): Obs'd:_________ Corr'd:__________ Therm ID No.:____________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

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Field Boring Log

DEPTH HOLE ______________ **PROJ. NO.** ______________ **PROJECT** ____________________ **BORING NO.** ______________

DEPTH SOIL DRILL ________ **GA INSP.** ______________ **DRILLING METHOD** ____________________ **SHEET** ________ **OF** ________

DEPTH ROCK CORE _______ **WEATHER** ______________ **DRILLING COMPANY** ____________________ **SURFACE ELEV.** ______________

ABANDONMENT ____________________ **DRILL RIG** ______________ **DRILLER** ______________ **DATUM** ______________

DEPTHS ________ / ________ / ________ / ________ **SAMPLER HAMMER TYPE** ______________ **WT.** ________ **DROP** ________ **STARTED** ________ / ________
WATER LEVEL CAVE-IN DATE-TIME NOTE TIME DATE

DEPTHS ________ / ________ / ________ / ________ **HOLE LOCATION** ____________________ **COMPLETED** ________ / ________
(DELAYED) WATER LEVEL CAVE-IN DATE-TIME NOTE TIME DATE

SAMPLE TYPES

	A.S.	AUGER SAMPLE
	C.S.	CHUNK SAMPLE
*	D.O.	DRIVE OPEN (SPT)
	D.S.	DENISON SAMPLE
	F.S.	FOIL SAMPLE
	P.S.	PITCHER SAMPLE
	S.C.	SOIL CORE
*	T.O.	THIN-WALLED, OPEN
*	T.P.	THIN-WALLED, PISTON
	W.S.	WASH SAMPLE
*	____	________________
*	____	________________
*	____	________________

* NOTE SIZE

ABBREVIATIONS

ANG	ANGULAR	GR	GRAY	R	RED
BL	BLACK	HE	HETEROGENEOUS	RES	RESIDUAL
BR	BROWN	HO	HOMOGENEOUS	RX	ROCK
C	COARSE	LYD	LAYERED	RND	ROUNDED
CIN	CAVE-IN	M	MEDIUM	SAT	SATURATED
CO	COHESIVE	MIC	MICACEOUS	SD	SAND
CL	CLAY	MOT	MOTTLED	SI	SILT
CLY	CLAYEY	MST	MOIST	SIY	SILTY
D	DRY	NC	NON-COHESIVE	SM	SOME
EL	ELONGATED	NP	NON-PLASTIC	TR	TRACE
F	FINE	OG	ORANGE	WL	WATER LEVEL
FL	FLAT	ORG	ORGANIC	WH	WEIGHT OF HAMMER
FRAG	FRAGMENTS	PP	POCKET PEN.	WR	WEIGHT OF RODS
GL	GRAVEL	PL	PLASTIC LIMIT	Y	YELLOW

ORDER OF DESCRIPTION

CONSTITUENTS
1) GROUP SYMBOL
2) SOIL GROUP NAME
3) PRIMARY COMPONENTS
4) SECONDARY COMPONENTS
5) MINOR COMPONENTS ;

PLUS DESCRIPTION:
CL/SI: PLASTICITY
SD: SIZE, GRADING
GL: SIZE, GRADING, SHAPE, ROCK TYPE

GENERAL
6) COLOR
7) WEATHERING
8) STRUCTURE
9) SENSITIVITY
10) CONTAMINATION
11) MINEROLOGY
12) ORIGIN ;

BEHAVIOR
13) BEHAVIOR (CO/NC)
14) MOISTURE/WATER CONTENT
15) DENSITY/CONSISTENCY

PROPORTIONS

"TRACE"	0 – 5%
"SOME"	5 – 12%
PREFIX "-Y"	12 – 35%
"AND"	35 – 50%

NON-COHESIVE SOILS

RELATIVE DENSITY		BLOWS
VERY LOOSE	VLS	0 – 4
LOOSE	LS	4 – 10
COMPACT	CP	10 – 30
DENSE	DN	30 – 50
VERY DENSE	VDN	>50

MOISTURE CONDITION

DRY	SOIL FLOWS
MOIST	FEELS COOL
WET	WITH FREE WATER

COHESIVE SOILS

CONSISTENCY		PP(TSF)	FINGER PRESSURE
VERY SOFT	VS	<0.25	EXTRUDES
SOFT	S	0.25 - 0.5	MOLDS EASILY
FIRM	FM	0.5 – 1	MOLDS
STIFF	ST	1 – 2	THUMB INDENTS
VERY STIFF	VST	2 – 4	THUMBNAIL INDENTS
HARD	H	>4	RESISTS THUMBNAIL

WATER CONTENT - W

W < PL	CANNOT ROLL 4 mm THREAD
W ~ PL	CAN ROLL THREAD 2 – 4 mm
W > PL	CAN ROLL THREAD <2 mm

ELEV. / DEPTH	LITHOLOGY	SAMPLES						CONSTITUENTS			BEHAVIOR			USCS	SAMPLE DESCRIPTION AND DRILLING NOTES
		NO.	TYPE	DEPTH	SPT N / PP(TSF)	BLOWS PER 6 IN	REC / ATT	GL	SD	CL/SI	CO or NC	MOIST. or W	DENS./ CONS.		
								PROPORTION; SIZE, SHAPE, GRADING; PLASTICITY							

Dec 2012

Golder Associates

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Golder Associates

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40 CFR Part 257.98

Corrective Action Groundwater Monitoring Plan

Meramec Surface Impoundments, Meramec Energy Center, St. Louis County, Missouri

Submitted to:

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Submitted by:

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May 1, 2020

Distribution List

1 Electronic Copy – Ameren Missouri

1 Electronic Copy – Golder Associates Inc.

Revision History

Version	Date	Description
0	November 2019	Corrective Action Groundwater Monitoring Plan
1	May 1, 2020	Added MW-9 and MW-10 to Corrective Action Monitoring Well Network. Removed proposed MW-12S and MW-12D from Monitoring Well Network. Changed location of MW-11S and MW-11D.

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FIGURES

APPENDICES

1.0 INTRODUCTION

On August 30th, 2019, Ameren Missouri (Ameren) posted the "Selection of Remedy Report – 40 CFR § 257.97 Rush Island, Labadie, Sioux and Meramec CCR Basins" report to its publicly available website (Ameren 2019). This report selected the final remedy to be implemented to address groundwater contamination from the Meramec Surface Impoundments at Ameren's Meramec Energy Center (MEC or Facility) in St. Louis County, Missouri (see location on **Figure 1**).

This Corrective Action Groundwater Monitoring Plan (GMP) was developed pursuant to § 257.98(a)(1) of "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule" (the CCR Rule). This section of the CCR Rule requires owners or operators establish and implement a Corrective Action GMP within 90 days of selecting a remedy. This Corrective Action GMP presents information on the design of the groundwater monitoring system, groundwater sampling and analysis procedures, groundwater statistical analysis methods, and data evaluation methods needed to complete the selected remedy of source control through installation of a low permeability cover system and use of Monitored Natural Attenuation (MNA) for groundwater impacts.

1.1 Overview of CCR Rule Activities for the Meramec Surface Impoundments

The CCR Rule was published in the Federal Register on April 17, 2015. This rule required CCR surface impoundments and landfills to monitor groundwater around these CCR units. Prior to the first major deadline of October 17, 2017, Ameren completed the following tasks: (1) installation of a groundwater monitoring well system; (2) a Statistical Method Certification; (3) a Groundwater Monitoring Plan (GMP) that details design, installation, development, sampling procedures, as well as statistical methods; and (4) eight baseline groundwater sampling events for all Appendix III and Appendix IV parameters of the CCR Rule. In November 2017, the first Detection Monitoring event was completed. Results from this event demonstrated some Appendix III parameters were present at concentrations that were a Statistically Significant Increase (SSI) over background and were then verified in January 2018 testing. In accordance with the CCR Rule, Ameren placed a "Notification of the Establishment of a CCR Assessment Monitoring Program" and began Assessment Monitoring within 90 Days.

Results from the Assessment Monitoring Events for the MEC surface impoundments indicated the presence of molybdenum, lithium and arsenic at a Statistically Significant Level (SSL) over the site Groundwater Protection Standard (GWPS) in several of the compliance wells. As required, Ameren placed a "Notification of the Detection of Statistically Significant Levels Above CCR Groundwater Protection Standards" on its website and commenced an assessment of potential Corrective Measures. On August 30th, 2019 subsequent to a public meeting held to discuss those findings, Ameren selected a final remedy of source control through installation of a low permeability cover system and use of MNA. Ameren has posted a "Notification of intent to Close a CCR Unit and Certification for Final Cover Design" and has commenced closure of the MEC surface impoundments and intends to complete closure by the end of 2023.

This Corrective Action GMP is designed to support the final remedy selection. At this time, molybdenum, lithium, and arsenic are the only parameters that were detected at an SSL above a site GWPS and are the focus of the MNA analysis.

2.0 SITE SETTING

The MEC is located approximately 18 miles southwest of downtown St. Louis in St. Louis County, Missouri. **Figure 1** depicts the location of the Facility and property boundaries referenced to local features, as well as the Meramec and Mississippi Rivers. The Facility encompasses approximately 480 acres and is primarily located in the topographical low area north of the confluence of the Mississippi and Meramec Rivers. The property is bounded to the northeast by wooded and partially developed land, to the southeast by the Mississippi River, to the southwest and west by the Meramec River and to the northwest by wooded and partially developed land.

2.1 Meramec Coal Combustion Residuals (CCR) Surface Impoundments

The MEC currently manages and has historically managed Coal Combustion Residuals (CCR) generated from the Facility at a number of surface impoundments. The surface impoundments onsite consist of:

- Active Surface Impoundments
  - Surface Impoundment 492 (MCPA), approximately 6 acres
  - Surface Impoundment 493 (MCPB), approximately 6 acres
  - Surface Impoundment 496 (MCPC), approximately 10 acres
  - Surface Impoundment 498 (MCPD), approximately 17 acres
- Closed Surface Impoundments
  - Surface Impoundment 489 (MCPE), approximately 24 acres
- Excluded Surface Impoundments
  - Surface Impoundment 490 (MOPF), approximately 23 acres
  - Surface Impoundment 491 (MOPG), approximately 12 acres
  - Surface Impoundment 494 (MOPH), approximately 31 acres
  - Surface Impoundment 495 (MOPI), approximately 16 acres (this unit is also partially closed)

According to the CCR Rule, all of the Meramec surface impoundments are considered to be unlined. However, Surface Impoundments 489 and 498 do have a liner in place. Since all the surface impoundments lie very close to one another and dividing berms were constructed with locally derived alluvial material and Coal Combustion Residuals (CCR), the groundwater monitoring network monitors the Meramec surface impoundments as one multi-unit system.

The present site grade is as much as 20 feet above the original ground surface. As part of the MEC plant construction project, the original grade of the plant was raised by using fill material. The ash ponds were reportedly made by excavating on-site silts and clays and using the materials as construction fill beneath the plant, as well as for surface impoundment berms (CH2MHILL, 1997). Reportedly, the Meramec surface impoundments were excavated approximately 10-20 feet below the original grade and then were used to contain the CCR. Therefore, present day ash thickness is reported to be typically 20 to 30 feet below the present site grade, which is considered to be nominally at approximately 420 feet above mean sea level (feet MSL)

(CH2MHILL, 1997). Based on this information, the generalized elevation of the base of the coal ash is estimated to be approximately 390 feet MSL.

CCR thickness was directly measured at three locations in Surface Impoundment 494 (MOPH) to be at least 26.5 feet thick (Golder, 2008) and at an elevation as low as approximately 387 feet MSL. CCR thickness was measured at two locations in Surface Impoundment 489 (Woodward-Clyde Consultants, 1988). The bottom of ash elevations were estimated to be 387.3 and 389.1 feet MSL.

2.2 Geology

2.2.1 Physiographic Setting and Regional Geology

The Facility is located in the extreme southeastern corner of the Central Lowland Physiographic Province and the Dissected Till Plains (Miller et al., 1974). However, the Facility lies between two major river systems near their confluence and within the floodplain of the Mississippi and Meramec Rivers in an area that contains alluvial river deposits. Therefore, the local site is characterized by alluvial floodplain landforms.

2.2.2 Local Geology

The geology immediately surrounding the Facility is comprised of two distinctly different geological terrains; (1) floodplain deposits of the Mississippi and Meramec River Valleys and (2) older sedimentary bedrock formations. Most of the Facility, including all the plant infrastructure and the Meramec surface impoundments, lie within these floodplain deposits. The river valley area is comprised of floodplain and alluvial deposits that are the result of the water flow and deposition of the Mississippi and Meramec Rivers.

Based on previous investigations, the alluvial materials on the east side of the Facility tend to have more clayey silts, silty clays, and fine sands (CH2MHILL, 1997). Alluvial materials to the west, closer to the Meramec River, include coarser materials, including fine- to medium-grained sand with clay, silt, and some gravels (CH2MHILL, 1997). The depth of the alluvial deposits near the MEC range from approximately 105 to 120 feet below ground surface (bgs) and become shallower towards the bluffs to the northeast.

Shannon and Wilson (1979) completed a geotechnical investigation in the area directly around the MEC. Sixteen (16) geotechnical borings were completed as a part of this investigation. Based on borings and cross sections from this report, the local geology directly adjacent to the MEC is as follows:

- Approximately 420-410 feet MSL – Fill Materials
- Approximately 410-375 feet MSL – Clays, Clayey Silts, and Silty Clays
- Approximately 375-340 feet MSL – Silts, Sandy Silts, Silty Sands, and Sands that thicken to the southeast towards the Mississippi River
- Approximately 340-320 feet MSL – Clays and Silty Clays
- Approximately 320-310 feet MSL – Intermittent Sands, Gravels, and Clayey Gravels
- Approximately 310 feet MSL and below – Limestone and Shale Bedrock

Drilling completed for the CCR Rule monitoring show similar results to previous studies. Borings located to the southwest of the MEC (MW-5, MW-6 and MW-7) encounter poorly and well graded sands that are likely associated with paleo channels and meanders of the adjacent Mississippi and Meramec Rivers. The sand in these wells becomes more prevalent at locations closer to the Mississippi River to the south/southeast. Drilling completed further from the Mississippi River to the northwest encountered more fine-grained materials such as silts, clays and silty clays with occasional sandy/gravelly lens deposits. These deposits are typical for low energy floodplain deposits with occasional sandy/gravel units from historical Meramec River channel meanders.

Bedrock beneath the Facility consists of the Warsaw Formation, of the Mississippian-aged Meramecian Series and consists of shales and fine-grained shaley limestone (CH2MHILL, 1997). The bluff area on the east side of the Facility consists of the Salem Formation at lower elevations and St. Louis Limestone at higher elevations (Middendorf and Brill, 2002).

2.3 Site Hydrogeology

Site hydrogeology has been characterized based on data collected during several different investigations. In 1988, 5 monitoring wells were installed around the MEC by Woodward-Clyde Consultants (Woodward-Clyde). Observations from these 5 monitoring wells is summarized below. CH2MHill (1997) also completed a hydrogeological assessment using the monitoring wells installed by Woodward Clyde.

Golder (2008) installed 5 piezometers both in and directly adjacent to Surface Impoundment 494. This effort provides information on the depth of ash in the Meramec surface impoundments, geotechnical data of the soil in and around the Meramec surface impoundments, and water level information in and around the Meramec surface impoundments.

Golder has completed over 20 monitoring wells, piezometers and borings as a part of the CCR Rule program (Golder 2017, Golder 2018, Golder 2019). **Figure 2** provides a generalized west-east depiction of the MEC surface impoundments referenced to local geology and the Meramec River.

2.3.1 Uppermost Aquifer

The CCR Rule requires that a groundwater monitoring system be completed in the uppermost aquifer around each Active CCR Surface Impoundment (§257.91(a)). The uppermost aquifer is the alluvial silt, sand and gravel deposits associated with the Meramec and Mississippi River Valley alluvium (CH2MHILL, 1997; Shannon & Wilson, 1979; Golder 2017). These channel deposits are intermixed with a wide variety of clay/silty clay floodplain deposits and, therefore, can appear at varying depths. However, sandy/gravelly units were encountered at many locations at approximately 360-370 feet MSL, likely deposited from a meandering paleo channel of the Meramec River. These alluvial deposits overlie Mississippian-age limestone and shale of the Meramecian Series. The depth of the alluvial aquifer typically ranges from approximately 105 to 120 feet bgs (approximately 255 to 331 feet MSL) but thins to the east toward the bluff (CH2MHILL, 1997), where it is not present at higher elevations above the floodplain.

2.3.2 CCR Surface Impoundments Water Elevations

Meramec pond gauge measurements were provided by Ameren for Surface Impoundments 492, 493, 496, and 498. These measurements were obtained during a similar timeframe as the groundwater measurements from each of the CCR Rule groundwater sampling events. Surface Impoundment 498 (MCPD) has had pond water levels ranging from approximately 415 to 418 feet MSL. This pond has a liner system in place and does not connect with the underlying aquifer or surrounding surface impoundments. The pond water level in Surface Impoundments 492, 493 and 496 (MCPA, MCPB and MCPC, respectively) ranged between approximately 408 and 412 feet MSL. These water levels ranged between 8 to 40 feet above the natural groundwater elevations in the surrounding aquifer. The difference between the pond level and the natural groundwater elevation is greatest when the Mississippi River level is low. Data show water mounding within the Meramec surface impoundments without a liner regardless of the river level; however, the mounding is less pronounced at times of high river level.

It is anticipated that after closure, the static water level in these CCR units will drop and will equilibrate with the surrounding alluvial aquifer static groundwater levels, thus eliminating the mounding effects of the active operating conditions.

2.3.3 Alluvial Aquifer Groundwater Elevations

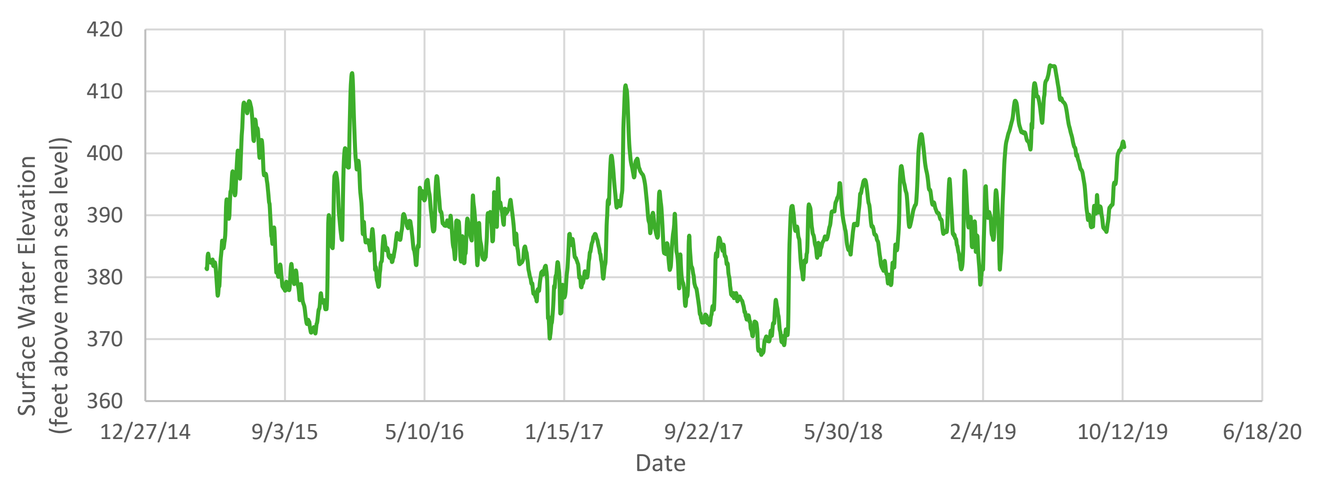
Groundwater elevations within the alluvial aquifer in the Facility area have been obtained in several different studies. Historical groundwater measurements come from 5 monitoring wells installed in 1988 by Woodward-Clyde and then re-analyzed in 1997 by CH2MHILL. Three of the monitoring wells (B-4, B-5 and B-6) were installed with total depths ranging from 90 and 101 feet bgs. These three monitoring wells were located near Surface Impoundment 489 at the southwest corner of the Facility, near the Meramec River. Groundwater elevations in the downgradient monitoring wells near Surface Impoundment 489 ranged between approximately 377 and 385 feet MSL, and were similar to the concurrent Mississippi River level. Monitoring wells B-1 and B-2 were installed on the east (upgradient) side of the Facility with total depths ranging from 41 to 56 feet bgs. Groundwater elevations in these monitoring wells ranged from approximately 403 to 415 feet MSL and were typically 20 to 30 feet higher in elevation than the Mississippi River. Additionally, one monitoring well (B-7) was installed into the coal ash to an elevation of approximately 389 feet MSL and was dry in all readings (Woodward-Clyde, 1988).

Golder obtained groundwater elevation measurements from March 2016 through October 2019 within the alluvial aquifer for the CCR monitoring wells. For each of the sampling events, groundwater elevations were measured at monitoring wells within a 24-hour timeframe and a potentiometric map was generated from the data (**Appendix A**). Groundwater elevations ranged from approximately 370 feet MSL to 400 feet MSL excluding MW-1.

2.3.4 Alluvial Aquifer Groundwater Flow Direction

Groundwater flow within the alluvial aquifer is dynamic and is influenced by seasonal changes in the water level in the adjacent Mississippi and Meramec Rivers. River water levels measured at the Facility display large seasonal changes in the elevation of the Mississippi River water surface. For example, since April 2015 river water levels fluctuated between approximately 367 to 414 feet MSL (**Figure 3**). Water flows into and out of the alluvial aquifer as a result of fluctuating river water levels that produce “bank recharge” and “bank discharge” conditions. Under normal aquifer conditions, groundwater flow in the alluvial aquifer would be expected to have a flow direction component toward the Mississippi and Meramec Rivers, with a net flow direction generally to the southwest.

Figure 3: Mississippi River Elevation at MEC



Notes:

1) Mississippi River Elevations provided by Ameren.

Although the movement of groundwater within the alluvial aquifer at the Facility can be complex, the movement has been characterized by frequent groundwater elevation measurements and the generation of potentiometric surface maps generated by Golder (**Appendix A** and **Table 1**). The potentiometric surface maps display minor variability in the groundwater flow direction. These changes in flow direction are related to the level within the adjacent Mississippi and Meramec Rivers.

Groundwater flow direction and hydraulic gradient were estimated for the alluvial aquifer wells (Devlin 2002). Estimated results from this analysis are provided in **Table 2**. These results indicate that while groundwater flow direction is somewhat variable, overall net groundwater flow from 2015 to 2019 was generally toward the west/southwest, flowing from the bluffs toward the rivers.

Based on the potentiometric surface maps and groundwater calculations, a general flow direction from the northeast (bluffs) to the southwest (Mississippi and Meramec Rivers) under normal river conditions is expected. However, during periods of high river levels, groundwater flow can temporarily reverse in localized areas. During these times of high river stage and temporary flow direction changes, horizontal groundwater gradients generally decrease and little net movement of groundwater to the north and east occurs.

Horizontal and vertical groundwater flow within the uppermost aquifer has been locally influenced by operation of the Meramec surface impoundments. Ponding of water in the Meramec surface impoundments that do not have a liner in place at elevations greater than the static water levels in the underlying alluvial aquifer groundwater creates a localized mounding effect, resulting in localized downward gradients and localized radial groundwater flow downward and outward from these impoundments. It is anticipated that after closure, these downward gradients will be greatly reduced and effectively eliminated. The full effects of the closure on groundwater elevations will continue to be monitored after closure of the CCR units is completed, to see if there are any major changes to groundwater flow.

2.3.4.1 Horizontal Gradient

Horizontal groundwater gradients in the alluvial aquifer are typically low and flat. Site-wide horizontal gradients were also calculated for each of the CCR groundwater sampling events and the results of these are displayed on **Table 2**. The horizontal groundwater gradients are low, ranging from 0.0001 to 0.004 feet/foot.

A review of the potentiometric surface maps confirms the gradient estimates for a larger scale, but also demonstrates that localized horizontal gradients can be higher or lower especially in areas near the Mississippi and Meramec Rivers.

2.3.4.2 Vertical Gradient

A review of downward gradients observed in piezometers was completed by comparing groundwater elevations obtained by Golder during CCR Rule monitoring. This analysis was completed by comparing water levels from shallow and intermediate/deep zone piezometer locations where the piezometers are nested (two or more piezometers in close proximity, screened at different elevations). **Figure 4** displays the vertical gradients over time from the different well pairs. From the review of the data, areas away from the active MEC surface impoundments show relatively variable vertical gradients that fluctuate between upward and downward with no consistent vertical gradient present between shallow and deeper zones of the alluvial aquifer. The average vertical gradient in these wells is 0.0036 (very slightly upward), which further demonstrates the relatively flat gradient. There are no nested piezometers directly adjacent to the active CCR Units at the MEC, however based on the difference between the pond elevation and the groundwater elevations in the alluvial aquifer, there is likely a downward gradient from the mounding effect associated with the ponds in active condition. It is anticipated that once the MEC surface impoundments no longer receive CCR or water, the gradients will stabilize and will reflect those of the surrounding aquifer.

2.3.5 Hydraulic Conductivity and Groundwater Velocity

Golder performed rising head hydraulic conductivity tests on the 10 original CCR Rule monitoring wells in order to estimate the hydraulic conductivities. The tests were conducted using a pneumatic slug (Hi-K slug) and a downhole pressure transducer. Results from this testing demonstrate an average hydraulic conductivity of 2.35 x 10^{-2} centimeters per second (cm/sec) with a geometric mean of 1.4 x 10^{-2} cm/sec, a maximum of 6.52 x 10^{-2} cm/sec and a minimum of 9.91 x 10^{-4} cm/sec.

Estimated groundwater flow velocities were calculated using the CCR monitoring well hydraulic conductivity, hydraulic gradients and an estimated value for effective porosity (**Table 2**). Using these values, groundwater flow velocities are estimated to range between 0.02 and 0.5 feet per day, and average approximately 79 feet (net) per year in the prevailing downgradient direction.

2.3.6 Porosity and Effective Porosity

Porosities were estimated based on the grain size distributions of an aquifer soil sample collected during monitoring well drilling. A representative grain size distribution was collected from the screen interval at MW-6 and MW-8 using the ASTM D6912 Method B and the results are provided in the Detection/Assessment GMP for the MEC. MW-6 represents monitoring wells that were located closer to the Mississippi River and had more sandy environments, whereas MW-8 represents wells that contained gravel/silty sand environments that were further from the Mississippi River and are historical Meramec River channels. The results indicate that the screened intervals of the alluvial aquifer near the Mississippi River are mostly comprised of sand (at least 90%) with lesser amounts of gravel, silt and clay. Also, the typical grain size of the sand ranges from fine to medium sand. Textbook values of porosities for sands and sand/gravel mixes range from 25-50% (Fetter, 2000 and Freeze and Cherry, 1979) and fine sands typically range from 29-46%, whereas coarse sands typically range from 26-43% (Das, 2008). An average porosity of 35% is estimated for the alluvial aquifer based on the site data.

Effective porosity is the porosity that is available for fluid flow. Studies completed in unconsolidated sediments have determined that water molecules pass through all pores and the effective porosity is approximately equal to the total porosity (Fetter, 2000). Therefore, the effective porosity of the alluvial aquifer is also estimated to be 35%.

3.0 GROUNDWATER MONITORING PROGRAM

3.1 Groundwater Monitoring Well Network

For Corrective Action, the CCR Rule requires a demonstration that compliance with the GWPS has been achieved at all points within the plume of contamination that lie beyond the initial Detection and Assessment Monitoring well networks (§ 257.98(c)(1)). To meet with these requirements, a Corrective Action Monitoring Well Network has been established. Monitoring wells to be used for this network are identified below in **Table 3** and their locations, in addition to the wells used for Detection and Assessment Monitoring networks are provided in **Figure 5**.

Table 3 –Corrective Action Groundwater Monitoring Well Network

Shallow Zone of the Alluvial Aquifer	Intermediate/Deep Zone of the Alluvial Aquifer
MW-9	TP-1
MW-10	TP-2
MW-11S	MW-11D

3.2 Groundwater Sampling Frequency and Parameters

3.2.1 CCR Rule Minimum Requirements

The CCR Rule has specific minimum requirements for sampling frequency and parameters. At a minimum, sampling must meet the requirements of an Assessment Monitoring Program (§257.95). Therefore, the minimum monitoring well sampling frequency would be three sampling events the first year, followed by semi-annual sampling thereafter. Minimum requirements for sampling parameters are that all Appendix IV parameters must be tested at least annually, with only detected Appendix IV parameters required for subsequent events. Appendix III parameters must also be tested at least semi-annually. **Table 4** displays the parameters associated with Appendix III and IV, as well as other MNA parameters.

Table 4 – Sampling Parameters List

Groundwater Parameters			
Parameter	**Method**	**Parameter**	**Method**
Appendix III Parameters		**Cations & Anions**	
Boron	200.7	Alkalinity	SM 2320B
Calcium	200.7	Iron	200.7
Chloride	EPA 300.0	Magnesium	200.7
Fluoride	EPA 300.0	Manganese	200.7
pH	NA	Potassium	200.7
Sulfate	EPA 300.0	Sodium	200.7
Total Dissolved Solids	SM2540C	**Other Parameters**	
Appendix IV Parameters		Sulfide	SM4500-S2D
Antimony	200.8	**Iron Speciation**	
Arsenic	200.8	Ferrous Iron	SM3500-Fe-D
Barium	200.7	Ferric Iron	Calculation
Beryllium	200.7		
Cadmium	200.8		
Chromium	200.8		
Cobalt	200.7		
Fluoride	EPA 300.0		
Lead	200.7		
Lithium	200.7		
Mercury	EPA7470A		
Molybdenum	200.7		
Radium 226	EPA 903.1		
Radium 228	EPA 904.0		
Selenium	200.8		
Thallium	200.8		

Notes:

1) The methods provided are those currently used for Detection/Assessment Monitoring. Methods may be adjusted in the future as analytical methods evolve and detection limit adjustments are needed.

3.2.2 Prior to Completion of Source Control

The first step in the selected remedy is to provide source control through the installation of a low permeability cover system. In the time prior to the cap completion, the requirements of the CCR Rule will be met with completion of three sampling events for the Corrective Action monitoring wells in 2020 and the subsequent years as follows:

1) Q2 2020 (~April) – An initial sampling event for all Appendix IV parameters at all monitoring wells.

2) Q2 2020 (~May) – Sampling event within 90 days for all detected Appendix IV parameters and all Appendix III parameters.

3) Q4 2020 (~November) – Semi-annual sampling event for all detected Appendix IV parameters and all Appendix III parameters.

4) Q2 2021+ (~May) – Semi-annual sampling event for all Appendix III and IV parameters at all monitoring wells.

5) Q4 2021+ (~November) - Semi-annual sampling event for all detected Appendix IV parameters and all Appendix III parameters.

These sampling events are subject to change depending on unforeseen conditions such as flooding, etc.

In addition to the requirements of the CCR Rule, in order to complete Corrective Action statistical analysis, a minimum of 4 samples are required and 8 samples are recommended by the Unified Guidance (USEPA 2009). Parameters that have been detected at an SSL should have a minimum of 8 sample results for analysis prior to MEC pond closure completion.

Also, several parameters such as major cations/anions, iron speciation and sulfide are very beneficial for MNA analysis and are needed to demonstrate that MNA is occurring. Major cations and anions will be tested from each Corrective Action monitoring well sample during each sampling events. Iron speciation and sulfide will be tested annually along with the sampling event for all Appendix IV and III parameters. **Table 4** provides a list of the parameters to be sampled for groundwater sampling.

3.2.3 Long-Term Performance Monitoring

Once source control is completed, long-term monitoring of MNA and statistical compliance will be initiated. In order to comply with the requirements of the CCR Rule, sampling will be completed on a semi-annual basis. For this sampling, the first sampling event each year will test for all Appendix III and IV parameters. Additionally, for MNA evaluation, major cations, anions, iron speciation, and sulfide will be tested. During the second event of each year, samples will be tested for Appendix IV parameters that were detected during that year's first sampling event, as well as all Appendix III parameters and major cations/anions will be tested.

3.3 Groundwater Level Measurements

To meet the requirements of §257.93(c), water level measurements will be taken at all monitoring wells to be sampled and prior to the start of any groundwater purging at the monitoring well. These measurements will be taken within a 24-hour period and will be recorded on the Record of Water Level Readings form or Groundwater Sample Collection Form. Static water levels will be measured in each monitoring well prior to purging using an electric meter accurate to 0.01-foot. The measuring probe will be rinsed with distilled or deionized water before and after use at each well. In addition, other monitoring wells or piezometers that may be beneficial for groundwater elevation mapping may also be measured.

3.4 Groundwater Sampling Methods and Procedures

Sampling will be performed in accordance with generally accepted practices within the industry and Missouri requirements. **Appendix B** provides details of procedures used to collect groundwater samples.

4.0 DATA EVALUATION AND REPORTING

The following sections describe the evaluation and analysis procedures that are followed upon receipt of the laboratory analytical data.

4.1 Evaluation of Rate and Direction of Groundwater Flow

Groundwater elevations will be determined for each sampling event and will be used to develop a groundwater elevation contour map that will be submitted with reports. The direction of groundwater flow will be determined from up- and downgradient relationships as depicted on the potentiometric surface map. Based on these maps, groundwater flow velocities will be estimated for each event, as well as groundwater flow directions. Additional software or analysis (Modflow, USEPA gradient calculator, etc.) may also be used as applicable for groundwater flow analysis.

4.2 Data Validation

Before the data are used for statistical analysis, they will be evaluated by examining the quality control data in the laboratory report. Relevant quality control data could include measures of accuracy (percent recovery), precision (relative percent difference, RPD), and sample contamination (blank determinations). Data that fail any of these checks will be flagged for further evaluation. A Data Quality Review (DQR) may be initiated with the laboratory for anomalous data.

4.3 Statistical Evaluations for Corrective Action

Upon completion of the data validation, Corrective Action statistical analysis will be completed to determine if groundwater concentrations are present at a level statistically above or below the site-specific GWPS. As required in the CCR Rule, a statistical evaluation of the groundwater data must be completed within 90 days of receiving data from the laboratory. Once the statistical evaluation is completed, the results will be placed in the operating record. The data will be analyzed using the methods and procedures outlined in the Statistical Analysis Plan (**Appendix C**).

As specified in 257.98(C) of the CCR Rule, in order to complete Corrective Action monitoring the following must be demonstrated:

- Compliance with the GWPS at all points within the plume of contamination that lie beyond the Detection/Assessment Monitoring groundwater monitoring well system.
- Compliance with the GWPS where concentrations of constituents listed in Appendix IV to this part have not exceeded the GWPS for a period of three consecutive years.

Additionally, because Corrective Action and its effects on the groundwater regime should result in changes in plume concentrations and size over time, individual monitoring wells may be removed from Corrective Action monitoring once concentrations are below the GWPS for three consecutive years. As outlined in the CCR Rule, the Corrective Action Program will be deemed complete once all points within the plume beyond the Detection/Assessment Monitoring groundwater monitoring well system are statistically within compliance of the GWPS for three consecutive years. Once this demonstration can be made, a notification stating that the remedy has been completed is required to be posted to the operating record and the publicly available website. This notification must be certified by a Professional Engineer.

4.4 Data Evaluation to Demonstrate MNA

The CCR Rule (§ 257.98(a)(1)(ii)) requires that the Corrective Action GMP provide a way to document the effectiveness of the Corrective Action remedy. The statistical analysis is required by the CCR Rule in order to determine when monitoring wells are in compliance with the GWPS and are the basis of removing the CCR unit from Corrective Action, however, these statistical methods do not directly indicate if MNA is occurring. Multiple lines of evidence and analysis can be used to evaluate the effectiveness of the remedy. Methods that may be used for evaluating and demonstrating the MNA is occurring are as follows:

1) **Well Specific Constituent Trend Graphs:** Constituent concentration versus time graphs can be used to determine if concentrations are behaving as anticipated or if unexpected conditions are occurring. Decreasing trends of constituents over time can be used to assess the progress of MNA. Increasing trends could represent a new source, unanticipated plume behavior, a change in ambient conditions, or a possible increase of transformation products.

2) **Concentration Maps:** Concentrations of constituents plotted in 2D, 3D, or cross-sectional view can be used to define the extents and concentrations within the plume at a given time. Comparison of the plume extents, location, size, configuration, concentrations, and center of mass which will allow for an assessment of MNA progress and an identification of potential migration patterns.

3) **Geochemical Analysis:** Completion of geochemical analysis such as Piper and Stiff diagrams can provide information on water chemistry changed over time and/or spatial area. Changes in chemistry over time can show that MNA is occurring. Changes may also identify possible changes in ambient conditions, which may change estimates of MNA timeframes, etc.

These methods are examples of initial methods to evaluate MNA and remedy effectiveness. Other methods may be used in the evaluation as the monitoring program progresses.

4.5 Verify no Adverse Impacts to Downgradient Receptors

One key objective in any MNA program is to verify that there are no adverse impacts to downgradient receptors. A human health risk assessment for the site was completed by Haley & Aldrich in 2018. From this assessment, the potential downgradient receptors are:

1. Users of the Mississippi and Meramec Rivers including people who used the rivers for recreational activities that may bring them into direct contact with the rivers.
2. The drinking water intake located approximately 51.2 miles downstream from the MEC at the Chester Intake.

Multiple rounds of surface water samples collected from the Mississippi and Meramec Rivers adjacent to the MEC have shown no impact from the MEC to these rivers. Calculated Risk-Based Screening Levels for the Mississippi River were generated in the Haley & Aldrich 2018 report that provides a conservative groundwater target level (or threshold) that is protective of the rivers. For each constituent, the lowest of the human health drinking water, recreational, and ecological screening levels is used. A dilution factor (100,000 for the Mississippi River and 700 for the Meramec River) is then applied to the lowest screening level for surface water and results in the Calculated Risk-Based Screening Level.

In order to verify that there are no adverse impacts to downgradient receptors, groundwater concentrations adjacent to the Meramec and Mississippi Rivers will continue to be monitored, and if concentrations in these monitoring wells reach the calculated risk-based thresholds, the following actions will be taken:

- The monitoring well that displayed the impacts will be re-sampled for verification.
- If verified, a surface water sampling plan will be prepared and surface water sampling in the Mississippi and/or Meramec Rivers will be completed.

4.6 Monitoring Well Network Review and Long-Term Monitoring Well Network Optimization

Annual review of the monitoring well network will be completed to evaluate if the current network is still accurately monitoring MNA at the site. This review will be completed to determine if any monitoring wells should be added or removed from the network. This review will be based on data reviews completed above, as well as professional judgment. In addition, monitoring well network optimization programs may be used to determine if any changes to the network are warranted.

4.7 Supplemental Corrective Measures

Groundwater treatment technologies are being evaluated to determine if treatment may be able to supplement the selected remedy. Pilot studies and additional treatment testing may be performed at the MEC as a supplemental corrective measure. If treatment is to be used as a supplemental corrective measure, this monitoring plan may be updated to include the groundwater monitoring requirements and methods associated with evaluating and monitoring the supplemental corrective measure.

4.8 Annual Groundwater Monitoring and Corrective Action Report

In addition to the periodical reporting listed above, an annual groundwater monitoring report will be prepared according to the requirements of 40 CFR §257.90(e). At a minimum, the annual groundwater monitoring report will contain the following information:

- The current status of the groundwater monitoring program
- A projection of key activities planned for the upcoming year
- A map showing the CCR unit and all background (or upgradient), compliance monitoring wells installed under § 257.91 of the CCR Rule (MEC GMP, Detection and Assessment Monitoring well network), and the Corrective Action Monitoring well network discussed in this GMP
- A discussion of any monitoring wells that were installed or decommissioned during the preceding year or any other changes made to the groundwater monitoring system
- Analytical results from groundwater sampling required by Detection, Assessment and Corrective Action Monitoring
- A demonstration, if appropriate, for an alternative groundwater sampling frequency for Detection, Assessment or Corrective Action Monitoring
- The monitoring data obtained under §§ 257.90 through 257.98, including a summary of the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates

the samples were collected, and whether the sample was required by the Detection, Assessment or Corrective Action Monitoring

- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from Detection Monitoring to Assessment Monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels)
- If required, an alternate source demonstration that is certified by a Professional Engineer demonstrating that any new Detection or Assessment Monitoring SSIs or SSLs over background are not due to the release from the Facility
- A listing of GWPS for both Assessment and Corrective Action Monitoring

In addition to the requirements of the CCR Rule, additional information on the evaluation of MNA, treatability studies, or risk assessments may also be included in the Annual Report, if applicable.

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Tables

Table 1
Groundwater Elevation Measurements
Meramec Energy Center
St. Louis County, Missouri

	Well ID	Location		Top of Casing	Ground Surface Elevation	Date Installed	3/28/2016		5/13/2016		7/18/2016		9/7/2016		11/10/2016		1/6/2017		3/7/2017		6/14/2017		11/6/2017	
		Northing	Easting	FT MSL	FT MSL		DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE
CCR Rule Groundwater Monitoring Wells	MW-1	937676.9	865954.1	406.43	404.10	1/23/2016	4.83	401.60	2.61	403.82	5.57	400.86	4.72	401.71	5.36	401.07	7.08	399.35	5.55	400.88	2.46	403.97	7.43	399.00
	MW-2	937325.1	864864.5	398.62	396.13	1/23/2016	12.76	385.86	3.54	395.08	14.79	383.83	11.69	386.93	16.42	382.20	19.10	379.52	13.25	385.37	7.72	390.90	19.29	379.33
	MW-3	936750.8	864447.2	397.12	394.63	1/22/2016	11.30	385.82	2.07	395.05	13.27	383.85	10.15	386.97	14.93	382.19	17.62	379.50	11.81	385.31	6.23	390.89	17.78	379.34
	MW-4	935618.0	864629.8	404.10	402.03	1/22/2016	18.17	385.93	9.13	394.97	20.02	384.08	16.48	387.62	21.65	382.45	24.43	379.67	18.93	385.17	13.08	391.02	24.50	379.60
	MW-5	934874.4	864781.0	402.93	400.83	1/22/2016	16.94	385.99	7.93	395.00	18.67	384.26	15.65	387.28	20.27	382.66	23.14	379.79	17.83	385.10	11.69	391.24	23.13	379.80
	MW-6	933905.2	865153.5	418.12	415.84	1/21/2016	32.26	385.86	23.33	394.79	33.56	384.56	30.56	387.56	35.11	383.01	38.29	379.83	33.64	384.48	26.49	391.63	37.99	380.13
	MW-7	934334.4	866242.5	417.94	415.67	1/24/2016	32.01	385.93	23.04	394.90	33.32	384.62	30.37	387.57	34.68	383.26	37.79	380.15	33.52	384.42	26.39	391.55	37.53	380.41
	MW-8	935303.6	866797.8	423.37	421.03	1/24/2016	36.68	386.69	27.46	395.91	38.07	385.30	35.14	388.23	39.60	383.77	42.59	380.78	37.57	385.80	31.27	392.10	42.59	380.78
	BMW-1	935220.4	867989.4	419.08	416.79	4/7/2016	24.40	394.68	19.78	399.30	28.16	390.92	24.96	394.12	27.41	391.67	32.64	386.44	28.51	390.57	22.49	396.59	34.14	384.94
	BMW-2	937927.1	866342.2	409.02	406.80	1/25/2016	14.21	394.81	11.22	397.80	15.45	393.57	14.58	394.44	15.36	393.66	17.29	391.73	15.71	393.31	11.39	397.63	17.85	391.17
Temporary Piezometers	MW-9 (AMW-1)	935106.5	864425.3	393.71	391.12	6/20/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MW-10 (AMW-2)	934137.4	867158.9	405.62	402.83	6/19/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TP-1	935109.7	864437.0	393.71	390.68	6/20/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TP-2	934151.5	867171.1	405.22	402.35	6/18/2018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background Investigation	BMW-3	938110.9	865000.6	396.16	393.45	1/24/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BMW-4	938425.9	864543.5	396.34	393.52	1/23/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BMW-5	938750.3	864082.0	402.05	399.53	1/23/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
River Level	Mississippi River	934893	868520	NA	NA	NA	NA	386.59	NA	395.52	NA	384.25	NA	387.53	NA	382.37	NA	380.70	NA	385.77	NA	390.10	NA	379.80
Pond Gauges	MCPA, MCPB, MCPC	937490	865938	NA	NA	NA	NA	408.30	NA	408.20	NA	409.00	NA	409.00	NA	410.10	NA	409.00	NA	410.60	NA	411.50	NA	409.60
	MCPD	936384	865935	NA	NA	NA	NA	417.05	NA	417.15	NA	417.20	NA	417.20	NA	417.30	NA	417.50	NA	417.20	NA	417.20	NA	NA

Notes:
1.) CCR - Coal Combustion Residuals.
2.) DTW - Depth to water measured in feet below top of casing.
3.) GWE - Groundwater elevation measured in feet above mean sea level.
4.) MSL - Feet above mean sea level.
5.) NA - Not Applicable.
6.) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone feet.
7.) Vertical Datum: NAVD88 feet.
8.) Mississippi River Level and Pond Gauge elevations are provided by Ameren.
9.) Mississippi River gauge location is estimated.
10.) BG - Below gauge.

Prepared By: JSI
Checked By: EMS
Reviewed By: MNH

Table 1
Groundwater Elevation Measurements
Meramec Energy Center
St. Louis County, Missouri

	Well ID	1/2/2018		4/3/2018		5/17/2018		7/23/2018		8/21/2018		9/25/2018		11/19/2018		1/9/2019		1/28/2019		2/26/2019		8/12/2019		10/3/2019	
		DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE
CCR Rule Groundwater Monitoring Wells	MW-1	10.58	395.85	4.00	402.43	4.02	402.41	4.64	401.79	6.80	399.63	4.74	401.69	3.96	402.47	3.66	402.77	3.72	402.71	3.59	402.84	2.54	403.89	1.18	405.25
	MW-2	27.44	371.18	10.36	388.26	7.22	391.40	11.49	387.13	18.90	379.72	11.21	387.41	9.54	389.08	10.97	387.65	16.71	381.91	6.86	391.76	9.65	388.97	NA	NA
	MW-3	26.18	370.94	8.91	388.21	5.75	391.37	10.01	387.11	17.39	379.73	9.67	387.45	8.03	389.09	9.44	387.68	15.18	381.94	5.45	391.67	8.02	389.10	NA	NA
	MW-4	33.50	370.60	15.72	388.38	12.75	391.35	16.92	387.18	24.22	379.88	16.47	387.63	14.87	389.23	16.23	387.87	21.70	382.40	12.64	391.46	14.80	389.30	5.54	398.56
	MW-5	32.28	370.65	14.44	388.49	11.60	391.33	15.67	387.26	22.95	379.98	15.17	387.76	13.54	389.39	14.82	388.11	20.17	382.76	11.50	391.43	13.44	389.49	4.55	398.38
	MW-6	47.26	370.86	29.51	388.61	27.07	391.05	30.74	387.38	38.09	380.03	30.17	387.95	28.52	389.60	29.56	388.56	34.59	383.53	27.23	390.89	28.47	389.65	20.22	397.90
	MW-7	47.53	370.41	29.23	388.71	26.98	390.96	30.66	387.28	38.05	379.89	30.12	387.82	28.53	389.41	29.55	388.39	34.24	383.70	27.01	390.93	28.41	389.53	20.17	397.77
	MW-8	52.23	371.14	34.14	389.23	31.56	391.81	35.22	388.15	42.45	380.92	34.91	388.46	33.37	390.00	34.46	388.91	39.42	383.95	31.71	391.66	33.04	390.33	24.80	398.57
	BMW-1	41.55	377.53	23.08	396.00	23.97	395.11	26.14	392.94	31.64	387.44	25.98	393.10	24.64	394.44	25.72	393.36	28.90	390.18	24.21	394.87	24.71	394.37	20.64	398.44
	BMW-2	20.18	388.84	12.51	396.51	12.54	396.48	13.51	395.51	16.28	392.74	13.57	395.45	12.82	396.20	12.11	396.91	12.44	396.58	12.34	396.68	11.52	397.50	10.30	398.72
Temporary Piezometers	MW-9 (AMW-1)	NA	NA	NA	NA	NA	NA	6.41	387.30	13.82	379.89	6.10	387.61	4.40	389.31	5.75	387.96	11.32	382.39	NA	NA	4.01	389.70	NA	NA
	MW-10 (AMW-2)	NA	NA	NA	NA	NA	NA	18.58	387.04	25.97	379.65	18.26	387.36	16.49	389.13	17.93	387.69	23.53	382.09	13.94	391.68	16.00	389.62	6.83	398.79
	TP-1	NA	NA	NA	NA	NA	NA	6.22	387.49	13.55	380.16	5.70	388.01	4.14	389.57	5.28	388.43	10.40	383.31	NA	NA	3.90	389.81	NA	NA
	TP-2	NA	NA	NA	NA	NA	NA	18.16	387.06	25.53	379.69	17.81	387.41	16.03	389.19	17.47	387.75	23.07	382.15	13.57	391.65	15.53	389.69	6.47	398.75
Background Investigation	BMW-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.26	381.90	4.44	391.72	7.10	389.06	NA	NA
	BMW-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.52	381.82	4.02	392.32	7.27	389.07	NA	NA
	BMW-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.37	381.68	9.61	392.44	13.00	389.05	NA	NA
River Level	Mississippi River	NA	367.89	NA	388.40	NA	392.25	NA	387.73	NA	380.35	NA	388.13	NA	389.35	NA	388.04	NA	381.93	NA	392.75	NA	389.88	NA	399.62
Pond Gauges	MCPA, MCPB, MCPC	NA	410.10	NA	BG	NA	NA	NA	408.63	NA	408.63	NA	409.13	NA	408.63	NA	BG	NA	408.72	NA	NA	NA	BG	NA	409.05
	MCPD	NA	417.00	NA	417.20	NA	NA	NA	417.30	NA	415.30	NA	417.40	NA	417.40	NA	417.30	NA	417.30	NA	NA	NA	417.50	NA	417.40

Notes:
1.) CCR - Coal Combustion Residuals.
2.) DTW - Depth to water measured in feet below top of casing.
3.) GWE - Groundwater elevation measured in feet above mean sea level.
4.) MSL - Feet above mean sea level.
5.) NA - Not Applicable.
6.) Horizontal Datum: State Plane Coordinates NAD83 (2000) Missouri East Zone feet.
7.) Vertical Datum: NAVD88 feet.
8.) Mississippi River Level and Pond Gauge elevations are provided by Ameren.
9.) Mississippi River gauge location is estimated.
10.) BG - Below gauge.

Prepared By: JSI
Checked By: EMS
Reviewed By: MNH

Table 2
Generalized Hydraulic Properties of Uppermost Aquifer
Meramec Energy Center
St. Louis County, Missouri

Baseline Sampling Event Date	Average Groundwater Flow Direction (Azimuth)	Estimated Hydraulic Gradient (Feet/Foot)	Hydraulic Conductivity (Feet/Day)	Mean Hydraulic Conductivity (Cm/Sec)	Estimated Effective Porosity	Estimated Groundwater Velocity (Feet/Day)
3/28/2016	242	0.00280	37.02	1.3E-02	0.35	0.30
5/13/2016	249	0.00122	37.02	1.3E-02	0.35	0.13
7/18/2016	240	0.00253	37.02	1.3E-02	0.35	0.27
9/7/2016	245	0.00220	37.02	1.3E-02	0.35	0.23
11/10/2016	242	0.00317	37.02	1.3E-02	0.35	0.34
1/6/2017	234	0.00295	37.02	1.3E-02	0.35	0.31
3/7/2017	231	0.00225	37.02	1.3E-02	0.35	0.24
6/14/2017	244	0.00187	37.02	1.3E-02	0.35	0.20
11/6/2017	233	0.00260	37.02	1.3E-02	0.35	0.28
1/2/2018	224	0.00397	37.02	1.3E-02	0.35	0.42
4/3/2018	243	0.00247	37.02	1.3E-02	0.35	0.26
5/17/2018	234	0.00145	37.02	1.3E-02	0.35	0.15
7/23/2018	223	0.00188	37.02	1.3E-02	0.35	0.20
8/21/2018	221	0.00279	37.02	1.3E-02	0.35	0.29
9/25/2018	224	0.00173	37.02	1.3E-02	0.35	0.18
11/19/2018	225	0.00157	37.02	1.3E-02	0.35	0.17
1/9/2019	223	0.00186	37.02	1.3E-02	0.35	0.20
1/28/2019	245	0.00226	37.02	1.3E-02	0.35	0.24
2/26/2019	234	0.00127	37.02	1.3E-02	0.35	0.13
8/12/2019	246	0.00142	37.02	1.3E-02	0.35	0.15
10/3/2019	223	0.00016	37.02	1.3E-02	0.35	0.02

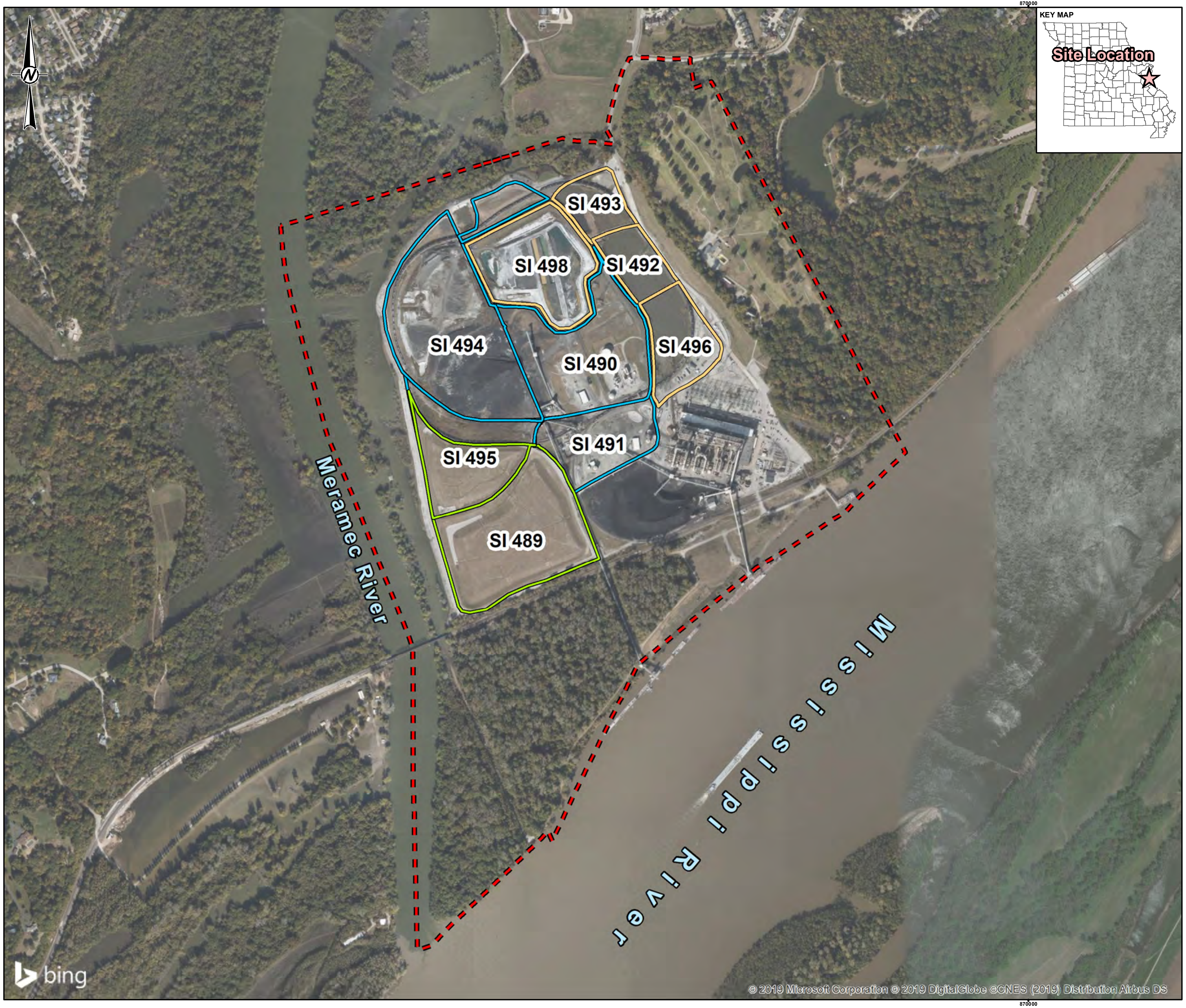
Estimated Results	
Resultant Groundwater Flow Direction (Azimuth)	235
Estimated Annual Net Groundwater Movement (Feet/Year)	79

Prepared By: JSI
Checked By: TJG
Reviewed By: MNH

Notes:

1. Azimuth and Hydraulic Gradient calculated using the spreadsheet tool from the 2005 report entitled "A Spreadsheet Method For Estimating Hydraulic Gradient With Heads From Multiple Wells" submitted to Ground Water" by J.F. Devlin.
2. Hydraulic conductivity value is the geometric mean of slug test results for the CCR compliance wells.
3. An effective porosity of 0.35 was used based on grain size distributions and published values (Fetter 2000, Cohen 1953, and Johnson 1967).
4. Azimuth is measured clockwise in degrees from north.
5. Cm/Sec - centimeters per second.

Figures



LEGEND

▬ ▬	Meramec Energy Center Property Boundary
🟧	Active Surface Impoundment
🟩	Capped and Closed Surface Impoundment
🟦	Exempt Surface Impoundment

0 500 1,000 1,500 2,000 2,500
Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
2. SI - SURFACE IMPOUNDMENT.
3. EXEMPT SURFACE IMPOUNDMENTS ARE EXCLUDED FROM COAL COMBUSTION RESIDUALS MONITORING.

REFERENCE(S)

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
SITE LOCATION MAP

CONSULTANT

YYYY-MM-DD	2019-11-15
DESIGNED	JSI
PREPARED	JSI
REVIEWED	TJG
APPROVED	MNH

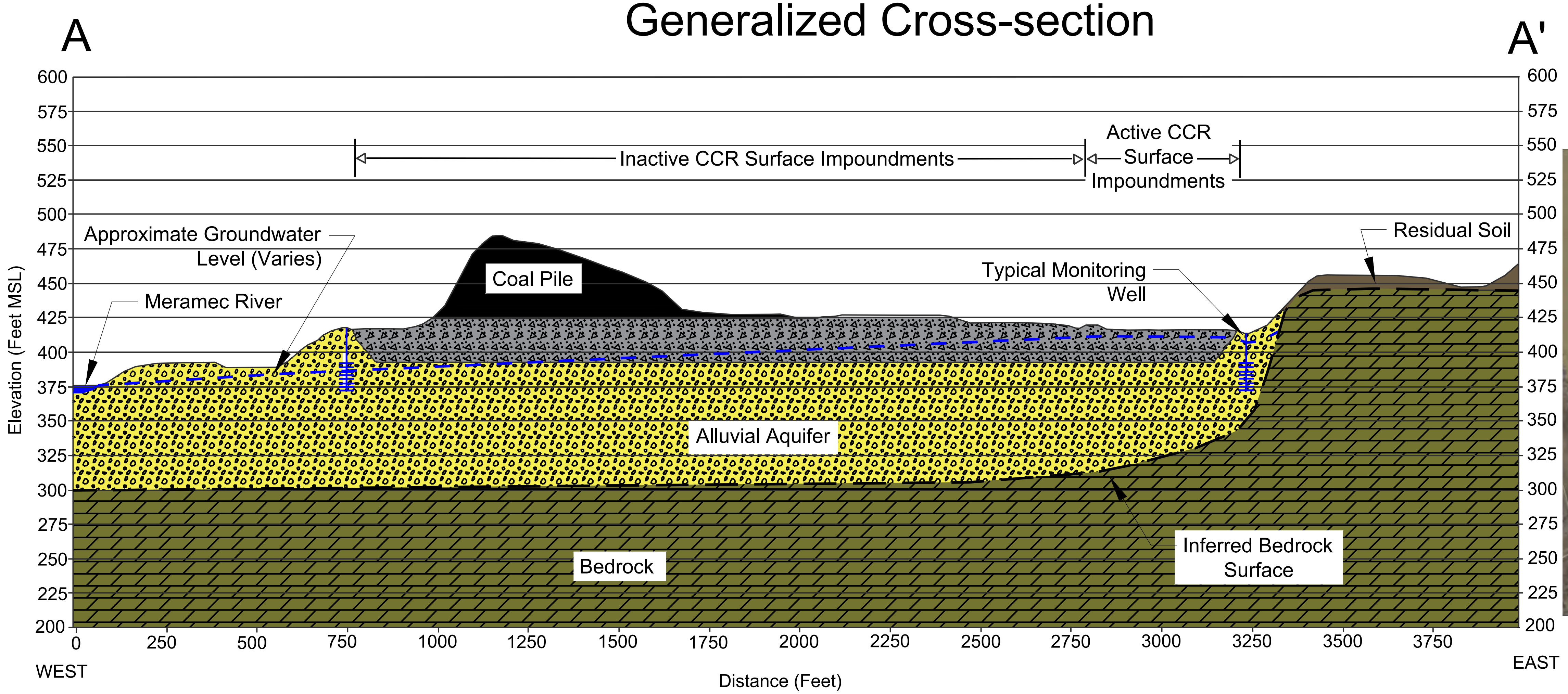
PROJECT NO.	REV.	FIGURE
153140602	0	1

PATH: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019_11 - CAGMP MEC\Figure 1 - Site Location.mxd PRINTED ON: 2019-11-20 AT: 3:06:42 PM

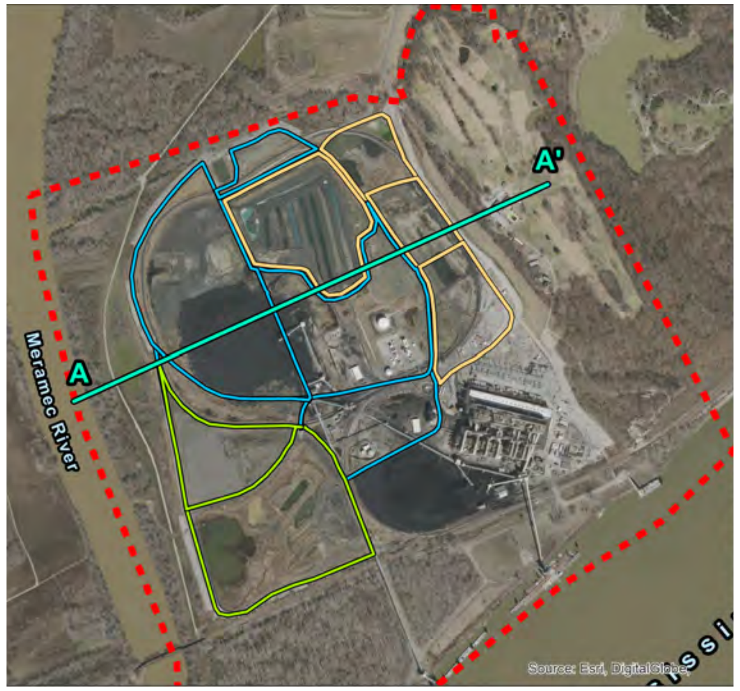
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in

Generalized Cross-section



Overview Map



NOT TO SCALE

NOTES
1.) ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2.) CROSS-SECTION IS NOT TO SCALE AND IS ONLY A VISUAL REPRESENTATION OF THE SUBSURFACE GEOLOGY.
3.) MSL - MEAN SEA LEVEL.
4.) DEPTH OF CCR IS ESTIMATED BASED ON DRAWINGS. ACTUAL DEPTH OF CCR IS UNKNOWN.
5.) CCR - COAL COMBUSTION RESIDUALS.
6.) BEDROCK SURFACE IS ESTIMATED; INFERRED FROM AVAILABLE INFORMATION.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) CH2MHILL, 1997, HYDROGEOLOGIC ASSESSMENT OF POTENTIAL IMPACTS OF MERAMEC ASH PONDS ON LOCAL GROUNDWATER AND SURFACE WATER.
3.) SHANNON & WILSON, INC., 1979. GEOTECHNICAL INVESTIGATION - MERAMEC PLANT RETROFIT - UNION ELECTRIC COMPANY - ST. LOUIS, MISSOURI.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

CONSULTANT
GOLDER

YYYY-MM-DD	2015-12-11
DESIGNED	JSI
PREPARED	JSI
REVIEWED	JS
APPROVED	MNH

PROJECT
GROUNDWATER MONITORING PROGRAM

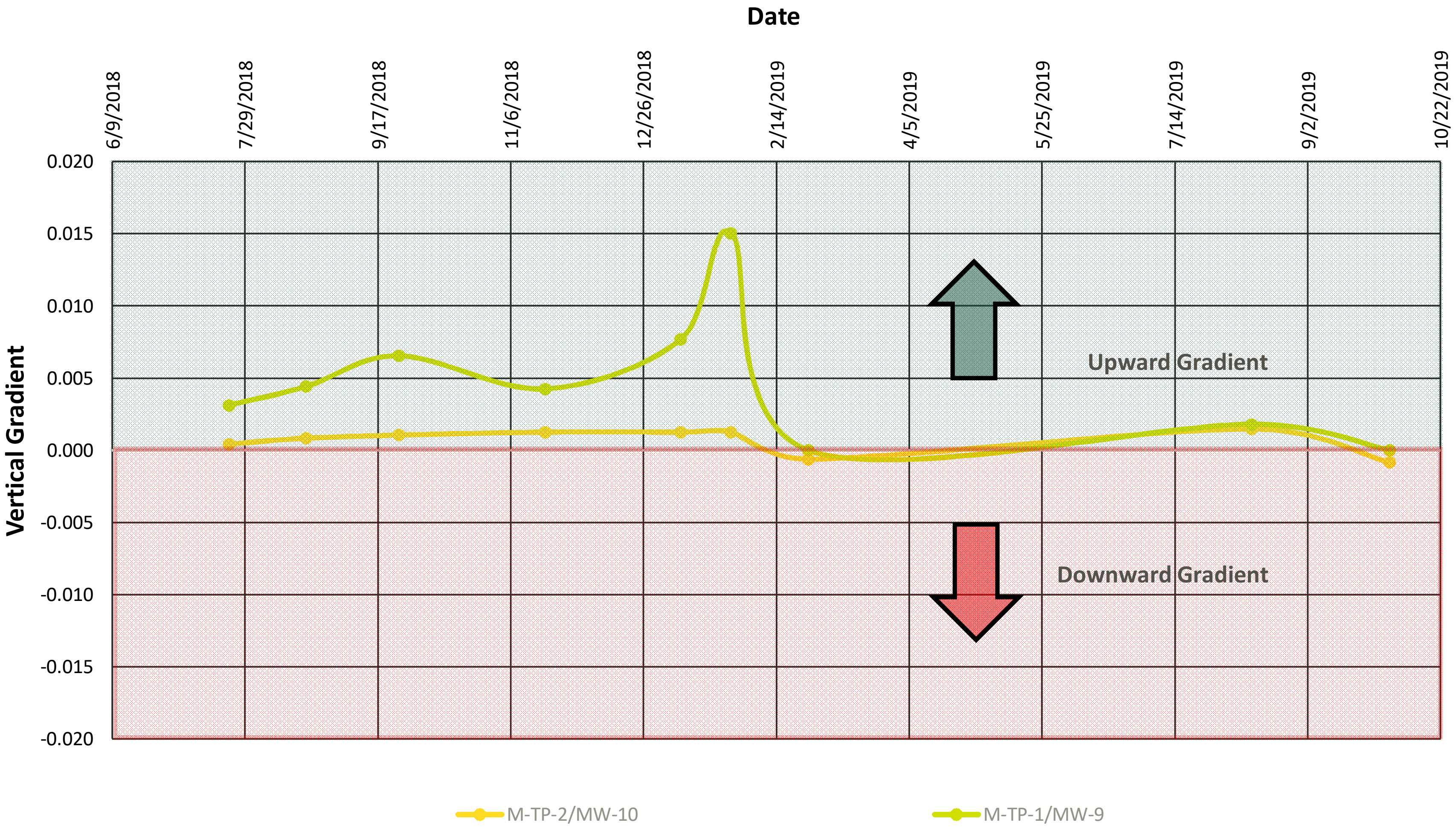
TITLE
GENERALIZED CROSS-SECTION

PROJECT NO.	PHASE	REV.	FIGURE
153140602	0004	0.0	2

Path: \\stl1-v-fs1.golder.gds\common\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Figure 3 - Generalized Cross Section\ | File Name: Generalized Cross-section Rev 1.0_recover.dwg

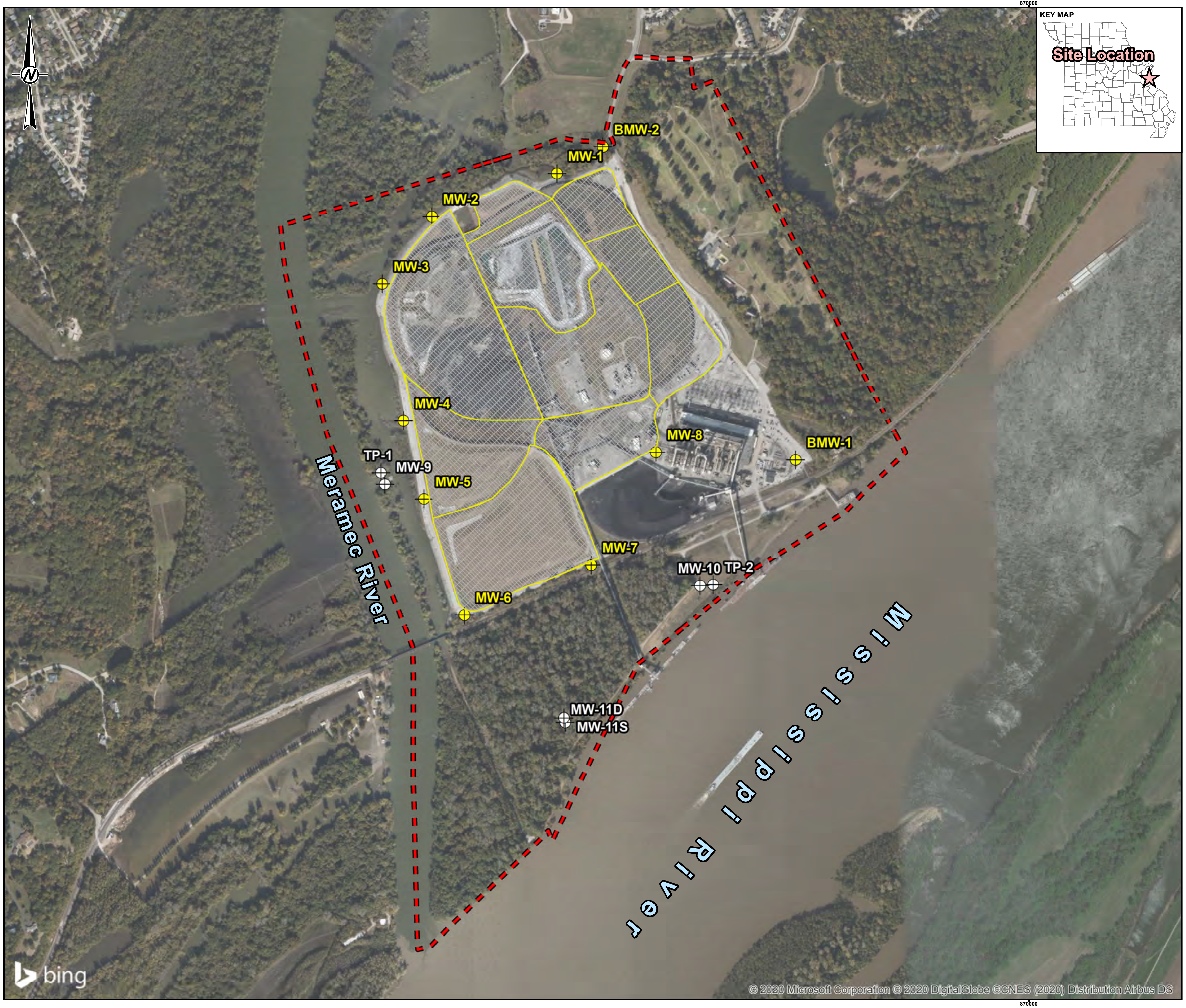
0
1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Figure 4: Vertical Gradients



Notes:
1) A positive gradient indicates upward flow and is in the green zone.
2) A negative gradient indicates downward flow and is in the red zone.

Prepared By: EMS 11/20/2019
Checked By: AMM 11/20/2019
Reviewed By: MNH 11/27/2019



LEGEND

- Meramec Energy Center Property Boundary
- ▨ Meramec Surface Impoundments

Groundwater Monitoring Wells

- ⊕ Detection/Assessment Monitoring Well Network
- ⊕ Corrective Action Monitoring Well Network

0 500 1,000 1,500 2,000 2,500

Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
2.) LOCATION OF NESTED WELL PAIRS MAY BE OFFSET FOR CLARITY.

REFERENCE(S)

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
MERAMEC ENERGY CENTER GROUNDWATER MONITORING PROGRAMS MONITORING WELL LOCATION MAP

CONSULTANT

YYYY-MM-DD	2020-04-23
DESIGNED	JSI
PREPARED	JSI
REVIEWED	BTT
APPROVED	CMR

PROJECT NO.	REV.	FIGURE
153140602	1	5

PATH: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2020_04 - CAGMP MEC\Figure 3 - CAMWN.mxd PRINTED ON: 2020-04-23 AT: 4:17:18 PM

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1 in
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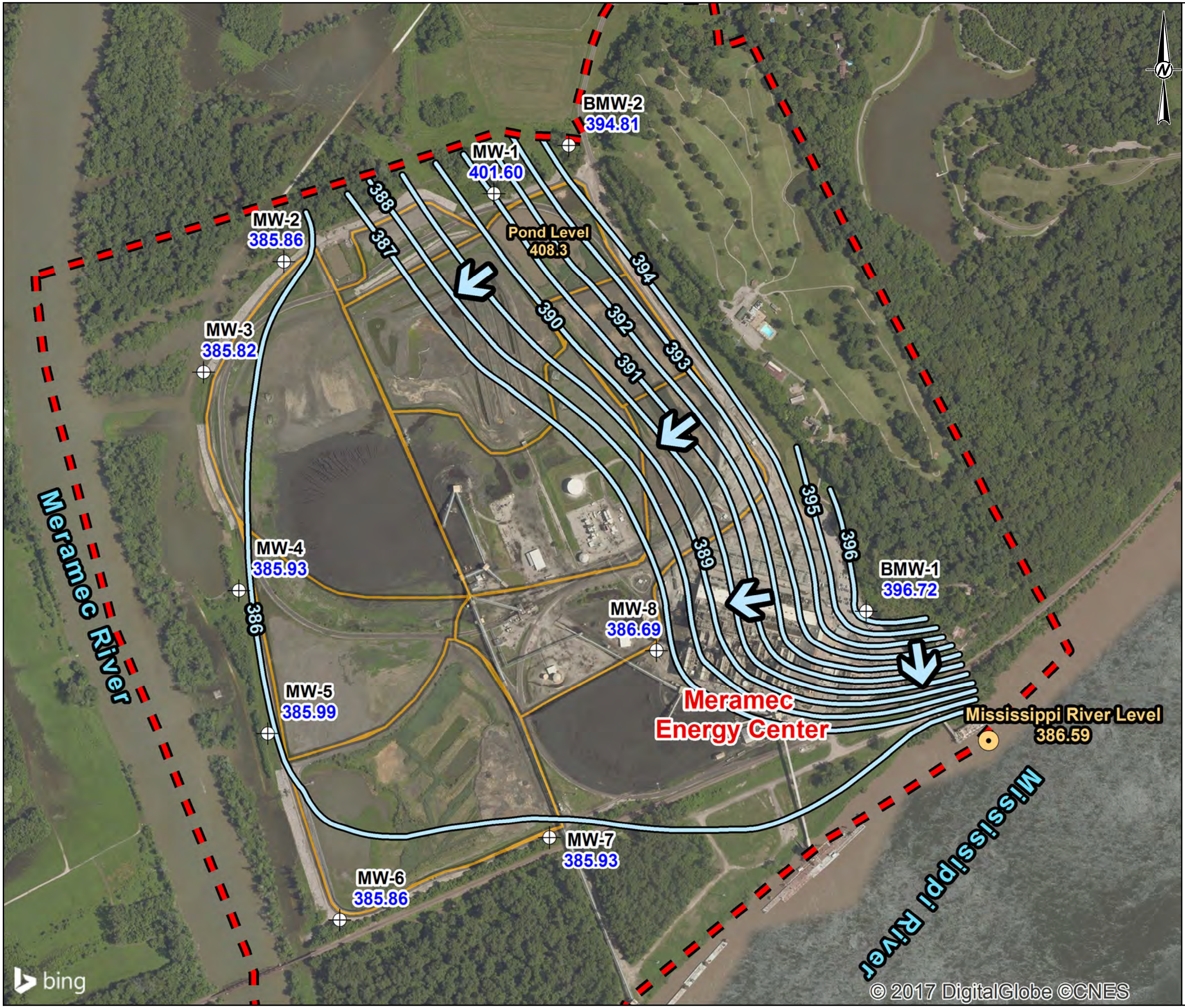
APPENDIX A

CCR Rule Program Potentiometric Surface Maps



LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

Groundwater Elevation Contour (FT MSL)

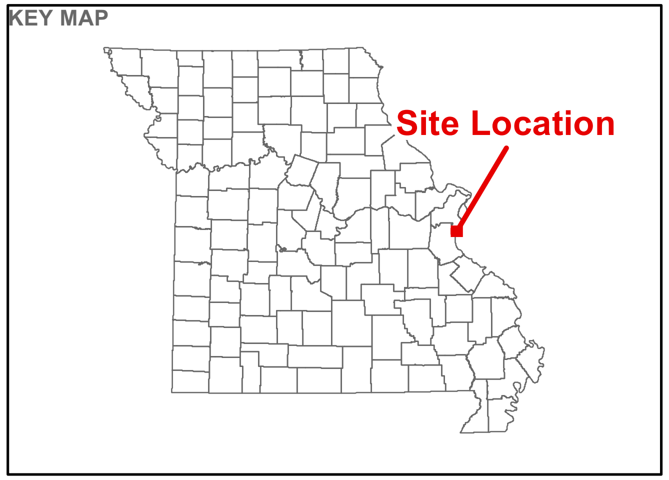
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➘ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 1 - MARCH 28, 2016

CONSULTANT

YYYY-MM-DD	2016-03-31
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	A1

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

1 in

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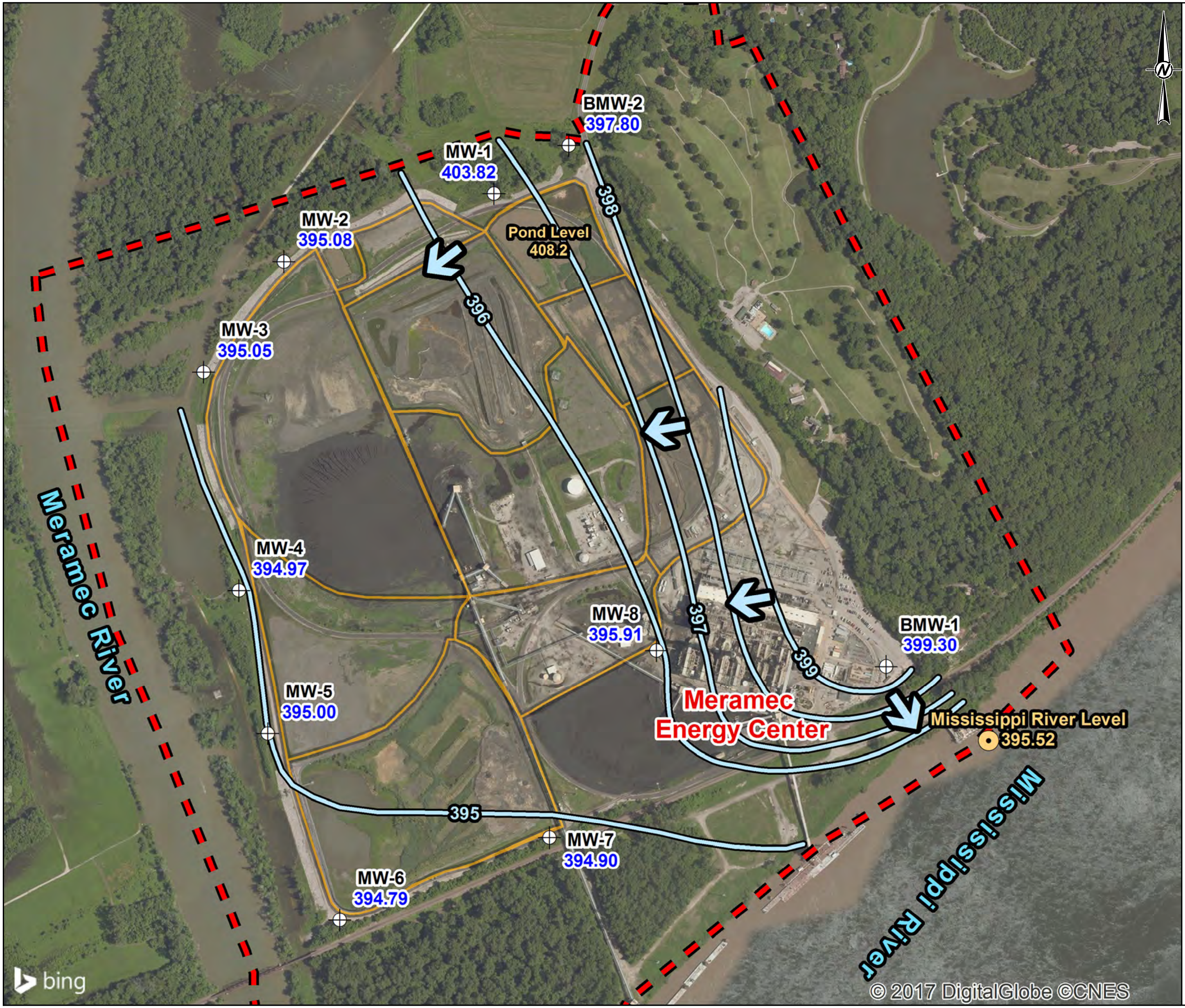


LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

═ Groundwater Elevation Contour (FT MSL)

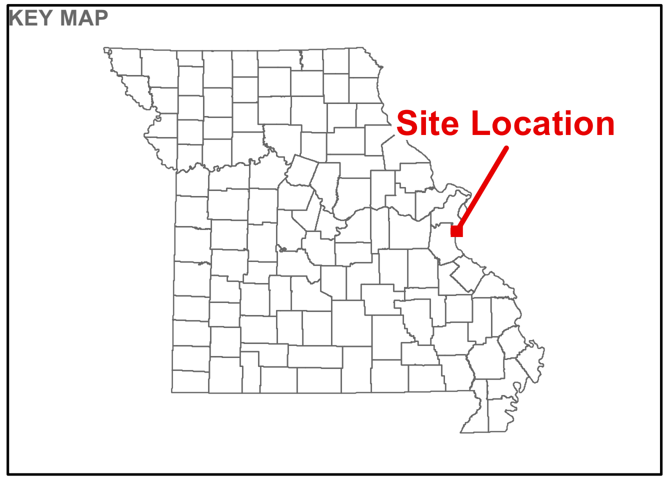
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES

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3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
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6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 2 - MAY 13, 2016

CONSULTANT

YYYY-MM-DD	2016-05-24
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	A2

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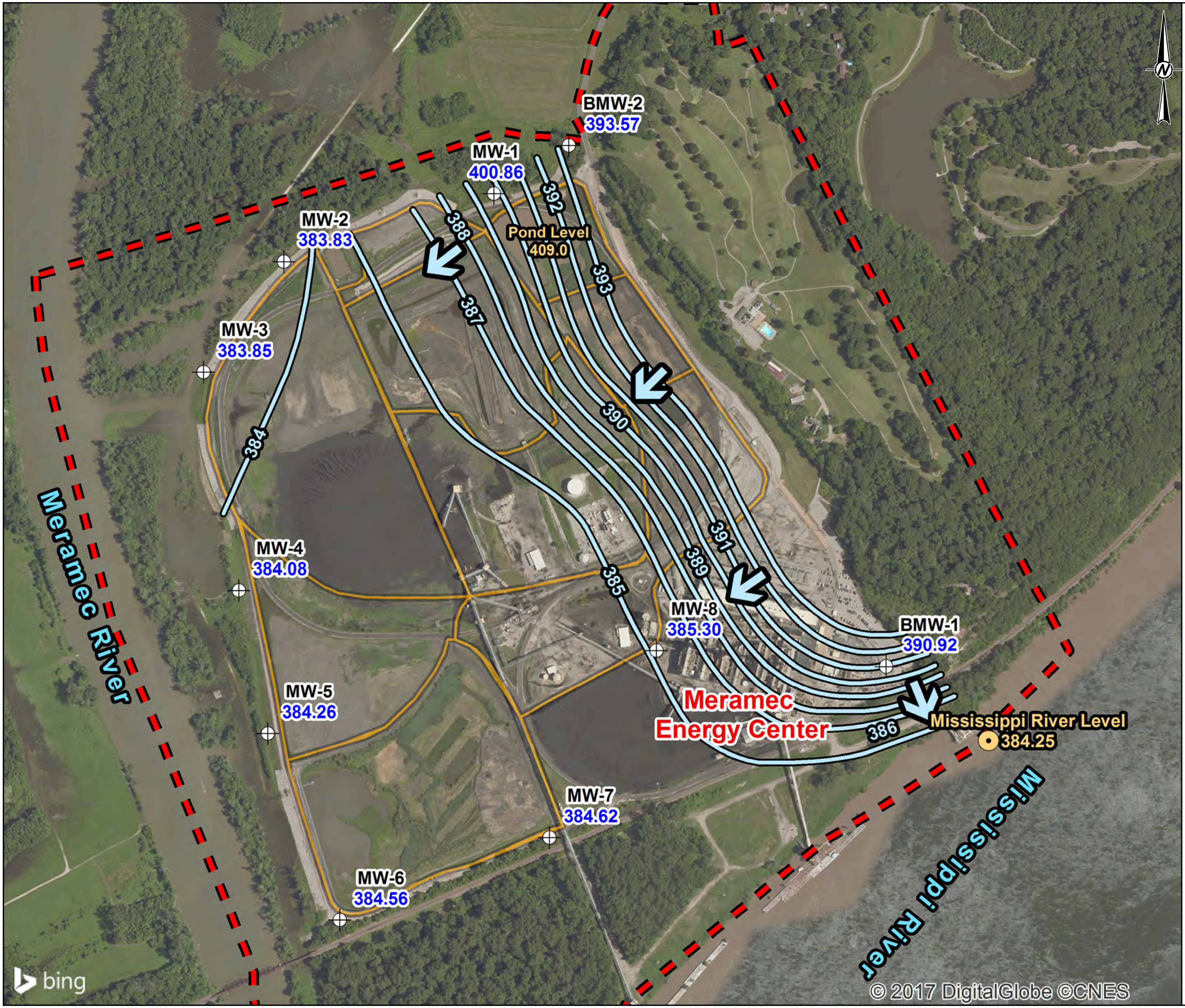


LEGEND

▭ Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

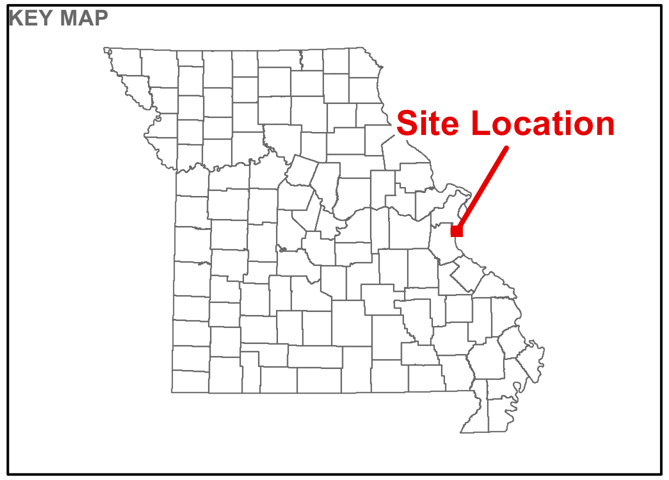
═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction



NOTES

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3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 3 - JULY 18, 2016

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-08-16
PREPARED	JS
DESIGN	JS
REVIEW	JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A3**

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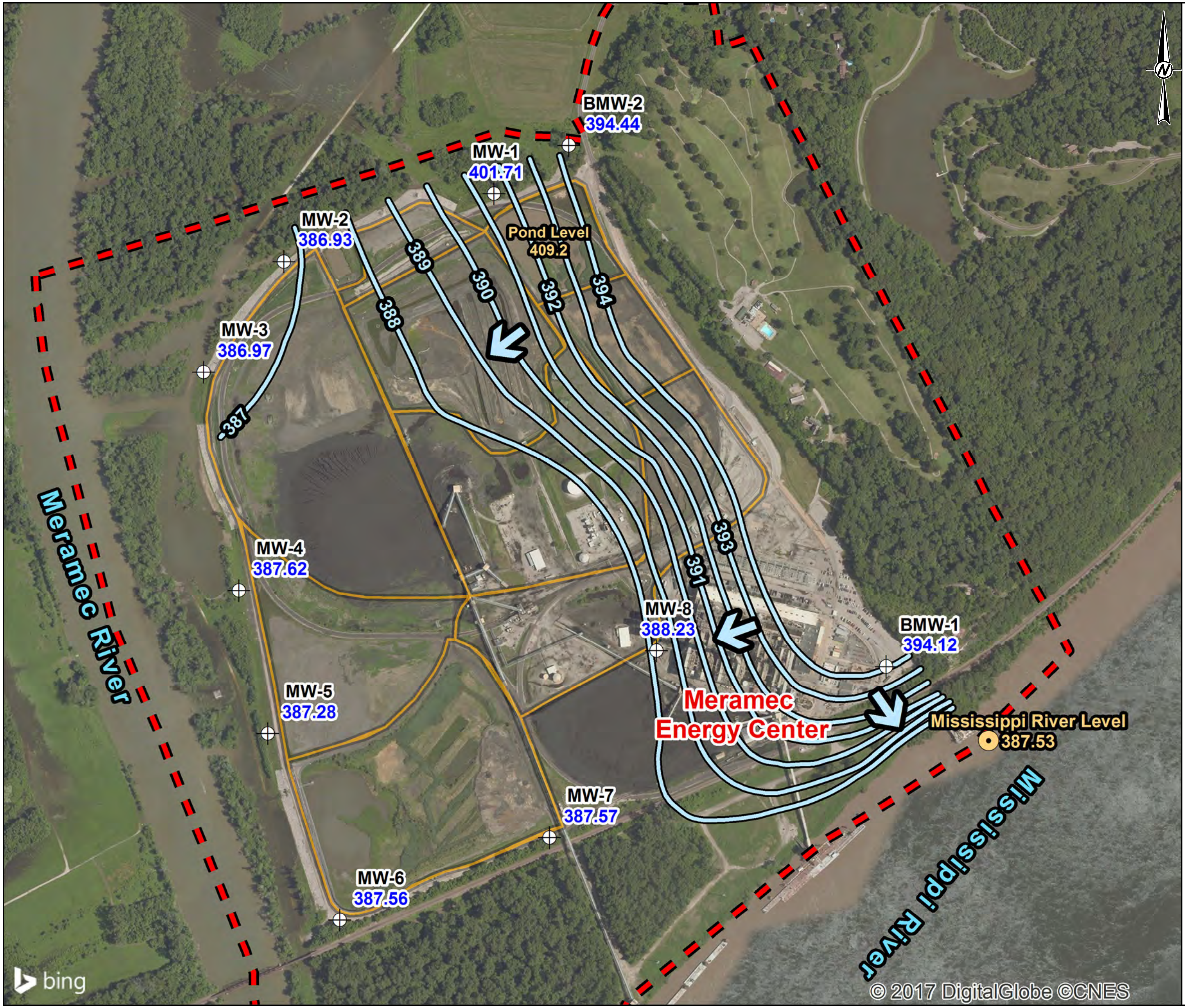
1 in



LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

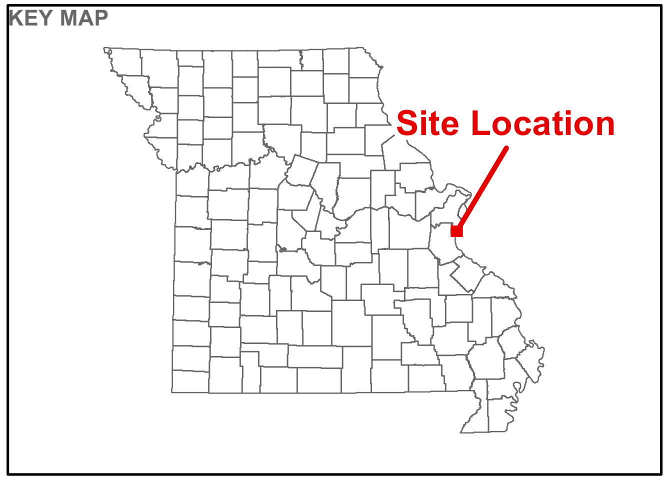
═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 4 - SEPTEMBER 7, 2016

CONSULTANT

YYYY-MM-DD	2017-09-27
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A4**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E4.mxd

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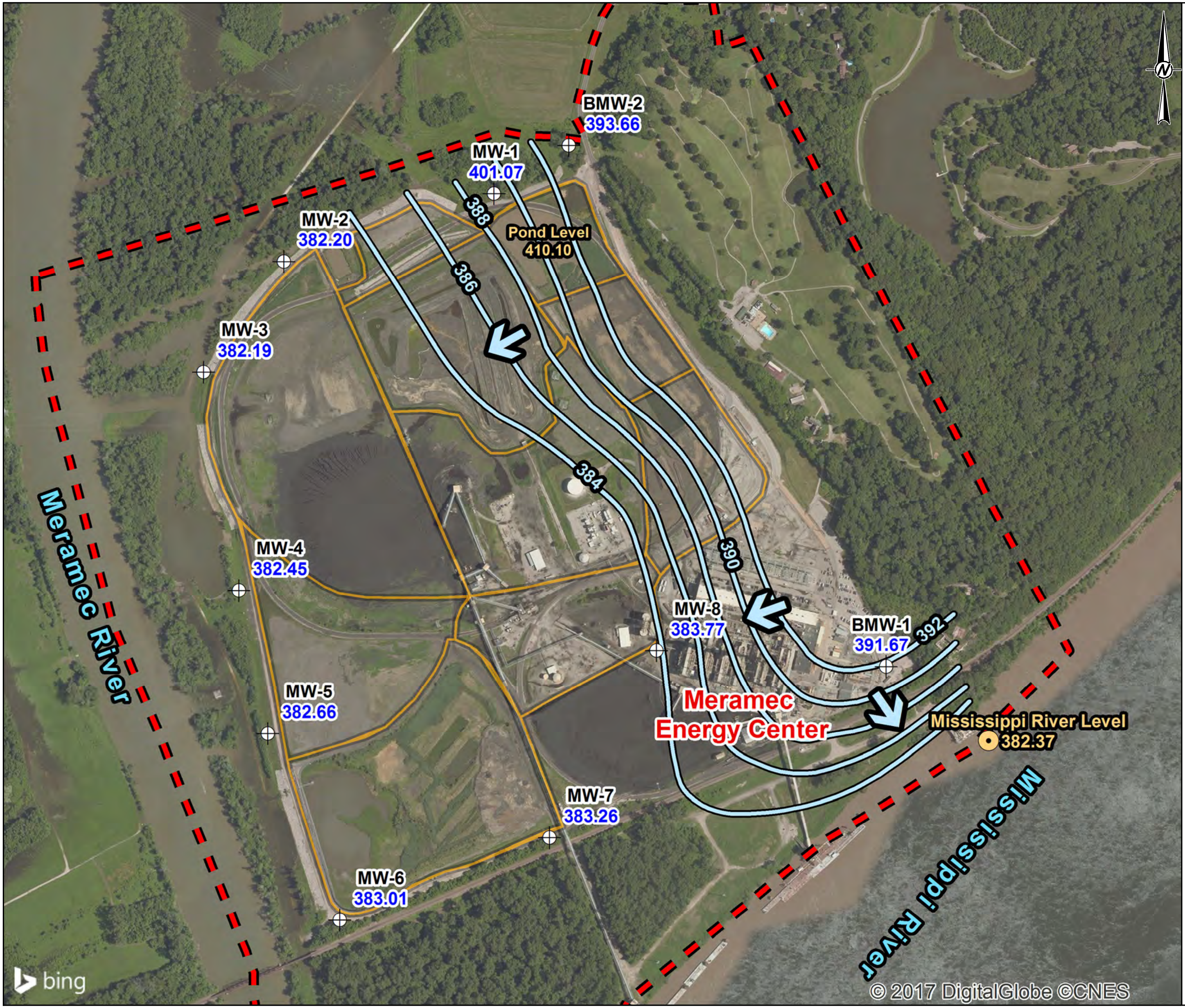

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LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

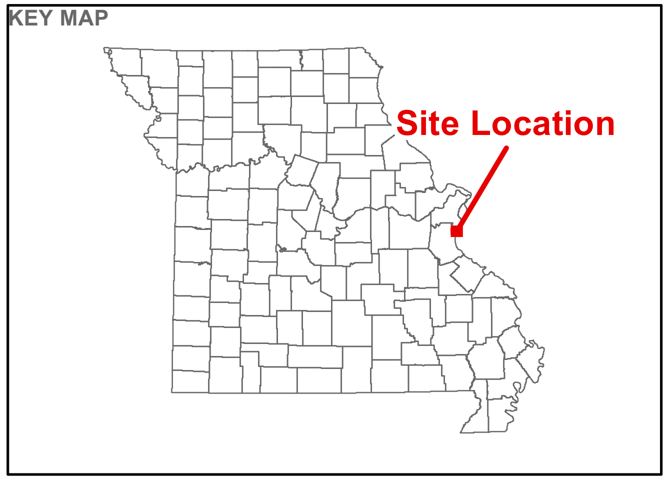
Groundwater Elevation Contours

- ═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- ➚ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 5 - NOVEMBER 10, 2016

CONSULTANT

Golder Associates

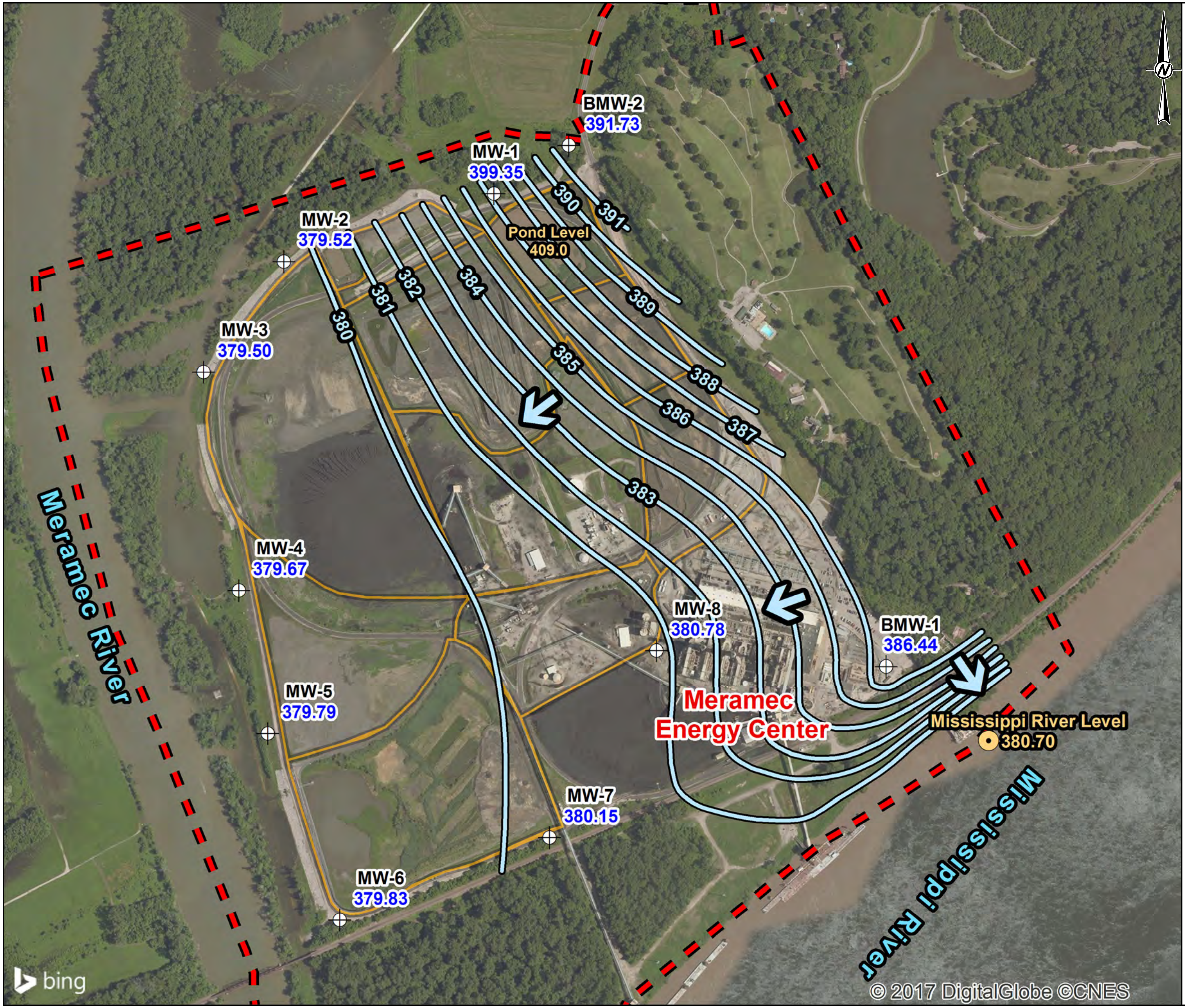
YYYY-MM-DD	2017-11-21
PREPARED	JSI
DESIGN	JSI
REVIEW	MSG
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

0 1 in

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E5.mxd



LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

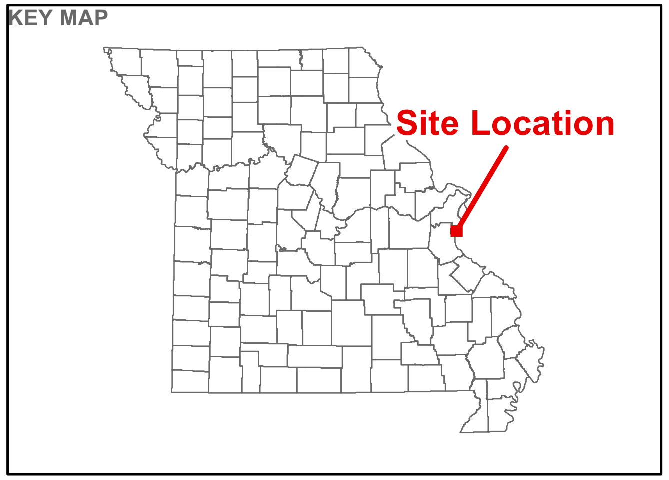
Groundwater Elevation Contours

- ▭ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ● Mississippi River Gauge
- ⬉ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 6 - JANUARY 6, 2017

CONSULTANT

Golder Associates

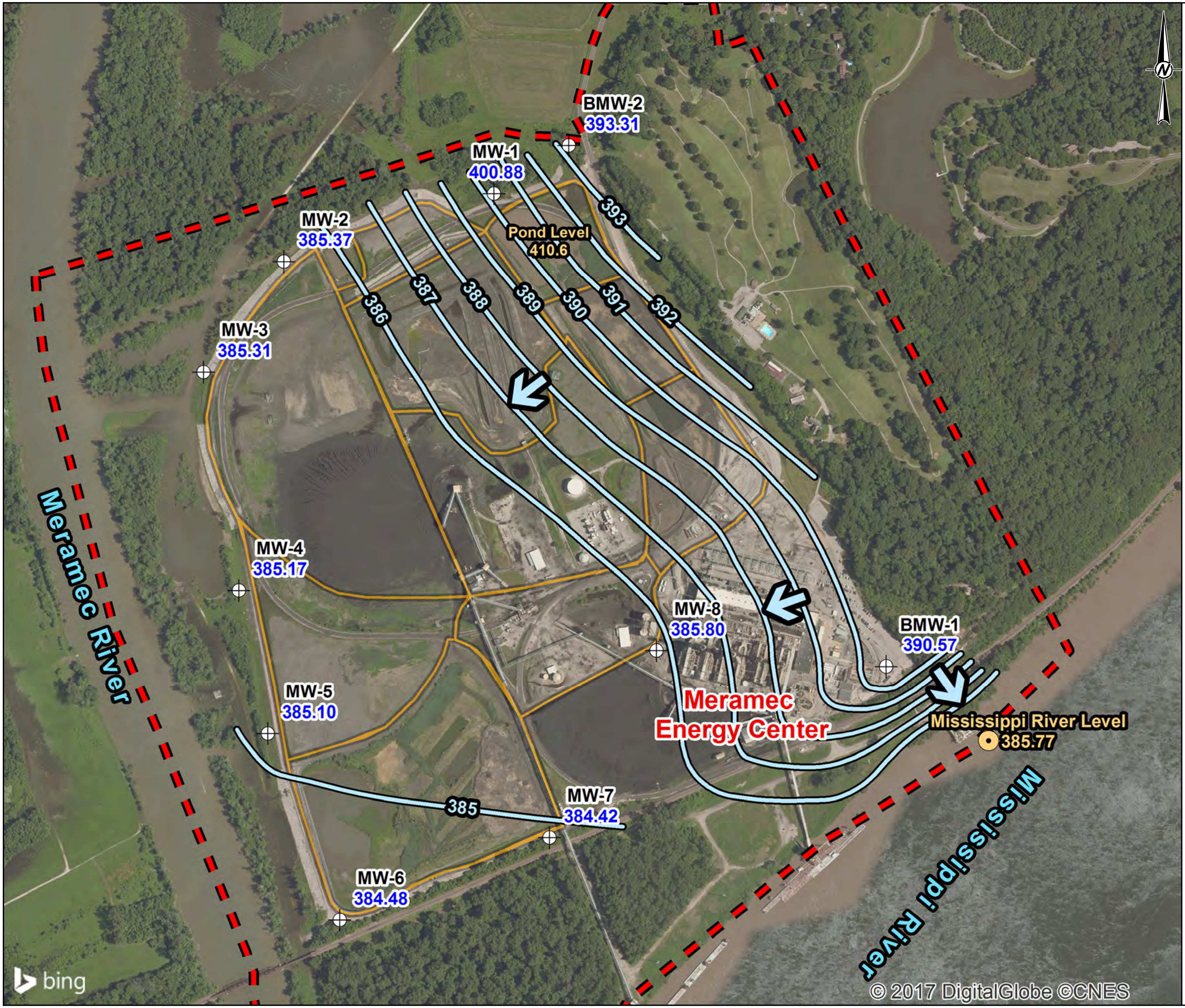
YYYY-MM-DD	2017-01-23
PREPARED	JS
DESIGN	JSI
REVIEW	BEF
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A6**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E6.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

0 1 in



LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

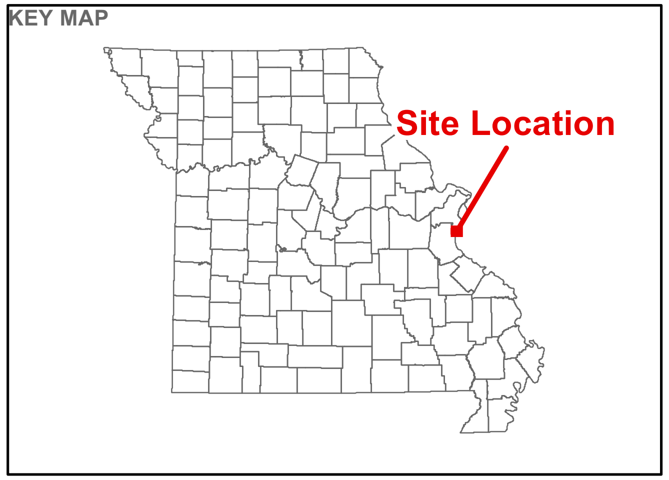
═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➘ Groundwater Flow Direction



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 7 - MARCH 7, 2017

CONSULTANT

YYYY-MM-DD	2017-03-14
PREPARED	JS
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
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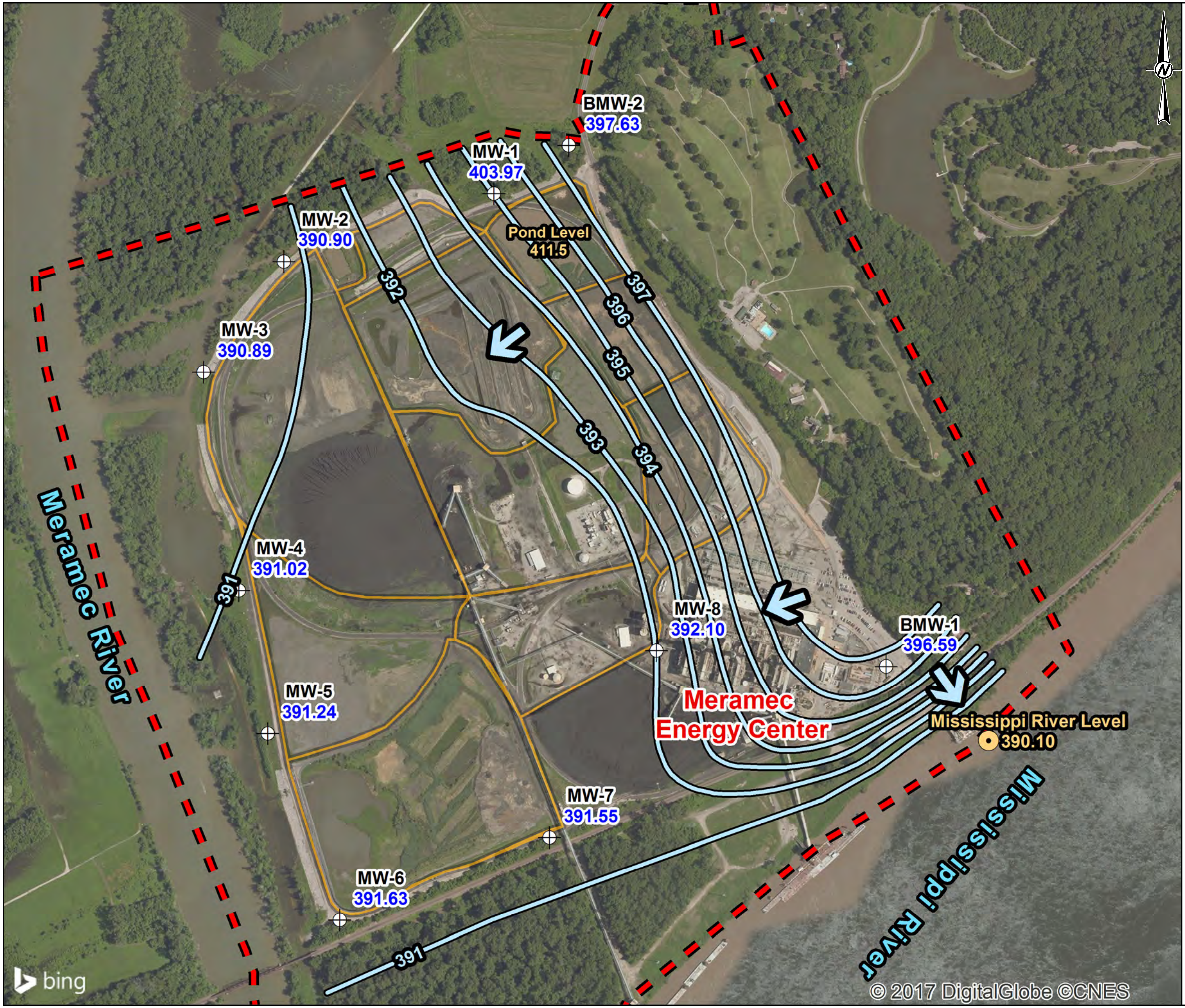


LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

═ Groundwater Elevation Contour (FT MSL)

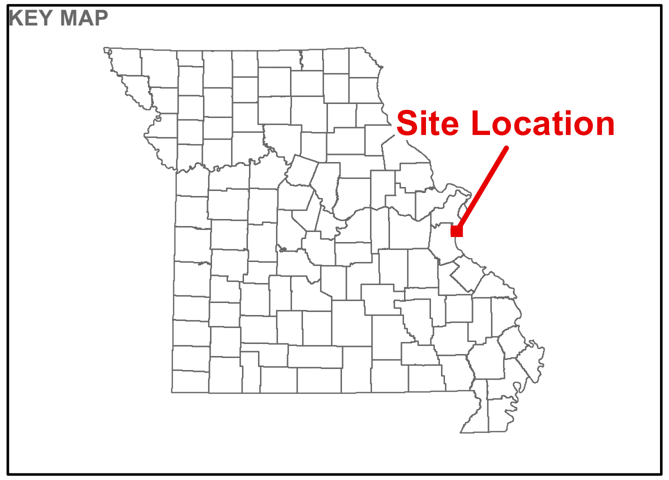
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

⊙ Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES
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REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
BACKGROUND EVENT 8 - JUNE 14, 2017

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-07-06
PREPARED	JS
DESIGN	JSI
REVIEW	RJF
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A8**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - E8.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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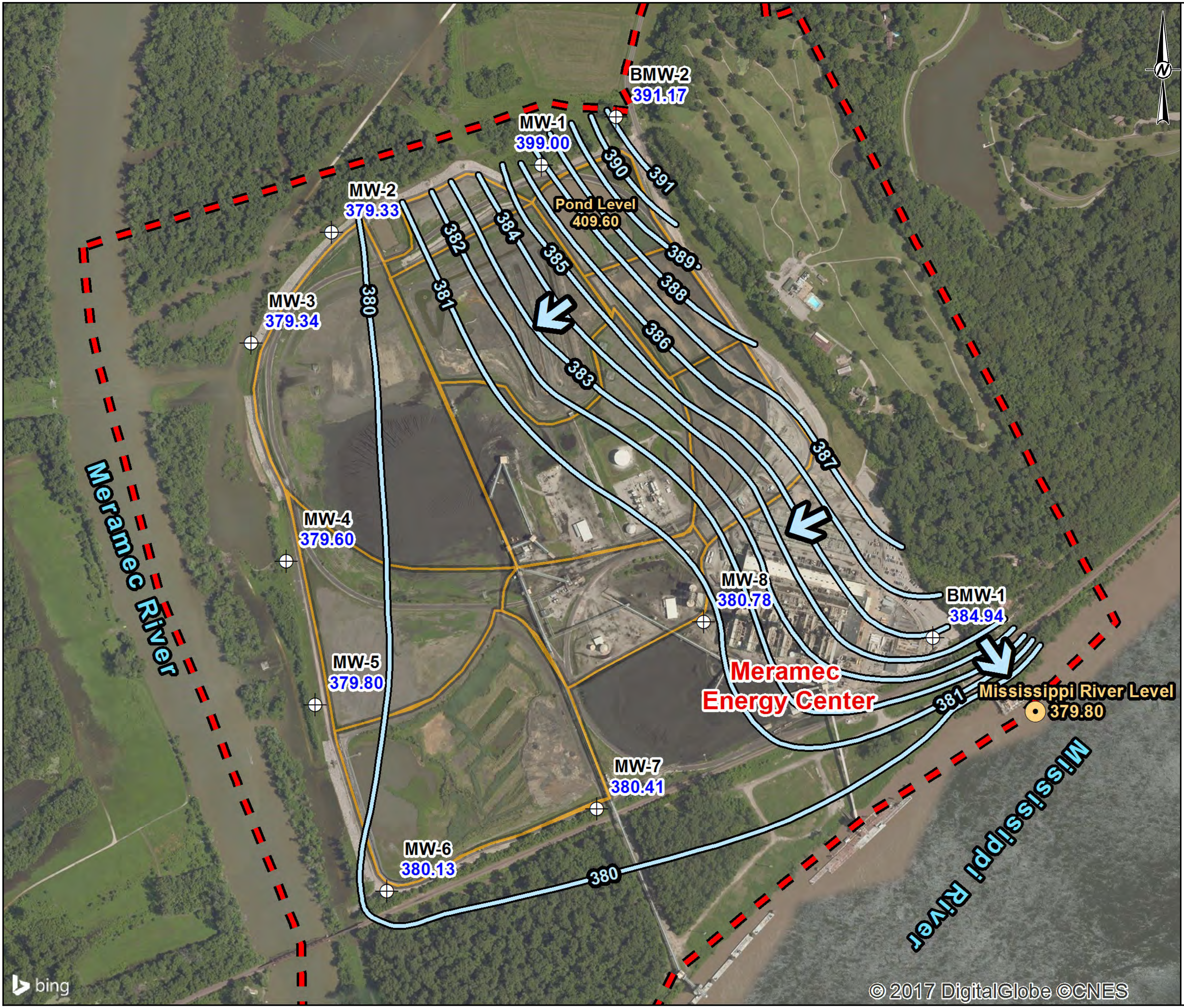
1 in



LEGEND

🟥	Meramec Energy Center Property Boundary
🟨	All Surface Impoundments

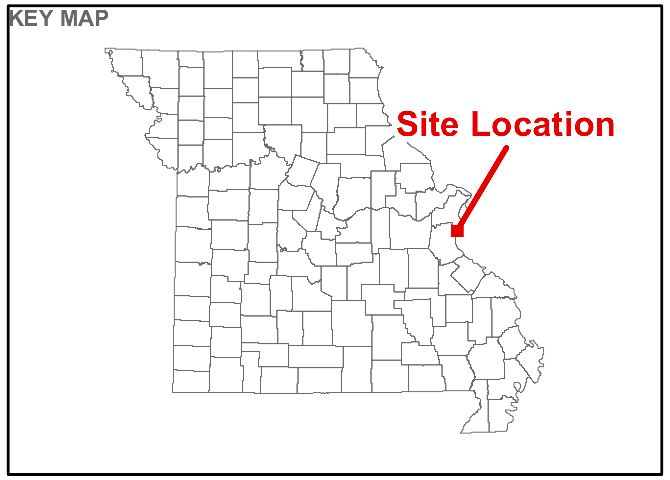
Groundwater Elevation Contours

—	Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖	Groundwater Monitoring Well
●	Mississippi River Gauge
⬉	Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON FEBRUARY 4 AND APRIL 28, 2016.
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6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500 Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP
DETECTION MONITORING - NOVEMBER 6, 2017

CONSULTANT

YYYY-MM-DD	2017-11-20
PREPARED	RJF
DESIGN	JSI
REVIEW	JS/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004A	0.0	**A9**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\Final\MEC - DM - Nov 17.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

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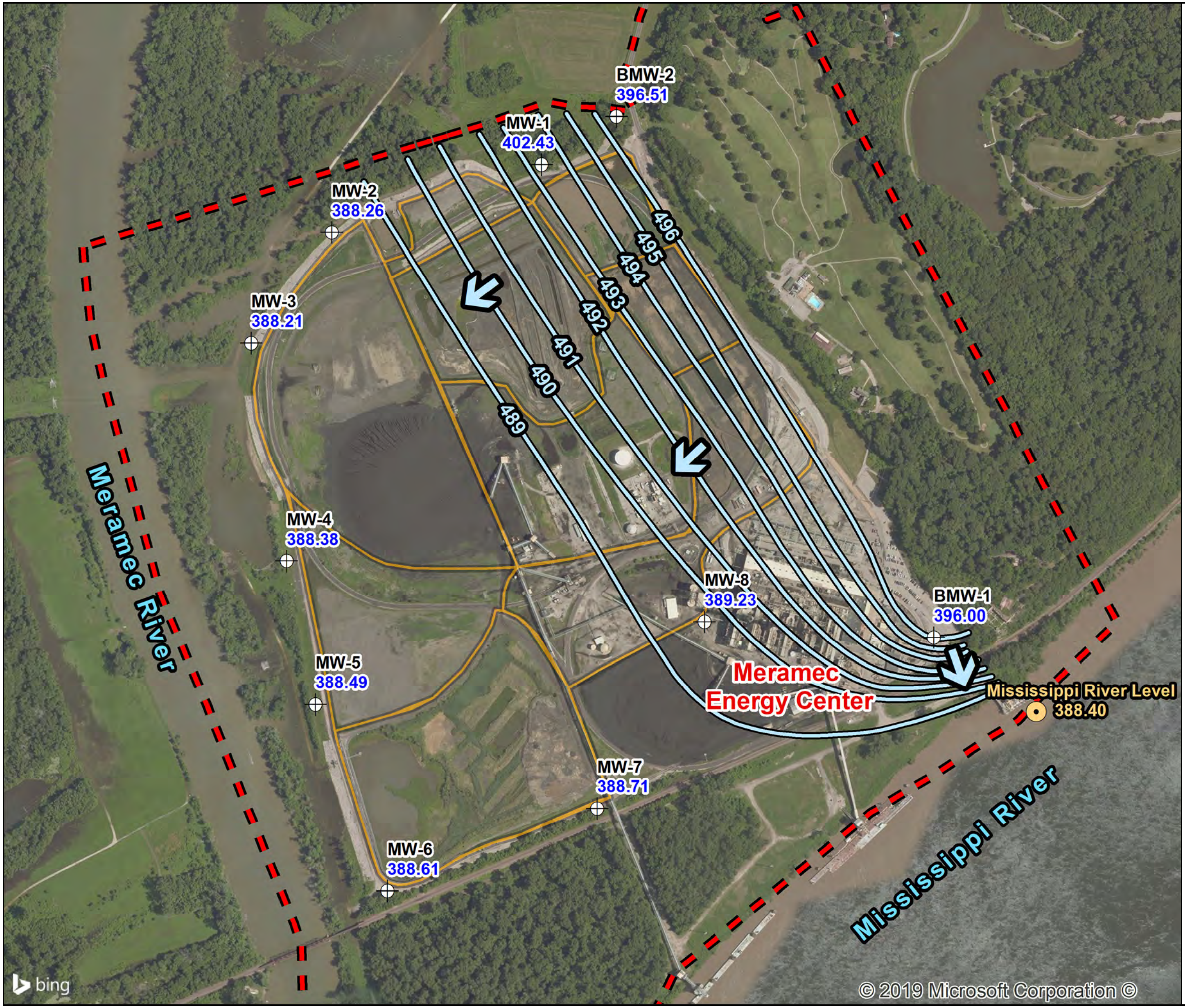


LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

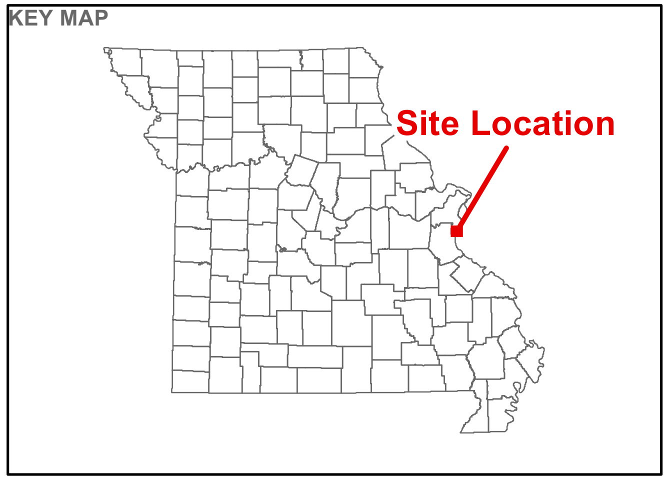
Groundwater Elevation Contours

- ═ Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- ⇖ Groundwater Flow Direction

KEY MAP



NOTES

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6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - APRIL 3, 2018

CONSULTANT

GOLDER

YYYY-MM-DD	2018-05-03
PREPARED	EFT
DESIGN	JSI
REVIEW	EMS/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004	0.0	**A10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

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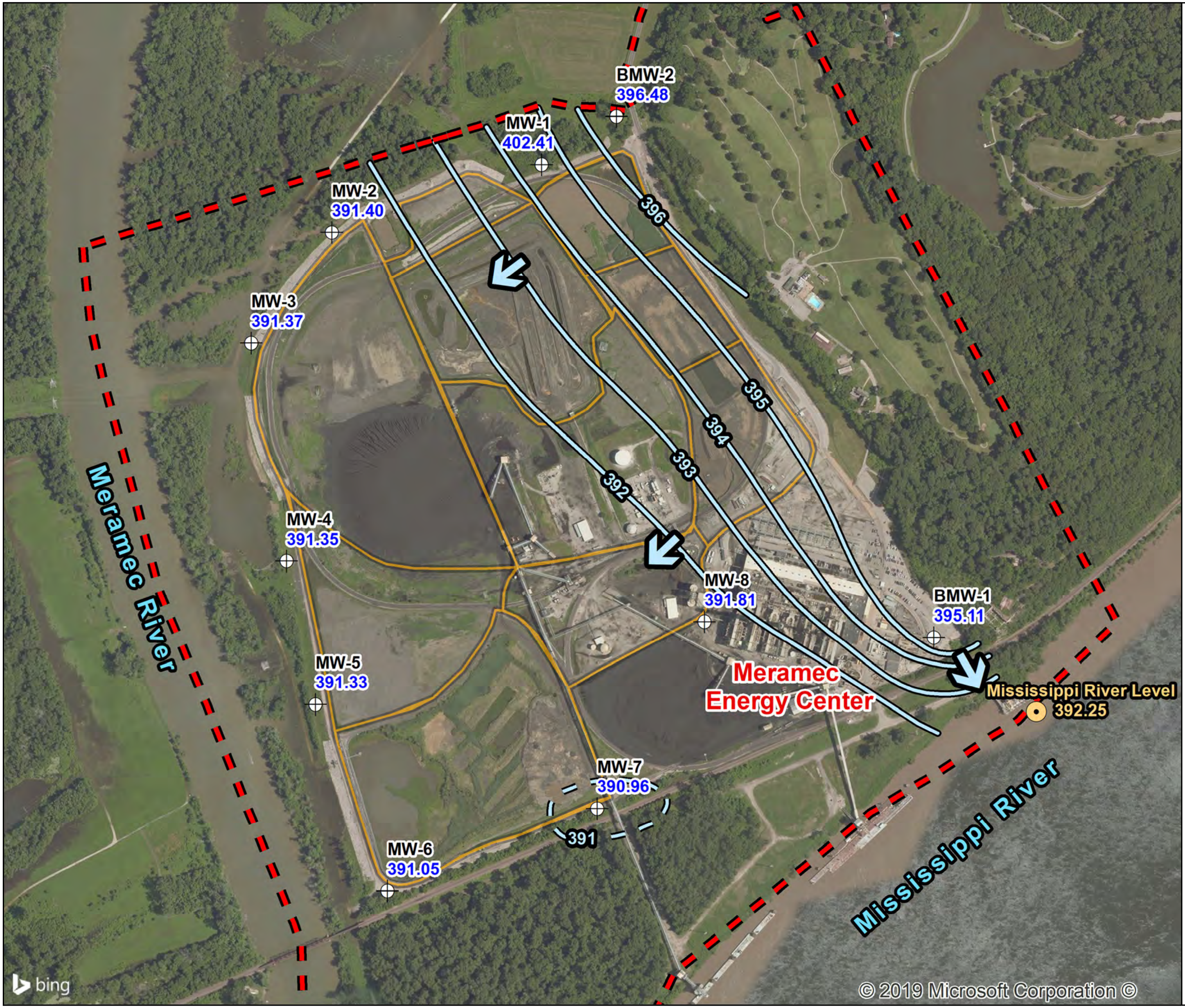
1 in

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\2018 potmaps\Figure 2_MEC - AM - April - 2018.mxd



LEGEND

🟥 Meramec Energy Center Property Boundary

▭ All Surface Impoundments

Groundwater Elevation Contours

═ Groundwater Elevation Contour (FT MSL)

= = Inferred Groundwater Elevation Contour (FT MSL)

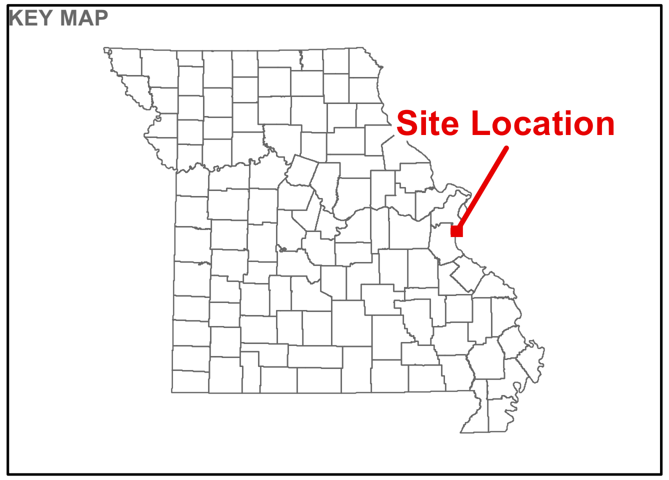
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

● Mississippi River Gauge

⬋ Groundwater Flow Direction

KEY MAP



NOTES

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5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - MAY 17, 2018

CONSULTANT
GOLDER

YYYY-MM-DD	2018-06-20
PREPARED	EFT
DESIGN	JSI
REVIEW	EMS/JSI
APPROVED	MNH

PROJECT No.	PHASE	FIGURE
153-1406	0004	A11

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\2018 potmaps\Figure 3_MEC - AM - May 2018.mxd

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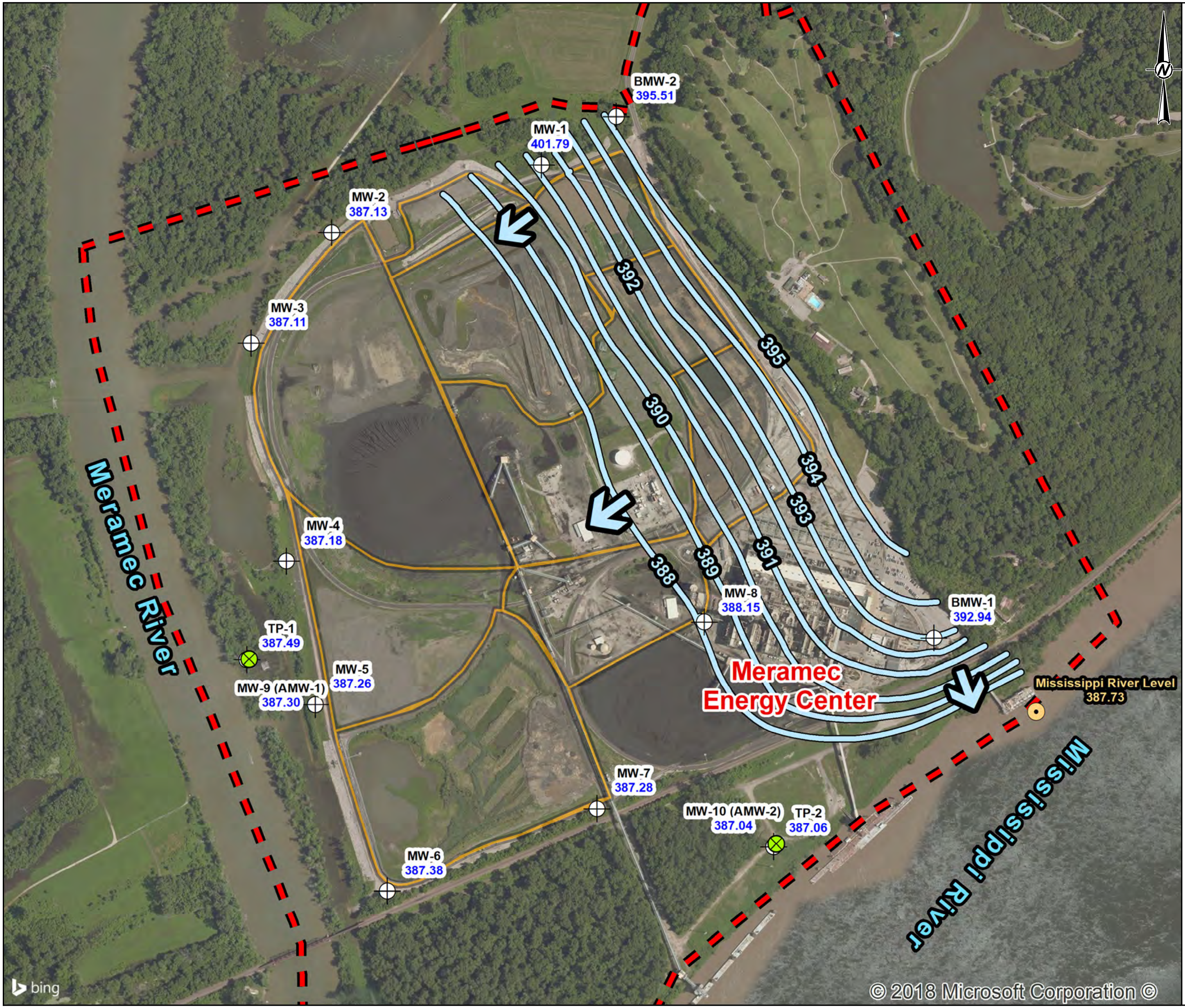


LEGEND

- Meramec Energy Center Property Boundary
- All Surface Impoundments

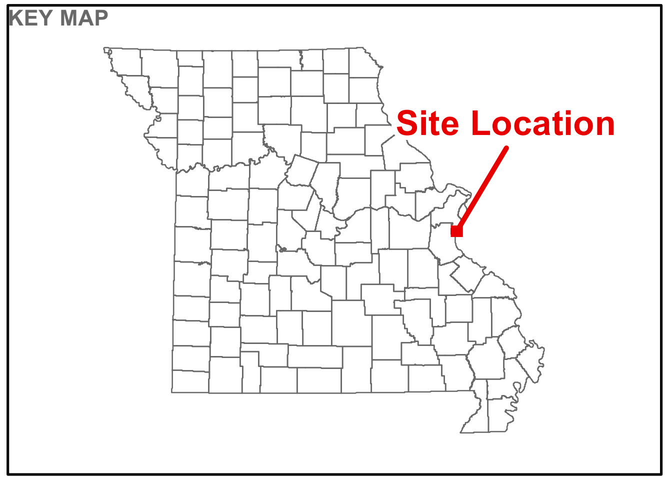
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ CCR Groundwater Monitoring Wells
- ⊗ Temporary Nature and Extent Piezometer
- ⊙ Mississippi River Gauge
- Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
5. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
JULY 2018 POTENTIOMETRIC SURFACE MAP

CONSULTANT

YYYY-MM-DD	2018-09-05
PREPARED	JS
DESIGN	JSI
REVIEW	TJG/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004	0.0	**A12**

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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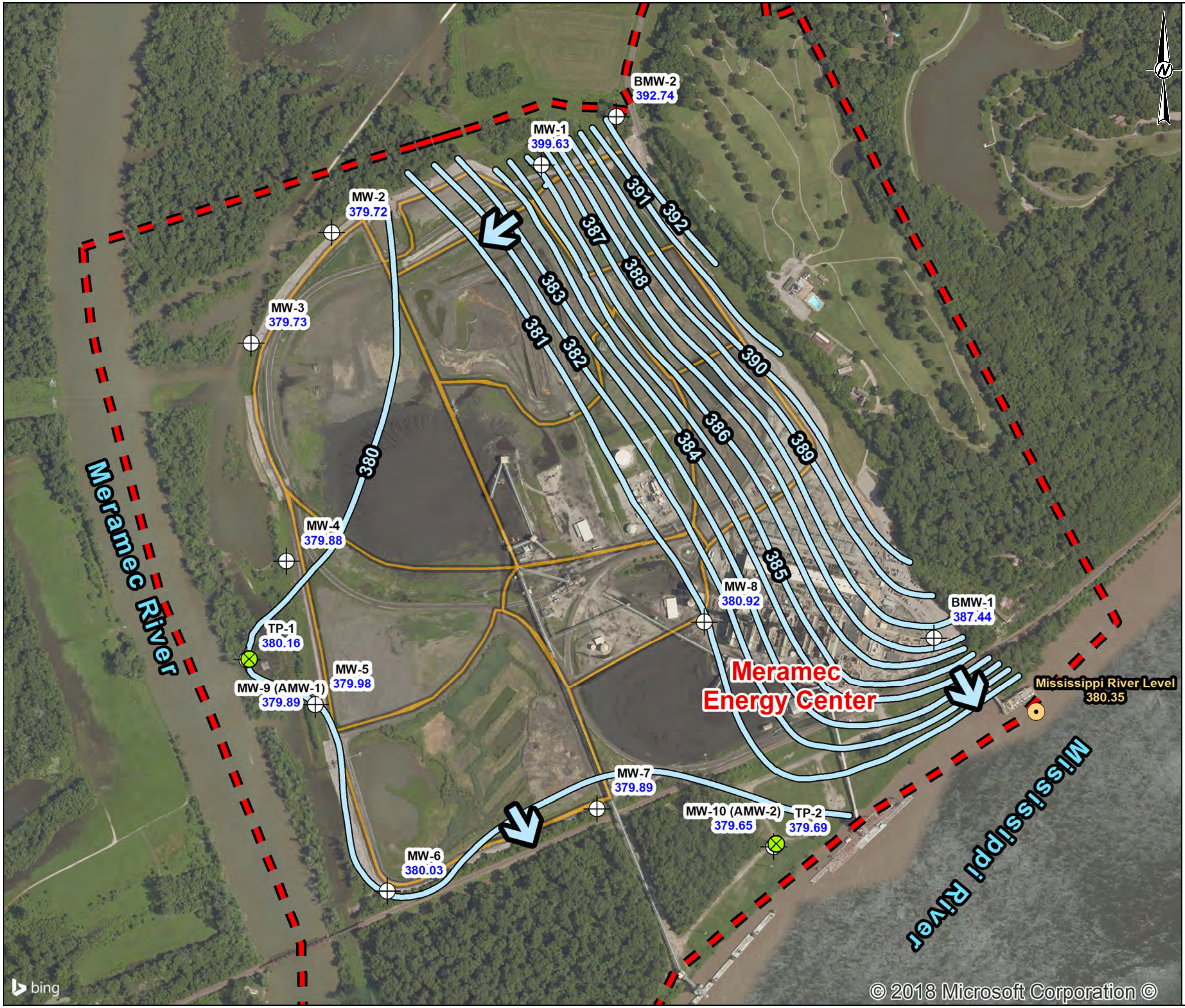


LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

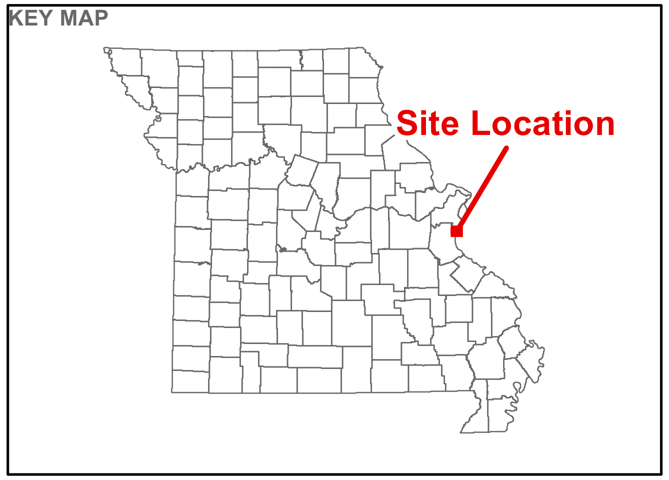
Groundwater Elevation Contours

- ━ Groundwater Elevation Contour (FT MSL)
- = = Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⊕ CCR Groundwater Monitoring Wells
- ⊗ Temporary Nature and Extent Piezometer
- ⊙ Mississippi River Gauge
- ➘ Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
5. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
AUGUST 2018 POTENTIOMETRIC SURFACE MAP

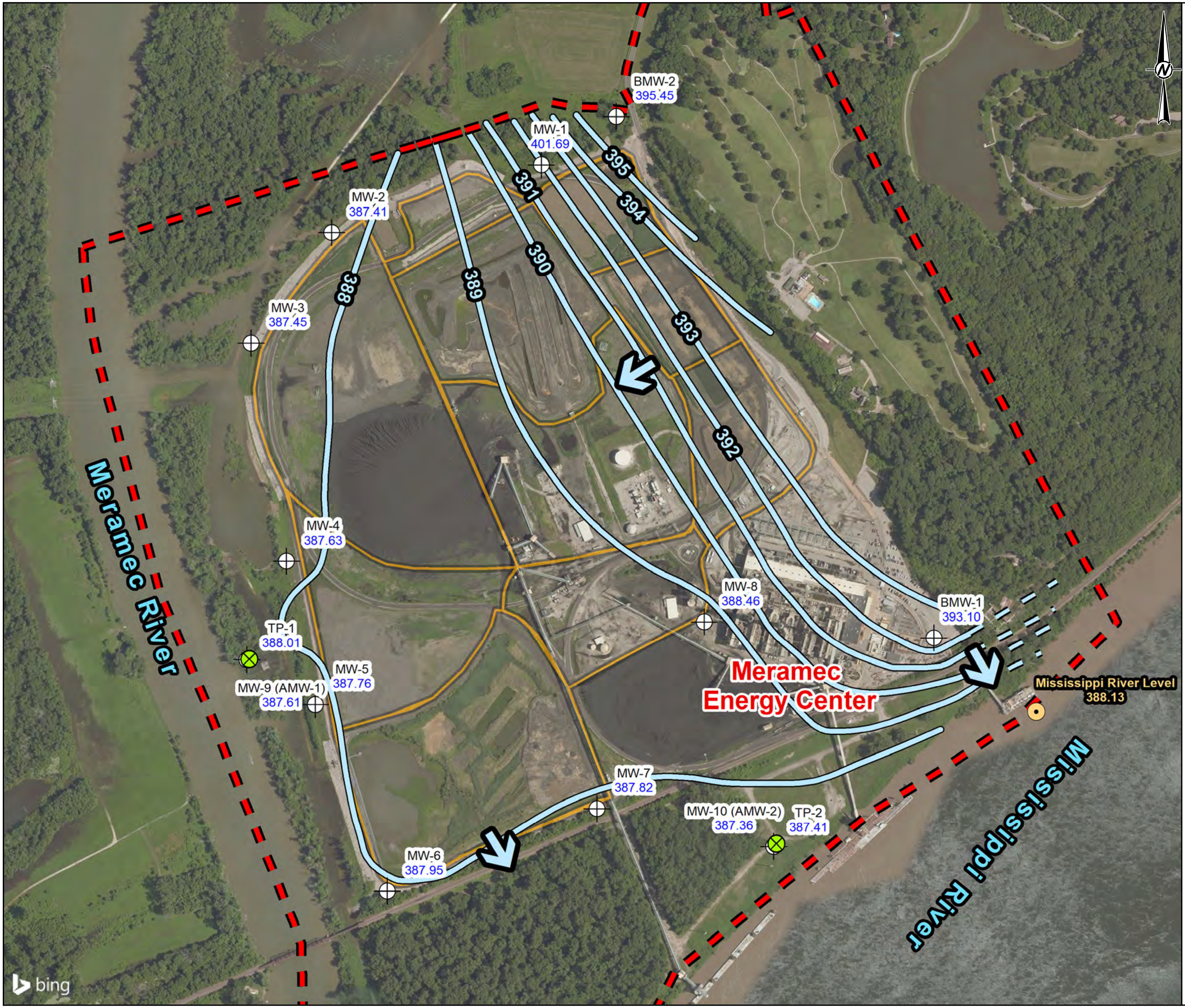
CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-05
PREPARED	JS
DESIGN	JSI
REVIEW	TJG/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004	0.0	A13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\MEC - NE2 - 8-21-2018.mxd



LEGEND

- Meramec Energy Center Property Boundary
- All Surface Impoundments

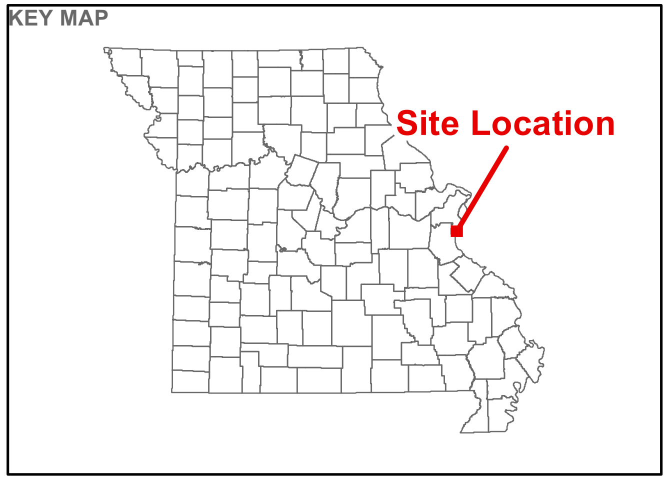
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)
- Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ CCR Groundwater Monitoring Wells
- ⊗ Temporary Nature and Extent Piezometer
- ⊙ Mississippi River Gauge
- Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. WELL MW-1 AND PIEZOMETER TP-1 WERE NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
5. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 250 500 1,000 1,500
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
SEPTEMBER 2018 POTENTIOMETRIC SURFACE MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2018-10-11
PREPARED	RJF
DESIGN	JSI
REVIEW	EMS/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004	0.0	**A14**

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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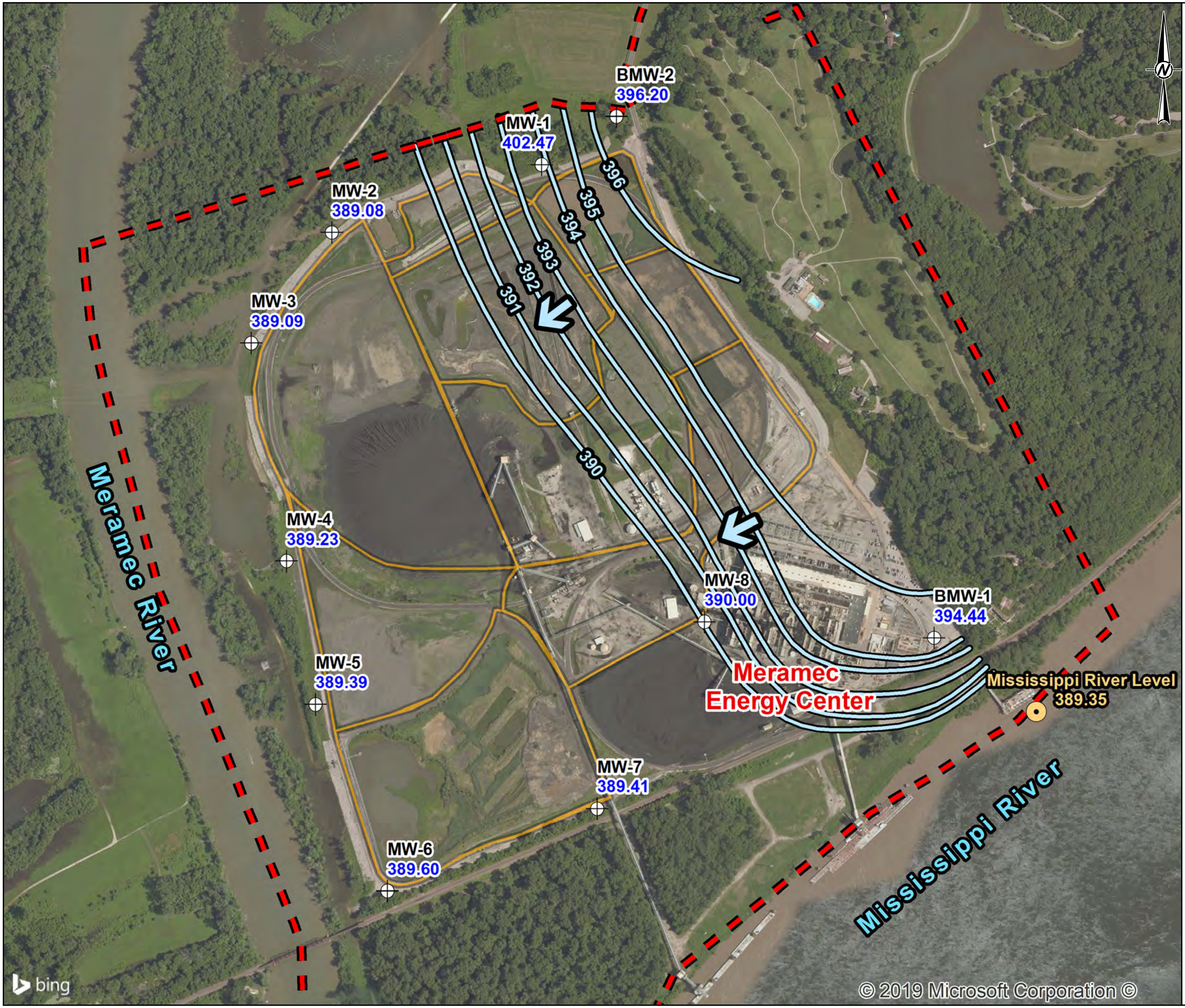
1 in



LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

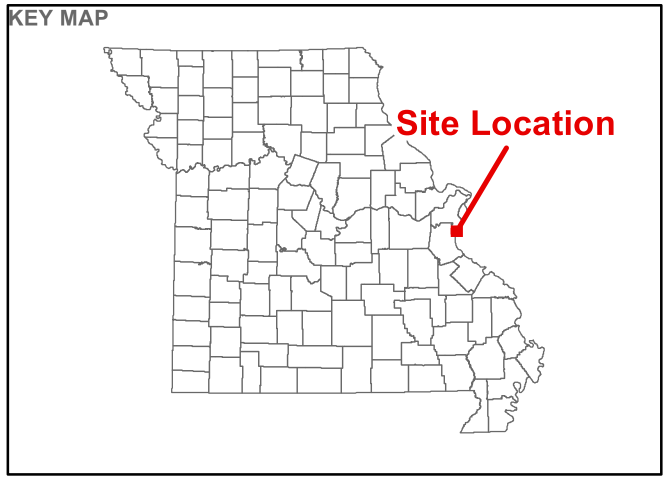
Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP



NOTES

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4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - NOVEMBER 19, 2018

CONSULTANT

YYYY-MM-DD	2018-12-21
PREPARED	EFT
DESIGN	JSI
REVIEW	JAP
APPROVED	MNH

PROJECT No.
153-1406

PHASE
0004

FIGURE
A15

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\GMP\Pot Maps\2018 potmaps\Figure 4_MEC - DM - Nov 18(2).mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0
1 in

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- ▭ All Surface Impoundments

Groundwater Elevation Contours

- ▬ Groundwater Elevation Contour (FT MSL)
- = = = Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ● Mississippi River Gauge
- ➚ Groundwater Flow Direction

KEY MAP

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - JANUARY 9, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2018-12-21
PREPARED	RJF
DESIGN	JSI
REVIEW	KAB
APPROVED	MNH

PROJECT No.
153-140601

PHASE
0004

FIGURE
A16

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\Jan Pot Map UPDATED 11-20-2019.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

1 in

0

LEGEND

- Meramec Energy Center Property Boundary
- All Surface Impoundments

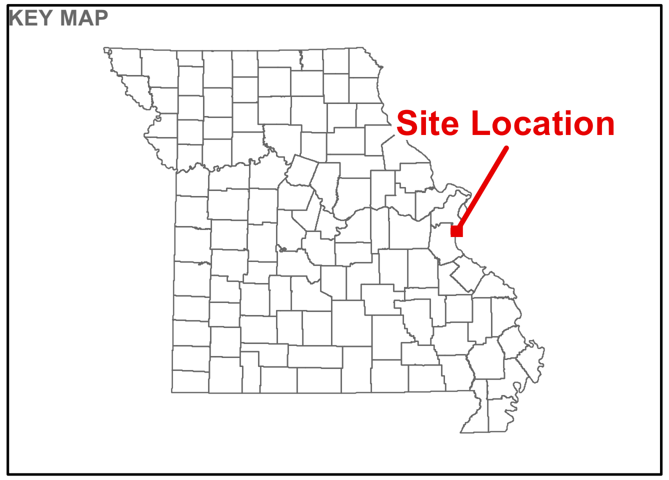
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ⊙ Mississippi River Gauge
- Groundwater Flow Direction

KEY MAP



NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER AND POND LEVELS PROVIDED BY AMEREN.

REFERENCES

1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
JANUARY 28, 2019 POTENTIOMETRIC SURFACE MAP

CONSULTANT

YYYY-MM-DD	2019-02-19
PREPARED	EMS
DESIGN	JSI
REVIEW	TJG
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-1406	0004D	0.0	**A17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019 BMW Pot Maps\Pot Map Draft MEC 01-31-2019 (3).mxd

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⌖ Groundwater Monitoring Well

● Mississippi River Gauge

↖ Groundwater Flow Direction

KEY MAP

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1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
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3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.
7. MW-9 (AMW-1) AND TP-1 ACCESS BLOCKED DUE TO HIGH WATER, NO GROUNDWATER ELEVATION DATA RECORDED.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - FEBRUARY 26, 2019

CONSULTANT

YYYY-MM-DD	2019-11-27
PREPARED	EMS
DESIGN	JSI
REVIEW	RJF/JSI
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	**A18**

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\2019-02-19 Map for XDD\2019-02-26 Pot Map\Pot Map Draft MEC 2019-02-26 (1).mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0

LEGEND

- 🟥 Meramec Energy Center Property Boundary
- 🟨 All Surface Impoundments

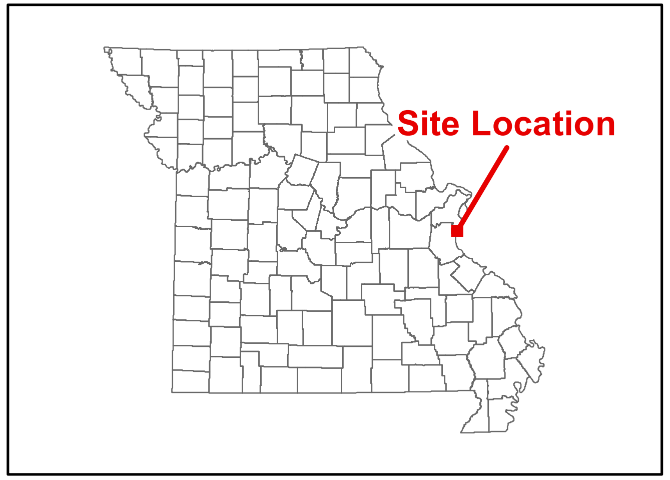
Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

- ⌖ Groundwater Monitoring Well
- ● Mississippi River Gauge
- ↖ Groundwater Flow Direction

KEY MAP



NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
6. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - AUGUST 12, 2019

CONSULTANT
GOLDER

YYYY-MM-DD	2019-08-29
PREPARED	JSI
DESIGN	JSI
REVIEW	KAB/EMS
APPROVED	MNH

PROJECT No.	PHASE	Rev.	FIGURE
153-140601	0004	0.0	A19

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES\DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-08 - Pot Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0

LEGEND

🟥 Meramec Energy Center Property Boundary

🟨 All Surface Impoundments

Groundwater Elevation Contours

— Groundwater Elevation Contour (FT MSL)

- - Inferred Groundwater Elevation Contour (FT MSL)

Ground/Surface Water Measurement Locations

⊕ Groundwater Monitoring Well

● Mississippi River Gauge

➚ Groundwater Flow Direction

KEY MAP

NOTES
1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEASUREMENTS OBTAINED BY GOLDER.
3. GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC.
4. WELL MW-1 NOT USED FOR POTENTIOMETRIC SURFACE MAP CONTOURING.
4. GROUNDWATER ELEVATION MEASUREMNTS COULD NOT BE COLLECTED AT MW-2, MW-3, MW-9 (AMW-1), BMW-3, BMW-4, AND BMW-5 DUE TO FLOODING.
6. GROUNDWATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
7. MISSISSIPPI RIVER LEVEL PROVIDED BY AMEREN.

REFERENCES
1.) AMEREN MISSOURI MERAMEC ENERGY CENTER, MERAMEC PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATEPLANE MISSOURI EAST FIPS 2401 FEET.

0 500 1,000
Feet

CLIENT
AMEREN MISSOURI
MERAMEC ENERGY CENTER

Ameren

PROJECT
CCR GROUNDWATER MONITORING PROGRAM

TITLE
POTENTIOMETRIC SURFACE MAP - OCTOBER 3, 2019

CONSULTANT

GOLDER

YYYY-MM-DD	2019-10-18
PREPARED	AMM
DESIGN	JSI
REVIEW	RJF
APPROVED	MNH

PROJECT No.	PHASE	FIGURE
153-140601	0004	A20

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0004 - Meramec Energy\800 - FIGURES-DRAWINGS\PRODUCTION\Nature and Extent\2019\2019-10-03 - Pot Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 0 1 in

APPENDIX B

Groundwater Sampling Methods and Procedures

Groundwater Sampling Methodology and Procedures

Groundwater Monitoring Plan

Ameren Missouri
1901 Chouteau Avenue, St. Louis, Missouri 63103

Golder Associates Inc.
13515 Barrett Parkway Drive, Suite 260, Ballwin, Missouri, USA 63021

+1 314 984-8800

153140601

November 2019

Table of Contents

1.0 INTRODUCTION

Sampling will be performed in accordance with generally accepted practices within the industry and with the provisions of Missouri regulations. This document is an appendix to the Groundwater Monitoring Plan and provides details regarding the procedures that will be used to collect groundwater samples. Although this appendix provides references to specific forms, the use of other equivalent forms to record the necessary data is permissible.

2.0 GROUNDWATER SAMPLING METHODOLOGY

2.1 Monitoring Well Inspection

Prior to performing any water purging or sampling, each monitoring well will be inspected to assess its integrity. The condition of each monitoring well will be evaluated for any physical damage or other breach of integrity. The security of each monitoring well will be assessed in order to confirm that no outside source constituents have been introduced to the monitoring well.

2.2 Monitoring Well Purging

Prior to collecting samples, each monitoring well will be purged. Purging will be accomplished using either:

- Low-flow (a.k.a., minimal drawdown, or micropurge) techniques
- Traditional purging techniques where at least three well volumes are evacuated before samples are collected

2.2.1 Low-Flow Sampling Technique

Low-flow groundwater sampling procedures will be used for purging and sampling monitoring wells that are equipped with dedicated pumps/tubing and will sustain a pumping rate of at least 100 milliliters per minute (ml/min). Water will be purged from these wells at low rates in order to minimize drawdown in the well during purging and sampling. Depth to water measurements and field water quality parameters (temperature, pH, turbidity, and conductivity) recorded during purging will be used as criteria to determine when purging has been completed. Sample collection will be initiated immediately after purging at each well.

During water purging, wells will be pumped at rates that minimize drawdown in the well. Purging rates in the range of 100-500 ml/min typically will be used; however, higher rates may be used if sustained by the well. Stabilization of the water column is achieved when three consecutive water level measurements vary by 0.3-foot or less at a pumping rate of no less than 100 ml/min (United States Environmental Protection Agency [USEPA], 2010).

At a minimum, field water quality parameter measurements of temperature, pH, turbidity, and conductivity, will be measured during purging at each well. Prior to collecting the initial set of field water quality parameters, the water in the sampling pump and discharge tubing (i.e., pump system volume) remaining from the previous sampling event will be removed.

After evacuating the water in the pump system, field measurements will begin. Depth to water measurements and field water quality parameter measurements will be made during purging. If a field meter equipped with a flow cell is used, an amount of water equal to the volume of the flow cell should be allowed to pass through the flow cell between individual field stabilization measurements. Stabilization will be attained and purging considered complete when three consecutive measurements of each field parameter vary within the following limits:

- ± 0.2 for pH

- ± 3% for Conductivity
- ± 10% for Temperature
- Less than 10 nephelometric turbidity units (NTU) or ± 10% for Turbidity

All data gathered during monitoring well purging will be recorded on a form, an example of which is included in **Appendix A**.

2.3 Traditional Purge Techniques

If low-flow sampling is not performed, wells will be purged a minimum of 3 well volumes before collecting a sample. Purging procedures will generally follow those for low-flow sampling including measurement of the field parameters listed above with two exceptions:

- Higher flow rate may be used during purging
- Purging is completed after a minimum of 3 well volumes have been removed (see below)

Even where low-flow sampling is not performed, the sampling goals are to:

- Stabilize field parameters (listed in previous section) prior to collecting samples
- Minimize drawdown in the well

When traditional purge techniques are used, field stabilization measurements will be collected at the beginning of purging and between each well volume purged. The stability criteria will be those described above for low-flow sampling.

2.3.1 Low Yielding Wells

If a monitoring well purges dry, it will be allowed to recover up to 24 hours before samples are collected. No additional purging will be performed after initially purging the monitoring well dry. If recharge is insufficient to fill all necessary sample containers, samplers will note this on the field form, and fill as many sample containers as possible.

3.0 CALIBRATION, FIELD DOCUMENTATION, AND LABORATORY DOCUMENTATION

3.1 Equipment Calibration

Equipment used to record field water quality parameters will be calibrated each day prior to use following manufacturers’ recommendations. Calibration solutions for standardization materials will be freshly prepared or from non-expired stock. In the absence of manufacturer or regulatory guidance, field equipment should be calibrated to within +/- 10 percent of the standard (or 0.1 standard units for pH meters). Equipment that fails calibration may not be used. Calibration records will be maintained. A sample field Instrument Calibration Form is included in **Appendix A.**

3.1.1 Sample Collection

Sampling should take place immediately after purging is complete. Samples will be transferred directly from field sampling equipment into containers supplied by the analytical laboratory appropriate for the constituents being monitored. Sample containers will be kept closed until the time each set of sample containers is filled.

3.1.2 Equipment Decontamination

All non-dedicated field equipment that is used for purging or sample collection shall be cleaned with a phosphate-free detergent and triple-rinsed, inside and out, with deionized or distilled water prior to use and between each monitoring well. Decontamination water shall be disposed of at an Ameren approved location. Any disposable tubing used with non-dedicated pumps should be discarded after use at each monitoring well. Clean latex or nitrile gloves will be worn by sampling personnel during monitoring well purging and sample collection.

3.1.3 Sample Preservation and Handling

In accordance with §257.93 of the CCR Rule, groundwater samples collected as part of the monitoring program will not be filtered prior to analysis. Once groundwater samples have been collected and preserved in laboratory supplied containers, they will be packed into insulated, ice-filled coolers to be maintained at a temperature as close as possible to 4 degrees Celsius. Groundwater samples will be collected in the designated size and type of containers required for specific parameters. Sample containers will be filled in such a manner as not to lose preservatives by spilling or overfilling. Samples will be delivered to the laboratory or sent via overnight courier following chain-of-custody procedures.

3.1.4 Chain-of-Custody Program

The chain-of-custody (COC) program will allow for tracing sample possession and handling from the time of field collection through laboratory analysis. The COC program includes sample labels, sample seals, field Groundwater Sample Collection Forms, and COC record. A sample Chain-of-Custody (COC) form is provided in **Appendix A**.

Each sample will be assigned a unique sample identification number to be recorded on the sample label. The sample identification number for all samples will be designated differently based on the nature of the samples. Each sample identification number and description will be recorded on the field Groundwater Sample Collection Form and on the COC document.

3.1.5 Sample Labels

Sample labels sufficiently durable to remain legible when wet will contain the following information, written with indelible ink:

- Site and sample identification number
- Monitoring well number or other location
- Date and time of collection
- Name of collector
- Parameters to be analyzed
- Preservative, if applicable

3.1.6 Sample Seal

The shipping container will be sealed to prevent the samples from being disturbed during transport to the laboratory.

3.1.7 Field Forms

All field information must be completely and accurately documented to become part of the final report for the groundwater monitoring event. Example field forms are included in **Appendix A**. The field forms will document the following information:

- Identification of the monitoring well
- Sample identification number
- Field meter calibration information
- Water level depth
- Purge volume
- Time monitoring well was purged
- Date and time of collection
- Parameters requested for analysis
- Preservative used
- Field water quality parameter measurements
- Field observations on sampling event
- Name of collector(s)
- Weather conditions including air temperature and precipitation

3.1.8 Chain-of-Custody Record

The COC record is required for tracing sample possession from time of collection to time of receipt at the laboratory. The National Enforcement Investigations Center (NEIC) of USEPA considers a sample to be in custody under any of the following conditions:

- It is in the individual’s possession
- It is in the individual’s view after being in their possession
- It was in the individual’s possession and they locked it up
- It is in a designated secure area

All environmental samples will be handled under strict COC procedures beginning in the field. The field team leader will be the field sample custodian and will be responsible for ensuring that COC procedures are followed. A COC record will accompany each individual shipment. The record will contain the following information:

- Sample destination and transporter
- Sample identification numbers
- Signature of collector
- Date and time of collection
- Sample type
- Identification of monitoring well
- Number of sample containers in shipping container
- Parameters requested for analysis
- Signature of person(s) involved in the chain of possession
- Inclusive dates of possession

A copy of the completed COC form will be placed in a water-resistant bag and accompany the shipment and will be returned to the shipper after the shipping container reaches its destination. The COC record will also be used as the analysis request sheet. When shipping by courier, the courier does not sign the COC record: copies of shipping forms are retained to document custody.

3.1.9 Temperature Control and Sample Transportation

After collection, sample preservation, and labeling, sample containers will be placed in coolers containing water-ice with the goal of reducing the groundwater samples to a temperature of approximately 4°C or less. All samples included in the shipping container will be packed in such a manner to minimize the potential for container breakage. Samples will be either hand-delivered or shipped via commercial carrier to the certified analytical laboratory. Custody seals will be placed on the shipping containers if a third-party courier is used.

4.0 ANALYTICAL AND QUALITY CONTROL PROCEDURES

4.1.1 Data Quality Objectives

As part of the evaluation component of the Quality Assurance (QA) program, analytical results will be evaluated for precision, accuracy, representativeness, completeness, and comparability (PARCC). These are defined as follows:

- Precision is the agreement or reproducibility among individual measurements of the same property, usually made under the same conditions
- Accuracy is the degree of agreement of a measurement with the true or accepted value
- Representativeness is the degree to which a measurement accurately and precisely represents a characteristic of a population, parameter, or variations at a sampling point, a process condition, or an environmental condition
- Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions
- Comparability is an expression of the confidence with which one data set can be compared with another data set in regard to the same property

The accuracy, precision and representativeness of data will be functions of the sample origin, analytical procedures and the specific sample matrices. Quality Control (QC) practices for the evaluation of these data quality indicators include the use of accepted analytical procedures, adherence to hold time, and analysis of QC samples (e.g., blanks, replicates, spikes, calibration standards and reference standards).

Quantitative QA objectives for precision and accuracy, along with sensitivity (detection limits) are established in accordance with the specific analytical methodologies, historical data, laboratory method validation studies, and laboratory experience with similar samples. The Representativeness of the analytical data is a function of the procedures used to process the samples.

Completeness is a qualitative characteristic which is defined as the fraction of valid data obtained from a measurement system (e.g., sampling and analysis) compared to that which was planned. Completeness can be less than 100 percent due to poor sample recovery, sample damage, or disqualification of results which are outside of control limits due to laboratory error or matrix-specific interferences. Completeness is documented by including sufficient information in the laboratory reports to allow the data user to assess the quality of the results. The overall completeness goal for each task is difficult to determine prior to data acquisition. For this project, all reasonable attempts will be made to attain 90% completeness or better (laboratory).

Comparability is a qualitative characteristic which allows for comparison of analytical results with those obtained by other laboratories. This may be accomplished through the use of standard accepted methodologies, traceability of standards to the National Bureau of Standards (NBS) or USEPA sources, use of appropriate levels of quality control, reporting results in consistent, standard units of measure, and participation in inter-laboratory studies designed to evaluate laboratory performance.

Data quality and the standard commercial report package will be evaluated with respect to PARCC criteria using the laboratory's QA practices, use of standard analytical methods, certifications, participation in inter-laboratory studies, temperature control, adherence to hold times, and COC documentation (also called Data Validation).

4.1.2 Quality Assurance/Quality Control Samples

This section describes the various Quality Assurance/Quality Control (QA/QC) samples that will be collected in the field and analyzed in the laboratory and the frequency at which they will be performed.

4.1.2.1 Field Equipment Rinsate Blanks

In cases where sampling equipment is not dedicated or disposable, an equipment rinsate blank will be collected. The equipment rinsate blanks are prepared in the field using laboratory-supplied analyte-free water. The water is poured over and through each type of sampling equipment following decontamination and submitted to the laboratory for analysis of target constituents. **One rinsate blank will be collected for every 10 samples.**

4.1.2.2 Field Duplicates

Field duplicates are collected by sampling the same location twice, but the field duplicate is assigned a unique sample identification number. Samplers will document which location is used for the duplicate sample. **One field duplicate will be collected for every 10 samples.**

4.1.2.3 Field Blank

Field blanks are collected in the field using laboratory-supplied analyte-free water. The water is poured directly into the supplied sample containers in the field and submitted to the laboratory for analysis of target constituents. **One field blank will be collected for every 10 samples.**

4.1.2.4 Laboratory Quality Control Samples

The laboratory will have an established QC check program using procedural (method) blanks, laboratory control spikes, matrix spikes, and duplicates. Details of the internal QC checks used by the laboratory will be found in the laboratory QAP and the published analytical methods. These QC samples will be used to determine if results may have been affected by field activities or procedures used in sample transportation or if matrix interferences are an issue. **One (1) Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) set** (i.e. one sample plus one MS, and one MSD sample at one location) **will be collected per 20 samples.** MS/MSD samples will have a naming convention as follows:

- Sample: MW-1
- MS: MW-1-MS
- MSD: MW-1-MSD

5.0 REFERENCES

MDNR. 2011. Missouri Well Construction Rules. Missouri Department of Natural Resources Division of Geology and Land Survey. Rolla, MO. August 2011.

USEPA. 2010. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells., U.S. Environmental Protection Agency, Revised January 19, 2010.

APPENDIX A

Example Field Forms

GOLDER

Sheet ___ of ___

WELL DEVELOPMENT/PURGING FORM

Project Ref: ______________________ **Project No.:** ______________________

Location ☐

Monitored By: ☐ Date ☐ Time ☐

Well Piezometer Data

(*circle one)*

Depth of Well (from top of PVC or ground) ☐ feet

Depth of Water (from top of PVC or ground) ☐ feet

Radius of Casing ☐ inches
☐ feet

Casing Volume ☐ cubic feet
☐ gallons

Development / Purging Discharge Data

Purging Method ☐

Start Purging Date ☐ Time ☐

Stop Purging Date ☐ Time ☐

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°__)	pH	Spec.Cond. (__S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments

GOLDER

GROUNDWATER SAMPLE COLLECTION FORM

Project Ref: ______________________________ **Project No. :**________________

WEATHER CONDITIONS

Temperature ____________________ Weather ______________________________

SAMPLE INFORMATION

Sample Location ______________________ Sample No. ____________________
Sample Date ______________ Time __________ Sample By____________________
Sample Method ______________________ Sample Type____________________

Water Level Before Purging: ______________________
Well Volume: ______________________
Volume Water Removed Before Sampling: ______________________
Water Level Before Sampling: ______________________
Water Level After Sampling: ______________________
Appearance of Sample: ______________________

FIELD MEASUREMENTS

Parameter	Units	Measurement	Measurement	Measurement	Measurement	Sample
Time	hhmm					
Volume Discharge	gals					
pH	Standard					
Spec. Cond.	___S/CM					
Turbidity	NTU					
Temperature	°___					
Dissolved Oxygen	mg/l					
Redox Potential	+/- mV					

LABORATORY CONTAINERS

Sub-Sample	Analysis Requested	Type and Size of Sample Container	Filtered (Yes or No)	Type of Preservative
1				
2				
3				
4				
5				
6				
7				
8				

REMARKS: ______________________________

NA = Not applicable

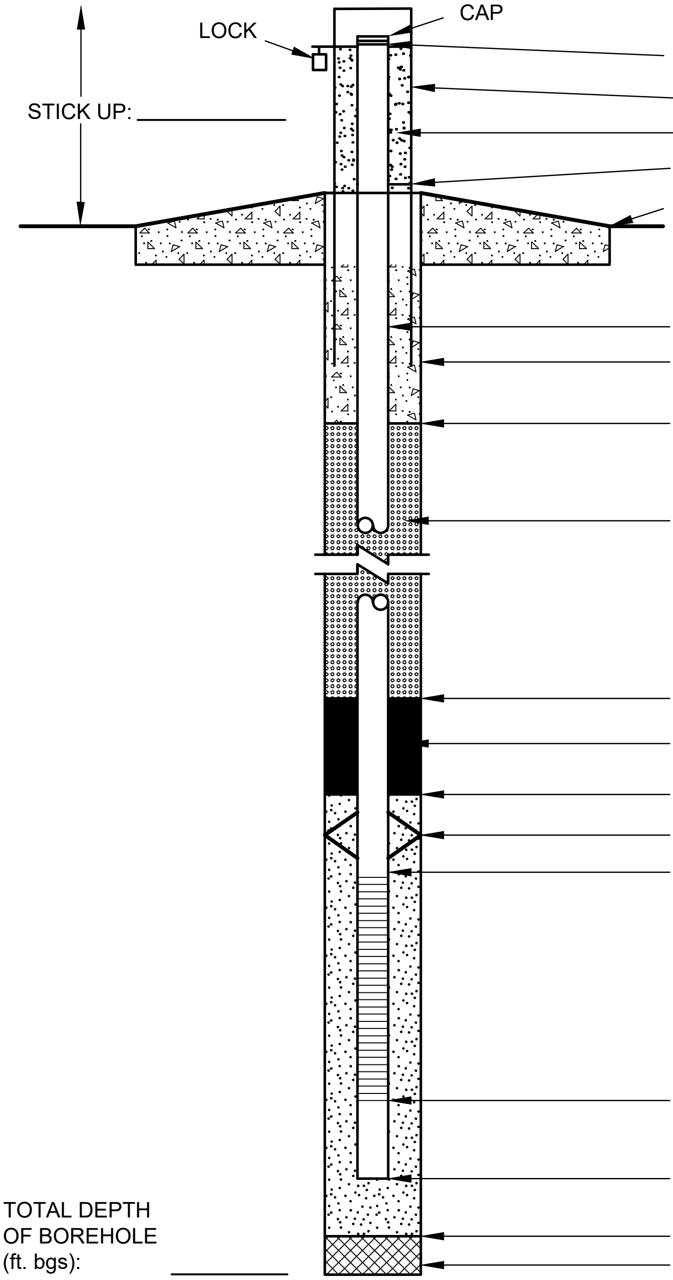
SAMPLING METHODS:

Bailer:	PVC/PE	Peristaltic Pump	Air-Lift Pump
	Stainless Steel	Submersible Pump	Other___________
	Teflon	Hand Pump	

GOLDER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG ________________

PROJECT NAME:		PROJECT NUMBER:
SITE NAME:		LOCATION:
CLIENT:		SURFACE ELEVATION:
GEOLOGIST:	NORTHING:	EASTING:
DRILLER:	STATIC WATER LEVEL:	COMPLETION DATE:
DRILLING COMPANY:		DRILLING METHODS:



TOP OF CASING ELEVATION: ________________

PROTECTIVE CASING (yes / no): ________________

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: ________________

DIAMETER OF RISER PIPE (in.): ________________

DIAMETER OF BOREHOLE (in.): ________________

CONCRETE SEAL DEPTH (ft. bgs): ________________

TYPE AND AMOUNT OF ANNULAR SEAL: ________________

TOP OF BENTONITE SEAL DEPTH (ft. bgs): ________________

TYPE AND AMOUNT OF BENTONITE SEAL: ________________

TOP OF SAND PACK DEPTH (ft. bgs): ________________

CENTRALIZER (yes / no) - TYPE: ________________

TOP OF SCREEN DEPTH (ft. bgs): ________________

TYPE OF SCREEN: ________________

SCREEN SLOT SIZE (in.): ________________

SIZE OF SAND PACK: ________________

AMOUNT OF SAND: ________________

BOTTOM OF SCREEN DEPTH (ft. bgs): ________________

BOTTOM OF WELL DEPTH (ft. bgs): ________________

TOTAL DEPTH
OF BOREHOLE
(ft. bgs): ____________

BOTTOM OF FILTER PACK (ft. bgs): ________________

TYPE AND AMOUNT OF BACKFILL: ________________

ADDITIONAL NOTES: ____

CHECKED BY: ________________

DATE CHECKED: ________________

PREPARED BY: ________________

GOLDER

RECORD OF WATER LEVEL READINGS

Project Name: ___________________________ **Location:** ___________________________________ **Project No.:** _____________________________

Borehole No.	Date	Time	Measuring Device / Serial No.	Measurement Point (M.P)	Water Level Below M.P.	Correction To Survey Mark	Survey Mark Elevation	Water Level Elevation	By	Comments

Sheet ___ of ___

GOLDER

INSTRUMENT CALIBRATION FORM

Project Name: ____________________________ **Project No:** ______________________

Calibration By:

Instrument Details

Instrument Name	
Serial No.	
Model No.	

Calibration Details

Required Calibration Frequency/Last Calibration	
Calibration Standard	
Calibration Standard(s) Expiration Date	

Calibration:

Date	Time	**Calibration Standard** Units: ___________	**Instrument Reading** Units: _________

Comments:

>>> Select a Laboratory <<<

Chain of Custody Record

#N/A
#N/A
#N/A
#N/A

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_______ of ______ COCs
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below _________			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)																		Sample Specific Notes:
Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= Other ______________																									

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for__________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No

Custody Seal No.:

Cooler Temp. (°C): Obs'd:_________ Corr'd:__________ Therm ID No.:____________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Golder Associates

Field Boring Log

DEPTH HOLE ______________ **PROJ. NO.** ______________ **PROJECT** ____________________ **BORING NO.** ______________

DEPTH SOIL DRILL ________ **GA INSP.** ______________ **DRILLING METHOD** ____________________ **SHEET** ________ **OF** ________

DEPTH ROCK CORE_______ **WEATHER** ______________ **DRILLING COMPANY** ____________________ **SURFACE ELEV.** ______________

ABANDONMENT____________________ **DRILL RIG** ______________ **DRILLER** ______________ **DATUM** ______________

DEPTHS_________/_________/_________/_________ **SAMPLER HAMMER TYPE** ______________ **WT.** ________ **DROP**_______ **STARTED** ________/________
WATER LEVEL CAVE-IN DATE-TIME NOTE TIME DATE

DEPTHS_________/_________/_________/_________ **HOLE LOCATION** ____________________ **COMPLETED** ________/________
(DELAYED) WATER LEVEL CAVE-IN DATE-TIME NOTE TIME DATE

SAMPLE TYPES

	A.S.	AUGER SAMPLE
	C.S.	CHUNK SAMPLE
*	D.O.	DRIVE OPEN (SPT)
	D.S.	DENISON SAMPLE
	F.S.	FOIL SAMPLE
	P.S.	PITCHER SAMPLE
	S.C.	SOIL CORE
*	T.O.	THIN-WALLED, OPEN
*	T.P.	THIN-WALLED, PISTON
	W.S.	WASH SAMPLE
*	____	________________
*	____	________________
*	____	________________

* NOTE SIZE

ABBREVIATIONS

ANG	ANGULAR	GR	GRAY	R	RED
BL	BLACK	HE	HETEROGENEOUS	RES	RESIDUAL
BR	BROWN	HO	HOMOGENEOUS	RX	ROCK
C	COARSE	LYD	LAYERED	RND	ROUNDED
CIN	CAVE-IN	M	MEDIUM	SAT	SATURATED
CO	COHESIVE	MIC	MICACEOUS	SD	SAND
CL	CLAY	MOT	MOTTLED	SI	SILT
CLY	CLAYEY	MST	MOIST	SIY	SILTY
D	DRY	NC	NON-COHESIVE	SM	SOME
EL	ELONGATED	NP	NON-PLASTIC	TR	TRACE
F	FINE	OG	ORANGE	WL	WATER LEVEL
FL	FLAT	ORG	ORGANIC	WH	WEIGHT OF HAMMER
FRAG	FRAGMENTS	PP	POCKET PEN.	WR	WEIGHT OF RODS
GL	GRAVEL	PL	PLASTIC LIMIT	Y	YELLOW

ORDER OF DESCRIPTION

CONSTITUENTS
1) GROUP SYMBOL
2) SOIL GROUP NAME
3) PRIMARY COMPONENTS
4) SECONDARY COMPONENTS
5) MINOR COMPONENTS ;

PLUS DESCRIPTION:
CL/SI: PLASTICITY
SD: SIZE, GRADING
GL: SIZE, GRADING, SHAPE, ROCK TYPE

GENERAL
6) COLOR
7) WEATHERING
8) STRUCTURE
9) SENSITIVITY
10) CONTAMINATION
11) MINEROLOGY
12) ORIGIN ;

BEHAVIOR
13) BEHAVIOR (CO/NC)
14) MOISTURE/WATER CONTENT
15) DENSITY/CONSISTENCY

PROPORTIONS

"TRACE"	0 – 5%
"SOME"	5 – 12%
PREFIX "-Y"	12 – 35%
"AND"	35 – 50%

NON-COHESIVE SOILS

RELATIVE DENSITY		BLOWS
VERY LOOSE	VLS	0 – 4
LOOSE	LS	4 – 10
COMPACT	CP	10 – 30
DENSE	DN	30 – 50
VERY DENSE	VDN	>50

MOISTURE CONDITION

DRY	SOIL FLOWS
MOIST	FEELS COOL
WET	WITH FREE WATER

COHESIVE SOILS

CONSISTENCY		PP(TSF)	FINGER PRESSURE
VERY SOFT	VS	<0.25	EXTRUDES
SOFT	S	0.25 - 0.5	MOLDS EASILY
FIRM	FM	0.5 – 1	MOLDS
STIFF	ST	1 – 2	THUMB INDENTS
VERY STIFF	VST	2 – 4	THUMBNAIL INDENTS
HARD	H	>4	RESISTS THUMBNAIL

WATER CONTENT - W

W < PL	CANNOT ROLL 4 mm THREAD
W ~ PL	CAN ROLL THREAD 2 – 4 mm
W > PL	CAN ROLL THREAD <2 mm

ELEV. / DEPTH	LITHOLOGY	SAMPLES						CONSTITUENTS			BEHAVIOR			USCS	SAMPLE DESCRIPTION AND DRILLING NOTES
		NO.	TYPE	DEPTH	SPT N / PP(TSF)	BLOWS PER 6 IN	REC / ATT	GL	SD	CL/SI	CO or NC	MOIST. or W	DENS./ CONS.		

PROPORTION; SIZE, SHAPE, GRADING; PLASTICITY

Dec 2012

APPENDIX C

Statistical Analysis Plan

Corrective Action Statistical Analysis Plan

Meramec Energy Center - St. Louis County, Missouri

Submitted to:

Ameren Missouri
1901 Chouteau Avenue, St. Louis, Missouri 63103

Submitted by:

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November 2019

Executive Summary

This Corrective Action Statistical Analysis Plan (SAP) was developed to meet the requirements of United States Environmental Protection Agency (USEPA) 40 CFR Part 257 “Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule” (the Rule or CCR Rule), specifically § 257.98(a)(1) on the Implementation of a Corrective Action Program. This section of the CCR Rule requires owners or operators establish and implement a Corrective Action Groundwater Monitoring Plan (GMP) within 90 days of selecting a remedy. On August 30, 2019 Ameren Missouri (Ameren) selected the remedy of source control through installation of a low permeability cover system and use of Monitored Natural Attenuation (MNA) for groundwater impacts from the Meramec Surface Impoundments at the Meramec Energy Center (MEC).

As a part of the groundwater sampling and analysis requirements of the Rule, statistical methods as described in Section §257.93(f) of the Rule need to be implemented to statistically evaluate groundwater quality. The selected statistical method must then be certified by a qualified Professional Engineer stating that the statistical method is appropriate for evaluating the groundwater monitoring data for the CCR Unit. Detailed descriptions of the acceptable statistical data methods are provided in the USEPA’s “Statistical Analysis of Groundwater Data at RCRA Facilities, Unified Guidance” (USEPA, 2009) (Unified Guidance). The Unified Guidance is also recommended in the CCR Rule to be used for guidance in the selection of the appropriate statistical evaluation method.

This SAP details the statistical procedures to be used for Corrective Action monitoring for Ameren Missouri at the above mentioned CCR Unit. Details on statistical analysis for detection monitoring and assessment monitoring are provided in the GMP for the MEC and are not included in this document. Detailed information on collection, sampling techniques, preservation, etc. are provided in the Corrective Action Groundwater Monitoring Plan (GMP) for the CCR Unit specified above. This SAP is a companion document to the GMP and assumes that data analyzed by the procedures described in this SAP are from samples that were collected in accordance with the Corrective Action GMP.

This SAP was prepared by Golder Associates Inc. (Golder), on behalf of Ameren, to document appropriate methods of groundwater data evaluation in compliance with CCR Rules. The methods and groundwater data evaluation techniques used in this SAP are appropriate for evaluation of the groundwater monitoring data for the above mentioned CCR Unit and are in compliance with performance standards outlined in the CCR Rule.

Table of Contents

TABLES

1.0 INTRODUCTION

This SAP discusses the procedures, methods, and processes that will be implemented as part of the Corrective Action statistical evaluation. Corrective Action statistical analysis will begin once source control through the installation of a low permeability cover system is complete. Additionally, as specified in the Corrective Action GMP, a minimum of eight rounds of sampling for all constituents present at a Statistically Significant Level (SSL) from Assessment Monitoring will be collected prior to initiating statistical analysis. This background monitoring period provides baseline data for each monitoring well which can be used as the basis of the statistical evaluation.

2.0 STATISTICAL DATA PREPARATION AND INITIAL REVIEW

Many of the statistical comparison tests used in Corrective Action monitoring require various analyses to be completed prior to the data being used for the calculation of statistical limits. This section discusses the methods and procedures for completing the initial review of the data. The analyses required include testing for statistical independence, physical independence, and procedures to evaluate potential outliers.

2.1.1 Physical and Statistical Independence of Groundwater Samples

Corrective Action Monitoring statistical evaluations assume that background and downgradient sampling results are statistically independent. The Unified Guidance states that *"Physical independence of samples does not guarantee statistical independence, but it increases the likelihood of statistical independence."* (Section 14.1, Unified Guidance). Physical independence is most likely achieved when consecutive groundwater samples are collected from independent volumes of water within a given aquifer zone. Using the Darcy Equation, minimum time intervals between sampling events can be calculated to confirm the minimum time interval for groundwater to travel through the borehole is less than the time between sampling events (**Table 1, Physical Independence**). This minimum time can be calculated as displayed in Section *14.3.2* of the Unified Guidance. This table displays the range of conductivities collected onsite. If a sampling frequency less than those provided below are to be used, then well specific calculations will need to be completed to ensure that the samples will be physically independent.

Table 1: Physical Independence

Well ID	Hydraulic Conductivity	Average Hydraulic Gradient	Effective Porosity	Well Bore Volume	Minimum Time
Symbol	K	I	n	D	T_{min}
Units	Feet/Day	Feet/Foot	%	Feet	Days
CCR Rule Monitoring Wells					
Minimum	3	0.0021	0.35	0.5	29.4
Geomean	40	0.0021	0.35	0.5	2.1
Maximum	185	0.0021	0.35	0.5	0.4

Notes:

1. Average hydraulic gradient and effective porosity obtained from GMP
2. Hydraulic conductivity obtained from ranges provided in GMP
3. Calculation completed using the Darcy Equation as outlined in section 14.3.2 of the Unified Guidance.

2.1.2 Data Review – Testing for Outliers

Careful review of the data is critical for verifying that there is an accurate representation of the groundwater conditions. Early identification of anomalous data (outliers) helps play a key role in a successful SAP. Possible causes for outliers include:

- Sampling error or field contamination;
- Analytical errors or laboratory contamination;
- Recording or transcription errors;
- Faulty sample preparation, preservation, or shelf-life exceedance; or
- Extreme, but accurately detected environmental conditions (e.g., spills, migration from the facility).

The following sections outline a few graphical and statistical tests that should be completed prior to using the data to calculate statistical limits.

2.1.2.1 Time Series Plots

Time Series plots are a quick and simple method to check for possible outliers. Time series plots should be generated with the concentration of the analyte on the Y-axis and the sample date (time) on the X-axis. If any data points look to be potential outliers, the data should be flagged and further evaluated as described in Section 2.1.2.2 below.

2.1.2.2 Dixon’s and Rosner’s Tests

If graphical methods demonstrate that potential outliers exist, further investigation of these data points can be completed using Dixon’s test for datasets with fewer than 25 samples and Rosner’s test with datasets greater than 20 samples. Formal testing should only be performed if an observation seems particularly high compared to the rest of the dataset. If statistical testing is to be completed to whether an outlier exists, it should be cautioned that these outlier tests assume that the rest of the data (other than the outlier) are normally distributed. Additionally, because log-normally distributed data often contain one or more values that appear high relative to the rest, it is recommended that the outlier test be run on the transformed values instead of their original observations. This way, one can avoid classifying a high log-normal measurement as an outlier just because the test assumptions were violated. Most groundwater statistical packages can complete Dixon’s and Rosner’s tests and more information about Dixon’s and Rosner’s tests is provided in Sections 12.3 and 12.4 of the Unified Guidance. If the test designates an observation as a statistical outlier, the source of the abnormal measurement should be investigated. In general, if a data point is found to be a statistical outlier, it should not be used for statistical evaluation. However, outlier removal should be performed carefully, and typically only when a specific cause for the outlier can be identified.

In some cases where a specific cause for an outlier cannot be identified, professional judgment can be used to determine whether the outlier significantly affects the statistical results to the extent that removal is deemed necessary. If an outlier value with much higher concentration than other background observations is not removed from background prior to statistical testing, it will tend to increase both the background sample mean and standard deviation. In turn, this may substantially raise the magnitude of the prediction limit or control limit calculated from that data set. Thus, experience shows that it is a good practice to remove obvious outliers from the database even when independent evidence of the source of the outlier does not exist. The removal of outliers tends to normalize the data and therefore produce a more robust statistical limit. Outlier removal also tends to produce a more conservative statistical limit, since the data variability is decreased, thereby decreasing the standard deviation.

2.1.3 Calculate for Mean and Standard Deviation

Following outlier removal, initial summary statistics including mean and standard deviation should be calculated for the background monitoring well datasets. While these summary statistics are easily completed in many groundwater statistical software packages, it is important to account for values that have low or zero values as described below.

2.1.3.1 Reporting of Low and Zero Values

2.1.3.1.1 Estimated Values (J Flag)

Estimated values are values that have a concentration between the method detection limit (MDL[1]) and the practical quantitation limit (PQL[2]) for any given compound. These values are typically displayed with a J flag in laboratory report packages and are often referred to as “J-values”. In most cases, The Unified Guidance recommends using the estimated value provided for statistical evaluation. Estimated values are typically used because the accuracy and power of most statistical evaluations lose power as the percentage of non-detects (NDs) increases. While they are below the PQL, estimated values are considered detectable concentrations for statistical calculations, which has the effect of lowering the percentage of NDs.

This “rule” should be applied with care, as there is an exception. Estimated values are not considered detectable concentrations if all values for a single constituent are less than the PQL. In these cases, the Double Quantification Rule (DQR) as described in this CCR Units GMP should be used.

2.1.3.1.2 Non-Detects Values (ND)

Non-Detect Values (ND) are concentrations that were not detected at a concentration above the MDL. ND values are typically displayed with a “U” or “ND” flag in laboratory data report packages. The following approaches for managing ND values are based on recommendations in the Unified Guidance and are applicable for use with the statistical evaluation procedures that will be further discussed and used in this SAP (prediction intervals, confidence intervals, and tolerance intervals):

- If <15% ND below the PQL, substitute ½ the PQL;
- If between 15% to 50% ND below the PQL, use the Kaplan-Meier or robust regression on ordered statistics to estimate the mean and standard deviation;
- If >50% but less than 100% ND below the PQL, use a non-parametric test; or
- If 100% of values are less than the PQL, use the Double Quantification Rule (If necessary)

---

[1] MDL = lowest level of an analyte (substance) that the laboratory can reliably detect with calibrated instrumentation; generally based on results of an annual “MDL study” performed in accordance with 40 CFR Part 136, Appendix B; MDLs are generally set using laboratory grade deionized water spiked with a known concentration and thus do not account for effects of matrix interference inherent in typical groundwaters.

[2] PQL = minimum concentration of an analyte (substance) that can be measured with a high degree of confidence that the analyte is present at or above that concentration (typically 5-10x higher than the MDL).

2.1.4 Data Distribution

Statistical evaluations of groundwater data require an understanding of the data distribution for each analyte in each monitoring well. Data typically fall into one of the following distributions:

- **Normal distribution** – Sometimes referred to as Gaussian distribution, a normal distribution is a common continuous distribution where data form a symmetrical bell-shaped curve around a mean. Normally distributed data are tested using parametric methods.
- **Transformed-normal distribution** – Similar to a normal distribution, however, data are asymmetrical until transformation is applied to all data which then causes it to form a bell-curve. Transformed-normal data distributions are also tested use parametric methods.
- **Non-Normal Distribution** – When the data are not or cannot be transformed into a symmetrical distribution. Non-normal data distributions are tested using Non-parametric methods.

Testing for data distributions can be completed in several different ways including the skewness coefficient, probability plots with Filliben's test, or the Shapiro-Wilk/Shapiro-Francia Test. All of these methods may be employed, however, the Shapiro-Wilk and Shapiro-Francia tests are generally considered the best method according to the Unified Guidance. The Shapiro-Wilk test is best for sample sizes under 50 while the Shapiro-Francia test is best with larger datasets of 50 or more observations. Most groundwater statistical software packages can complete both Shapiro-Wilk and Shapiro-Francia tests and a detailed discussion of the testing procedures is provided in Section *10.5.1* of the Unified Guidance.

Based on the outcome of the data distribution testing, data will use either Parametric or Non-parametric tests. It is important to note that non-parametric testing usually requires larger datasets in order to minimize the Site Wide False Positive Rate (SWFPR) therefore when the raw data are not normally distributed, a transformed-normal distribution is preferred when possible.

2.1.5 Temporal Trend

Most statistical tests assume that the sample data are statistically independent and identically distributed. Therefore, samples collected over a period of time should not exhibit a time dependence. A time dependence could include the presence of trends or cyclical patterns when observations are graphed on a time series plot. Trend analysis methodologies test to see whether the dataset displays an increasing, decreasing, or seasonal trend.

If a trend is suspected, a Theil-Sen trend line should be used to estimate slope and the Mann-Kendall Trend Test should be used to evaluate the slope significance (Chapter 14, Unified Guidance). Following implementation of a successful remediation strategy, it is expected that CCR-related groundwater constituents concentrations will decrease with time. If a statistically significant trend is reported, based on a Sen's slope/Mann-Kendall trend test, it is inappropriate to perform "normal" statistical calculations (see Section 21.3 of the Unified Guidance). In such cases, an adjustment or an alternate method is required.

3.0 CORRECTIVE ACTION STATISTICAL EVALUATION

Following the removal of outliers and the performance of general statistics described in Section 2.0, the specific Corrective Action Statistical Evaluation will be completed. This evaluation is very similar to the Assessment Monitoring statistical procedures except the null hypothesis for the confidence intervals is reversed. For Corrective Action, the Unified Guidance states that the appropriate null hypothesis is that the groundwater population (mean) exceeds the GWPS for those constituents that exceed the GWPS under Assessment Monitoring program. Therefore, in Corrective Action the Upper Confidence Limit (UCL) is compared to the Groundwater Protection Standard (GWPS) instead of the Lower Confidence Limit (LCL) [as was used during Assessment Monitoring].

3.1 Statistical Power

One of the primary goals of the selection of a proper statistical evaluation method is to limit the potential for results to falsely trigger a compliance while also maintaining sufficient statistical power to detect when compliance is achieved. Falsely triggering compliance when groundwater concentrations are still statistically above the GWPS occurred is referred to as a false positive in corrective action. The False Positive Rate (FPR), typically denoted by the Greek letter α, is also known as the “significance level”. The FPR is the probability that a future compliance observation will be declared to be from a different statistical distribution than the background data. If the FPR is set too high, it can lead to the conclusion that there is evidence of impact when none exists. Conversely, if the FPR is set too low, it can lead to a false conclusion that no contamination exists, when it actually does exist (also known as a “false negative”). Ultimately, the ability to accurately identify compliance depends on the selection of an appropriate FPR, which is referred to as the statistical power. However, statistical analysis programs and the resulting decision making do not depend on each individual measurement/comparison error rates but are dependent on the collective error rate from all of the individual comparisons.

In Corrective Action monitoring, it is not possible to calculate a FPR or a site-wide false positive rate, as is calculated during Detection Monitoring. The Unified Guidance gives two methods for determining the statistical power in Corrective Action monitoring, both methods are dependent on the minimizing the FPR and at the same time minimizing the false negative rate. As stated in the Unified Guidance, ultimately, the statistical power of the confidence interval test will increase as the sample size increases, as long as the FPR is held constant. For this CCR Unit, an initial FPR of 0.05 is proposed for the confidence interval test methodology. Initially, when sample sizes are low, the overall power of the test will also be relatively low, but the power (and thus the confidence in making sound judgements relative to the success of the remedial efforts) will increase over time, as the sample size increases.

Ultimately, the goal of Corrective Action monitoring is to determine whether the selected remedy has been effective in cleaning up the groundwater to a point at which continued monitoring is no longer required. In that sense, the power of the statistical approach is important for confirming that the statistical method is accurately determining the end point of the remedial effort. Thus, particular caution will be exercised in situations where the compliance statistic (in this case, the upper confidence level (UCL), is at or near the compliance limit (in this case, the groundwater protection standard [GWPS]). Corrective Action monitoring will only be discontinued if it can be clearly demonstrated that the UCL is and will remain below the GWPS. Additional discussion is provided below regarding the specifics of the confidence interval method that will be used in Corrective Action monitoring.

3.2 Confidence Interval Approach

The statistical method for evaluating data in Correction Action is similar to the method that was used during Assessment Monitoring. Thus, intrawell confidence intervals will be calculated for each detected Appendix IV constituent in each well and the resulting confidence intervals will be compared with the appropriate Groundwater Protection Standard (GWPS). During the Assessment Monitoring phase of the program, a site wide GWPS generated for each detected Appendix IV constituent. Over time, as additional background data are collected, the GWPS will be updated accordingly, as described in Section 3.2.2, below.

3.2.1 Maximum Contaminant Level (MCL) Based GWPS

All the Appendix IV analytes have either an USEPA MCL or a health based GWPS that was adopted for Appendix IV parameters without an MCL (i.e. cobalt, lithium, molybdenum, and lead). As specified in Section §257.95(b) of the CCR Rule, the GWPS must either be the MCL (or adopted heath based standard), or a limit based on site-specific background data, whichever is greater. This section describes the methods to be used for statistical analysis when the MCL (or adopted heath based standard) is to be used as the GWPS. Additional discussion is provided below in Section 3.2.2 for situations where the site-specific background is greater than the MCL or health based standard.

For Corrective Action, the Unified Guidance recommends the confidence interval method to evaluate for potential compliance under the GWPS (Chapter 22, Unified Guidance). Using confidence intervals, potential compliance under the GWPS is identified by comparing the calculated confidence interval against the GWPS. A confidence interval statistically defines the upper and lower bounds of a specified population within a stipulated level of significance. Confidence intervals are required to be calculated based on a minimum of 4 independent observations, but a more representative confidence interval can be developed when all of the available data are used. As discussed in Section 3.1, above, the statistical power of the method increases with an increasing number of observations, so it is generally preferred that all available data be used to calculate the confidence interval. However, if trends are noted in the data, it may be necessary to exclude historical data prior to the trend, so that the confidence interval can be more accurately calculated. As described in preceding sections, it is expected that trends will develop following the implementation of remedial actions, and thus, it is likely that the well specific data sets will require adjustment over time to account for trends.

The specific type of confidence interval should be based the attributes of the data being analyzed, including: (1) the data distribution, (2) the detection frequency, and (3) potential trends in the data. **Table 2** below is based on Table 4-5 from the Electric Power Research Institute's *Groundwater Monitoring Guidance for the Coal Combustion Residual Rule* (2015), which displays the criteria for selecting an appropriate confidence interval. The method and procedure for calculating the UCL and LCL is provided in the section reference from the Unified Guidance, which is listed in the last column of **Table 2**, below.

Table 2: Confidence Interval Method Selection

Data Distribution	Non-detect Frequency	Data Trend	Confidence Interval Method
Normal	Low	Stable	Confidence Interval Around Normal Mean (Section 21.1.1)
Transformed Normal (Log-Normal)	Low	Stable	Confidence Interval Around Lognormal Arithmetic Mean (Section 21.1.3)
Non-normal	N/A	Stable	Nonparametric Confidence Interval Around Median (Section 21.2)
Cannot Be Determined	High	Stable	Nonparametric Confidence Interval Around Median (Section 21.2)
Statistical Trend Noted in Well Specific Data Set	Low	Trend	Confidence Band Around Theil-Sen Line (Section 21.3.2)

In a Corrective Action monitoring program, the UCL is of primary interest. If the UCL exceeds the GWPS, the constituent is still present at a concentration that is statistically above the GWPS; however, if the UCL is less than the GWPS, the constituent is below the GWPS. If the UCL is lower than the GWPS for three consecutive years, then the monitoring well is in considered to be in full compliance.

As discussed above in Section 3.1, during Corrective Action, a per test FPR (α) of 0.05 will be used as an initial error level for calculating the two-tailed confidence intervals for the compliance wells (which actually means 2.5% FPR per tail). In some cases, based on recommendations from the Unified Guidance, it is appropriate to adjust the FPR of the confidence interval based on the number of data points available as well as the distribution of the data being evaluated. If deemed necessary based on recommendations from the Unified Guidance, an approach is provided in Section 22 of the Unified Guidance for determining an appropriate per test FPR based on the data characteristics.

When performing Corrective Action monitoring statistical evaluations, it is important to evaluate the compliance data for shifts. If no shifts have occurred, then all of the available Appendix IV data for a particular constituent can be used in the statistical evaluation. If shifts are noted (typically based on qualitative evaluation of a time series plot), only the data collected after the shift should be used in the statistical evaluation.

3.2.2 Updating the GWPS

In general, the GWPS have already been established for each Appendix IV constituent at this CCR Unit. However, it may be necessary to update the GWPS in the future to account for changes in background constituent concentrations. Recalculating the GWPS by incorporating additional background data over time typically results in a more robust value for the GWPS. During Corrective Action monitoring, background or historical concentration limits should be assessed using the following techniques for each of the detected

Appendix IV analytes. These concentration limits should then be compared with the MCL or health-based value, and the higher of these two values will be used as the GWPS. Updates to the GWPS will only apply to those constituents whose site-specific background concentration is above the established MCL or health-based value. Additional details regarding the timeframes for updating the GWPS are provided in Section 3.4, below.

The Unified Guidance provides two acceptable approaches for establishing a non-MCL based GWPS. As described in the SAP of the this CCR Units GMP, for situations where the site-specific background is greater than the MCL/health base limit, the two methods for calculating the GWPS include the tolerance interval approach or the prediction interval approach, described further below.

3.2.2.1 Tolerance Interval Approach

If the background dataset is normally or transformed normally distributed, the Unified Guidance recommends Tolerance Intervals over the Prediction Intervals for establishing a GWPS. The GWPS should be based on a 95 percent coverage/95 percent confidence tolerance interval. If the background data are non-normal (even after transformation), then a large number of background observations are required to calculate a non-parametric tolerance interval (typically a minimum of 60 background observations are required to meet these requirements). If there is an insufficient number of background observations to calculate a non-parametric tolerance interval, then a non-parametric Prediction Interval approach should be used, as described in Section 3.2.2.2 below.

The Upper Tolerance Limit (UTL) is calculated for each required Appendix VI constituent. Tolerance Limits, as outlined in the Unified Guidance (Section 17.2), are a concentration limit that is designed to contain a pre-specified percentage of the dataset population. Two coefficients associated with tolerance intervals are (1) the specified population proportion and (2) the statistical confidence. The coverage coefficient (γ), which is used to contain the population portion, and the tolerance coefficient (or confidence level ($1-\alpha$)), which is used to set the confidence of the test. Typically, the UTL is calculated to have both a coverage and a confidence of 95%. When the background concentrations are greater than the MCL, the calculated UTL for each constituent is used as the GWPS. The intrawell confidence interval for each required Appendix IV constituent is then compared with the GWPS.

In order to calculate a valid confidence interval, a minimum of four data points are necessary for each of the required Appendix IV constituents in each compliance monitoring well; however a dataset of at least eight samples is recommended by the Unified Guidance. Using the Tolerance Interval Approach, a monitoring well is considered “in compliance” when the calculated UCL for each parameter in that well is less than the GWPS for three consecutive years.

Tolerance Intervals can be completed using both parametric (Section 17.2.1 of Unified Guidance) or non-parametric methods (Section 17.2.2 of Unified Guidance). However, as described above, the non-parametric method requires at least 60 background (or historical) measurements in order to achieve 95% confidence with 95% coverage. Tolerance Intervals can be calculated using most groundwater statistical software packages.

3.2.2.2 Prediction Interval Approach

If Tolerance Intervals cannot be used to calculate the GWPS (based on recommendation from the Unified Guidance, such as non-parametric datasets, etc.), then a Prediction Interval method should be used. This method is very similar to the methods used for Detection Monitoring as specified in the SAP of the GMP for this CCR Unit; however, for Corrective Action, the Unified Guidance suggests using a prediction interval about a future mean for normally/transformed-normally distributed datasets or a prediction interval about a future median for datasets with a high percent of ND or non-normally distributed data.

When using prediction intervals to calculate for a GWPS, a one-sided prediction interval is calculated using background (or historical) datasets based on a specified number of future comparisons - four future comparisons is typical. The Upper Prediction Limit that is calculated as a product of this method then becomes the GWPS and is compared against the confidence interval for the compliance data, as described in Section 3.2.2.1 above. As also described above, if the UCL is less than the calculated prediction limit for each constituent for three consecutive years then the monitoring well is “in compliance”.

3.3 Completing Corrective Action Monitoring

As specified in 257.98(C) of the CCR Rule, because the selected remedy (capping and closure) depends on a monitored natural attenuation approach, in order to complete corrective action monitoring and declare the remedial efforts completed the following must be demonstrated:

- Compliance with the GWPS at all points within the plume of contamination that lie beyond the Detection/Assessment Groundwater Monitoring Well Network.
- Compliance with the GWPS where concentrations of constituents listed in Appendix IV have not exceeded the GWPS for a period of three consecutive years.

Additionally, because Corrective Action can be a dynamic process, with frequent changes in plume concentrations and size, individual monitoring wells may be removed from corrective action once they are under the GWPS for three consecutive years. The Corrective Action Program, however, will only be deemed competed once all points within the plume beyond the detection/assessment monitoring groundwater monitoring well system are statistically within compliance of the GWPS.

3.4 Updating Background Values

The Unified Guidance suggests that updating statistical limits should only be completed after a minimum of 4 to 8 new measurements are available (i.e., every 2 to 4 years of semiannual monitoring). The periodic update of background, during which additional data are incorporated into the background, improves statistical power and accuracy by providing a more conservative estimate of the true background population. Prior to incorporating new data into the background dataset, a test should be performed to demonstrate that the “new data” are from the same statistical population as the existing background results. Below are three methods that can be used in determining whether the “new” data should be included in the background:

- Time Series Graphs – As described in Section 2.1.2.1, time series graphs can be used as a qualitative test to assist with the determination whether a new group of data match the historical data or if there is a concentration trend that could be indicative of a release or evolving groundwater conditions.
- Box-Whisker plots can also be used to determine whether or not the datasets are similar.
- Mann-Whitney (or Wilcoxon Rank) Test – Used to evaluate the ranked medians of both the historical and new dataset populations. An α of 0.05 should be used for this evaluation. After calculation, if the Mann-Whitney statistic does not exceed the critical point, the test assumes that the two data populations have equal medians, and therefore are likely similar.

Ultimately, the Mann-Whitney (Wilcoxon Rank Sum) Test is the statistical test that will be used to determine whether new observations should be included in the background dataset. It is important to note that a difference in background datasets does not automatically prevent the new data from being used; however, if differences are noted, a review of the new data will be conducted to determine if the noted difference is a result of a change in the natural conditions of the groundwater or if it is the result of a potential release from the CCR Unit. If the new data are included in the background dataset, the GWPS will be recalculated, as described above.

3.5 Alternative Source Demonstrations

If the Corrective Action statistical evaluation for detected Appendix IV parameters determines that a constituent has a UCL above the GWPS that was not identified as an SSL in Assessment Monitoring, then the data must be evaluated to determine if the cause of elevated UCL is due to a release from the CCR Unit or from an alternative source. Possible alternative sources may include new or previously unknown CCR constituent sources, nearby source areas, laboratory or sampling causes, statistical evaluation causes, or natural variation. If the value can be attributed to one of these alternative sources and was not caused by an SSL directly related to impacts from the CCR Unit, then an alternate source demonstration (ASD) can be completed. An ASD must be certified by a qualified Professional Engineer and completed in writing within 90 days of completing the statistical evaluation for a particular sampling event.

4.0 REFERENCES

EPRI. 2015. Groundwater Monitoring Guidance for the Coal Combustion Residual Rule. Electric Power Research Institute. November.

Golder Associates Inc., 2017. 40 CFR Part 257 Groundwater Monitoring Plan, Meramec Surface Impoundments, Meramec Energy Center-St. Louis County, Missouri, USA.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery – Program Implementation and Information Division. March

USEPA. 2015. Federal Register. Volume 80. No. 74. Friday April 17, 2015. Part II. Environmental Protection Agency. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule/ [EPA-HQ-RCRA-2009-0640; FRL-9919-44-OSWER]. RIN-2050-AE81. April.

GOLDER

golder.com

TECHNICAL MEMORANDUM

DATE November 25, 2020 **Project No.** 153140602

TO Craig Giesmann, PE
Ameren Missouri

CC Jeff Ingram, RG

FROM Mark Haddock, PE, RG **EMAIL mhaddock@golder.com**

CCR RULE MONITORING WELL MW-1 INVESTIGATION AND WATER LEVEL REVIEW, MERAMEC ENERGY CENTER

Golder Associates Inc. (Golder) has prepared this Technical Memorandum to describe the sampling, history and use of monitoring well MW-1 in the current groundwater monitoring program at Ameren Missouri's Meramec Energy Center (MEC). MW-1 was installed in January of 2016 as part of the downgradient well network for monitoring the MEC CCR impoundments. Baseline sampling, water level measurement, and analytical testing began in 2016 and has been conducted according to the required detection and assessment monitoring schedule since that time.

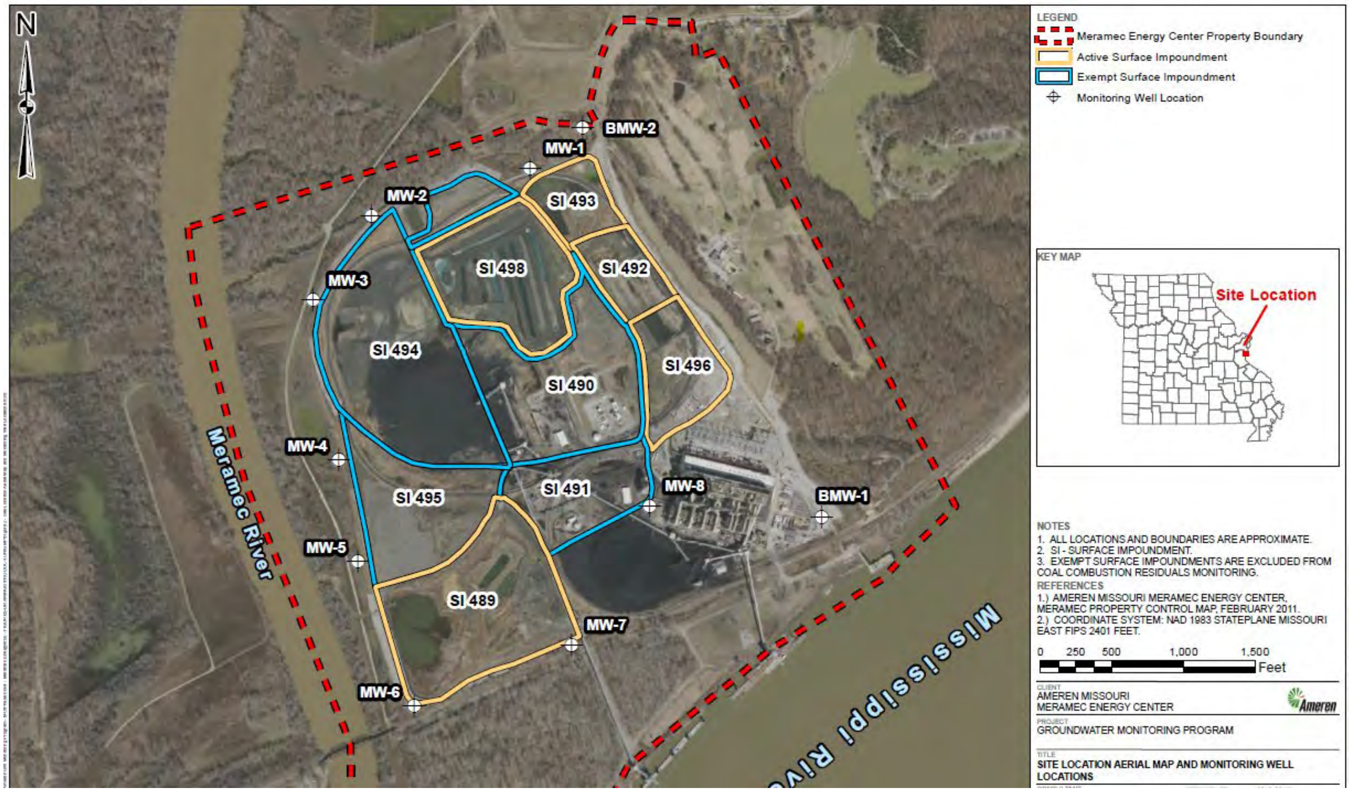

Figure 1 - MW-1 and well network locations at MEC

Golder Associates Inc.
13515 Barrett Parkway Drive, Suite 260, Ballwin, Missouri, USA 63021 T: +1 314 984-8800 F: +1 314 984-8770

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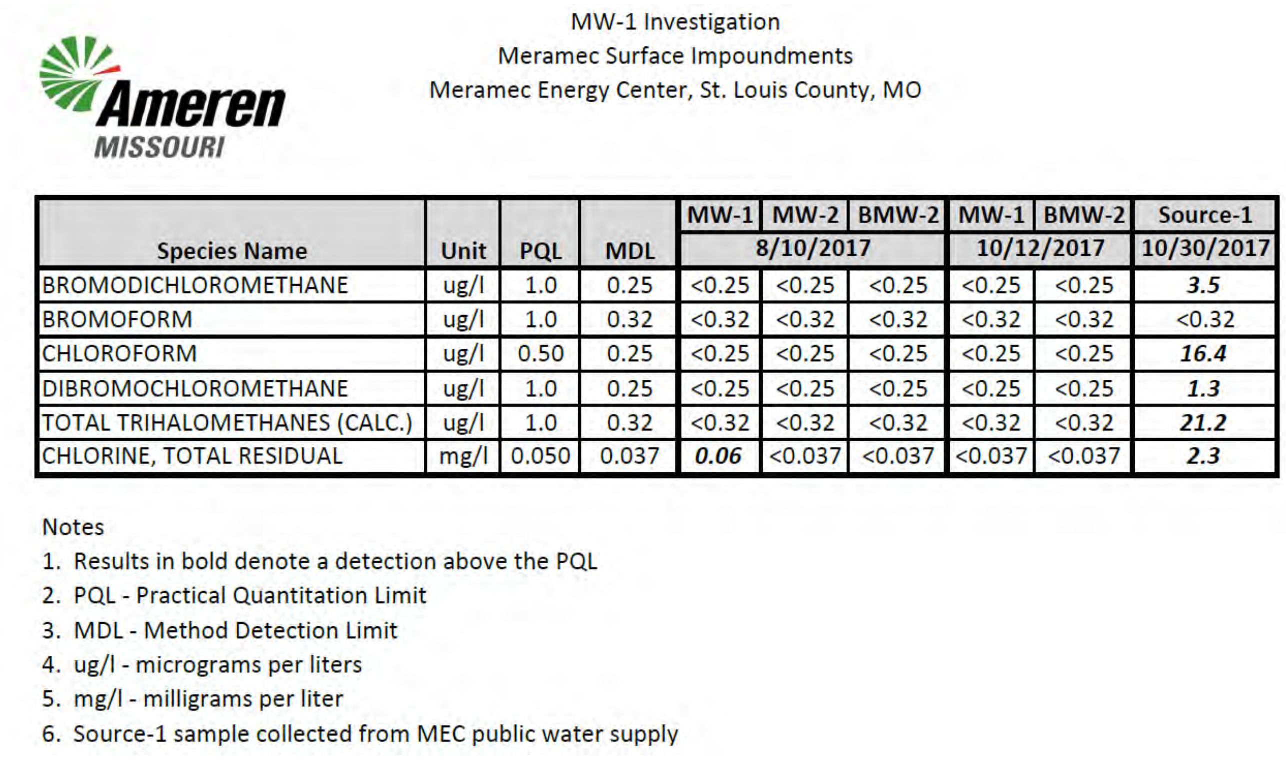
MW-1 is located in a cross-gradient (slightly downgradient) location relative to the northern-most area of the MEC CCR impoundments as seen on Figure 1. MW-1 is located close to a natural creek channel and only approximately 500 feet downgradient from the background well BMW-2.

MW-1 is approximately 40 feet deep and constructed with a screen interval that intercepts groundwater in a sand and gravel lens within the alluvial aquifer. Beginning with water level measurements shortly after installation, Golder observed abnormally high (nearly artesian) static groundwater levels in MW-1 relative to nearby wells. As a result of these unusually high water levels, Golder has omitted this well from the groundwater potentiometric surface contours used to create maps. Water levels have been measured and recorded for MW-1 with every sampling event and the records continue to show unusually high (nearly artesian) conditions.

In an effort to evaluate the reason for the high water level in MW-1, Golder undertook an investigation in 2017. The investigation included review of water utility maps to assess the proximity of water lines relative to MW-1 and Golder performed additional water sample testing. A public water supply pipeline was identified to be present along Fine Road (which serves as the entrance road to the MEC) and this pipeline provides potable water to the MEC facilities. To evaluate whether a water supply line leak was causing the high water level in MW-1, Golder collected water samples from MW-1, MW-2, BMW-2 and a potable supply faucet at MEC and tested the samples for potable water supply indicator parameters such as trihalomethanes and chlorine. The results from this testing are summarized in the table below.

Table 1 - MW-1 Investigation Testing Results



MW-1 Investigation
Meramec Surface Impoundments
Meramec Energy Center, St. Louis County, MO

Species Name	Unit	PQL	MDL	MW-1	MW-2	BMW-2	MW-1	BMW-2	Source-1
				8/10/2017			10/12/2017		10/30/2017
BROMODICHLOROMETHANE	ug/l	1.0	0.25	<0.25	<0.25	<0.25	<0.25	<0.25	***3.5***
BROMOFORM	ug/l	1.0	0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
CHLOROFORM	ug/l	0.50	0.25	<0.25	<0.25	<0.25	<0.25	<0.25	***16.4***
DIBROMOCHLOROMETHANE	ug/l	1.0	0.25	<0.25	<0.25	<0.25	<0.25	<0.25	***1.3***
TOTAL TRIHALOMETHANES (CALC.)	ug/l	1.0	0.32	<0.32	<0.32	<0.32	<0.32	<0.32	***21.2***
CHLORINE, TOTAL RESIDUAL	mg/l	0.050	0.037	***0.06***	<0.037	<0.037	<0.037	<0.037	***2.3***

Notes
1. Results in bold denote a detection above the PQL
2. PQL - Practical Quantitation Limit
3. MDL - Method Detection Limit
4. ug/l - micrograms per liters
5. mg/l - milligrams per liter
6. Source-1 sample collected from MEC public water supply

The results of this potable water testing indicate that a potable water source/leak is not the cause of the elevated water levels recorded in MW-1.

CCR Rule analytical testing results for MW-1 collected since installation do not show signs of CCR impact and MW-1 regularly has some of the lowest concentrations of CCR indicator parameters, such as boron.

It is Golder’s opinion that the high water level in MW-1 may be caused from a natural spring condition in the alluvial aquifer. The well is located near the existing creek that receives runoff from the bedrock bluff and hill to the northeast and observations in this creek indicate that it may also be fed by a spring condition in the vicinity of MW-1. The alluvial aquifer receives groundwater recharge from the bedrock bluff immediately northeast of MW-1 and a natural spring may exist at or very near MW-1.

MW-1 continues to serve as a valuable monitoring well for CCR Rule groundwater testing of the north side of the CCR area, but water levels should be excluded from potentiometric surface map contouring as we believe it is a very localized condition. As the impoundments are closed and water levels in the impoundments are further lowered, and if MW-1 continues to show no impact from CCR sources, use of MW-1 in the monitoring program will be reevaluated.

Mark Haddock, PE, RG
Principal, Practice Leader

mnh

c:\users\mhaddock\desktop\tm meramec mw1 25nov2020.docx

Attachment 10

MDNR Draft Permit

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

UNDERGROUND INJECTION CONTROL MISSOURI STATE OPERATING PERMIT

DRAFT

Permit No. UI-0000043

Owner: Union Electric Co. d/b/a Ameren Missouri
Address: 1901 Chouteau Ave. PO Box 66149, MC 602, St. Louis MO 63166

Continuing Authority: Same as above
Address: Same as above

Facility Name: Ameren Missouri- Rush Island Energy Center
Facility Address: 100 Big Hollow Road, Festus, MO 63028

Legal Description: NE ¼, SW ¼, Sec. 04, T39N, R7E, Jefferson County
UTM Coordinates: X = 470620, Y = 4223050

Receiving Stream: n/a underground injection
First Classified Waterbody: groundwater
USGS Basin & Sub-watershed No.: Old Mayestown Creek – Mississippi River; 07140101-0904

is authorized to operate the facility described herein, in accordance with the requirements as set forth herein:

FACILITY DESCRIPTION

Pumping with ex-situ treatment (aeration, pH reduction, addition of $FeCl_3$, pH increase, flocculation/settling, sand filtration, resin filtration) and injection into same geologic groundwater formation. SIC # 4911; NAICS # 221112, Ameren Missouri- Rush Island Energy Center is a steam electric power generating facility primarily engaged in the generation of electricity for distribution and sale. Treatment system filter sludge and treatment wastes are containerized and disposed off site. This permit is co-located with MO-0000043.
Injection Design Flow: 0.01152 MGD (8 gpm)

In compliance with the Safe Drinking Water Act and authorized by 40 CFR 147 Subpart AA, this permit authorizes only underground injection activities; it does not apply to other regulated areas.

Effective Date

Edward B. Galbraith, Director, Division of Environmental Quality

Expiration Date

Chris Wieberg, Director, Water Protection Program

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

UIC REQUIREMENTS	TABLE A-1 FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to inject wastewater as specified. The final effluent limitations shall become effective on **Effective Date** and remain in effect until expiration of the permit. Injection shall be controlled, limited, and monitored by the permittee as specified below:

EFFLUENT PARAMETERS	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
LIMIT SET: M						
PHYSICAL						
Flow	MGD	*		*	once/month	24 hr. total
CONVENTIONAL						
pH †	SU	6.0 to 9.0		6.0 to 9.0	once/month	grab
METALS						
Antimony, Total Recoverable	µg/L	*		6.0	once/month	grab
Arsenic, Total Recoverable	µg/L	*		50	once/month	grab
Barium, Total Recoverable	µg/L	*		2000	once/month	grab
Boron, Total Recoverable	µg/L	*		2000	once/month	grab
Lead, Total Recoverable	µg/L	*		15	once/month	grab
Molybdenum, Total Recoverable	µg/L	*		*	once/month	grab
Selenium, Total Recoverable	µg/L	*		50	once/month	grab
OTHER						
Sulfate	mg/L	*		250	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE MONTH 28, 20XX.
THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

* Monitoring and reporting requirement only

† pH: the facility will report the minimum and maximum values; pH is not to be averaged.

B. STANDARD CONDITIONS

In addition to specified conditions stated herein, this permit is subject to the attached Part I standard conditions dated August 1, 2014, and hereby incorporated as though fully set forth herein.

D. SPECIAL CONDITIONS

1. This permit authorizes and allows only the injection of wastewater which has been treated and cleaned to the limitations in this permit through the XDD system as provided for in the application for this operating permit. No other operations are covered. This permit does not authorize injection of waste, wastewater, or solids classified as hazardous in accordance with 40 CFR 261, or not in compliance with the permit.

2. Well Requirements:
   (a) Well drillers must hold a non-restricted permit and must be registered in accordance with 10 CSR 23-1.090 in Missouri, be current, and in good standing.
   (b) All wells must be registered with Wellhead Protection in accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes (including closure).
   (c) All wells must be closed in accordance with 10 CSR 23-4.080.

D. SPECIAL CONDITIONS (CONTINUED)

3. Injection wells must be placed between the coal combustion residual waste mass and the alluvial monitoring wells.

4. Spills, Overflows, and Other Unauthorized Discharges.
   Any spill, overflow, or other discharge(s) causing any contaminants to enter waters of the state is not authorized and must be reported to the regional office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department’s 24 hour spill line at 573-634-2436.

5. Electronic Discharge Monitoring Report (eDMR) Submission System and Requirements.
   (a) A designated individual(s) must electronically submit compliance monitoring data via the eDMR system after enrollment. Standard Conditions Part I, Section B, #7 indicates the eDMR system use is required.
   (b) The permittee shall supply necessary information for enrollment in the eDMR system by or before January 31, 2021.
   (c) Programmatic Reporting Requirements. All reports must be electronically submitted via the eDMR system.
   (d) Electronic Submission: access the eDMR system via web browser; a link to the eDMR system can be found by visiting https://dnr.mo.gov/env/wpp/ on the Water Protection Program’s home page.
   (e) Electronic Reporting Waivers. The permittee must electronically submit compliance monitoring data and reports unless a waiver is granted by the Department in compliance with 40 CFR Part 127. The permittee may obtain an electronic reporting waiver by first submitting an eDMR Waiver Request Form: http://dnr.mo.gov/forms/780-2692-f.pdf. The Department will either approve or deny this electronic reporting waiver request within 120 calendar days. Only permittees with an approved waiver request may submit monitoring data and reports on paper to the Department, and only for the period the approved electronic reporting waiver is effective.

6. Site-wide minimum Best Management Practices (BMPs). At a minimum, the permittee shall adhere to the following:
   (a) Prevent the spillage or loss of fluids to prevent the contamination of stormwater from these substances.
   (b) Ensure adequate provisions are provided to protect embankments from erosion. Ensure drill rig ruts or marks on the ground surface do not contribute to solids in stormwater runoff which would cause a general criteria violation per 10 CSR 20-7.031(4).
   (c) Provide collection facilities and arrange for proper disposal of waste products.
   (d) Store all additives, waste products, and storage containers (such as drums, cans, or cartons) so these materials are not exposed to stormwater or provide other prescribed BMPs such as plastic lids and/or portable spill pans to prevent the commingling of stormwater with container contents. Commingled water may not be discharged under this permit. Provide spill prevention control, and/or management sufficient to prevent any spills of these pollutants from entering waters of the state. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall also prevent the contamination of groundwater. Spill records should be retained on-site.
   (e) Provide good housekeeping practices on the site to keep trash from entry into waters of the state.
   (f) Provide sediment and erosion control sufficient to prevent or control sediment loss off of the property.

7. The full implementation of this operating permit, which includes implementation of any applicable schedules of compliance, shall constitute compliance with all applicable federal and state statutes and regulations in accordance with RSMo 644.051.16, and the CWA section 402(k); however, this permit may be reopened and modified, or alternatively revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Clean Water Act Sections 301(b)(2)(C) and (D), §304(b)(2), and §307(a) (2), if the effluent standard or limitation so issued or approved contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or controls any pollutant not limited in the permit. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, termination, notice of planned changes, or anticipated non-compliance does not stay any permit condition.

8. Report “operational shutdown” when injection does not occur during the entire reporting period.

9. The Department may require sampling and reporting as a result of illegal discharges from the site, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities or discharges at the facility. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent.

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D. SPECIAL CONDITIONS (CONTINUED)

10. Changes in Discharges of Toxic Pollutants. The permittee must notify the Department that any activity has occurred or will occur which would result in any discharge to the subsurface, any pollutant which is not limited in the permit, if that discharge will exceed the highest of the following “notification levels”:
    (a) Five hundred micrograms per liter (500 µg/l) of any pollutant not considered in the application;
    (b) One milligram per liter (1 mg/l) for antimony;
    (c) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7).
    (d) The level established by this permit in accordance with 40 CFR 122.44(f) in Table A-1 of the permit and:
        (1) Beryllium, total; the facility will notify the Department if upon testing the post-treatment effluent prior to injection for beryllium, the value is above 4 µg/L.
        (2) Lithium, total; the facility will notify the Department upon testing the post-treatment effluent prior to injection for lithium if the value is above 40 µg/L.
        (3) Mercury, total; the facility will notify the Department upon testing the post-treatment effluent prior to injection for mercury if the value is above 2 µg/L.

11. Reporting of Non-Detects.
    (a) Compliance analysis conducted by the permittee or any contracted laboratory shall be conducted in such a way the precision and accuracy of the analyzed result can be enumerated. See sufficiently sensitive test method requirements in Standard Conditions Part I, Section A, #4 regarding proper testing and detection limits used for sample analysis. For the purposes of this permit, the definitions in 40 CFR 136 apply; method detection limit (MDL) and laboratory established reporting limit (RL) are used interchangeably in this permit.
    (b) The permittee shall not report a sample result as “non-detect” without also reporting the MDL. Reporting “non-detect” without also including the MDL will be considered failure to report, which is a violation of this permit.
    (c) For the daily maximum, the permittee shall report the highest value; if the highest value was a non-detect, use the less than “<” symbol and the laboratory’s highest method detection limit (MDL) or the highest reporting limit (RL); whichever is higher (e.g. <6).
    (d) When calculating monthly averages, zero shall be used in place of any value(s) not detected. Where all data used in the average are below the MDL or RL, the highest MDL or RL shall be reported as “<#” for the average as indicated in item (c).

12. Failure to pay fees associated with this permit is a violation of the Missouri Clean Water Law (644.055 RSMo).

13. This permit does not cover land disturbance activities.

14. This permit does not authorize the placement of fill materials in flood plains, placement of solid materials into any waterway, the obstruction of stream flow, or changing the channel of a defined drainage course. The facility must contact the U.S. Army Corps of Engineers (Corps) to determine if a CWA §404 Department of Army permit or §401 water quality certification is required for the project.

15. Renewal Application Requirements.
    (a) This facility shall submit an appropriate and complete application to the Department no less than 180 days from the expiration date listed on page 1 of the permit.
    (b) The facility may use the electronic submission system to submit the application to the Program, if available.
    (c) This facility must submit all groundwater monitoring data collected for the term of this permit at the Rush Island site regardless of coverage under this permit.
    (d) The facility must submit analytical results post treatment for total beryllium, total lithium, and total mercury upon permit renewal in addition to other pollutants of concern.

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F. NOTICE OF RIGHT TO APPEAL

If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: https://ahc.mo.gov

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MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET
FOR UIC
OF
UI-0000043
AMEREN MISSOURI - RUSH ISLAND UNDERGROUND INJECTION

DRAFT

The Federal Water Pollution Control Act ("Clean Water Act" Section 402 Public Law 92-500 as amended) established the National Pollutant Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States, and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the "Clean Water Act"). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (MSOPs) are issued by the Director of the Missouri Department of Natural Resources (Department) under an approved program, operating in accordance with federal and state laws (Federal "Clean Water Act" and "Missouri Clean Water Law" Section 644 as amended). MSOPs are issued for a period of five (5) years unless otherwise specified for less.

As per [40 CFR Part 124.8(a)] and [10 CSR 20-6.020(1)(A)2.] a factsheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the Missouri State Operating Permit (MSOP or operating permit) listed below. A factsheet is not an enforceable part of an operating permit.

This permit is issued under the authority of the Save Drinking Water Act, authorized by the EPA for State of Missouri administration at 40 CFR 147.1301 which incorporates portions of RSMo 644, 10 CSR 20-6, and 10 CSR 20-7 by reference. Additional regulations are incorporated but not listed here for permit brevity.

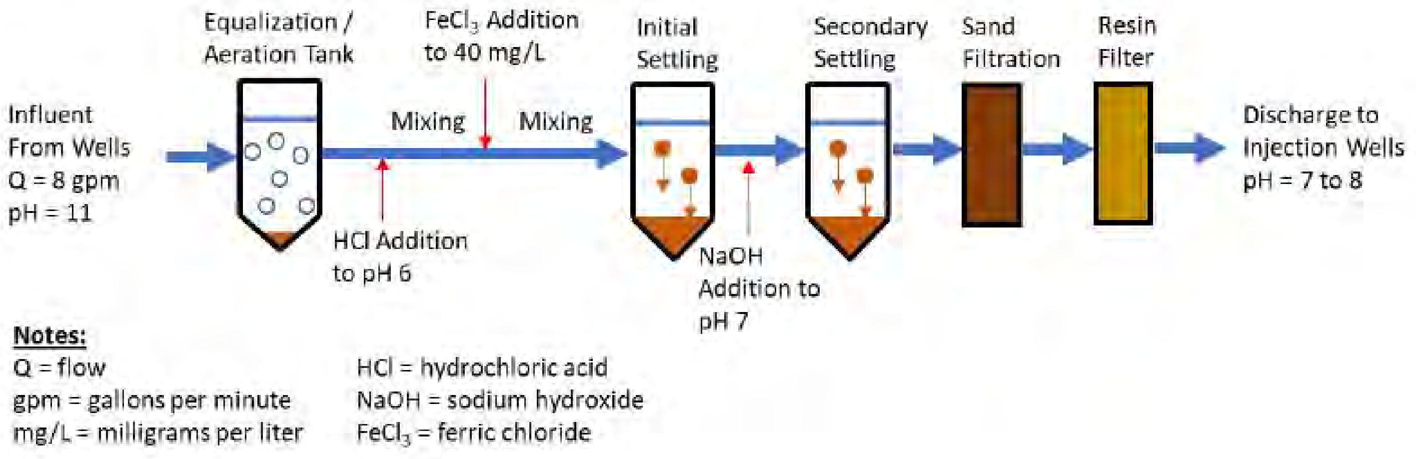
PART I. FACILITY INFORMATION

Facility Type: Industrial: underground injection; <1 MGD
SIC Code(s): 4911
NAICS Code(s): 221112
Application Date: 03/26/2020
Expiration Date: n/a new permit
Last Inspection: n/a new permit

FACILITY DESCRIPTION:
Extracted waters will be processed in an above-grade structure designed by XDD using the following treatment train:

1) Aeration
2) pH adjustment (reduction to ~6.0 using HCL)
3) Addition of FeCl3 at 40 mg/L
4) Flocculation and settling
5) pH adjustment (increase to ~7.0 using NaOH)
6) Flocculation and settling
7) Sand filtration
8) Resin filtration

The following is a graphical illustration of the process:



Precipitant sludges containing the metals will be removed as necessary in secondary containers and processed onsite for transport and disposal offsite. Backwash fluids generated from the sand filters will be redirected to the initial settling tank for additional processing and settlement. Regeneration waste from the resin filtration system will be neutralized as part of the regeneration process and contained in secondary containers for offsite disposal. All generated waste will be handled, transported and disposed in accordance with all applicable state and federal regulations. Based upon results from the treatability studies, hazardous waste is not expected to be generated during this process. After treatment, the water will be injected into the subsurface through the four injection wells planned at this time.

BUSINESS REGISTRATION:

The charter number for the continuing authority for this facility is 00040441; this number was verified by the permit writer to be associated with the facility.

PERMITS HELD:

In accordance with 40 CFR 122.21(f)(6), the Department evaluated other permits currently held by this facility. This facility is co-located with MO-0000043; see https://dnr.mo.gov/env/wpp/permits/issued/docs/0000043.pdf; the terms and conditions of MO-0000043 may cover certain areas of the UIC area as well. The facility must adhere to the more stringent of the two permits if conflicting information is presented.

COMMENTS:

This is a new facility; some data was submitted with the application which was reviewed. Permit decisions were based solely on the application materials and institutional knowledge of coal combustion residual impoundment leachate characteristics. While the applicant is proposing only a limited scale project currently, this UIC permit allows for the compliant injection overall at the site. Per 10 CSR 20-7.031(7) Effluent Limitations for Subsurface Waters. (A) No person shall release any water into aquifers, store or dispose of water in a way which causes or permits it to enter aquifers either directly or indirectly unless it meets the requirements of … appropriate groundwater protection criteria set in 10 CSR 20-7.031, Table A. Additionally, per 10 CSR 20-7.031(6) Groundwater. (A) Water contaminants shall not cause or contribute to exceedance of Table A1, groundwater limits in aquifers and caves. Table A1 values listed as health advisory levels shall be used in establishing management strategies and groundwater cleanup criteria, until additional data becomes available to support alternative criteria or other standards are established. Substances not listed in Table A1 shall be limited so that drinking water, livestock watering, and irrigation uses are protected.

FACILITY MAP:

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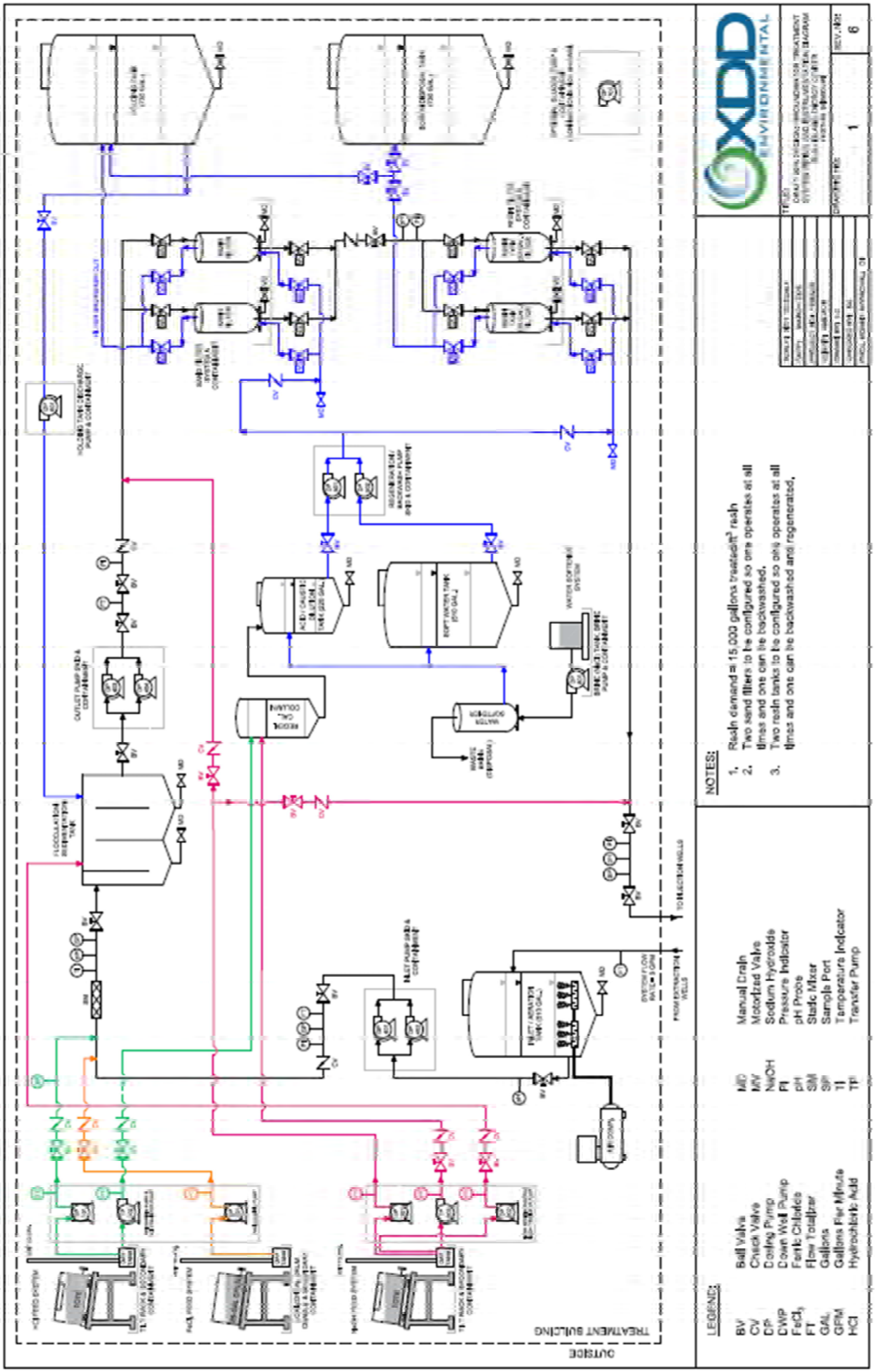
INITIAL WELL LAYOUT:
As observed on the diagram below, the monitoring wells to determine the scope of pollution are positioned between the surface impoundment, treatment injection, and the Mississippi River, thus preventing contaminants from migrating off site. Pumping, treating and reinjection of cleaned groundwater is expected to decrease time of natural attenuation of the groundwater contaminants.

TREATMENT DIAGRAM:



NOTES:

1. Resin demand = 15,000 gallons treated/ft^3 resin
2. Two sand filters to be configured so one operates at all times and one can be backwashed.
3. Two resin tanks to be configured so one operates at all times and one can be backwashed and regenerated.

LEGEND:

BV	Ball Valve	MD	Manual Drain
CV	Check Valve	MV	Motorized Valve
DP	Dosing Pump	NaOH	Sodium Hydroxide
DWP	Down Well Pump	PI	Pressure Indicator
$FeCl_3$	Ferric Chloride	pH	pH Probe
FT	Flow Totalizer	SM	Static Mixer
GAL	Gallons	SP	Sample Port
GPM	Gallons Per Minute	TI	Temperature Indicator
HCl	Hydrochloric Acid	TP	Transfer Pump

PART II. RECEIVING WATERBODY INFORMATION

RECEIVING WATERBODY TABLE:

OUTFALL	WATERBODY NAME	CLASS	WBID	DESIGNATED USES	DISTANCE TO SEGMENT	12-DIGIT HUC
UIC	Groundwater	n/a	n/a	GEN, GRW, DWS, LWP, IRR,	0.0 mi	Old Mayestown Creek – Mississippi River; 07140101-0904

Classes are representations of hydrologic flow volume or lake basin size as defined in 10 CSR 20-7.031(1)(F). L1: Lakes with drinking water supply - wastewater discharges are not permitted to occur to L1 watersheds per 10 CSR 20-7.015(3)(C); L2: major reservoirs; L3: all other public and private lakes; P: permanent streams; C: streams which may cease flow in dry periods but maintain pools supporting aquatic life; E: streams which do not maintain surface flow; and W: wetland. Losing streams are defined in 10 CSR 20-7.031(1)(O) and are designated on the Losing Stream dataset or determined by the Department to lose 30% or more of flow to the subsurface.

WBID = Waterbody Identification: Missouri Use Designation Dataset per 10 CSR 20-7.031(1)(Q) and (S) as 100K Extant-Remaining Streams or newer; data can be found as an ArcGIS shapefile on MSDIS at ftp://msdis.missouri.edu/pub/Inland_Water_Resources/MO_2014_WQS_Stream_Classifications_and_Use_shp.zip; New C streams described on the dataset per 10 CSR 20-7.031(2)(A)3. as 100K Extent Remaining Streams.

10 CSR 20-7.031(1)(C)1.: **ALP** = Aquatic Life Protection (formerly AQL); current uses are defined to ensure the protection and propagation of fish shellfish and wildlife, further subcategorized as: WWH = Warm Water Habitat; CLH = Cool Water Habitat; CDH = Cold Water Habitat; EAH = Ephemeral Aquatic Habitat; MAH = Modified Aquatic Habitat; LAH = Limited Aquatic Habitat. This permit uses ALP effluent limitations in 10 CSR 20-7.031 Table A1-B3 for all habitat designations unless otherwise specified.
10 CSR 20-7.031(1)(C)2.: Recreation in and on the water
  WBC = Whole Body Contact recreation where the entire body is capable of being submerged;
    WBC-A = whole body contact recreation supporting swimming uses and has public access;
    WBC-B = whole body contact recreation not included in WBC-A;
  SCR = Secondary Contact Recreation (like fishing, wading, and boating)
10 CSR 20-7.031(1)(C)3. to 7.:
  HHP (formerly HHF) = Human Health Protection as it relates to the consumption of fish and drinking of water;
  IRR = irrigation for use on crops utilized for human or livestock consumption, includes aquifers per 10 CSR 20-7.031(6)(A);
  LWW = Livestock and Wildlife Watering (current narrative use is defined as LWP = Livestock and Wildlife Protection), includes aquifers per 10 CSR 20-7.031(6)(A);
  DWS = Drinking Water Supply, includes aquifers per 10 CSR 20-7.031(6)(A);
  IND = industrial water supply
10 CSR 20-7.031(1)(C)8. to 11.: Wetlands (10 CSR 20-7.031 Tables A1-B3 currently does not have corresponding habitat use criteria for these defined uses): WSA = storm- and flood-water storage and attenuation; WHP = habitat for resident and migratory wildlife species; WRC = recreational, cultural, educational, scientific, and natural aesthetic values and uses; WHC = hydrologic cycle maintenance.
10 CSR 20-7.015(7) and 10 CSR 20-7.031(6): **GRW** = Groundwater
10 CSR 20-7.031(4): **GEN** = general criteria; acute toxicity criteria applicable to all waters even those lacking designated uses
n/a = not applicable

EXISTING WATER QUALITY:

Groundwater data is required to be posted by Ameren online per 40 CFR 257. The information can be found by using a web browser https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion

303(D) LIST:

Section 303(d) of the federal Clean Water Act requires each state identify waters not meeting water quality standards and for which adequate water pollution controls have not been required. Water quality standards protect such beneficial uses of water as whole body contact (such as swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock, and wildlife. The 303(d) list helps state and federal agencies keep track of impaired waters not addressed by normal water pollution control programs. http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm

✓ Applicable; the Mississippi River is listed on the 2014 Missouri 303(d) list for E coli. This facility is not considered a source of the above listed pollutant(s) or considered to contribute to the impairment.

TOTAL MAXIMUM DAILY LOAD (TMDL):

A TMDL is a calculation of the maximum amount of a given pollutant a water body can absorb before its water quality is affected; hence, the purpose of a TMDL is to determine the pollutant loading a specific waterbody can assimilate without exceeding water quality standards. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan or TMDL may be developed. The TMDL shall include the WLA calculation. http://dnr.mo.gov/env/wpp/tmdl/

✓ Not applicable; this facility does not discharge to a waterbody/watershed with a TMDL.

UPSTREAM OR DOWNSTREAM IMPAIRMENTS:

The permit writer has reviewed upstream and downstream stream segments of this facility for impairments.

✓ The permit writer has noted no upstream impairments near this facility.
✓ The permit writer has noted downstream of the facility the stream is on the 303(d) list; see above.

DESIGNATION OF WATERS OF THE STATE:

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Per Missouri's technology-based effluent regulations [10 CSR 20-7.015], waters of the state are divided into seven categories per 10 CSR 20-7.015(1)(B) 1. through 7. and implemented in 10 CSR 20-7.015(2) through (8). Considerations are made for the facility type, and may not be applicable under the implementing regulations. Rather, effluent limitations may be based on a best professional judgment evaluation, which takes the designation and uses of the receiving water body into consideration. Effluent limitation derivations are discussed in PART IV: EFFLUENTS LIMITS DETERMINATIONS.

✓ Subsurface Water (including underground injection control permits)

LAKE NUMERIC NUTRIENT CRITERIA:

Water quality standards per 10 CSR 20-7.031(5)(N) describe nutrient criteria requirements assigned to lakes (which include reservoirs) in Missouri, equal to or greater than 10 acres during normal pool conditions. The Department's Nutrient Criteria Implementation Plan (NCIP) may be reviewed at: https://dnr.mo.gov/env/wpp/rules/documents/nutrient-implementation-plan-final-072618.pdf Discharges of wastewater in to lakes or lake watersheds designated as L1 (drinking water use) are prohibited per 10 CSR 20-7.015(3)(C).

✓ Not applicable; this facility does not discharge in a lake watershed or the lake is less than 10 acres.

RECEIVING WATERBODY MONITORING REQUIREMENTS:

This facility is monitoring the groundwater outside of the injection boundary to assure pollutants are not migrating off site.

MIXING CONSIDERATIONS:

Not applicable, groundwater limits must be met at 10 feet below grade per 10 CSR 20-7.015(7).

PART III. RATIONALE AND DERIVATION OF PERMIT CONDITIONS

ALTERNATIVE EVALUATIONS FOR NEW FACILITIES:

As per [10 CSR 20-7.015(4)(A)], discharges to losing streams shall be permitted only after other alternatives including land application, discharges to a gaining stream and connection to a regional wastewater treatment facility have been evaluated and determined to be unacceptable for environmental and/or economic reasons.

✓ Not applicable; this operating permit is enacted to remediate the groundwater at the site. Injection is preferable to leaving contaminated utility waste leachate in place.

ANTIBACKSLIDING:

Federal Regulations [CWA §303(d)(4); CWA §402(c); 40 CFR Part 122.44(l)] require a reissued permit to be as stringent as the previous permit with some exceptions. Backsliding (a less stringent permit limitation) is only allowed under certain conditions.

✓ New permit, backsliding does not apply.

ANTIDEGRADATION REVIEW:

Process water discharges with new, altered, or expanding flows, the Department is to document, by means of antidegradation review, if the use of a water body's available assimilative capacity is justified. In accordance with Missouri's water quality regulations for antidegradation [10 CSR 20-7.031(3)], degradation may be justified by documenting the socio-economic importance of a discharge after determining the necessity of the discharge. Facilities must submit the antidegradation review request to the Department prior to establishing, altering, or expanding discharges. See http://dnr.mo.gov/env/wpp/permits/antideg-implementation.htm

✓ Applicable; new, sub surface discharge. The issuance of this permit conforms to the implementing procedures of the antidegradation regulations. No schedule of compliance can be afforded as the treatment devices must be designed and controlled as to immediately meet all water quality standards.

BEST MANAGEMENT PRACTICES:

Minimum site-wide best management practices are established in this permit to ensure all permittees are managing their sites equally to protect waters of the state from certain activities which could cause negative effects in receiving water bodies. While not all sites require a SWPPP because the SIC codes are specifically exempted in 40 CFR 122.26(b)(14), these best management practices are not specifically included for stormwater purposes. These practices are minimum requirements for all industrial sites to protect waters of the state. If the minimum best management practices are not followed, the facility may violate general criteria [10 CSR 20-7.031(4)]. Statutes are applicable to all permitted facilities in the state, therefore pollutants cannot be released unless in accordance with RSMo 644.011 and 644.016 (17).

COST ANALYSIS FOR COMPLIANCE (CAFCOM):

Pursuant to Section 644.145, RSMo, when incorporating a new requirement for discharges from publicly owned facilities, or when enforcing provisions of this chapter or the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., pertaining to any portion of a publicly owned facility, the Department of Natural Resources shall make a "finding of affordability" on the costs to be incurred and the impact of any rate changes on ratepayers upon which to base such permits and decisions, to the extent allowable under this chapter

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and the Federal Water Pollution Control Act. This process is completed through a cost analysis for compliance. Permits not including new requirements may be deemed affordable.

- ✓ The Department is not required to complete a cost analysis for compliance because the facility is not publicly owned.

CHANGES IN DISCHARGES OF TOXIC POLLUTANT:

This special condition reiterates the federal rules found in 40 CFR 122.44(f) and 122.42(a)(1). In these rules, the facility is required to report changes in amounts of toxic substances discharged. Toxic substances are defined in 40 CFR 122.2 as "…any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA." Section 307 of the clean water act then refers to those parameters found in 40 CFR 401.15. The permittee should also consider any other toxic pollutant in the discharge as reportable under this condition.

COMPLIANCE AND ENFORCEMENT:

Enforcement is the action taken by the Water Protection Program (WPP) to bring an entity into compliance with the Missouri Clean Water Law, its implementing regulations, and/or any terms and conditions of an operating permit. The primary purpose of the enforcement activity in the WPP is to resolve violations and return the entity to compliance.

- ✓ Not applicable; the permittee/facility is not currently under Water Protection Program enforcement action.

DOMESTIC WASTEWATER, SLUDGE, AND BIOSOLIDS:

Domestic wastewater is defined as wastewater (i.e., human sewage) originating primarily from the sanitary conveyances of bathrooms and kitchens. Domestic wastewater excludes stormwater, animal waste, process waste, and other similar waste. Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works. Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for productive use (i.e. fertilizer) and after having pathogens removed.

- ✓ Not applicable; conditions for domestic wastewater are not included under this permit. The co-located permit, MO-0000043 has domestic wastewater requirements.

EFFLUENT LIMITATIONS:

Effluent limitations derived and established for this permit are based on current operations of the facility and applied per 10 CSR 20-7.015(9)(A). Any flow through the outfall is considered a discharge and must be sampled and reported as provided in the permit. Future permit action due to facility modification may contain new operating permit terms and conditions which supersede the terms and conditions, including effluent limitations, of this operating permit. Daily maximums and monthly averages are required per 40 CFR 122.45(d)(1) for continuous discharges (not from a POTW).

EFFLUENT LIMITATION GUIDELINE:

Effluent Limitation Guidelines, or ELGs, are found at 40 CFR 400-499. These are limitations established by the EPA based on the SIC code and the type of work a facility is conducting. Most ELGs are for process wastewater and some address stormwater. All are technology based limitations which must be met by the applicable facility at all times.

- ✓ The operating permit does not implement an ELG. However, this facility type has an effluent limitation guideline applied to surface discharges covered under MO00000043. Additionally, 40 CFR 423.15(b)(16) was used as a guide for leachate characteristics.

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:

The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize Clean Water Act reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. The final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online.

Per 40 CFR 127.15 and 127.24, permitted facilities may request a temporary waiver for up to 5 years or a permanent waiver from electronic reporting from the Department. To obtain an electronic reporting waiver, a permittee must first submit an eDMR Waiver Request Form: http://dnr.mo.gov/forms/780-2692-f.pdf. A request must be made for each facility. If more than one facility is owned or operated by a single entity, then the entity must submit a separate request for each facility based on its specific circumstances. An approved waiver is not transferable.

The Department must review and notify the facility within 120 calendar days of receipt if the waiver request has been approved or rejected [40 CFR 124.27(a)]. During the Department review period as well as after a waiver is granted, the facility must continue submitting a hard-copy of any reports required by their permit. The Department will enter data submitted in hard-copy from those facilities allowed to do so and electronically submit the data to the EPA on behalf of the facility.

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To assist the facility in entering data into the eDMR system, the permit describes limit sets in each table in Part A of the permit. The data entry personnel should use these identifiers to ensure data entry is being completed appropriately.

- ✓ The EDMR system, as currently designed, is not set up to include permits beginning with "UI". However, in late fall, the Department is planning on switching providers which will allow for any permit type to be included. The facility is required at that time to be enrolled in the eDMR system to comply with the above regulations. See eDMR special condition.

GENERAL CRITERIA CONSIDERATIONS:

In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into permits for pollutants determined to cause, have reasonable potential to cause, or to contribute to, an excursion above any water quality standard, including narrative water quality criteria. In order to comply with this regulation, the permit writer has completed a reasonable potential determination on whether discharges have reasonable potential to cause, or contribute to an excursion of the general criteria listed in 10 CSR 20-7.031(4). In instances where reasonable potential exists, the permit includes limitations within the permit to address the reasonable potential. In discharges where reasonable potential does not exist, the permit may include monitoring to later determine the discharge's potential to impact the narrative criteria. Additionally, RSMo 644.076.1, as well as Section D – Administrative Requirements of Standard Conditions Part I of this permit state it shall be unlawful for any person to cause or allow any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule, or regulation promulgated by the commission. See Part IV for specific determinations.

GROUNDWATER MONITORING:

Groundwater is a water of the state according to RSMo 644.016(27), is subject to regulations at 10 CSR 20-7.015(7) and 10 CSR 20-7.031(6), and must be protected accordingly.

- ✓ This facility is monitoring the groundwater at the site to determine efficacy of the removal system. Data for the groundwater is supplied online by Ameren under 40 CFR 257, and conditions found within MO-0000043. This permit will defer reporting to the other requirements as listed.

LAND APPLICATION:

Land application, or surficial dispersion of wastewater and/or sludge, is performed by facilities to maintain a basin as no-discharge. Requirements for these types of operations are found in 10 CSR 20-6.015; authority to regulate these activities is from RSMo 644.026.

- ✓ Not applicable; this permit does not authorize operation of a surficial land application system to disperse wastewater or sludge.

LAND DISTURBANCE:

Land disturbance, sometimes called construction activities, are actions which cause disturbance of the root layer or soil; these include clearing, grading, and excavating of the land. 40 CFR 122.26(b)(14) and 10 CSR 20-6.200(3) requires permit coverage for these activities. Coverage is not required for facilities when only providing maintenance of original line and grade, hydraulic capacity, or to continue the original purpose of the facility.

- ✓ Not applicable; this permit does not provide coverage for land disturbance activities. The facility may obtain a separate land disturbance permit (MORA) online at https://dnr.mo.gov/env/wpp/stormwater/sw-land-disturb-permits.htm; MORA permits do not cover disturbance of contaminated soils.

MAJOR WATER USER:

Any surface or groundwater user with a water source and the equipment necessary to withdraw or divert 100,000 gallons (or 70 gallons per minute) or more per day combined from all sources from any stream, river, lake, well, spring, or other water source is considered a major water user in Missouri. All major water users are required by law to register water use annually (Missouri Revised Statues Chapter 256.400 Geology, Water Resources and Geodetic Survey Section). https://dnr.mo.gov/pubs/pub2236.htm

- ✓ Not applicable; the withdrawal pumps for this project do not withdraw water from the state in excess of 70 gpm/0.1 MGD; however, this facility is considered a major water user as a whole.

NUTRIENT MONITORING:

Nutrient monitoring is required for facilities characteristically or expected to discharge nutrients (nitrogenous compounds and/or phosphorus) when the design flow is equal to or greater than 0.1 MGD per 10 CSR 20-7.015(9)(D)8.

- ✓ Not applicable; this is a UIC permit not subject to said regulations.

OIL/WATER SEPARATORS:

Oil water separator (OWS) tank systems are frequently found at industrial sites where process water and stormwater may contain oils and greases, oily wastewaters, or other immiscible liquids requiring separation. Food industry discharges typically require pretreatment prior to discharge to municipally owned treatment works. Per 10 CSR 26-2.010(2)(B), all oil water separator tanks must be operated according to manufacturer's specifications and authorized in NPDES permits per 10 CSR 26-2.010(2) or may be regulated as a petroleum tank.

- ✓ Not applicable; this is a UIC permit not subject to said regulations.

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OPERATOR CERTIFICATION REQUIREMENTS:

Operators or supervisors of operations at regulated domestic wastewater treatment facilities shall be certified in accordance with 10 CSR 20-9.020(2) and any other applicable state law or regulation.

- ✓ Not applicable; this is a UIC permit not subject to said regulations.

PRETREATMENT:

This permit does not regulate pretreatment requirements for facilities discharging to an accepting permitted wastewater treatment facility. If applicable, the receiving entity (the publicly owned treatment works - POTW) is to ensure compliance with any effluent limitation guidelines for pretreatment listed in 40 CFR Subchapter N per 10 CSR 20-6.100. Pretreatment regulations per RSMo 644.016 are limitations on the introduction of pollutants or water contaminants into publicly owned treatment works or facilities.

- ✓ Not applicable, this facility does not discharge wastewater to a POTW.

REASONABLE POTENTIAL (RP):

Federal regulation [40 CFR Part 122.44(d)(1)(i)] requires effluent limitations for all pollutants which are (or may be) discharged at a level causing or have the reasonable potential to cause (or contribute to) an in-stream excursion above narrative or numeric water quality standards. Per 10 CSR 20-7.031(4), general criteria shall be applicable to all waters of the state at all times; however, acute toxicity criteria may be exceeded by permit in zones of initial dilution, and chronic toxicity criteria may be exceeded by permit in mixing zones. If the permit writer determines any given pollutant has the reasonable potential to cause or contribute to an in-stream excursion above the WQS, the permit must contain effluent limits for the pollutant per 40 CFR Part 122.44(d)(1)(iii) and the most stringent limits per 10 CSR 20-7.031(9)(A). Permit writers may use mathematical reasonable potential analysis (RPA) using the Technical Support Document for Water Quality Based Toxics Control (TSD) methods (EPA/505/2-90-001) as found in Section 3.3.2, or may also use reasonable potential determinations (RPD) as provided in Sections 3.1.2, 3.1.3, and 3.2 of the TSD.

- ✓ Applicable; the permit writer conducted an RPD on applicable parameters within the permit. See Part IV: Effluent Limits Determinations below.
- ✓ A mathematical RPA was not conducted for this facility given the limited information provided because this is a new permit. However, the permit writer completed an RPD, a reasonable potential determination, using best professional judgment for all of the appropriate parameters in this permit. An RPD consists of reviewing application data and comparing those data to narrative or numeric water quality criteria.
- ✓ Permit writers use the Department's permit writer's manual (http://dnr.mo.gov/env/wpp/permits/manual/permit-manual.htm), the EPA's permit writer's manual (https://www.epa.gov/npdes/npdes-permit-writers-manual), program policies, and best professional judgment. For each parameter in each permit, the permit writer carefully considers all applicable information regarding: technology based effluent limitations, effluent limitation guidelines, water quality standards, stream flows and uses, and all applicable site specific information and data gathered by the permittee through discharge monitoring reports and renewal (or new) application sampling. Best professional judgment is based on the experience of the permit writer, cohorts in the Department and resources at the EPA, research, and maintaining continuity of permits if necessary. For stormwater permits, the permit writer is required per 10 CSR 6.200(6)(B)2 to consider: A. application and other information supplied by the permittee; B. effluent guidelines; C. best professional judgment of the permit writer; D. water quality; and E. BMPs. Part IV provides specific decisions related to this permit.

SAMPLING FREQUENCY JUSTIFICATION:

This operation is new therefore monthly sampling is required to determine compliance with the operating permit in accordance with Appendix U of Missouri's Water Pollution Control Permit Manual.

SAMPLING TYPE JUSTIFICATION:

The sampling types are representative of the operations and are protective of water quality. Altering effluent should have composite sampling; uniform effluent can have grab samples. Grab samples are appropriate for ex-situ treatment and groundwater monitoring.

SCHEDULE OF COMPLIANCE (SOC):

A schedule of remedial measures included in a permit, including an enforceable sequence of interim requirements (actions, effluent limits, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. SOCs are allowed under 40 CFR 122.47 and 10 CSR 20-7.031(11) providing certain conditions are met. An SOC is not allowed:

- For effluent limitations based on technology-based standards established in accordance with federal requirements, if the deadline for compliance established in federal regulations has passed. 40 CFR 125.3.
- For a newly constructed facility in most cases. Newly constructed facilities must meet applicable effluent limitations when discharge begins, because the facility has installed the appropriate control technology as specified in a permit or antidegradation review. A SOC is allowed for a new water quality based effluent limit not included in a previously public noticed permit or antidegradation review, which may occur if a regulation changes during construction.
- To develop a TMDL, UAA, or other study associated with development of a site specific criterion. A facility is not prohibited from conducting these activities, but a SOC may not be granted for conducting these activities.

In order to provide guidance in developing SOCs, and to attain a greater level of consistency, the Department issued a policy on development of SOCs on October 25, 2012. The policy provides guidance to permit writers on standard time frames for schedules for common activities, and guidance on factors to modify the length of the schedule.

- ✓ Not applicable; this permit does not contain a SOC. Effluent limitations derived per 10 CSR 20-7.015 sections (2) through (8) are technology-based effluent limitations per 10 CSR 20-7.015(9)(A)1. therefore cannot be afforded schedules of compliance per 10 CSR 20-7.031(11)

SPILLS, OVERFLOWS, AND OTHER UNAUTHORIZED DISCHARGE REPORTING:
Per 260.505 RSMo, any emergency involving a hazardous substance must be reported to the Department's 24 hour Environmental Emergency Response hotline at (573) 634-2436 at the earliest practicable moment after discovery. The Department may require the submittal of a written report detailing measures taken to clean up a spill. These reporting requirements apply whether or not the spill results in chemicals or materials leaving the permitted property or reaching waters of the state. This requirement is in addition to the noncompliance reporting requirement found in Standard Conditions Part I. http://dnr.mo.gov/env/esp/spillbill.htm

Any other spills, overflows, or unauthorized discharges reaching waters of the state must be reported to the regional office during normal business hours, or after normal business hours, to the Department's 24 hour Environmental Emergency Response spill line at 573-634-2436.

SLUDGE – INDUSTRIAL:
Industrial sludge is solid, semi-solid, or liquid residue generated during the treatment of industrial process or non-process wastewater in a treatment works; including but not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment process; scum and solids filtered from water supplies and backwashed; and any material derived from industrial sludge. Industrial sludge could also be derived from lagoon dredging or other similar maintenance activities.

- ✓ Applicable; sludge from the ex-situ treatment system is removed and managed accordingly. The permitted management strategy must be followed, see permit under FACILITY DESCRIPTION. If the permitted management strategy cannot be followed, the permittee must obtain a permit modification.

STANDARD CONDITIONS:
The standard conditions Part I attached to this permit incorporate all sections of 10 CSR 20-6.010(8) and 40 CFR 122.41(a) through (n) by reference as required by law. These conditions, in addition to the conditions enumerated within the standard conditions should be reviewed by the permittee to ascertain compliance with this permit, state regulations, state statues, federal regulations, and the Clean Water Act. Standard Conditions Part III, if attached to this permit, incorporate requirements dealing with domestic wastewater, domestic sludge, and land application of domestic wastes.

STORMWATER PERMITTING: LIMITATIONS AND BENCHMARKS:
Because of the fleeting nature of stormwater discharges, the Department, under the direction of EPA guidance, has determined monthly averages are capricious measures of stormwater-only discharges. The ***Technical Support Document for Water Quality Based Toxics Control*** (EPA/505/2-90-001; 1991) Section 3.1 indicates most procedures within the document apply only to water quality based approaches, not end-of-pipe technology-based controls. Hence, stormwater-only outfalls will generally only contain a maximum daily limit (MDL), a benchmark, or a monitoring requirement as dictated by site specific conditions, the BMPs in place, the BMPs proposed, past performance of the facility, and the receiving water's current quality.

- ✓ Not applicable; UIC permits do not require stormwater monitoring per 40 CFR 122.26(b)(14) or 10 CSR 20-6.200. However, stormwater requirements may be applicable to the UIC areas as found under co-located permit MO-0000043.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):
A SWPPP must be prepared by the permittee if the SIC code is found in 40 CFR 122.26(b)(14) and/or 10 CSR 20-6.200(2). A SWPPP may be required of other facilities where stormwater has been identified as necessitating better management. The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff.

- ✓ Not applicable; this permit does not require stormwater monitoring per 40 CFR 122.26(b)(14); however, co-located permit MO-0000043 requires a SWPPP. The location of this operation may be required to have SWPPP inspections. The facility as a whole will need to decide if operations proceeding require stormwater monitoring.

SUFFICIENTLY SENSITIVE ANALYTICAL METHODS:
Please review Standard Conditions Part 1, section A, number 4. The analytical and sampling methods used shall conform to the reference methods listed in 10 CSR 20-7.015 and/or 40 CFR 136 unless alternates are approved by the Department and incorporated within this permit. The facility shall use sufficiently sensitive analytical methods for detecting, identifying, and measuring the concentrations of pollutants. The facility shall ensure the selected methods are able to quantify the presence of pollutants in a given discharge at concentrations low enough to determine compliance with Water Quality Standards in 10 CSR 20-7.031 or effluent limitations unless provisions in the permit allow for other alternatives. A method is "sufficiently sensitive" when; 1) the method quantifies the pollutant below the level of the applicable water quality criterion or; 2) the method minimum level is above the

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applicable water quality criterion, but the amount of pollutant in a facility's discharge is high enough the method detects and quantifies the level of pollutant in the discharge, or 3) the method has the lowest minimum level of the analytical methods approved under 10 CSR 20-7.015 and or 40 CFR 136. These methods are also required for parameters listed as monitoring only, as the data collected may be used to determine if numeric limitations need to be established. A permittee is responsible for working with their contractors to ensure the analysis performed is sufficiently sensitive.

UNDERGROUND INJECTION CONTROL (UIC):
The UIC program for all classes of wells in the State of Missouri is administered by the Missouri Department of Natural Resources and approved by EPA pursuant to section 1422 and 1425 of the Safe Drinking Water Act (SDWA) and 40 CFR 147 Subpart AA. Injection wells are classified based on the liquids which are being injected. Class I wells are hazardous waste wells which are banned by RSMo 577.155; Class II wells are established for oil and natural gas production; Class III wells are used to inject fluids to extract minerals; Class IV wells are also banned by Missouri in RSMo 577.155; Class V wells are shallow injection wells; some examples are heat pump wells and groundwater remediation wells. Domestic wastewater being disposed of sub-surface is also considered a Class V well. In accordance with 40 CFR 144.82, construction, operation, maintenance, conversion, plugging, or closure of injection wells shall not cause movement of fluids containing any contaminant into Underground Sources of Drinking Water (USDW) if the presence of any contaminant may cause a violation of drinking water standards or groundwater standards under 10 CSR 20-7.031, or other health based standards, or may otherwise adversely affect human health. If the director finds the injection activity may endanger USDWs, the Department may require closure of the injection wells, or other actions listed in 40 CFR 144.12(c), (d), or (e). In accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes, to the Missouri Department of Natural Resources, Geological Survey Program, P.O. Box 250, Rolla, Missouri 65402. The Class V Well Inventory Form can be requested from the Geological Survey Program or can be found at the following web address: http://dnr.mo.gov/forms/780-1774-f.pdf Single family residential septic systems and non-residential septic systems used solely for sanitary waste and having the capacity to serve fewer than 20 persons a day are excluded from the UIC requirements (40 CFR 144.81(9)).

✓ Applicable; this is a UIC permit. See additional conditions under Special Conditions and permit derivation of limits under Part IV of the fact sheet.

VARIANCE:
Per the Missouri Clean Water Law §644.061.4, variances shall be granted for such period of time and under such terms and conditions as specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law §§644.006 to 644.141 or any standard, rule or regulation promulgated pursuant to Missouri Clean Water Law §§644.006 to 644.141.

✓ Not applicable; this permit is not drafted under premise of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITS:
As per [10 CSR 20-2.010; definitions], the WLA is the amount of pollutant each discharger is allowed to discharge into the receiving stream without endangering water quality. Two general types of effluent limitations, technology-based effluent limits (TBELs) and water quality based effluent limits (WQBELs) are reviewed. If one limit does not provide adequate protection for the receiving water, then the other must be used per 10 CSR 20-7.015(9)(A). Total Maximum Daily Loads, if required for this facility, were also reviewed.

✓ Not applicable; wasteload allocations were either not calculated or were not based on traditional TSD methods.

WASTELOAD ALLOCATION (WLA) MODELING:
Permittees may submit site specific studies to better determine the site specific wasteload allocations applied in permits.

✓ Not applicable; a WLA study was either not submitted or determined not applicable by Department staff.

WATER QUALITY STANDARD REVISION:
In accordance with section 644.058, RSMo, the Department is required to utilize an evaluation of the environmental and economic impacts of modifications to water quality standards of twenty-five percent or more when making individual site-specific permit decisions.

✓ This operating permit does not contain requirements for a water quality standard changing twenty-five percent or more since the previous operating permit as this is a new permit.

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PART IV. EFFLUENT LIMITS DETERMINATIONS

UIC REQUIREMENTS

EFFLUENT LIMITATIONS TABLE:

PARAMETERS	UNIT	DAILY MAX	MONTHLY AVG.	MINIMUM SAMPLING FREQUENCY	REPORTING FREQUENCY	SAMPLE TYPE
PHYSICAL						
FLOW	MGD	*	*	ONCE/MONTH	MONTHLY	24 HR. TOT
CONVENTIONAL						
PH †	SU	6.0 TO 9.0	6.0 TO 9.0	ONCE/MONTH	MONTHLY	GRAB
METALS						
ANTIMONY, TR	µg/L	*	6.0	ONCE/MONTH	MONTHLY	GRAB
ARSENIC, TR	µg/L	*	50	ONCE/MONTH	MONTHLY	GRAB
BARIUM, TR	µg/L	*	2000	ONCE/MONTH	MONTHLY	GRAB
BORON, TR	µg/L	*	2000	ONCE/MONTH	MONTHLY	GRAB
LEAD, TR	µg/L	*	15	ONCE/MONTH	MONTHLY	GRAB
MOLYBDENUM, TR	µg/L	*	*	ONCE/MONTH	MONTHLY	GRAB
SELENIUM, TR	µg/L	*	50	ONCE/MONTH	MONTHLY	GRAB
OTHER						
SULFATE	mg/L	*	250	ONCE/MONTH	MONTHLY	GRAB

*	monitoring and reporting requirement only
†	report the minimum and maximum pH values; pH is not to be averaged
TR	total recoverable

DERIVATION AND DISCUSSION OF LIMITS:

PHYSICAL:

Flow
The volume of effluent injected is needed to ensure well integrity, monitoring compliance, and future conditions.

CONVENTIONAL:

pH
6.0 to 9.0 SU. pH adjustment occurs during the treatment of the groundwater. Monitoring is required to determine treatment efficacy. No groundwater standards exist for pH; however technological industrial wastewater standards apply per 10 CSR 20-7.015(9)(I) as a non-domestic wastewater treatment facility.

METALS:

Groundwater quality standards are chronic technology standards therefore the standard is applied as the monthly average; 10 CSR 20-7.015(6) references table A1 in 10 CSR 20-7.031. There is no maximum applied as a daily limit as long as the averages are below the standard for the parameter for the month. Multiple samples may need to be averaged to meet the monthly limit.

Antimony, Total Recoverable
Antimony is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove antimony prior to injection. Groundwater quality standards are 6 µg/L which must be met at the end of treatment prior to injection. The facility reported 6.4 µg/L in the groundwater at the site.

Arsenic, Total Recoverable
Arsenic is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove arsenic prior to injection. Groundwater quality standards are 50 µg/L which must be met at the end of treatment prior to injection. The facility reported 257 µg/L in the groundwater at the site.

Barium, Total Recoverable

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Barium is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove barium prior to injection. Groundwater quality standards are 2000 µg/L which must be met at the end of treatment prior to injection. The facility reported 551 µg/L in the groundwater at the site.

Boron, Total Recoverable
Boron is a pollutant of concern at the site. The resin filtration process is designed to remove boron prior to injection. Groundwater quality standards are 2000 µg/L which must be met at the end of treatment prior to injection. The facility reported 15,700 µg/L in the groundwater at the site.

Lead, Total Recoverable
Lead is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove lead prior to injection. Groundwater quality standards are 15 µg/L which must be met at the end of treatment prior to injection. The facility reported 17.7 µg/L in the groundwater at the site.

Molybdenum, Total Recoverable
Molybdenum is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove molybdenum prior to injection. There are no Missouri groundwater quality standards for this pollutant, however, 40 CFR 257 limits this pollutant at impoundments to 100 µg/L. The facility reported 943 µg/L in the groundwater at the site.

Selenium, Total Recoverable
Selenium is a pollutant of concern at the site. The pH adjustment and flocculation process is designed to remove selenium prior to injection. Groundwater quality standards are 50 µg/L which must be met at the end of treatment prior to injection. The facility reported 12.7 µg/L in the groundwater at the site.

OTHER:

Sulfate
The facility reported 382 µg/L in the application; as the laboratory typically reports sulfate data in mg/L, the permit writer requested additional information from the applicant. On 6/29/2020, the applicant indicated via email the units were mg/L. Sulfate is a known parameter of concern in coal ash, therefore monitoring is required. Groundwater is assumed to have the drinking water use per 10 CSR 20-7.031(6)(A) therefore will be limited at 250 mg/L for injection.

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PART V. ADMINISTRATIVE REQUIREMENTS

On the basis of preliminary staff review and the application of applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the operating permit. The proposed determinations are tentative pending public comment.

PERMIT SYNCHRONIZATION:
The Department of Natural Resources is currently undergoing a synchronization process for operating permits. Permits are normally issued on a five-year term, but to achieve synchronization many permits will need to be issued for less than the full five years allowed by regulation. The intent is all permits within a watershed will move through the Watershed Based Management (WBM) cycle together will all expire in the same fiscal year. http://dnr.mo.gov/env/wpp/cpp/docs/watershed-based-management.pdf. This will allow further streamlining by placing multiple permits within a smaller geographic area on public notice simultaneously, thereby reducing repeated administrative efforts. This will also allow the Department to explore a watershed based permitting effort at some point in the future. Renewal applications must continue to be submitted within 180 days of expiration, however, in instances where effluent data from the previous renewal is less than two years old, such data may be re-submitted to meet the requirements of the renewal application. If the permit provides a schedule of compliance for meeting new water quality based effluent limits beyond the expiration date of the permit, the time remaining in the schedule of compliance will be allotted in the renewed permit.
✓ Not applicable; this is a UIC permit and does not discharge to the surface.

PUBLIC NOTICE:
The Department shall give public notice a draft permit has been prepared and its issuance is pending. http://dnr.mo.gov/env/wpp/permits/pn/index.html Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest in or with water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and permittee must be notified of the denial in writing.

The Department must issue public notice of a pending operating permit or of a new or reissued statewide general permit. The public comment period is the length of time not less than 30 days following the date of the public notice which interested persons may submit written comments about the proposed permit.

For persons wanting to submit comments regarding this proposed operating permit, then please refer to the Public Notice page located at the front of this draft operating permit. The Public Notice page gives direction on how and where to submit appropriate comments.
✓ The Public Notice period for this operating permit is tentatively scheduled to begin in September 2020.

DATE OF FACT SHEET: AUGUST 21, 2020
COMPLETED BY:
PAM HACKLER, ENVIRONMENTAL SCIENTIST
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
OPERATING PERMITS SECTION - INDUSTRIAL UNIT
(573) 526-3386
pam.hackler@dnr.mo.gov

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Attachment 11

CCR Unit Closure Plans

Meramec Energy Center
CCR Surface Impoundment MCPA
(Pond 492)
CCR Unit Closure Plan

Meramec Energy Center
CCR Surface Impoundment MCPA
(Pond 492)
CCR Unit Closure Plan

Prepared for

Ameren Missouri
Project No. 90683
Ameren, Missouri

Revision 1
November 2016

Prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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INDEX AND CERTIFICATION

Ameren Missouri
Meramec Energy Center
CCR Surface Impoundment MCPA (Pond 492)
CCR Unit Closure Plan

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Missouri, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by Ameren Missouri or others without specific verification or adaptation by the Engineer. I certify that this Closure Plan and the Final Cover System specified herein satisfy the requirements presented in 40 CFR §257.102(b).

SCOTT
ALSON
MARTIN
NUMBER
PE-2010019572

Scott A Martin

11/14/16 10:29 PM cosign

Scott A. Martin, P.E.
License Number 2010019572
License renewal date: December 31, 2016.
Pages or sheets covered by this seal: As noted above

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LIST OF FIGURES

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LIST OF ABBREVIATIONS

Abbreviation	**Term/Phrase/Name**
Ameren	Ameren Missouri
BMcD	Burns & McDonnell
CCR	Coal Combustion Residual
CCR Rule	EPA Coal Combustion Rule Published April 17, 2015
CFR	Code of Federal Regulations
Cm/sec	Centimeters per second
CQA	Construction Quality Assurance
CY	Cubic yard
EPA	Environmental Protection Agency
EPDM	Ethylene propylene diene monomer
HDPE	High-density polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
LLDPE	Low-density polyethylene
MCPA	CCR Surface Impoundment MCPA or Pond 492
Meramec	Meramec Energy Center

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the federal Coal Combustion Residual Rule (CCR Rule) to regulate the disposal of coal combustion residual (CCR) materials generated by electric utilities and independent power producers.

Ameren Missouri (Ameren) is subject to the CCR Rule and is required to develop a Closure Plan for existing CCR surface impoundments per 40 Code of Federal Regulations (CFR) §257.102. This document serves as Ameren's Closure Plan for the existing CCR Surface Impoundment MCPA (Pond 492) at the Meramec Energy Center (Meramec). The Closure Plan is required to contain the following, as required in §257.102(b)(1):

- A description of how the CCR Unit will be closed.
  - For in-place closure: A description of the final cover system, methods for installing final cover system, and methods for achieving compliance with the standards outlined in §257.102(d).
- An estimate of the maximum inventory of CCR material ever stored in the CCR Unit over its active life.
- An estimate of the largest area requiring a final cover as required by §257.102(d) at any time during the active life of the CCR Unit.
- A schedule for completing CCR Unit closure activities, including the anticipated year of closure and major milestones for permitting and construction activities.

2.0 CLOSURE PLAN

2.1 Facility and Surface Impoundment Description

Meramec is located in southeastern St. Louis County, Missouri and consists of four generating units (a site aerial figure is included as Appendix A). Units 1 and 2 are fired on natural gas (fuel switching from coal to natural gas was completed in April 2016), and Units 3 and 4 are fired on coal. CCR generated at the facility includes fly ash and bottom ash.

Surface Impoundment MCPA (Pond 492), referred to herein as MCPA, is located on the northeast side of the Meramec facility. As-built construction documents are not available to document that a liner system was installed; therefore, MCPA has been classified as an existing, unlined CCR surface impoundment.

2.1.1 CCR Inventory and Extent

MCPA has an approximate surface area of 7 acres, as measured within the perimeter dikes, which represents the largest area that would require a final cover. The estimated maximum inventory of CCR in MCPA over its active life is approximately 187,000 cubic yards (CY) of CCR material. Ameren periodically removes CCR from MCPA for beneficial use (primarily used for cement kiln raw feed).

2.2 Closure Method

The CCR Rule allows for CCR Units to be closed through removal of CCR or by leaving CCR material in-place. MCPA is planned to be closed with CCR material in-place, and accordingly, will follow the closure performance standards referenced in 40 CFR §257.102(d). If the design or use changes in the future, this Closure Plan will be updated accordingly (see Section 3.0).

2.2.1 Drainage / Stabilization of CCR Material

Prior to installing the final cover system, Ameren will perform the following activities outlined in §257.102(d) of the CCR Rule:

- Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues.
- Stabilize remaining wastes sufficiently in order to support the final cover system.

Free liquids will be removed, with excess water discharged under the current NPDES Permit. Free liquid removal will be performed throughout construction, as necessary, to manage surface water and storm water runoff. Once stabilized, the CCR will be compacted and graded to promote drainage.

2.2.2 Final Cover System

The final cover system will be designed and constructed to meet the following criteria pursuant to §257.102(d)(3)(i):

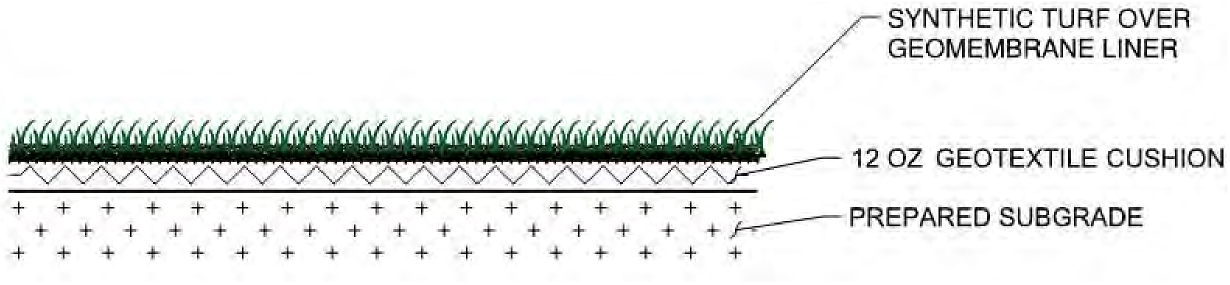
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1\text{x}10^{-5}$ centimeters per second (cm/sec), whichever is less.
- The infiltration of liquids through the closed CCR Unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
- The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.
- The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.
- The owner or operator may select an alternative final cover system design, provided the alternative final cover system meets the above requirements.

MCPA will be capped and closed in-place as described herein, and in accordance with the requirements of the CCR Rule. MCPA will be closed using an alternative cover system, which will consist of (from bottom to top):

- Geotextile cushion (to protect the overlying geomembrane),
- 40-mil (minimum) linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE), or ethylene propylene diene monomer (EPDM) geomembrane,
- Synthetic turf.

A typical cross section of this alternative cover system is shown in Figure 2-1.

Figure 2-1: Final Cover System



A construction quality assurance (CQA) plan will be compiled prior to the commencement of construction, and the CQA program will be implemented during construction of the cover system.

2.2.2.1 Permeability and Infiltration

The federal minimum standard requires MCPA's cover system permeability to be less than or equal to that of the bottom liner, natural underlying subsoils, or $1x10^{-5}$ cm/sec, whichever is less. As discussed above, MCPA construction documents are not available. MCPA was reportedly constructed by excavating soils within MCPA (silts and clays), and the excavated materials were utilized for pond berms. Site specific permeability information of the pond base and/or natural subsoils is not available at this time.

The proposed cover system will feature a geomembrane component which has a permeability of 2.0×10^{-12} cm/sec, which represents the maximum permeability value of the potential geomembrane material types planned to be utilized for closure[1]. The alternative final cover system uses a geomembrane component to achieve the minimum permeability requirements of the CCR Rule, rather than relying on the permeability of an 18-inch of infiltration layer.

2.2.2.2 Geometry and Stormwater Management

The geometry and stormwater management controls of MCPA following closure will allow the CCR Unit to meet the following requirements as outlined in §257.102(d) of the CCR Rule:

- Control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.
- Prevent future impoundment of water.
- Provide for slope stability to protect against sloughing or movement of the final cover system.

The closure system will be designed to provide adequate drainage during storm events. Intermediate swales will be utilized to limit the maximum overland flow distance, thereby minimizing ponded water, as well as limiting the infiltration of run-off.

2.2.2.3 Integrity of the Final Cover

Settling and subsidence of the final cover system is expected to be minimal. Settlement would potentially be caused by consolidation of the CCR material, general fill material, or underlying natural subsoils due

---

[1] Per the Hydrologic Evaluation of Landfill Performance (HELP) Model User's Guide for Version 3 - EPA/600/R-94/168a.

to the dynamic loads typically resulting from construction activities; consequently, this settlement is expected to be minimal following final cover installation activities. General fill will be installed in a controlled manner to minimize post-fill installation settlement. Maintenance will be conducted as necessary to maintain the integrity of the final cover, as outlined in the Post-Closure Plan for MCPA (separate document).

2.2.3 Final Cover Schedule

According to §257.101 of the CCR Rule, closure of the MCPA will commence no later than six months following the date on which a closure event is triggered. For the purposes of this Plan, closure of MCPA is assumed to have commenced when Ameren has ceased placing CCR material into MCPA and has completed any of the following actions or activities:

- Taken any steps necessary to implement the written Closure Plan.
- Submitted a completed application for any required state or agency permit or permit modification.
- Taken any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR Unit.

In the event that closure of MCPA is required due to a location restriction or groundwater impacts, but not a safety factor assessment, the CCR unit may continue to receive CCR material beyond the six-month maximum duration, provided that MCPA satisfies the criteria specified in §257.103(a) or §257.103(b).

No later than the date Ameren initiates closure of MCPA, a Notification of Intent to Close the CCR Unit will be prepared. The notification is considered completed when it has been placed in the facility's CCR Operating Record. The notification will then be posted on Ameren's CCR public website within 30 days.

2.2.3.1 Closure Completion

Closure for MCPA shall be completed within five years of commencing closure activities per the CCR Rule. The timeframe for completing closure of the CCR Unit may be extended if Ameren demonstrates that it is not feasible to complete closure of the CCR Unit within the required timeframe due to factors beyond the facility's control. A demonstration for an extension of the closure timeframe shall be completed pursuant to §257.102(f)(2).

For the purpose of this Closure Plan, closure of MCPA is considered complete when the final cover system is installed and applicable construction completion documentation is finalized. Based on the closure schedule provided in Appendix B, it is estimated that the closure of MCPA will be completed in less than five years. The estimated closure year is 2026.

Within 30 days of completion of closure of MCPA, Ameren will prepare a notification of closure and post it on the facility's CCR Operating Record and on Ameren's CCR public website. This notification shall include certification by a qualified professional engineer, registered in the State of Missouri, verifying that closure has been completed in accordance with this Closure Plan and the requirements of §257.102.

Following closure, Ameren will record a notation on the deed of the Meramec property, and within 30 days of the deed notation, Ameren will prepare a notification stating that the notation has been recorded per §257.102(i) and place within facility's CCR Operating Record.

In accordance with §257.102(i), Ameren will record a notation on the deed to the property, following completion of closure. This notation is inform any potential future owner of the property of the previous use of the land, and that the land is restricted by post-closure care requirements.

3.0 REVISIONS AND AMENDMENTS

The MCPA Closure Plan will be amended whenever there is a change in operation of the CCR unit that affects the current or planned closure operations. The Closure Plan will be amended 60 days prior to a planned change in operation, or within 60 days following an unplanned change in operation. If a written Closure Plan is revised after closure activities have commenced, the written Closure Plan will be amended no later than 30 days following the triggering event. The initial Closure Plan and any amendment will be certified by a qualified professional engineer in the State of Missouri for meeting the requirements of §257.102 of the CCR Rule. All amendments and revisions will be posted on the CCR public website within 30 days following placement in the facility's CCR Operating Record. A record of revisions made to this document is included in Section 4.0 of this document.

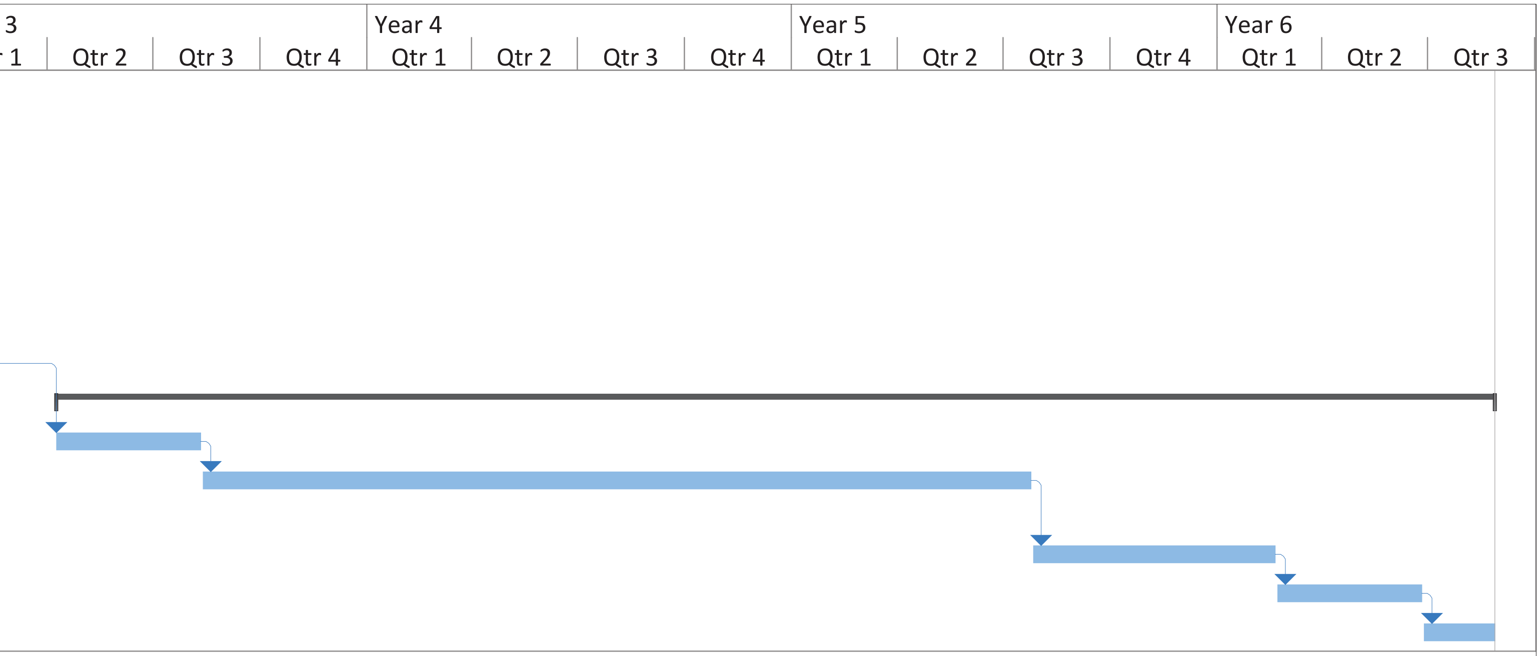
4.0 RECORD OF REVISIONS AND UPDATES

Revision Number	Date	Revisions Made	By Whom
0	10/13/2016	Initial Closure Plan	Burns & McDonnell
1	11/14/2016	Revisions to cover page to use Ameren's standard cover page, and Section 2.2.3.1 to include estimated year of MCPA closure	Burns & McDonnell

APPENDIX A – SITE AERIAL FIGURE


MCPA (POND 492)

APPENDIX B – CLOSURE SCHEDULE



e Milestone	◇	Manual Summary Rollup	▬	Deadline	⬇
e Summary	⌐¬	Manual Summary	⌐¬	Progress	―
Task	▬	Start-only	[	Manual Progress	―
n-only	▬	Finish-only	]		

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Prepared for

Ameren Missouri
Project No. 90683
Ameren, Missouri

Revision 1
November 2016

Prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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Ameren Missouri
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SCOTT MARTIN
NUMBER
PE-2010019572

Scott A. Martin, P.E.
License Number 2010019572
License renewal date: December 31, 2016.
Pages or sheets covered by this seal: As noted above

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EPDM	Ethylene propylene diene monomer
HDPE	High-density polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
LLDPE	Low-density polyethylene
MCPB	CCR Surface Impoundment MCPB or Pond 493
Meramec	Meramec Energy Center

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the final version of the federal Coal Combustion Residual Rule (CCR Rule) to regulate the disposal of coal combustion residual (CCR) materials generated by electric utilities and independent power producers.

Ameren Missouri (Ameren) is subject to the CCR Rule and is required to develop a Closure Plan for existing CCR surface impoundments per 40 Code of Federal Regulations (CFR) §257.102. This document serves as Ameren's Closure Plan for the existing CCR Surface Impoundment MCPB (Pond 493) at the Meramec Energy Center (Meramec). The Closure Plan is required to contain the following, as required in §257.102(b)(1):

- A description of how the CCR Unit will be closed.
    - For in-place closure: A description of the final cover system, methods for installing final cover system, and methods for achieving compliance with the standards outlined in §257.102(d).
- An estimate of the maximum inventory of CCR material ever stored in the CCR Unit over its active life.
- An estimate of the largest area requiring a final cover as required by §257.102(d) at any time during the active life of the CCR Unit.
- A schedule for completing CCR Unit closure activities, including the anticipated year of closure and major milestones for permitting and construction activities.

Additionally, the CCR Unit will be subject to the post-closure care requirements contained in §257.104, and a Post-Closure Plan has been prepared as a separate, stand-alone document.

2.0 CLOSURE PLAN

2.1 Facility and Surface Impoundment Description

Meramec is located in southeast St. Louis County, Missouri and consists of four generating units (a site aerial figure is included as Appendix A). Units 1 and 2 are fired on natural gas (fuel switching from coal to natural gas was completed in April 2016), and Units 3 and 4 are fired on coal. CCR generated at the facility includes fly ash and bottom ash.

Surface Impoundment MCPB (Pond 493), referred to herein as MCPB, is located on the northeast side of the Meramec facility. As-built construction documents are not available to document that a liner system was installed; therefore, MCPB has been classified as an existing, unlined CCR surface impoundment.

2.1.1 CCR Inventory and Extent

MCPB has an approximate surface area of 7 acres, as measured within the perimeter dikes, which represents the largest area that would require a final cover. The estimated maximum inventory of CCR in MCPB over its active life is approximately 59,000 cubic yards (CY) of CCR material. Ameren periodically removes CCR from MCPB for beneficial use (primarily used for cement kiln raw feed).

2.2 Closure Method

The CCR Rule allows for CCR Units to be closed through removal of CCR or by leaving CCR material in-place. MCPB is planned to be closed with CCR material in-place, and accordingly, will follow the closure performance standards referenced in 40 CFR §257.102(d). If the design or use changes in the future, this Closure Plan will be updated accordingly (see Section 3.0).

2.2.1 Drainage / Stabilization of CCR Material

Prior to installing the final cover system, Ameren will perform the following activities outlined in §257.102(d) of the CCR Rule:

- Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues.
- Stabilize remaining wastes sufficiently in order to support the final cover system.

Free liquids will be removed, with excess water discharged under the current NPDES Permit. Free liquid removal will be performed throughout construction, as necessary, to manage surface water and storm water runoff. Once stabilized, the CCR will be compacted and graded to promote drainage.

2.2.2 Final Cover System

The final cover system will be designed and constructed to meet the following criteria pursuant to §257.102(d)(3)(i):

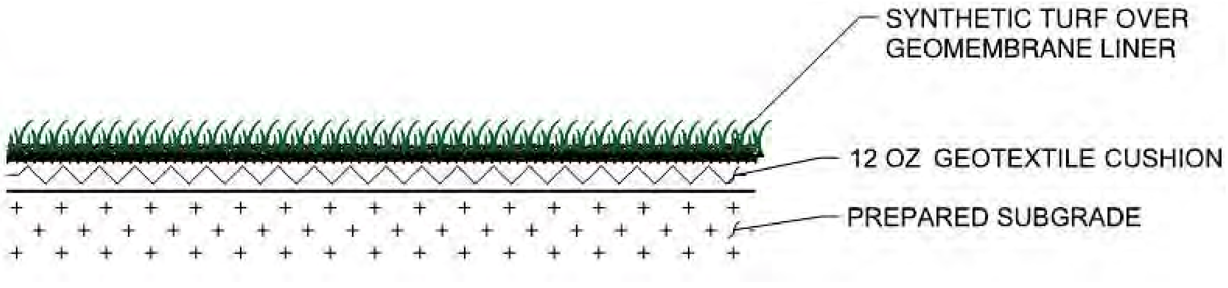
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ centimeters per second (cm/sec), whichever is less.
- The infiltration of liquids through the closed CCR Unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
- The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.
- The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.
- The owner or operator may select an alternative final cover system design, provided the alternative final cover system meets the above requirements.

MCPB will be capped and closed in-place as described herein, and in accordance with the requirements of the CCR Rule. MCPB will be closed using an alternative cover system, which will consist of (from bottom to top):

- Geotextile cushion (to protect the overlying geomembrane),
- 40-mil (minimum) linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE), or ethylene propylene diene monomer (EPDM) geomembrane,
- Synthetic turf.

A typical cross section of this alternative cover system is shown in Figure 2-1.

Figure 2-1: Final Cover System



A construction quality assurance (CQA) plan will be compiled prior to the commencement of construction, and the CQA program will be implemented during construction of the cover system.

2.2.2.1 Permeability and Infiltration

The federal minimum standard requires MCPB's cover system permeability to be less than or equal to that of the bottom liner, natural underlying subsoils, or $1x10^{-5}$ cm/sec, whichever is less. As discussed above, MCPB construction documents are not available. MCPB was reportedly constructed by excavating soils within MCPB (silts and clays), and the excavated materials were utilized for pond berms. Site specific permeability information of the pond base and/or natural subsoils is not available at this time.

The proposed cover system will feature a geomembrane component which has a permeability of 2.0×10^{-12} cm/sec, which represents the maximum permeability value of the potential geomembrane material types planned to be utilized for closure[1]. The alternative final cover system uses a geomembrane component to achieve the minimum permeability requirements of the CCR Rule, rather than relying on the permeability of an 18-inch infiltration layer.

2.2.2.2 Geometry and Stormwater Management

The geometry and stormwater management controls of MCPB following closure will allow the CCR Unit to meet the following requirements as outlined in §257.102(d) of the CCR Rule:

- Control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.
- Prevent future impoundment of water.
- Provide for slope stability to protect against sloughing or movement of the final cover system.

The closure system will be designed to provide adequate drainage during storm events. Intermediate swales will be utilized to limit the maximum overland flow distance, thereby minimizing ponded water, as well as limiting the infiltration of run-off.

2.2.2.3 Integrity of the Final Cover

Settling and subsidence of the final cover system is expected to be minimal. Settlement would potentially be caused by consolidation of the CCR material, general fill material, or underlying natural subsoils due

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[1] Per the Hydrologic Evaluation of Landfill Performance (HELP) Model User's Guide for Version 3 - EPA/600/R-94/168a.

to the dynamic loads typically resulting from construction activities; consequently, this settlement is expected to be minimal following final cover installation activities. General fill will be installed in a controlled manner to minimize post-fill installation settlement. Maintenance will be conducted as necessary to maintain the integrity of the final cover, as outlined in the Post-Closure Plan for MCPB (separate document).

2.2.3 Final Cover Schedule

According to §257.101 of the CCR Rule, closure of the MCPB will commence no later than six months following the date on which a closure event is triggered. For the purposes of this Plan, closure of MCPB is assumed to have commenced when Ameren has ceased placing CCR material into MCPB and has completed any of the following actions or activities:

- Taken any steps necessary to implement the written Closure Plan.
- Submitted a completed application for any required state or agency permit or permit modification.
- Taken any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR Unit.

In the event that closure of MCPB is required due to a location restriction or groundwater impacts, but not a safety factor assessment, the CCR unit may continue to receive CCR material beyond the six-month maximum duration, provided that MCPB satisfies the criteria specified §257.103(a) or §257.103(b).

No later than the date Ameren initiates closure of MCPB, a Notification of Intent to Close the CCR Unit will be prepared. The notification is considered completed when it has been placed in the facility's CCR Operating Record. The notification will then be posted on Ameren's CCR public website within 30 days.

2.2.3.1 Closure Completion

Closure for MCPB shall be completed within five years of commencing closure activities per the CCR Rule. The timeframe for completing closure of the CCR Unit may be extended if Ameren demonstrates that it is not feasible to complete closure of the CCR Unit within the required timeframe due to factors beyond the facility's control. A demonstration for an extension of the closure timeframe shall be completed pursuant to §257.102(f)(2).

For the purpose of this Closure Plan, closure of MCPB is considered complete when the final cover system is installed and applicable construction completion documentation is finalized. Based on the closure schedule provided in Appendix B, it is estimated that the closure of MCPB will be completed in less than 5 years. The estimated closure year is 2026.

Within 30 days of completion of closure of MCPB, Ameren will prepare a notification of closure and post it on the facility's CCR Operating Record and on Ameren's CCR public website. This notification shall include certification by a qualified professional engineer, registered in the State of Missouri, verifying that closure has been completed in accordance with this Closure Plan and the requirements of §257.102.

In accordance with §257.102(i), Ameren will record a notation on the deed to the property, following completion of closure. This notation is inform any potential future owner of the property of the previous use of the land, and that the land is restricted by post-closure care requirements.

3.0 REVISIONS AND AMENDMENTS

The MCPB Closure Plan will be amended whenever there is a change in operation of the CCR unit that affects the current or planned closure operations. The Closure Plan will be amended 60 days prior to a planned change in operation, or within 60 days following an unplanned change in operation. If a written Closure Plan is revised after closure activities have commenced, the written Closure Plan will be amended no later than 30 days following the triggering event. The initial Closure Plan and any amendment will be certified by a qualified professional engineer in the State of Missouri for meeting the requirements of §257.102 of the CCR Rule. All amendments and revisions will be posted on the CCR public website within 30 days following placement in the facility's CCR Operating Record. A record of revisions made to this document is included in Section 4.0 of this document.

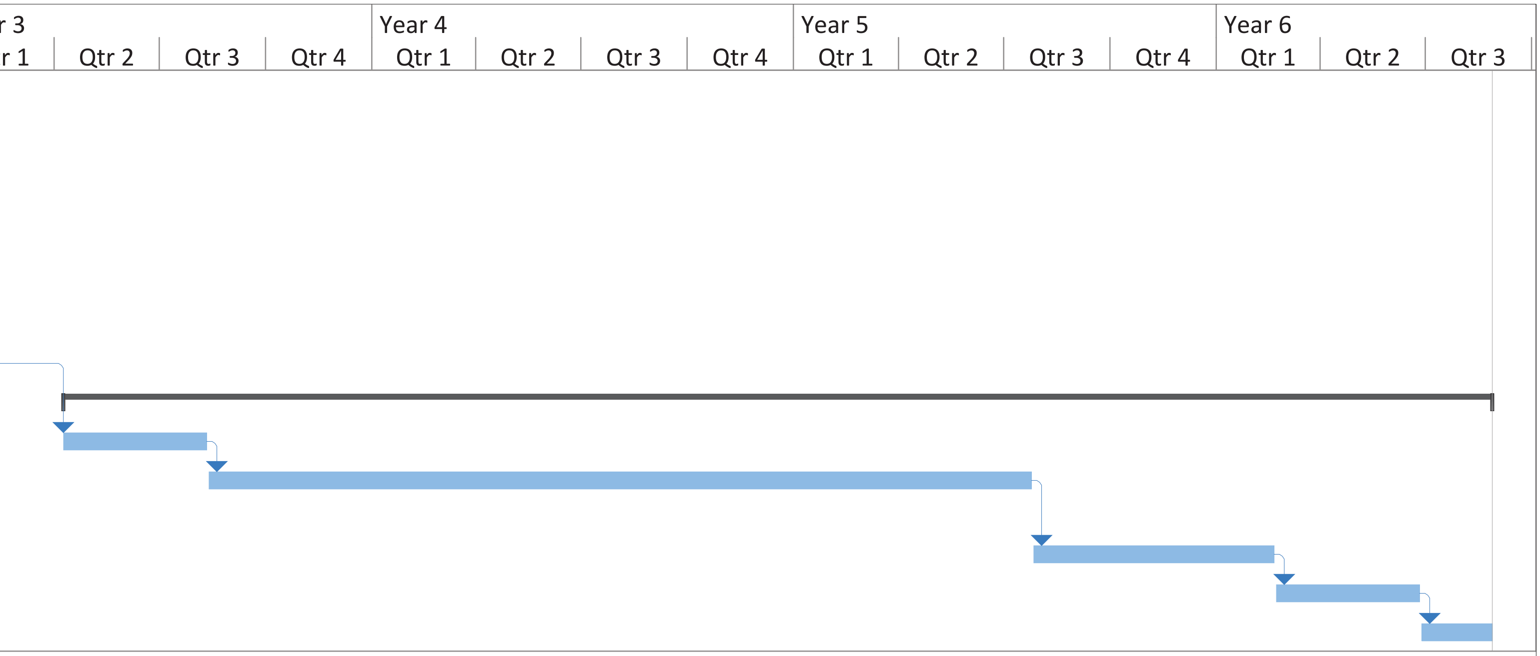
4.0 RECORD OF REVISIONS AND UPDATES

Revision Number	Date	Revisions Made	By Whom
0	10/13/2016	Initial Closure Plan	Burns & McDonnell
1	11/14/2016	Revisions to cover page to use Ameren's standard cover page, and Section 2.2.3.1 to include estimated year of MCPB closure	Burns & McDonnell

APPENDIX A – SITE AERIAL FIGURE


MCPB (POND 493)

APPENDIX B – CLOSURE SCHEDULE



e Milestone	◇	Manual Summary Rollup	▬	Deadline	⇩
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n-only	▬	Finish-only	]		

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Meramec Energy Center
CCR Surface Impoundment MCPC
(Pond 496)
CCR Unit Closure Plan

Meramec Energy Center
CCR Surface Impoundment MCPC
(Pond 496)
CCR Unit Closure Plan

Prepared for

Ameren Missouri
Project No. 90683
Ameren, Missouri

Revision 1
November 2016

Prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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INDEX AND CERTIFICATION

Ameren Missouri
Meramec Energy Center
CCR Surface Impoundment MCPC (Pond 496)
CCR Unit Closure Plan

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2.0	Closure Plan	5
3.0	Revisions and Amendments	1
4.0	Record of Revisions and Updates	1
Appendix A	Site Aerial Figure	1
Appendix B	Closure Schedule	1

Certification

I hereby certify, as a Professional Engineer in the state of Missouri, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by Ameren Missouri or others without specific verification or adaptation by the Engineer. I certify that this Closure Plan and the Final Cover System specified herein satisfy the requirements presented in 40 CFR §257.102(b)

SCOTT
[illegible]
MARTIN
NUMBER
PE-2010019572

11/14/16 10:14 PM cosign

Scott A. Martin, P.E.
License Number 2010019572
License renewal date: December 31, 2016.
Pages or sheets covered by this seal: As noted above

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LIST OF ABBREVIATIONS

Abbreviation	**Term/Phrase/Name**
Ameren	Ameren Missouri
BMcD	Burns & McDonnell
CCR	Coal Combustion Residual
CCR Rule	EPA Coal Combustion Rule Published April 17, 2015
CFR	Code of Federal Regulations
Cm/sec	Centimeters per second
CQA	Construction Quality Assurance
CY	Cubic yard
EPA	Environmental Protection Agency
EPDM	Ethylene propylene diene monomer
HDPE	High-density polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
LLDPE	Low-density polyethylene
MCPC	CCR Surface Impoundment MCPC or Pond 496
Meramec	Meramec Energy Center

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the final version of the federal Coal Combustion Residual Rule (CCR Rule) to regulate the disposal of coal combustion residual (CCR) materials generated by electric utilities and independent power producers.

Ameren Missouri (Ameren) is subject to the CCR Rule and is required to develop a Closure Plan for existing CCR surface impoundments per 40 Code of Federal Regulations (CFR) §257.102. This document serves as Ameren's Closure Plan for the existing CCR Surface Impoundment MCPC (Pond 496) at the Meramec Energy Center (Meramec). The Closure Plan is required to contain the following, as required in §257.102(b)(1):

- A description of how the CCR Unit will be closed.
    - For in-place closure: A description of the final cover system, methods for installing final cover system, and methods for achieving compliance with the standards outlined in §257.102(d).
- An estimate of the maximum inventory of CCR material ever stored in the CCR Unit over its active life.
- An estimate of the largest area requiring a final cover as required by §257.102(d) at any time during the active life of the CCR Unit.
- A schedule for completing CCR Unit closure activities, including the anticipated year of closure and major milestones for permitting and construction activities.

Additionally, the CCR Unit will be subject to the post-closure care requirements contained in §257.104, and a Post-Closure Plan has been prepared as a separate, stand-alone document.

2.0 CLOSURE PLAN

2.1 Facility and Surface Impoundment Description

Meramec is located in southeast St. Louis County, Missouri and consists of four generating units (a site aerial figure is included as Appendix A). Units 1 and 2 are fired on natural gas (fuel switching from coal to natural gas was completed in April 2016), and Units 3 and 4 are fired on coal. CCR generated at the facility includes fly ash and bottom ash.

Surface Impoundment MCPC (Pond 496), referred to herein as MCPC, is located on the northeast side of the Meramec facility. As-built construction documents are not available to document that a liner system was installed; therefore, MCPC has been classified as an existing, unlined CCR surface impoundment.

2.1.1 CCR Inventory and Extent

MCPC has an approximate surface area of 10 acres, as measured within the perimeter dikes, which represents the largest area that would require a final cover. The estimated maximum inventory of CCR in MCPC over its active life is approximately 274,000 cubic yards (CY) of CCR material. Ameren periodically removes CCR from MCPC for beneficial use (primarily used for cement kiln raw feed).

2.2 Closure Method

The CCR Rule allows for CCR Units to be closed through removal of CCR or by leaving CCR material in-place. MCPC is planned to be closed with CCR material in-place, and accordingly, will follow the closure performance standards referenced in 40 CFR §257.102(d). If the design or use changes in the future, this Closure Plan will be updated accordingly (see Section 3.0).

2.2.1 Drainage / Stabilization of CCR Material

Prior to installing the final cover system, Ameren will perform the following activities outlined in §257.102(d) of the CCR Rule:

- Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues.
- Stabilize remaining wastes sufficiently in order to support the final cover system.

Free liquids will be removed, with excess water discharged under the current NPDES Permit. Free liquid removal will be performed throughout construction, as necessary, to manage surface water and storm water runoff. Once stabilized, the CCR will be compacted and graded to promote drainage.

2.2.2 Final Cover System

The final cover system will be designed and constructed to meet the following criteria pursuant to §257.102(d)(3)(i):

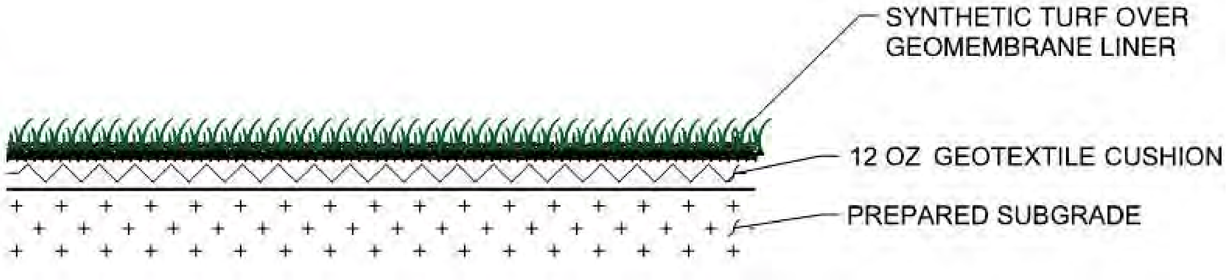
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ centimeters per second (cm/sec), whichever is less.
- The infiltration of liquids through the closed CCR Unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
- The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.
- The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.
- The owner or operator may select an alternative final cover system design, provided the alternative final cover system meets the above requirements.

MCPC will be capped and closed in-place as described herein, and in accordance with the requirements of the CCR Rule. MCPC will be closed using an alternative cover system, which will consist of (from bottom to top):

- Geotextile cushion (to protect the overlying geomembrane),
- 40-mil (minimum) linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE), or ethylene propylene diene monomer (EPDM) geomembrane,
- Synthetic turf.

A typical cross section of this alternative cover system is shown in Figure 2-1.

Figure 2-1: Final Cover System



A construction quality assurance (CQA) plan will be compiled prior to the commencement of construction, and the CQA program will be implemented during construction of the cover system.

2.2.2.1 Permeability and Infiltration

The federal minimum standard requires MCPC's cover system permeability to be less than or equal to that of the bottom liner, natural underlying subsoils, or $1x10^{-5}$ cm/sec, whichever is less. As discussed above, MCPC construction documents are not available. MCPC was reportedly constructed by excavating soils within MCPC (silts and clays), and the excavated materials were utilized for pond berms. Site specific permeability information of the pond base and/or natural subsoils is not available at this time.

The proposed cover system will feature a geomembrane component which has a permeability of 2.0×10^{-12} cm/sec, which represents the maximum permeability value of the potential geomembrane material types planned to be utilized for closure[1].The alternative final cover system uses a geomembrane component to achieve the minimum permeability requirements of the CCR Rule, rather than relying on the permeability of an 18-inch infiltration layer.

2.2.2.2 Geometry and Stormwater Management

The geometry and stormwater management controls of MCPC following closure will allow the CCR Unit to meet the following requirements as outlined in §257.102(d) of the CCR Rule:

- Control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.
- Prevent future impoundment of water.
- Provide for slope stability to protect against sloughing or movement of the final cover system.

The closure system will be designed to provide adequate drainage during storm events. Intermediate swales will be utilized to limit the maximum overland flow distance, thereby minimizing ponded water, as well as limiting the infiltration of run-off.

2.2.2.3 Integrity of the Final Cover

Settling and subsidence of the final cover system is expected to be minimal. Settlement would potentially be caused by consolidation of the CCR material, general fill material, or underlying natural subsoils due

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[1] Per the Hydrologic Evaluation of Landfill Performance (HELP) Model User's Guide for Version 3 - EPA/600/R-94/168a.

to the dynamic loads typically resulting from construction activities; consequently, this settlement is expected to be minimal following final cover installation activities. General fill will be installed in a controlled manner to minimize post-fill installation settlement. Maintenance will be conducted as necessary to maintain the integrity of the final cover, as outlined in the Post-Closure Plan for MCPC (separate document).

2.2.3 Final Cover Schedule

According to §257.101 of the CCR Rule, closure of the MCPC will commence no later than six months following the date on which a closure event is triggered. For the purposes of this Plan, closure of MCPC is assumed to have commenced when Ameren has ceased placing CCR material into MCPC and has completed any of the following actions or activities:

- Taken any steps necessary to implement the written Closure Plan.
- Submitted a completed application for any required state or agency permit or permit modification.
- Taken any steps necessary to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR Unit.

In the event that closure of MCPC is required due to a location restriction or groundwater impacts, but not a safety factor assessment, the CCR unit may continue to receive CCR material beyond the six-month maximum duration, provided that MCPC satisfies the criteria specified §257.103(a) or §257.103(b).

No later than the date Ameren initiates closure of MCPC, a Notification of Intent to Close the CCR Unit will be prepared. The notification is considered completed when it has been placed in the facility's CCR Operating Record. The notification will then be posted on Ameren's CCR public website within 30 days.

2.2.3.1 Closure Completion

Closure for MCPC shall be completed within five years of commencing closure activities per the CCR Rule. The timeframe for completing closure of the CCR Unit may be extended if Ameren demonstrates that it is not feasible to complete closure of the CCR Unit within the required timeframe due to factors beyond the facility's control. A demonstration for an extension of the closure timeframe shall be completed pursuant to §257.102(f)(2).

For the purpose of this Closure Plan, closure of MCPC is considered complete when the final cover system is installed and applicable construction completion documentation is finalized. Based on the closure schedule provided in Appendix B, it is estimated that the closure of MCPC will be completed in less than five years. The estimated closure year is 2026.

Within 30 days of completion of closure of MCPC, Ameren will prepare a notification of closure and post it on the facility's CCR Operating Record and on Ameren's CCR public website. This notification shall include certification by a qualified professional engineer, registered in the State of Missouri, verifying that closure has been completed in accordance with this Closure Plan and the requirements of §257.102.

In accordance with §257.102(i), Ameren will record a notation on the deed to the property, following completion of closure. This notation is inform any potential future owner of the property of the previous use of the land, and that the land is restricted by post-closure care requirements.

3.0 REVISIONS AND AMENDMENTS

The MCPC Closure Plan will be amended whenever there is a change in operation of the CCR unit that affects the current or planned closure operations. The Closure Plan will be amended 60 days prior to a planned change in operation, or within 60 days following an unplanned change in operation. If a written Closure Plan is revised after closure activities have commenced, the written Closure Plan will be amended no later than 30 days following the triggering event. The initial Closure Plan and any amendment will be certified by a qualified professional engineer in the State of Missouri for meeting the requirements of §257.102 of the CCR Rule. All amendments and revisions will be posted on the CCR public website within 30 days following placement in the facility's CCR Operating Record. A record of revisions made to this document is included in Section 4.0 of this document.

4.0 RECORD OF REVISIONS AND UPDATES

Revision Number	Date	Revisions Made	By Whom
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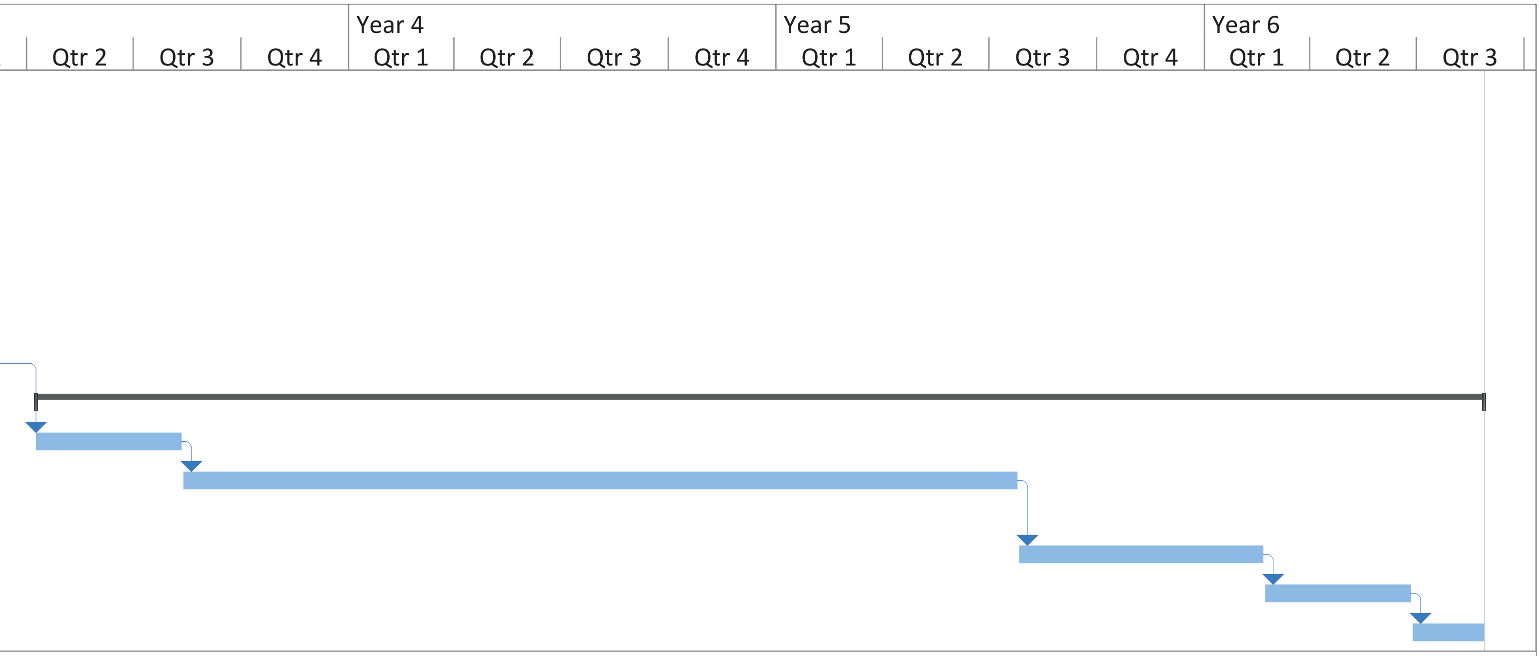
1	11/14/2016	Revisions to cover page to use Ameren's standard cover page, and Section 2.2.3.1 to include estimated year of MCPC closure	Burns & McDonnell

APPENDIX A – SITE AERIAL FIGURE

APPENDIX B – CLOSURE SCHEDULE



e Milestone	◇	Manual Summary Rollup	▬	Deadline	⬇
e Summary	▭	Manual Summary	┏━┓	Progress	━
Task	▬	Start-only	[	Manual Progress	━
n-only	▬	Finish-only	]		

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Attachment 12

Structural Integrity & Safety Factor Assessment

STRUCTURAL INTEGRITY CRITERIA & HYDROLOGIC/ HYDRAULIC CAPACITY ASSESSMENT MERAMEC ENERGY CENTER

Meramec Energy Center
8200 Fine Road
St. Louis, MO 63129

Contents

STRUCTURAL INEGRITY CRITERIA & HYDROLOGIC/ HYDRAULIC CAPACITY ASSESSMENT - MERAMEC ENERGY CENTER

I. Introduction

Ameren Missouri has evaluated the Meramec Energy Center's ("Meramec") active surface impoundments in accordance with the following operating and design criteria requirements:

§257.71, Liner Design Criteria;
§257.73(c)(1), History of Construction;
§257.73(a)(2), Periodic Hazard Potential Classification;
§257.73(d)(1), Periodic Structural Stability Assessment;
§257.73(e)(1), Periodic Safety Factor Assessment;
§257.82, Initial Hydrologic and Hydraulic Capacity Requirements; and

For this initial assessment, Ameren Missouri retained the engineering firm Reitz & Jens, Inc. to evaluate Meramec's active surface impoundments to determine whether such units conform to good engineering practices[1] with respect to the following criteria: liner design criteria; hazard potential classification; structural stability assessment; safety factor assessment; and initial hydrologic and hydraulic capacity requirements. Such criteria will be reassessed every five years until such time as the units are closed in accordance with regulatory requirements. Engineering calculations, diagrams modeling, and work papers supporting this assessment have been placed in the facility's operating record.

II. Background

A. **Active Ponds**

Meramec utilizes four (4) active surface impoundments for the management of process waters along with fly and bottom ash; Pond 498 (fly ash) and Ponds 492, 493 and 496 (bottom ash). Such impoundments have been identified as follows*: MCPD (498)*; and *MCPB (493), MCPA (492) and MCPC (496)*. The facility also uses a Retention Pond to manage stormwater and discharge waters from the active ponds, but such impoundment does not collect or manage CCR and is not subject to 40 CFR §257 requirements.

Ameren Missouri redeveloped MCPD in 2002 as an above grade, lined impoundment located within the footprint of the original 1950's vintage ash ponds which had been deactivated years earlier. MCPA, MCPB and MCPC were constructed in the 1950s, are interconnected, and two of the ponds (MCPA and MCPC) are incised. The location of the Meramec Energy Center is depicted on Figure

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[1] Based on engineering codes, widely accepted standards, or a practice widely recommended through the industry. See *40 CFR 25.53, Definitions*.

1, United States Geological Services ("USGS") topographical quadrangle map. Various design and operational features of the CCR units, including water flow path, is set forth on Figure 2.

B. Embankment Levee

The plant and all impoundments are contained within an approximate 6,500 foot perimeter embankment constructed in various phases beginning in the 1950s. Portions of the embankment levee have been armored with riprap installed in stages. The exterior sides of the active pond MCPB have been armored with riprap.

In 2000, Ameren Missouri constructed a rail line adjacent and parallel to the perimeter embankment. The rail loop bifurcates a portion of MCPB. The embankment and rail line are depicted on Figure 2. The height of the perimeter embankment varies, but in the vicinity of the bottom ash ponds is approximately 24.7 feet from the toe to the crest. All active impoundments are offset at least 1,400 feet from the Meramec River and further separated from the river by out-of-service impoundments. No residential homes, businesses or lifeline facilities are located down gradient of the ponds. Meramec's nearest neighbor is the Metropolitan Sewer District wastewater treatment plant located upstream (north) of the facility.

III. Structural Integrity Assessment

A. Liner Design Criteria – 40 CFR §257.71

For existing CCR surface impoundments constructed with liner systems, an owner/operator of such units must determine if such liner complies with the specified design and performance standards. At Meramec, only MCPD was constructed with a liner system: 60 MIL HDPE on the slopes and 40 MIL HDPE on the bottom. The existing liner system does not satisfy the required design criteria set forth in *40 CFR 257.71* in that it does not have a 2-foot layer of compacted soil with hydraulic conductivity of no more than 1 x 10^{-7} cm/sec.

1. Engineering Certification – Liner Design Criteria for Existing CCR Surface Impoundments

The existing CCR surface impoundments MCPA, MCPB, MCPC and MCPD at the Meramec Energy Center were evaluated to determine if they were constructed with a liner which meets the requirements of §257.71, Liner Design Criteria for Existing CCR Surface Impoundments. The existing liner system does not have a 2-foot layer of compacted soil with hydraulic conductivity of no more than 1 x 10^{-7} cm/sec.

CCR Unit	Existing liner meets requirements of 40 CFR 257.71
MCPA, MCPB and MCPC	No
MCPD	No

Engineer's Seal

JEFF
BERTEL
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10/3/2016

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B. **Periodic Hazard Potential Classification – 40 CFR §257.73(a)(2)**

Every five (5) years, an owner or operator of a coal combustion residual ("CCR") unit must update the hazard potential of CCR units and certify the results by a qualified professional engineer. The classification categories are based upon criteria established by the Federal Emergency Management Agency (FEMA) and range as follows: *low hazard potential, significant hazard potential, and high hazard potential.* The FEMA classification system categorizes a dam based on the probability of loss of human life and the impacts on economic, environmental, and lifeline facilities should the dam fail. The specific categories are defined as follows:

> *(1) High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.*
>
> *(2) Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.*
>
> *(3) Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.*

40 CFR §257.53

All of the active ponds at Meramec are classified as having a *low hazard potential* because any structural failure would not be expected to cause a loss of human life.

- **MCPD** - Failure of *MCPD* would result in a release of water and CCR into surrounding CCR units and thus be contained predominantly onsite. In the event of such a failure, loss of life or significant environmental damage would not be expected.
- **MCPA, MCPB, MCPC** are located east of *MCPD* and out-of-service *Pond 490* and north of the power plant building. For a release to occur at these units the perimeter levee would need to fail or overtop. In such a circumstance, the preferential pathway of such a release would be into the low flow tributary of the Meramec River located on the northern edge of the property. The embankment in this area has been armored with rip rap and positive drainage created. Failure of the impoundment is not expected to cause a loss of human life, and the economic, environmental and lifeline losses are expected to be low.

Since none of the active impoundments are classified as *high or significant potential hazards*, an emergency action plan does not need to be prepared. The hazard classification of these units must be re-evaluated every five (5) years.

1. Engineering Certification – Periodic Hazard Potential Classification

The 2015 Periodic Hazard Potential Classification Assessment was conducted for active CCR surface impoundments MCPA (Pond 492), MCPB (Pond 493), MCPC (Pond 496), and MCPD (Pond 498) at the Meramec Energy Center was conducted in accordance with the requirements of 40 CFR 257.73(a). These CCR surface impoundments are low hazard potential because failure of the impoundment is not expected to cause a loss of human life, and the economic, environmental and lifeline losses are expected to be low. The hazard potential classification was completed in general accordance with *Federal Guidelines for Dam Safety: Hazard Potential Classification for Dams* by the Federal Emergency Management Agency (January 2004). The engineering support for this certification has been placed in the operating record.

CCR Unit	Hazard Potential Classification
MCPD (Pond 498)	Low
MCPA (Pond 492), MCPB (Pond 493), MCPC (Pond 496)	Low

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C. **Periodic Structure Stability Assessment – 40 CFR §257.73(d)**

The owner or operator of a CCR unit must inspect and certify that the design, construction, operation and maintenance of a CCR unit are in accordance with good engineering practices. Such engineering assessment includes the following: stable foundations and abutments; slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown; berm compaction is sufficient to withstand the range of loading conditions, including low pool of an adjacent water body or sudden drawdown; adequately vegetated slopes and surrounding areas; adequate spillway capacity, operation and maintenance; spillways constructed, operated, and maintained to adequately manage the design flow event; and structural integrity and functionality of hydraulic structures underlying the base of CCR unit or passing through the dike.

The active ponds are protected by a perimeter embankment that has been armored with rip rap. Vegetative cover and riprap exists on the interior slopes of MCPB. MCPD's downstream slopes are vegetated, and the upstream slopes are covered with a synthetic liner. MCPA and MCPC are incised. Vegetative management protocols are set forth in the Operations and Maintenance Procedures and have been implemented so as to minimize erosion while facilitating the visibility of slopes during inspections.

The engineering team visually inspected the interior and exterior embankment slopes of the active surface impoundments, and reviewed pertinent geotechnical data. Reitz & Jens visually inspected berm foundations for signs of instability. None were observed. In addition, hydraulic structures (i.e. spillways, overflow pipes and ditches) were inspected to confirm proper maintenance and operation. No significant deficiencies of the structures were observed. (Some of the piping was under water and not available for visible inspection.) Recommended and ongoing activities include general maintenance (i.e. seeding for vegetative cover) and monitoring (e.g. spillways, submerged piping, pond levels, wet areas near berms, and installation of staff gauge to maintain pool levels).

1. Engineering Certification – Periodic Structural Stability Assessment

The 2015 Initial Periodic Structural Stability Assessment was conducted for the active CCR surface impoundments MCPA (Pond 492), MCPD (Pond 493), MCPC (Pond 496), and MCPD (Pond 498) at the Meramec Energy Center. The structural stability assessment was completed in general accordance with 40 CFR Part §257.73(d)(1). Assessment of all four CCR Units found no structural stability deficiencies, no significant issues with the current operations and maintenance, and that the design and construction are adequate, however some corrective measures were recommended. The engineering support for this certification has been placed in the operating record.

Requirement	MCPA (Pond 492), MCPB (Pond 493), and MCPC (Pond 496)	MCPD (Pond 498)
Initial periodic assessment was completed in general accordance with the requirements of 40 CFR Part §257.73(d)(1)	Yes	Yes

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D. Safety Factor Assessment – 40 CFR §257.73(e)

All active CCR units must have calculated Factors of Safety (FOS) that meet or exceed the following designated values:

Table 1

Loading Conditions	Minimum FOS
Maximum Storage Pool	1.50
Maximum Surcharge Pool	1.40
Seismic	1.00
Liquefaction	1.20

Reitz & Jens performed stability analysis on the active CCR surface impoundments and calculated the following values:

Table 2

Ponds	Maximum Storage Pool (FOS)	Maximum Surcharge Pool (FOS)	Seismic (FOS)	Liquefaction (FOS)
MCPD	2.21	2.22	1.18	1.62
MCPA	1.71	1.62	1.45	1.77
MCPB	1.71	1.62	1.45	1.77
MCPC	1.71	1.62	1.45	1.77

The calculated factors of safety for the critical cross-section at each CCR unit identified above ***meet or exceed*** the minimum factors of safety for each loading condition required by 40 CFR §257.73(e).

1. Engineering Certification – Safety Factor Assessment

The 2015 Periodic Safety Factor Assessment was conducted for the active CCR surface impoundments MCPA (Pond 492), MCPB (Pond 493), MCPC (Pond 496), and MCPD (Pond 498) at the Meramec Energy Center. The Periodic Safety Factor Assessment for each active CCR Unit at the Meramec Energy Center shows that the critical cross section for these Units meet or exceed the minimum factors of safety specified in 40 CFR Part §257.73(e)(1) as summarized below. The engineering support for this certification has been placed in the operating record.

Requirement	MCPA (Pond 492), MCPB (Pond 493), and MCPC (Pond 496)	MCPD (Pond 498)
The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.	≥1.50	≥1.50
The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.	≥1.40	≥1.40
The calculated seismic factor of safety must equal or exceed 1.00.	≥1.00	≥1.00
The calculated liquefaction factor of safety must equal or exceed 1.20.	≥1.20	≥1.20

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E. Hydrologic and Hydraulic Capacity Requirements - 40 CFR §257.82

Flood control system plans must be adequate to manage the inflow from a designated flood event. Such plans must be updated and verified every five (5) years. The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge from the design flood event.

Pertinent data regarding the active surface impoundments is set forth below:

Table 3

CCR Unit	Maximum Surface Area (acres)	Levee Crest Elevation (feet)	Crest Length (feet)	Normal Pool Elevation (feet)	Maximum Surcharge Pool (feet)	Upstream Slope Steepness (H:V)	Downstream Slope Steepness (H:V)
MCPD	13.5	423.0	3,320	418.0	420.0	3H:1V & 4H:1V	3H:1V
MCPB	6.9	413.2	1,200	409.5	411.3	Unknown	2:1
MCPA	6.1	Incised	NA	410.3	412.7	NA	NA
MCPC	5.9	Incised	NA	410.3	412.7	NA	NA

Reitz & Jens performed a modeling analysis using the 100-year flood event for low hazard potential surface impoundments as the design flood as required by 40 CFR §257.82(a)(3)(iii). The hydrologic and hydraulic modeling analysis assumed rainfall of 7.21[2] inches as an estimated 24-year, 100-year precipitation event. As depicted on Figure 2, water flows from the incised ponds (MCPC and MCPA) to MCPB before passing through primary and secondary spillway pipes to the Retention Pond. Reitz & Jens modeling analysis assumed only the secondary spillway was functional. From MCPD, the water flows to a retention pond prior to discharging in a permitted outfall.

For the bottom ash system (*MCPA, MCPB and MCPC),* peak pool (maximum surcharge) levels within the ponds are estimated to occur in 24.5 hours after the start of the storm event. Peak water levels during a 100-year flood event are projected to rise to elevation 411.3 feet, 1.9 feet below the crest of MCPB. The pool level should return to within 0.2 feet of the normal pool elevation within about 120 hours. For the fly ash pond *(MCPD*), peak pool level occurs in 16.2 hours. Maximum flow through the MCPD outlet works at peak pool is approximately 10.63 cfs. Based on the model, the peak water level during a 100-year flood event would rise to elevation 418.4 feet, 4.6 feet below the crest of MCPD; therefore, MCPD has adequate storage to contain such an event provided that the outlet works remain functional. Normal pool levels resumed approximately 24 hours after a 100-year flood event. Accordingly, the facility's inflow design control system adequately manages flow through the CCR units during and following a 100-year flood event as required by 40 CFR §257.82. Outlet works and spillways should be maintained in proper condition to ensure normal pool elevation and to lower pool levels if necessary. The CCR in the ponds will be managed so that the available storage is at least as great as that assumed in the hydrologic and hydraulic models.

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[2] Huff, F.A. and J.R. Angel. (1992). "Rainfall Frequency Atlas of the Midwest." Bulletin 71, Midwestern Climate Center and Illinois State Water Survey.

F. Inflow Design Flood Control System Capacity Plan

The initial inflow design flood control system has been evaluated for both the fly ash (MCPD) and bottom ash system (MCPA, MCPB, and MCPC) at the Meramec Energy Center. Based on the hydrologic and hydraulic capacity calculations, the inflow control system for these ponds can adequately handle and discharge the 100-Year design flood event. Specifically, 1.9 feet of freeboard exists in MCPB and 4.6 feet in MCPD. So as to properly maintain such inflow storage capacity, the following measures of the *Inflow Design Flood Control System Plan* have been incorporated into the Operations and Maintenance Manual and should be observed:

- **MCPD** - normal pool elevation should be maintained no higher than elevation 418 feet to maintain a maximum surcharge pool at elevation 420 feet.
- **MCPB** - normal pool elevation should be maintained no higher than elevation 409.5 feet to maintain a maximum surcharge pool at elevation 411.3 feet.
- **MCPA and MCPC** - normal pool elevation should be maintained no higher than elevation 410.3 feet to maintain a maximum surcharge pool at elevation 412.7 feet.
- If the water levels exceed the maximum surcharge pool elevations, special inspections by the Dam Safety Group of the primary spillways should be completed, and temporary measures implemented to prevent the water from overtopping the Pond embankments until the primary spillways are functioning as designed. Such measures could include cessation of generation, the addition of fill, sandbags, pumps, siphons, etc.
- Prior to the next scheduled evaluation of the Periodic Inflow Design Flood Control System Plan, topographic surveys should be completed on the interior of all active ponds to confirm the necessary water storage is available.
- Staff gage readings should be recorded during weekly inspections to confirm the assumed normal pool elevations.

1. Engineer's Certification – Hydrologic and Hydraulic Capacity

The initial inflow design flood control system plan was completed for the active CCR surface impoundments MCPA (Pond 492), MCPB (Pond 493), MCPC (Pond 496), and MCPD (Pond 498) at the Meramec Energy Center. The initial inflow design flood control system plan was completed in general accordance with 40 CFR Part §257(e)(1) using the 100-year design flood for low hazard potential CCR surface impoundments.

Requirement	MCPA (Pond 492), MCPB (Pond 493), and MCPC (Pond 496)	MCPD (Pond 498)
The initial inflow design flood control system plan meet the requirements of 40 CFR Part §257.82	Yes	Yes

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IV. Construction Summary – *40 CFR 257.73(c)*

The Meramec Energy Center is located in St Louis County at the confluence of the Mississippi and Meramec Rivers. At their confluence, the Mississippi River and Meramec Rivers have watershed areas of approximately 448,000,000 and 1,375,360 acres, respectively. River levels typically vary between el. 369 feet and el. 406.5 feet.

A. **Owner and Operator**

The CCR Units at the Meramec Energy Center are owned and operated by Ameren Missouri. MEC plant personnel have the primary responsibility of CCR unit operation. The Meramec Energy Center is located at 8200 Fine Road in St. Louis, Missouri 63129. The Ameren Missouri Dam Safety Group performs CCR unit inspections, and reviews all updates to the Operations and Maintenance Manual.

B. **Bottom Ash System (MCPA, MCPB, MCPC) (1950s)**

In the 1950's, Ameren Missouri constructed pond system MCPA, MCPB and MCPC to manage bottom ash from the plant's boilers and waste water from the facility's combined drain sumps (CDS). Construction and engineering drawings from that period are not available. Sluice waters are conveyed through the ponds via interior ditches that run in a south to north direction. Flow passes through the interconnected ponds from MCPC, to MCPA, and then to MCPB. Water levels in MCPA is controlled by two culverts through interior berms and fitted with knife gates. Water levels in MCPB are controlled by an 18" carbon steel primary discharge pipe. MCPB also has a secondary spillway in the form of a 24" corrugated metal pipe that discharges into a 6-foot wide bottom with 2H:1V sides that ultimately discharges into the Retention Pond. The assumed maximum depth of CCR in the bottom ash system is approximately 14-16 feet. From the Retention Pond, flows are then discharged via Outfall #3 into a tributary located on the north edge of the property. The outfall is located approximately 0.25 miles upstream of the Meramec River.

1. *Foundation and Abutment Geology (MCPB)(1950s)*

Boring logs in the vicinity of bottom ash pond show the uppermost stratum is generally lean clay with a thickness of 25 to 45 feet. The exception is at the south end of MCPC where a thin layer of sand was observed above the lean clay. Plant borings show the lean clay is generally firm to stiff. The lean clay is underlain by 6 to 35 feet of high plastic clay, which has a soft to stiff consistency. Beneath the high plastic clay, loose to dense sand and gravel was observed to the top of limestone bedrock which is encountered at elevations ranging from 306 to 310 feet.

2. *Embankment Material (MCPB)(1950s)*

There are no construction documents or records, or borings through the MCPB exterior embankment. Borings through adjacent pond embankments of the same time period show the fill material generally consists of brown and gray clays and silts of alluvial origin, which were presumably excavated from the incised portions of the ash ponds. Generally the consistency of the fine-grain fill is firm to stiff.

3. *Spillway and Embankment Levee Modification (MCPB) (1970s)*

In the late 1970's, Ameren Missouri raised the northern portion of MCPB's levee embankment approximately 0.5 to 2.5 feet and added fill to flatten the downstream slope to a gradient of 2H:1V. Compaction specifications required fill material to be placed in 6-inch layers and compacted to 95% Modified Proctor Density. In addition, the then-existing spillway (located in MCPB) was abandoned and replaced with a 764 feet long carbon steel spillway pipe which routes discharge waters to a Retention Pond also constructed in the 1970s.

4. Railroad Embankment (MCPA, MCPB, MCPC) (2000)

In 2000, Ameren Missouri completed construction of a railroad loop along the perimeter of the property and enlarged and flattened the downstream slope of MCPB. The rail loop bifurcates sections MCPB and MCPC, physically segregated those sections from the primary units. The railroad embankment was constructed using shot rock fill where it crosses the ponds. Where the alignment was common with the perimeter embankment, soil fill was used and sloped 2H:1V (upstream) and 3H:1V (downstream). The cutoff portions of MCPB and MCPC are filled with CCR. MCPC is currently used as a gravel covered parking lot. While physically segregated, the cutoff section of MCPB remains hydraulically connected to the pond.

5. Erosion Control (MCPB) and CDS Re-route (MCPC) (2012)

In 2012, Ameren Missouri armored the downstream slope of MCPB with riprap to improve stability and provide erosion protection for tributary floods. The slope gradient of this riprap area is 2H:1V. In addition, limestone rock fill was placed on top of the embankment for use as an access road adjacent to the rail line. The combined drain sump was rerouted from a now out-of-service pond via 20-inch HDPE pipe into MCPC.

6. Pond Overflow (MCPB) (2013)

In 2013, Ameren Missouri constructed a secondary spillway overflow pipe and overflow ditch from MCPB to the Retention Pond. The construction included 24-inch CMP pipe that discharges into an overflow ditch (2H:1V side slopes) lined with rip-rap. Water in the overflow ditch is collected in a 24-inch steel casing pipe and discharged into the retention pond.

7. Staff Gage and Erosion Control (MCPB) (2015)

In 2015, Ameren Missouri installed a staff gage near the principal spillway to monitor pond water level and additional rip-rap was placed on the downstream slope of MCPB. The area downstream of the exterior slope was graded to create positive drainage away from the embankment. The entire downstream slope of the embankment is now armored with rip-rap.

C. Fly Ash System (MCPD) (2002)

Dry fly ash is deposited within the MCPD and conditioned with process water piped from the energy center. MCPD was redeveloped in 2002 and located within the footprint of ponds constructed in the 1950s but have been filled and out-of-service. The pond is lined with 40 MIL HDPE on the bottom and 60 MIL HDPE on the interior slopes. Fly ash is deposited via an inlet pipe and flexible hosing which is periodically moved to designated cells areas within MCPD. The average and maximum depth of CCR in the fly ash system is approximately 19 and 38 feet, respectively.

1. Foundation and Abutment Geology (2002)

The foundation for the MCPD perimeter berms consists of fly ash underlain by lean silty clay and high plastic clay. The bottom of the pond was built on top of natural clays at elevation 395 to 398 feet. The clay extends to approximate elevations 315 to 325 feet. The clay is underlain by sand and gravel to an elevation of approximately 310 feet, where limestone is encountered.

2. Embankment Material (2002)

The perimeter berm is constructed of compacted fly ash above the ground surface, which was generally at about elevation 417 feet. Fly ash placed within the berm was moisture conditioned and compacted to a minimum of 95% of maximum density as determined by laboratory compaction tests. Additional fly ash fill was placed downstream of the perimeter berm. Downstream slopes of the embankment are 3:1; upstream slopes are 4:1 and 3:1 (west berm).

3. Spillway Modification (2011)

Excess process water accumulates at an outlet works and timber stop log structure that discharges via 24-inch HDPE and carbon steel pipe into the Retention Pond. (The last 25 feet of piping consist of carbon steel). The stop log structure was added to the outlet works in 2011 to increase water levels and allow for management of the levels in 6-inch increments. A precast concrete manhole contains butterfly valves on the outlet pipe approximately 25 feet upstream from the point of discharge.

4. Staff Gage (2015)

In 2015 a staff gage was installed. No other instrumentation has been installed and there are no historical records regarding pool levels. The staff gage is used to measure and record pool levels during weekly inspections. The outlet works include a timber stop log structure and drop inlet with a 24-inch HDPE pipe that discharges into the Retention Pond.

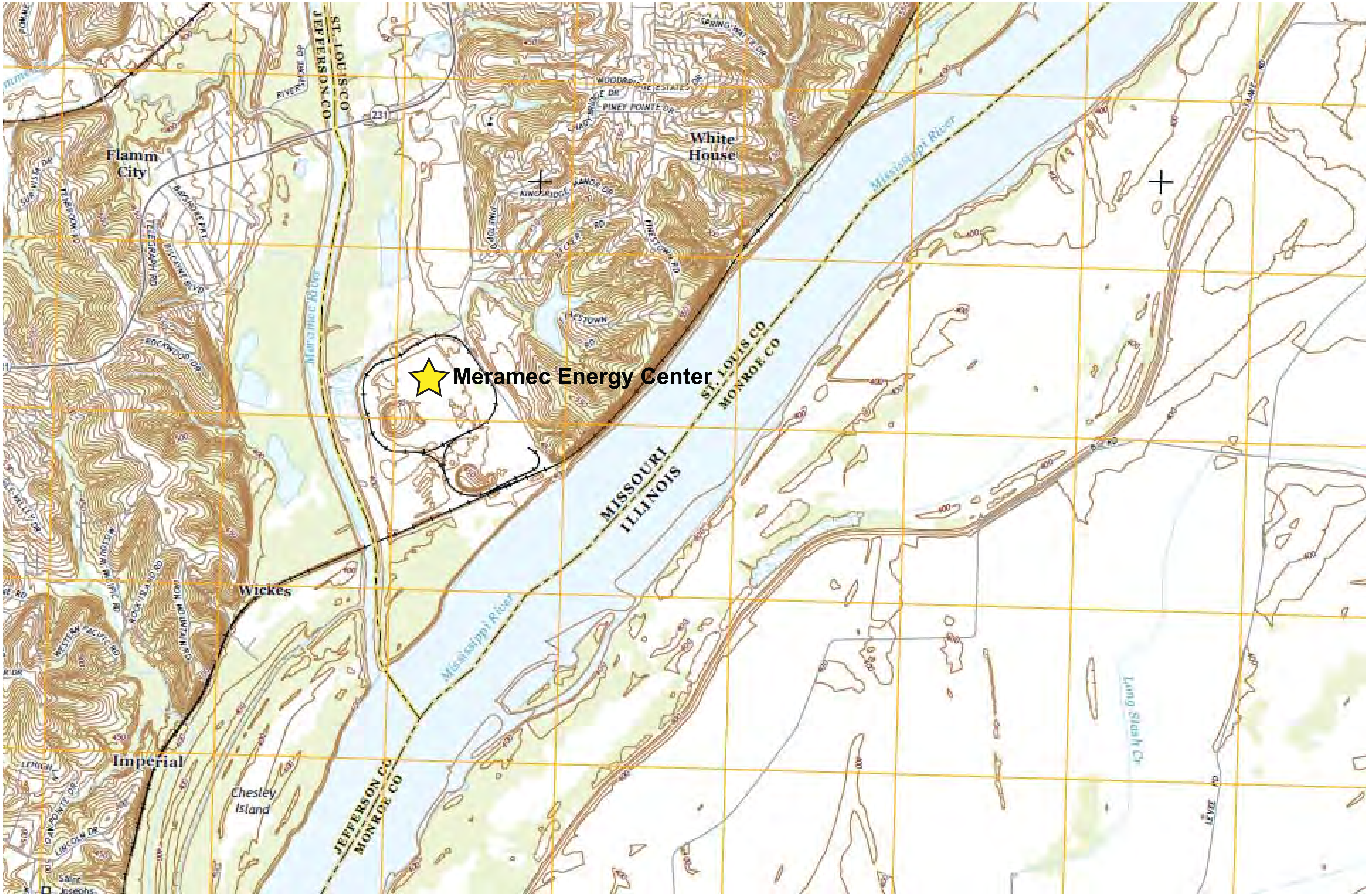
D. **Surveillance, Maintenance and Repair of the CCR Units**

The Meramec Ash Pond Embankment Operations and Maintenance Manual outlines objectives, responsibilities, and procedures for Ameren personnel who are responsible for the management of the Meramec CCR units. The embankments of the CCR units are visually inspected weekly by Ameren plant operations staff. Ameren Missouri Dam Safety Group personnel perform annual inspections and periodic inspections or assessments with plant operations staff. In addition, the Ameren Missouri Dam Safety Group may conduct unannounced safety inspections.

The Operations and Maintenance Manual requires that timely repairs must be made after problem areas are identified. The plant engineer is to specify the work to be completed using Ameren's Work Control Process and provide direction to correct items noted in the operation and maintenance, and engineering inspections. The work request by the plant engineer will be reviewed with the Dam Safety Group to ensure proper emphasis has been placed on the request. The Operations and Maintenance Manual specifies the minimum maintenance activities and requires that maintenance activities be documented. The Operations and Maintenance Manual further specifies that no alterations or repairs to structural elements should be made without the approval of the Chief Dam Safety Engineer.

E. Instrumentation

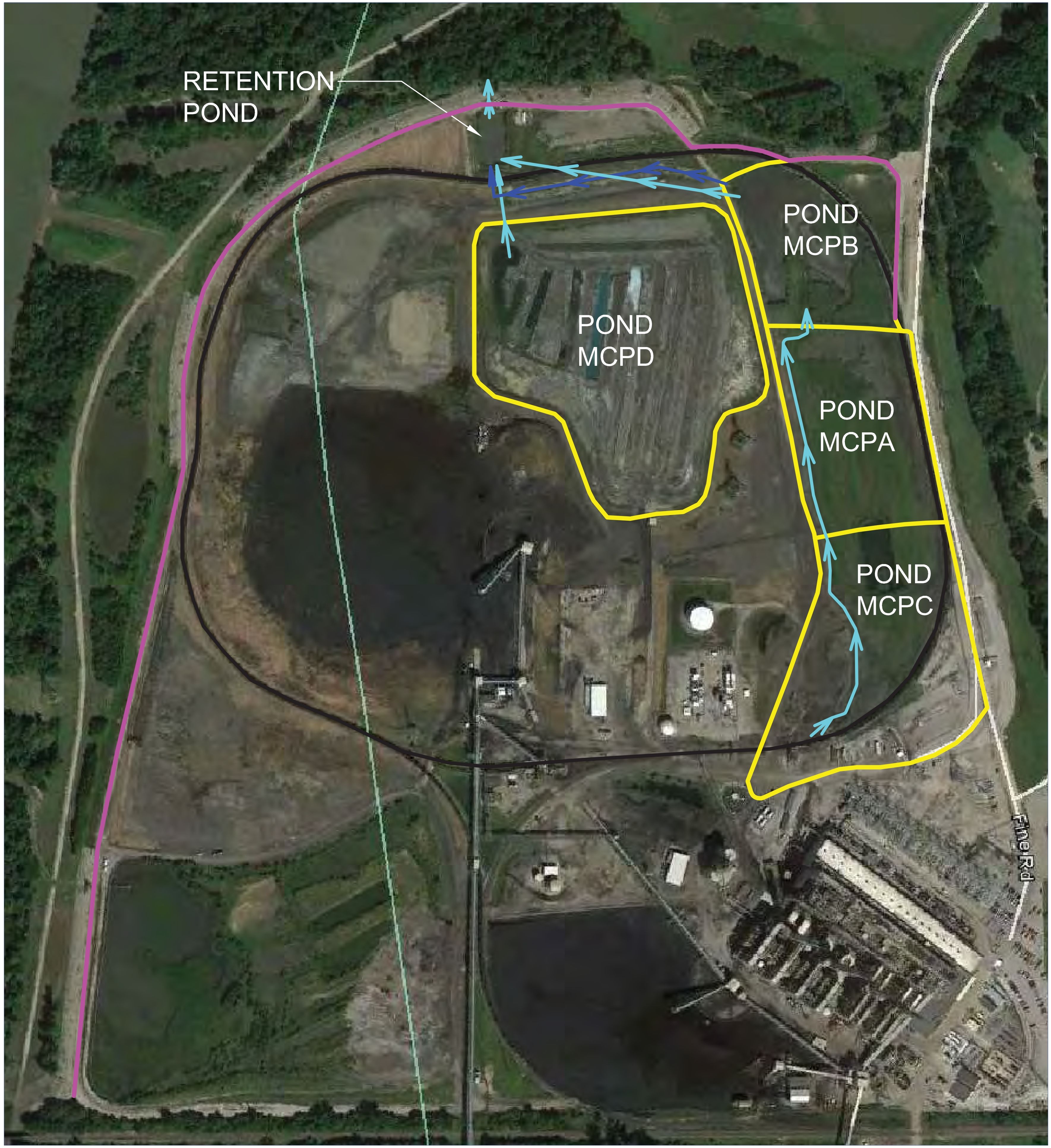
Staff gages were installed in the CCR units in late 2015. Pool level readings are documented in weekly inspection reports.



Ameren Missouri
Meramec Energy Center
CCR Unit Evaluation
USGS 7.5 minute quadrangle map

REITZ & JENS, INC.

Figure 1



CCR UNIT	MAXIMUM SURFACE ELEVATION (ACRES)	DAM CREST ELEVATION (FEET)	CREST LENGTH (FEET)	NORMAL POOL ELEVATION (FEET)	MAXIMUM SURCHARGE POOL (FEET)	UPSTREAM SLOPE STEEPNESS (H:V)	DOWNSTREAM SLOPE STEEPNESS (H:V)
MCPD	13.5	423.0	3320	418.0	420.0	3H:1V & 4H:1V	3H:1V
MCPB	6.9	413.2	1200	409.5	411.3	UNKNOWN	2H:1V
MCPA	6.1	INCISED	NA	410.3	412.7	NA	NA
MCPC	5.9	INCISED	NA	410.3	412.7	NA	NA

Legend:

—	Pond Footprint
⇉	Primary Flow Path
⇉	MCPB Overflow Spillway Flow Path
—	Perimeter Levee
—	Rail Line

Ameren Missouri

Meramec Energy Center

CCR Unit Evaluation

Figure 2 - Operational Data