Ash Ponds Closure

Closure Plan

Hutsonville Power Station
AmerenEnergy Medina Valley Cogen, L.L.C.
Crawford County, Illinois

September 15, 2014

NATURAL RESOURCE TECHNOLOGY

HANSON
Engineering | Planning | Allied Services

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1. Introduction

AmerenEnergy Generating Company, pursuant to Title 35, Ill. Admin. Code, Part 840 [35 IAC 840] (Illinois PCB, 2011), completed closure of the Ash Pond D Coal Combustion Waste (CCW) pond at the Hutsonville Power Station (Site) in January 2013. AmerenEnergy Medina Valley Cogen, L.L.C. (AmerenEnergy Generating Company successor, and hereafter referred to as Ameren), is submitting this Closure Plan for the remaining CCW ponds: Ash Pond A, Ash Pond B, Ash Pond C, and the Bottom Ash Sluice Pond. The operation of the remaining ash ponds are regulated under Title 35 Illinois Administrative Code, Part 309 (35 IAC 309), and they will be closed in compliance with the requirements of 35 IAC 620. The proposed Closure Plan for the remaining ash ponds was developed to generally conform with the Ash Pond D site-specific rule 35 IAC 840, and where judged appropriate, elements of the proposed 35 IAC 841 rules, currently under development. Comparison of this closure plan with the elements in 35 IAC 840 and the 35 IAC 841 rulemaking is detailed in Table 1. Concurrently submitted supporting documents are listed in the Reference section of this report.

Upon approval of the Closure Plan by the Illinois Environmental Protection Agency (EPA), Ameren will begin closing these remaining facilities.

1.1 Site Background

The Site is located on the west bank of the Wabash River, and approximately one and one-half miles north of the Village of Hutsonville in Crawford County, Illinois. The Site is located in the South ½ of Section 17, Township 8 North, Range 11 West of the Second Principal Meridian (see Figure 1).

All ash ponds at the Site (see Figure 2) are out-of-service. Ash Pond D, the largest and oldest of the four ash ponds at the Site, was covered and closed during 2011-2012 under the 35 IAC Part 840 rules. The remaining ponds, including Ash Pond A, Ash Pond B, Ash Pond C, and the Bottom Ash Sluice Pond, will be closed following approval of this Closure Plan.

1.2 Summary of Regional and Site Geology

The Site geology consists primarily of Wisconsinan Stage fluvial deposits with some Illinoian Stage diamictons overlying Pennsylvanian bedrock. There are various fill materials along with three surficial (unlithified) units identified at the Site, including fine-grained fluvial deposits classified as Cahokia Alluvium, poorly sorted outwash sand and gravels of the Henry Formation, and silty and clayey diamictons of the Glasford Formation. The details of the Site geology are described in the Hydrogeologic Site Investigation (Hanson, 2014b).

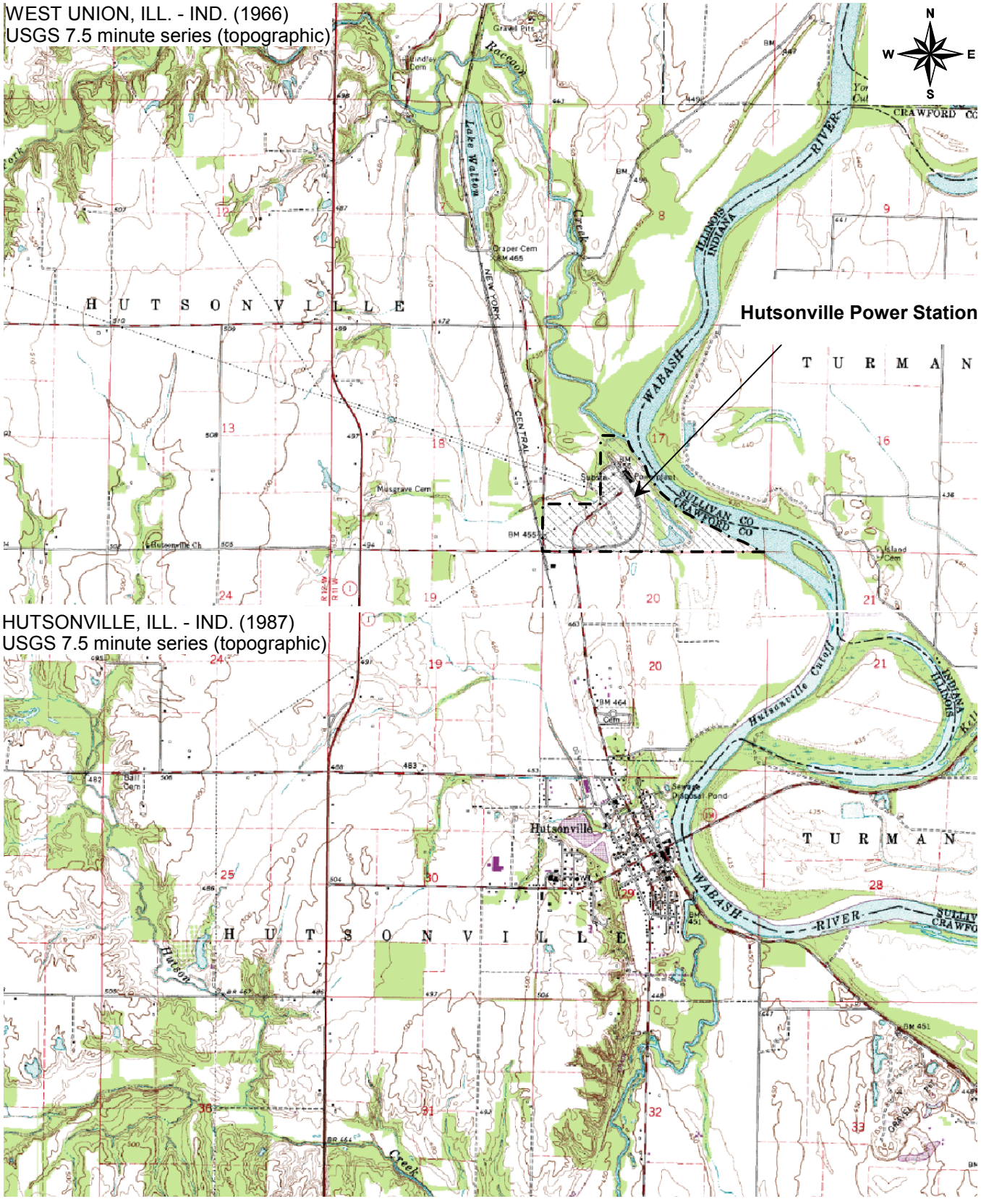
Earthen Fill is present across the majority of the Site, ranging from less than 2 to more than 10 feet (ft.) thick. Fill consists of sandy silts and silty sands, which has been used to elevate depressions and construct berms around the various ash ponds and structures. CCWs were found in ash pond areas. The thickness of CCWs in Ash Pond D ranges from 12 to 31 ft. The thickness of CCWs in the undeveloped area between Ash Ponds A and D, prior to the construction of Ash Ponds B and C, was up to 12 ft., but all CCWs were excavated during construction of Ash Pond B in 2000.

Table 1. Comparison of Closure Plan Requirements - 35 IAC 840.130 versus 35 IAC 841[1]

Part 840	Part 841	Description	Location in this Document
	841.210(b)	Site Map	Figure 2
840.130(b)	841.210(b)	Facility Description	Sections 1.1 and 3
840.130(c)	841.410(b)	[Desc.] Closure Activities to be Performed	Section 4 as summarized from the Project Plans and Specifications
840.130(d)	841.410(c) 841.200	[Desc.] Results of the Hydrogeologic Site Investigation	Section 1.2 as summarized from the Hydrogeologic Site Investigation
840.130(e)	N/A	[Desc.] Groundwater Trend Analysis Methods	N/A
NA	841.410(e) 841.235	[Desc.] Annual Statistical Analysis Methods	Section 7 as summarized from the Groundwater Monitoring Plan
840.130(f)	841.410(a) 841.210(a)	[Plans] for the Groundwater Monitoring System	Section 7 as summarized from the Groundwater Monitoring Plan
840.130(g)	841.410(d) 841.205	[Desc.] Groundwater Monitoring Program	Section 7 as summarized from the Groundwater Monitoring Plan
840.130(h)	841.410(a) 841.210(b)	Identification & Location of Monitoring Wells	Section 6 and Figure 2
840.130(i)	841.410(f) 841.315 841.320	[Plans] for the Groundwater Collection Trench (840); Groundwater Collection System and Discharge System (841)	Section 2.2 (Summary of previously installed Trench installation and operational plans)
840.130(j)	841.410(f) 841.415	[Plans] for the Final Slope Design; Compliance with Stability Criteria	Section 3.1
840.130(k)	841.410(f) 841.420	[Plans] for the Final Cover System	Sections 4.11 and 4.12
840.130(l)	841.410(g)	Estimates of Time to Complete Closure	Sections 4.6 and 8.1
840.130(l)	841.410(g)	Estimate of Time Required for Hydrostatic Equilibrium Beneath Unit, Cost of Closure, and Cost of Post-Closure Care	Section 8.2
840.130(m)	841.410(h)	[Desc.] Groundwater Management Zone	Section 5 as summarized from the Groundwater Management Zone Application
840.130(n)	841.410(i) 841.155	Construction Quality Assurance Program	Section 9 as summarized from the Construction Quality Assurance Plan
840.130(o)	841.410(j) 841.235	Actions Proposed to Mitigate Statistically Significant Increasing Trends	Section 7 as summarized from the Groundwater Monitoring Plan
	841.410(k)	[Desc.] Institutional Controls Prohibiting Potable Uses	Section 5
840.130(p)	841.410(l)	Professional Engineer Signature and Seal	Section 11

[ ] indicates paraphrasing; NA - Not applicable

[1] 35 IAC 841 draft version dated 06/12/2013



EXPLANATION

Property limits (approximate)

SCALE: 1 in. = 1,000 ft.

0 ft. 500 ft. 1,000 ft.

SOURCE:
http://www.isgs.uiuc.edu/nsdihome/webdocs/drgs/

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SITE LOCATION MAP

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE NO. 1

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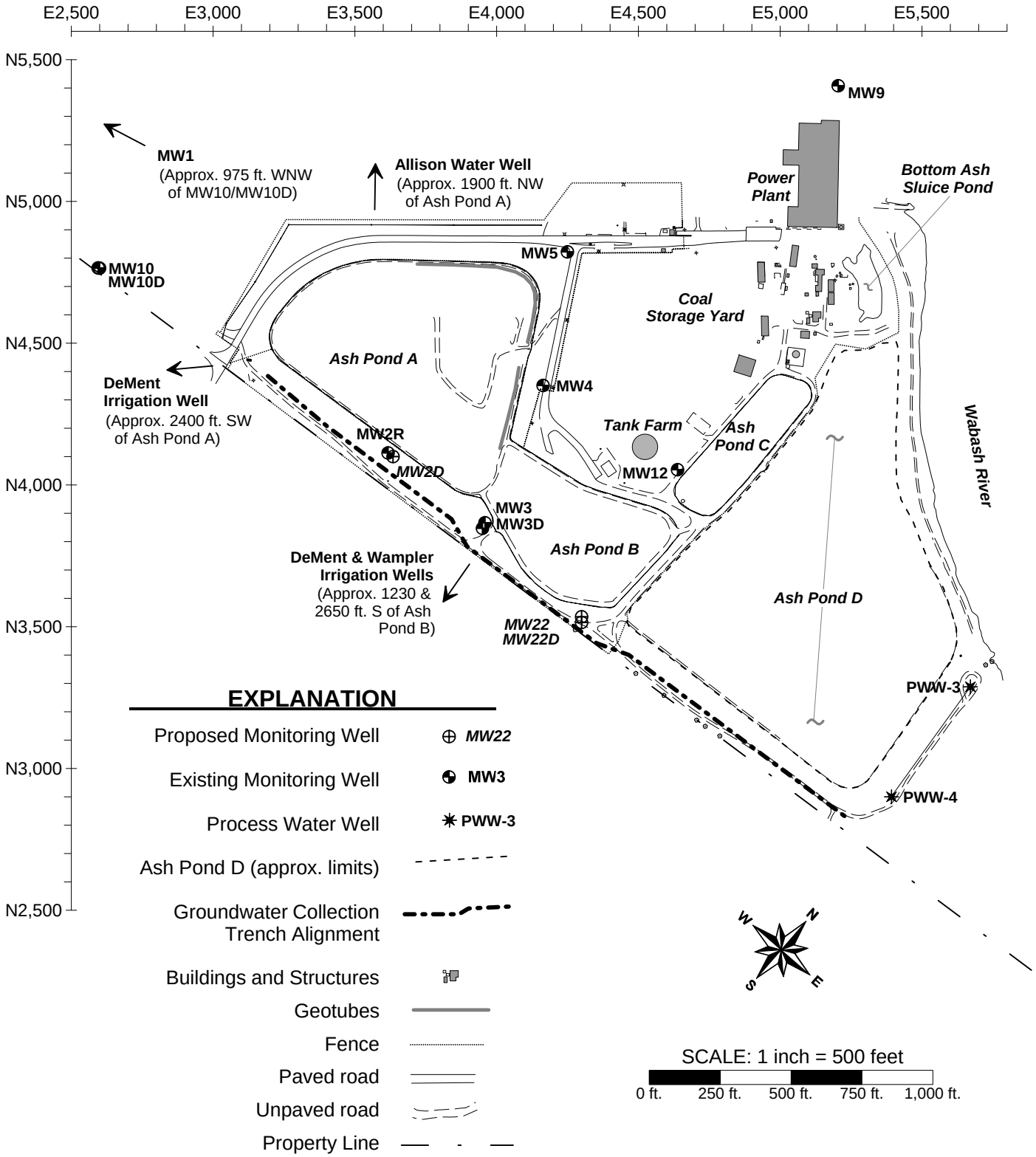

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SITE MAP

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE NO. 2

I:\14jobs\14E0016\Admin\14-Reports\GMZ\FIG_2SiteMap_140813.srf

Two groundwater flow zones are identified at the Site: a shallow groundwater zone and a deep groundwater zone. The shallow groundwater zone consists of sand and gravel with varying thickness, typically 10 to 20 ft., underlain by 15 to more than 30 ft. of the upper, permeable portions of the sandstone. The shallow sand appears to grade to a fine-grained silty clay toward the northern portion of the Site. A thick shale unit underlies the sandstone at an approximate elevation of about 415 to 420 ft. National Geodetic Vertical Datum (NGVD).

The Wabash River valley contains a relatively fine-grained alluvium from land surface to an elevation of about 410 to 415 ft. NGVD, underlain by sand and gravel to an elevation of about 350 ft. The sand and gravel at depth in the Wabash River valley is referred to as the deep groundwater zone.

Groundwater generally flows from west to east towards the Wabash River within the shallow zone and from southwest to northeast, almost perpendicular to the banks of the Wabash River within the deep zone.

1.3 Summary of Groundwater Quality Downgradient of Ash Ponds A, B, and C

Groundwater downgradient of the ash ponds had concentrations of boron, sulfate, iron, manganese, and TDS higher than Class I groundwater quality standards at multiple locations during the period of 2011 through 2013. Boron had the greatest extent of Class I exceedances attributable to coal ash leachate and was used to define the extent of groundwater impacts from Ash Ponds A, B, C and the Bottom Ash Sluice Pond. The extent of impacts attributable to the ash ponds undergoing closure is discussed further in the accompanying modeling report.

Exceedances of Class I groundwater quality standards for the coal ash indicators boron and sulfate were observed in Ash Pond A, B, C monitoring wells MW2, MW3, and MW3D, while wells MW4, MW5, and MW12 did not have boron or sulfate exceedances in 2011 through 2013.

2. Prior Treatment and Control Options

2.1 Description of Ash Pond D Closure

Ash Pond D was formerly the largest and oldest of the four ash ponds at the Site. Ash Pond D was an unlined pond constructed in 1967 – 1968 and was the primary ash management unit until Ash Pond A began operation in 1986. Since then, it was used as a secondary settling pond until 2000 when it was removed from service. Ash Pond D was covered with a 22 acre cap and closed during 2011-2012 under the Title 35, IAC Part 840 rules (Illinois PCB, 2011). Closure activities included placement of a 40-mil thick textured high density polyethylene (HDPE) geomembrane with three foot protective soil cover with a vegetated surface. Surface water management features incorporated into the final cover design included intermediate berms and ditches to direct runoff to rip-rap-lined chutes running off the ash pond to surrounding areas. Details of the closure are provided in the Project Plans and Specifications (Hanson, 2011c).

2.2 Groundwater Collection Trench

A groundwater collection trench (Trench) was installed between the outside south toe of Ash Ponds A, B, and D and the south property line, as shown on Figure 2. Operation of the Trench is anticipated to begin upon approval of the Site's NPDES permit renewal (No. IL0004120) authorizing its use, which was issued for public notice on August 21, 2014. The Trench is designed to intercept groundwater that may migrate to the south from the ash ponds. The Trench is designed to collect groundwater at four separate sumps: a pair in the east portion of the Trench adjacent to Ash Pond D, and a pair in the west

portion of the Trench adjacent to Ash Pond A. Details are provided in the Ash Pond D Closure Plan (Hanson, 2011a) and Project Plans and Specifications (Hanson, 2011c).

Water captured by the Trench will be pumped from the four sumps to a central catch basin located adjacent to the existing Ash Pond D outlet structure along the mid-east side of the pond, from which it will then discharge to the Wabash River in accordance with the Station's NPDES permit.

3. Description of Ash Ponds

3.1 Ash Pond A

Ash Pond A was operational from 1986 until the plant ceased generation in December 2011 for disposal of CCWs generated at the Site. Fly ash from the operating units was collected by an electrostatic precipitator and sluiced to Ash Pond A. The pond was constructed with an 80 mil HDPE liner. CCWs were sluiced to the pond where solids were permitted to settle out and supernatant liquids were decanted. The pond contains fly ash within an area of approximately 12 acres, with an average ash thickness of 20.4 feet. It is estimated that Ash Pond A currently has 80,667 cubic yards (yd^3) of ash. The ash pond is contained by a 2,400 ft. long perimeter embankment that has an average height variance between 17 ft. on the southwest side, 15 ft. on the east side, and 18 ft. on the north side.

The exterior embankment slopes are approximately 3H:1V along the southwest and east sides and 2H:1V along the north side. Interior embankment slopes are currently 11H:1V, The mean thickness of ash in the pond is approximately 20.4 feet.

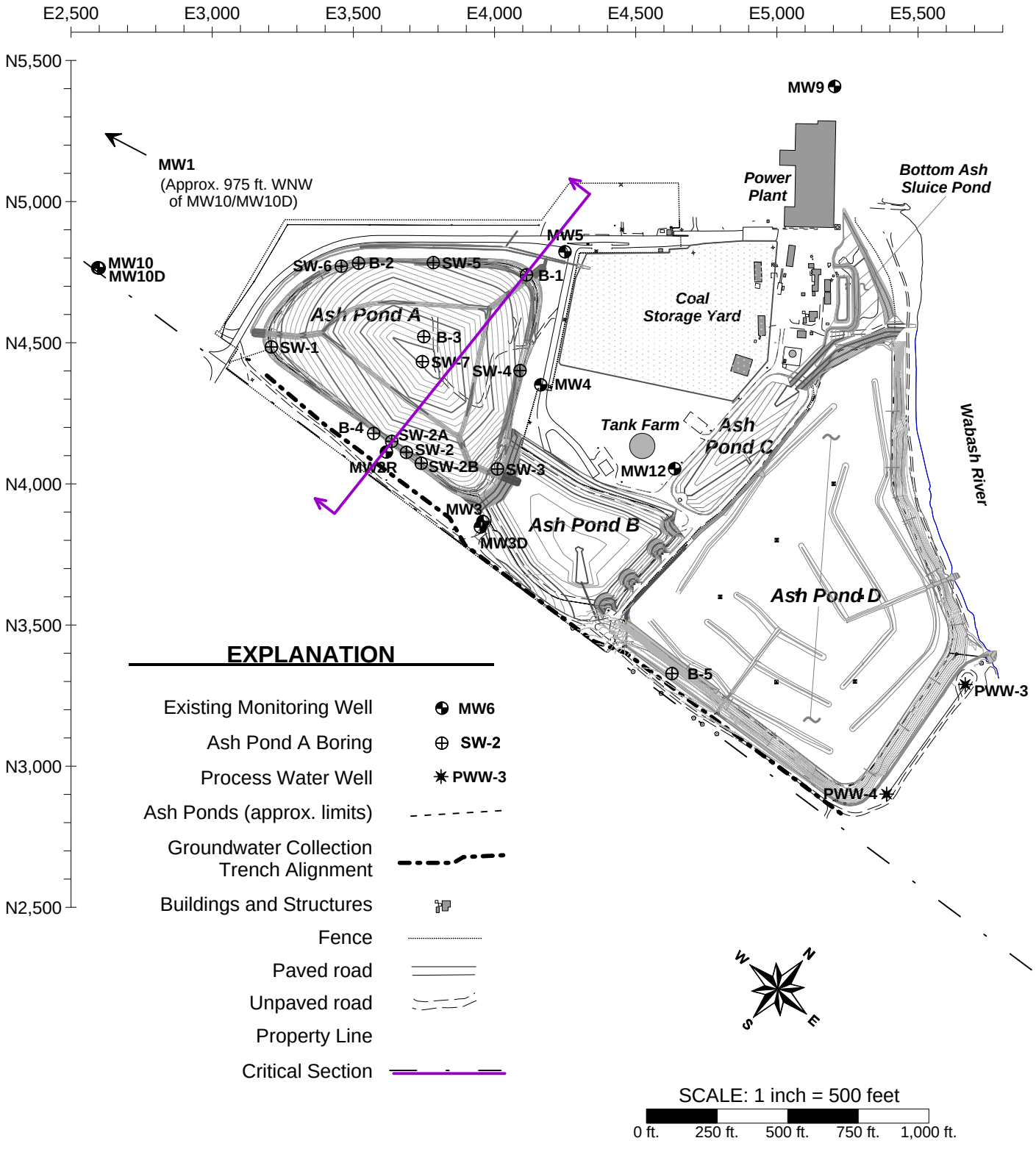
The cap will be constructed on a 20H:1V (5%) slope that will intersect the existing exterior embankment slope no higher than the existing ash surface. Soil embankment materials above that point will be removed and utilized for vegetative cover on the final cap.

Analyses of the structural integrity of Ash Pond A in the proposed closed condition, including slope stability, bearing capacity and settlement, have been completed. The critical sections, selected for slope stability analysis of the perimeter berm and the final cover, are shown on Figure 3. A cross-section of the fully constructed critical section and the critical analyzed potential failure surface are included on Figure 4. Analyses of the proposed final configuration of the pond resulted in the following factors of safety (FOS) and induced settlement with regard to the structural stability of the pond.

Table 2. Structural Stability Analysis Results for Ash Pond A

Structural Stability Criteria	Calculated FOS	Required FOS*
Short Term Slope Stability – Exterior Embankment	2.02	1.5
Long Term Slope Stability – Exterior Embankment	2.18	1.5
Seismic Event Slope Stability – Exterior Embankment	1.96	1.3
Short Term Slope Stability – Cover Materials	12.45	1.5
Long Term Slope Stability – Cover Materials	11.70	1.5
Seismic Event Slope Stability – Cover Materials	6.79	1.3
Bearing Capacity	36.9	2.0
Seismic Event Bearing Capacity	36.2	1.5
Maximum Induced Settlement	2.25	N.A.

*The Required FOS is based on Illinois EPA Landfill Requirements, for comparison purposes.



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CRITICAL SECTION LOCATION MAP

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE NO. 3

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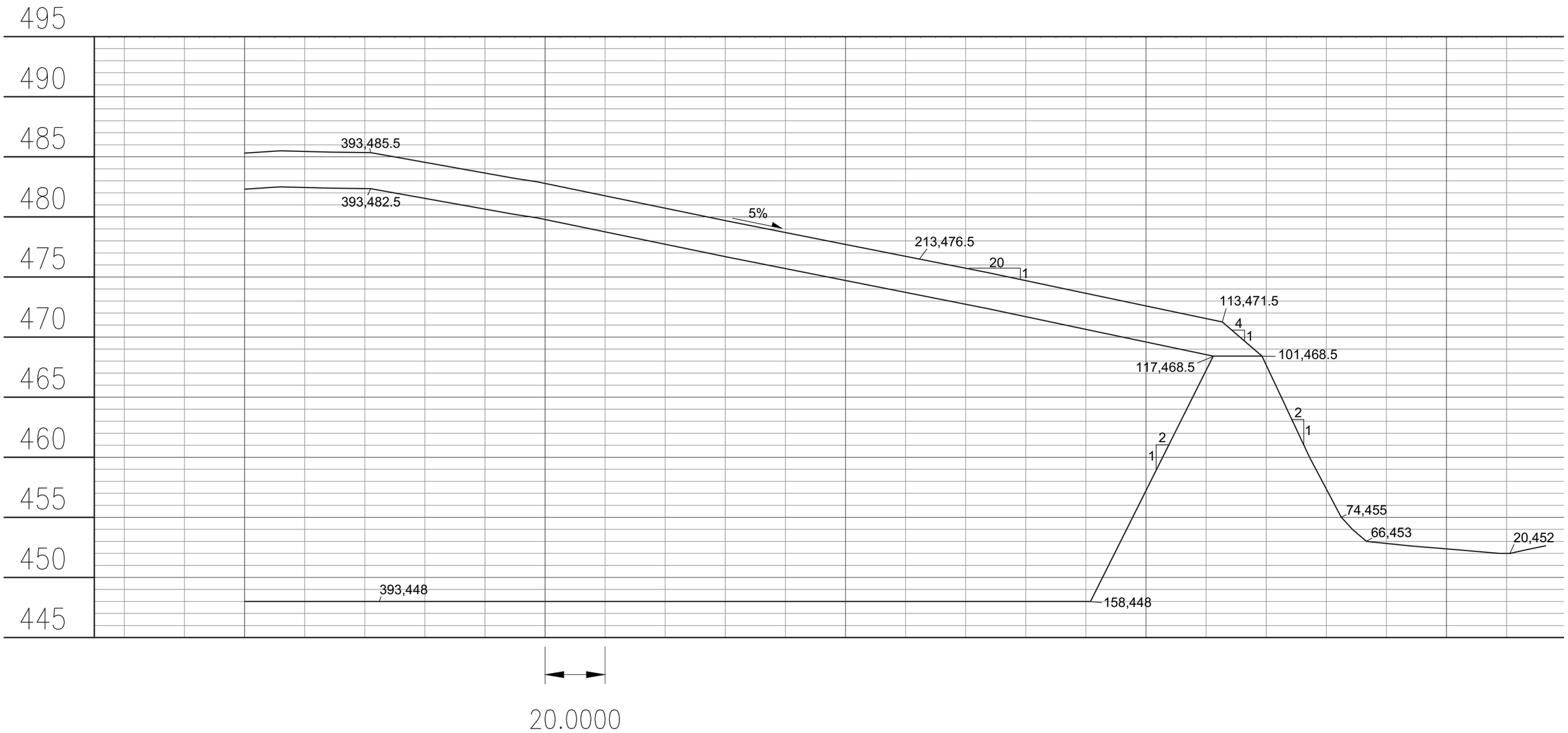
Cross Section at B-1



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CRITICAL EMBANKMENT CROSS SECTION

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE 4

I:\14jobs\14E0016\Admin\14-Reports\ClosurePlan\FIG_4CritSec_140915.srf

The results of the structural stability analyses indicate adequate slope stability and bearing factors of safety. The slope stability factors of safety above include those from analyses considering seismic events with a 224-year return period, based on United States Geologic Survey mapping. The maximum estimated induced settlement will occur in the middle of the pond area as the ash is graded and the cover system materials are placed, and will not be detrimental to the integrity of the cover system.

3.2 Ash Pond B

Ash Pond B, an HDPE-lined pond, was placed into service in 2000 for disposal of sluiced fly ash and bottom ash, but still receives wastewater and/or storm water for periodic discharge and is permitted under the site's NPDES and Subpart B permits. The ash pond has a surface area of approximately 4.4 acres, with a maximum unit height of 17 feet. It is estimated that Ash Pond B currently has 12,400 yd^3 of ash to an average depth of approximately 1.7 feet. Ash Pond B functioned as a polishing pond, receiving flow via a triplex pump station from Ash Pond C in addition to flow from Ash Pond A before discharging to the Wabash River via NPDES-permitted outfall #002 (IL0000175).

3.3 Ash Pond C

Ash Pond C, an HDPE-lined pond was placed into service from 2000 for disposal of sluiced bottom ash from the Bottom Ash Sluice Pond before discharge to the Wabash River via outfall #002. This pond still receives wastewater and/or storm water for periodic discharge and is permitted under the site's NPDES and Subpart B permits. As discussed above, water from Ash Pond C was discharged to Ash Pond B via a pump station. The ash pond has a surface area of approximately 2 acres, with a maximum unit height of 12 feet. It is estimated that Ash Pond C currently has 10,000 yd^3 of ash to an average depth of approximately 2.9 feet.

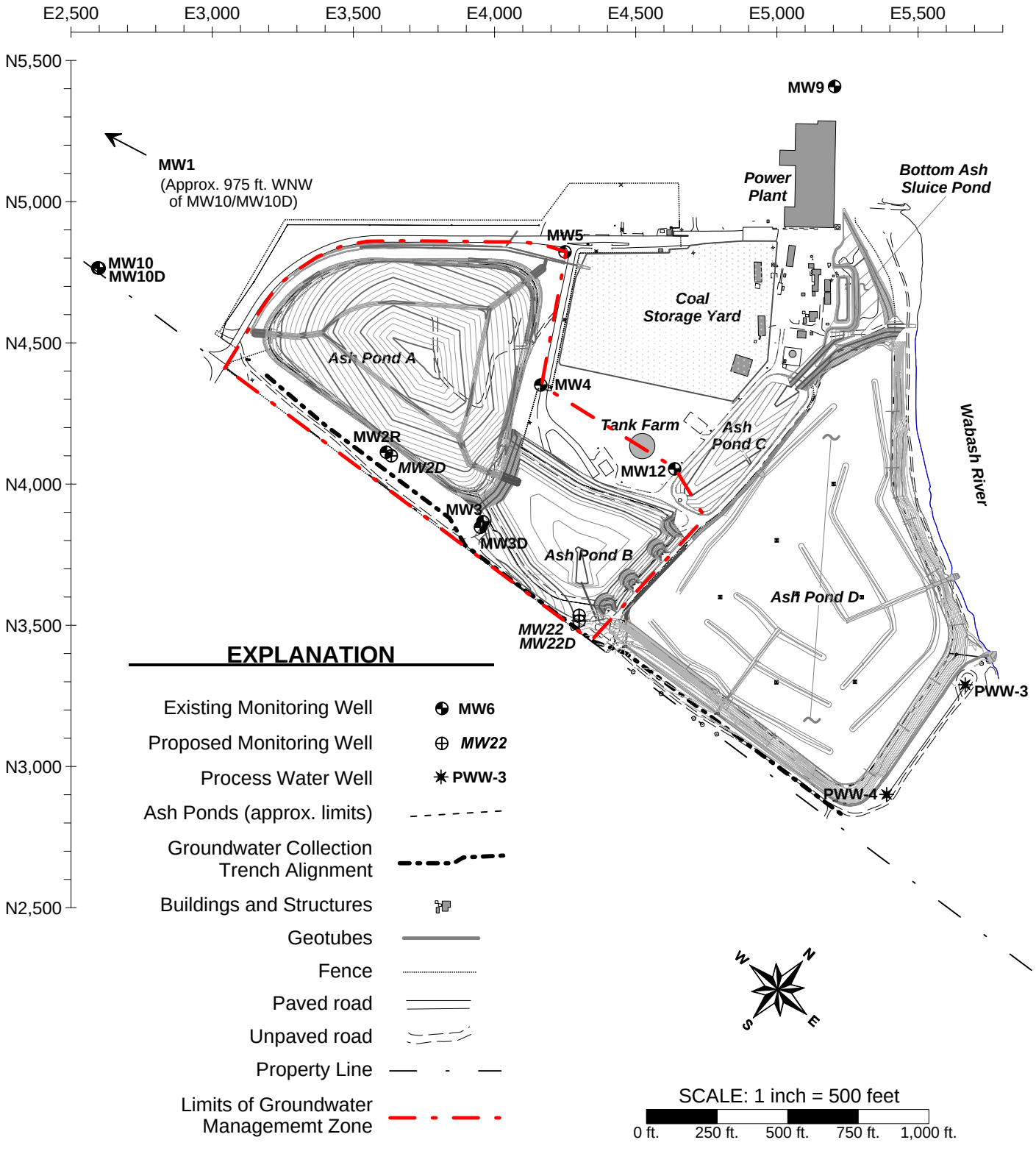
3.4 Bottom Ash Sluice Pond and Coal Yard

The Bottom Ash Sluice Pond was operational from 1969 until the plant ceased generation in December 2011 for disposal and reuse of bottom ash. This pond has a surface area of approximately 1.2 acres, with a maximum unit height of 15 feet. It is estimated that the Bottom Ash Sluice Pond contains 23,142 yd^3 of bottom ash to an estimated depth of 10 to 15 feet. This pond still receives wastewater and/or storm water for periodic discharge and is permitted under the site's NPDES and Subpart B permits.

The coal storage yard encompasses an area of approximately 7.9 acres and contains an average depth of 12 inches of spoils. It is estimated that approximately 12,700 yd^3 of material will be removed.

4. Closure Activities

Closure elements for each of the ash ponds are described below. Closure activities will be conducted in accordance with the Construction Quality Assurance (CQA) Plan prepared for this project that generally conforms with the Ash Pond D site-specific rule at 35 IAC 840, and where judged appropriate, elements of the proposed 35 IAC 841 rules, currently under development. The preliminary designs of the closure elements are shown on Figure 5.



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SITE CLOSURE PLAN (WITH GMZ LIMITS)

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE NO. 5

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4.1 Capping of Ash Pond A

Ash Pond A will be the depository for disposal of materials from Ash Pond B, Ash Pond C, and the Bottom Ash Sluice Pond, which are all being clean-closed. An estimated 1-foot depth of spoils from the Coal Yard will also be removed and relocated to Ash Pond A. Total material that is being moved to Ash Pond A from other areas of the Site is estimated to be approximately 58,000 yd^3. Ash Pond A is the only pond of the four being closed that will have a constructed cap.

4.11 Backfilling and Grading

Ash and fill materials will be graded to establish the final sloped surface of the cap. Base grading of Ash Pond A will require approximately 32,400 yd^3 of material to be cut and 76,400 yd^3 of fill. Ash will be graded to a maximum slope of 20H:1V to promote surface drainage toward the outside of the berm and prevent ponding of runoff. The final ash grading will intersect the existing exterior embankment slope no higher than the existing ash surface, in accordance with the Rules. Soil embankment materials above that point will be removed and utilized for vegetative cover on the final cap. The final cover design will result in a maximum of about 34 feet of re-graded ash near the center of the pond. The final surface of the ash cap will be rolled smooth prior to the placement of the final cover system.

4.12 Final Cover Placement

Final cover components will include approximately 55,400 yd^2 of low permeability geosynthetic membrane cover and approximately 53,600 yd^3 of final protective soil material. See the closure Plans and Specifications completed for this project (Hanson, 2014d).

The low permeability layer will consist of textured high density polyethylene (HDPE) geomembrane which will have a 40-mil minimum nominal thickness. Geomembrane seams will be continuously fusion or extrusion welded to form one continuous membrane covering the entire area of exposed ash. The perimeter edges of the HDPE geomembrane will be finished in an anchor trench excavated in soil materials. This will serve to keep the membrane anchored in place and prevent any lateral migration of surface water into the cap.

The low permeability geomembrane will be covered with a minimum of three feet of soil materials. These soils will be compacted only to the extent required for equipment traffic and construction of overlying drainage structures.

Soils used for the final protective cover will be fertilized, seeded and mulched to facilitate and support a permanent self-sustaining vegetative cover.

Installation of the low permeability geomembrane and the overlying soils will be conducted in accordance with the CQA program. Required records will be maintained on site during construction.

The acceptance report and certification of final cover placement will be submitted to the Illinois EPA and be maintained at the offices of Ameren Environmental Services in St. Louis, Missouri.

4.13 Ash Pond Dewatering

Dewatering of Ash Pond A will take place to the extent necessary to facilitate construction in accordance with this Plan. Since Ash Pond A has an HDPE bottom liner the water level within the pond may be above the surrounding water table.

4.14 Surface Water Management

Surface water management features have been incorporated into the final cover design, which will be graded to drain surface water at a uniform 5% slope toward the outside berm. The cover drainage is split into three collection areas. Drainage off the western-most third of the cover will collect in a rock chute at the northwest corner, where it is free to discharge toward the northeast using the existing roadside ditch and then out through an existing culvert beneath the north Site access road. Drainage from the eastern-most third of the cover will collect in a similar rock chute at the northeast corner, where it also discharges to the north through the same culvert beneath the Site access road. Drainage from the southern-most third of the cover will collect in a rock chute at the southeast corner, where it will discharge into a storm water retention pond in the area where Ash Pond B is currently located.

4.2 Clean Closure of Ash Pond B

Ash Pond B will be clean-closed and the berms removed to be re-used as cover material for Ash Pond A. Ash removal from Ash Pond B and relocation to Ash Pond A is estimated at approximately 12,500 yd^3. The geomembrane liner at Ash Pond B will be removed and the pond bottom graded to 4-ft. below the pond perimeter. The pond bottom will then be graded to drain to the southeast through a culvert and into the existing paved ditch along the south side of Ash Pond D. Storm water tributary to this pond will be detained for intermediate to large rain events to elevation 446.00 by under sizing the outlet culvert.

4.3 Clean Closure of Ash Pond C and Bottom Ash Sluice Pond

Ash Pond C and the Bottom Ash Sluice Pond will be clean-closed and graded to drain to the northeast through an open cut channel through the original east perimeter berm of Ash Pond D and discharged towards the Wabash River. Ash removal from Ash Pond C and relocation to Ash Pond A is estimated at 10,000 yd^3. The geomembrane liner at Ash Pond C will be removed. An estimated depth of 12 feet of bottom ash over the 1.2 acre area of the Bottom Ash Sluice Pond contains approximately 23,000 yd^3, which will be removed and relocated to Ash Pond A. All ash in these areas will be removed to ensure clean closure of these ponds. Any modifications required at the interface between previously closed Ash Pond D and the Bottom Ash Sluice Pond will be constructed in full compliance with the site-specific (Ash Pond D) closure requirements at 35 IAC 840.126. The required documentation will be submitted to the Illinois EPA upon completion of construction.

4.4 Groundwater Model Simulation of Closure

The groundwater model predicts that groundwater quality after Site closure as the following:

- The proposed closure activities, consisting of excavation, capping, and operation of the completed groundwater trench system, will facilitate compliance of the surrounding groundwater to the Class I groundwater standard.
- Monitoring wells for Ash Ponds A, B, and C are predicted to reach the Class I groundwater standard within 10 years.

4.5 Schedule

Completion of the closure activities is dependent on final approval of this Plan by the Illinois EPA. Assuming approval by December 31, 2014, and dependent on weather, the closure will be completed during the 2015 construction season.

5. Groundwater Management Zone Application

See the separate Groundwater Management Zone (GMZ) Application (Hanson and NRT, 2014a) that was prepared for this project. Ameren requested establishment of a GMZ pursuant to 35 IAC 620.250(a)(2) as a three-dimensional region containing groundwater being managed to mitigate impairments caused by a release of leachate from Ash Ponds A, B, and C.

The proposed GMZ covers a larger area than the area of impacted groundwater within the Site. The approximate boundary of the proposed GMZ is depicted in Figure 5. The GMZ will extend vertically through the unlithified deposits and sandstone bedrock, with the base of the GMZ coincident with the bottom of the sandstone, which rests on top of the shale bedrock at an approximate elevation of 405 to 410 feet NGVD within the boundaries of the GMZ.

6. Groundwater Monitoring System

See Sections 2 and 3 in the separate Groundwater Monitoring Plan (Hanson, 2014c) that was prepared for this project. A monitoring system maintenance plan is included at the end of Section 2.2 of that report.

Locations of the (potential) 11 monitoring wells to be used for statistical analysis are identified in Table 3 below and are shown on Figure 2.

Table 3. Ash Pond A Groundwater Monitoring System

Well ID	Well Designation	Monitoring Zone	Install Date	Location[2]		Screen Interval
				Easting	Northing	
MW2R	Downgradient	Shallow	6 Apr 12	3617.43	4112.60	446.0-435.2
MW2D[3]	Downgradient	Deep	*proposed*	3612.	4110.	435.0-430.0
MW3	Downgradient	Shallow	9 Feb 84	3952.03	3860.23	450.9-445.9
MW3D	Downgradient	Deep	6 Oct 98	3952.03	3860.23	433.6-438.6
MW4	Downgradient	Shallow	13 Feb 84	4164.06	4350.55	450.8-443.3
MW5	Downgradient	Shallow	13 Feb 84	4249.98	4821.99	453.5-440.5
MW9	Piezometer	Shallow	14 Oct 84	5202.	5408.	448.2-438.2
MW10	Upgradient	Shallow	7 Oct 98	2559.81	4730.48	447.2-442.2
MW10D	Upgradient	Deep	7 Oct 98	2564.72	4729.43	437.6-433.6
MW12	Downgradient	Shallow	8 Oct 98	4637.98	4053.58	448.6-438.6
MW22[3]	Downgradient	Shallow	*proposed*	4300.	3525.	450.0-445.0
MW22D[3]	Downgradient	Deep	*proposed*	4300.	3525.	435.0-430.0

[2] Well locations based on Plant coordinate system.

[3] Proposed monitoring well to be installed upon approval of this Groundwater Monitoring Plan by Illinois EPA. Deep wells (D suffix) may need to be installed due to shallow zone dewatering from collection trench.

7. Groundwater Monitoring Program

Upon approval of the Groundwater Management Zone Application (Hanson and NRT, 2014a), the groundwater monitoring program will be instituted. The requirements of the Groundwater Monitoring Program are found in the accompanying Groundwater Monitoring Plan (Hanson, 2014c).

The elements of the groundwater monitoring plan include:

1. Groundwater monitoring system with background (upgradient) and compliance (downgradient) monitoring wells identified including construction details/depths.
2. Groundwater monitoring for 7 field and 24 inorganic parameters (Table 4 and Table 5).
3. Quarterly groundwater monitoring frequency.
4. Groundwater sample collection protocol with standard operating procedures.
5. Laboratory analysis by a state-certified laboratory and listing of methods and reporting limits.
6. Quality Assurance Program for field collection of samples and laboratory analysis of samples.
7. Groundwater monitoring system maintenance, including schedule of inspections and methods for inspection of monitoring wells.
8. Data reporting schedule and content of reports.
9. Demonstration of compliance (Section 7.1 below). Statistical methods for evaluating groundwater quality data (Section 7.2 below). Included is a notification schedule with actions to be taken in cases of non-compliance.

Groundwater monitoring can be concluded upon successful completion of post-closure activities and approval of the Illinois EPA. All monitoring data and trend analysis data will be maintained at the offices of Ameren Environmental Services in St. Louis, Missouri, for a minimum of ten years following generation of the data.

7.1 Demonstration of Compliance

Compliance will be based on attainment of groundwater quality that meets the numeric standards for Class I potable resource groundwater as set forth in 35 IAC 620.410. Groundwater quality that does not meet the Class I standard will be considered in compliance when no statistically significant increasing trend can be attributed to the ash ponds at the compliance (GMZ) boundary for four (4) consecutive years, which must be approved by the Illinois EPA. Post-closure groundwater compliance monitoring will continue for a minimum of ten years from the Illinois EPA's approval of this Closure Plan.

Table 4. Field Monitoring Parameters

Parameters[2]
pH[3]
Specific Conductance[3]
Elevation of GW Surface[3]
Depth of Well (bls)[3]
Temperature
Depth to Water (bmp)
Elevation of measuring point

Table 5. Routine Monitoring Parameters

Parameters[2]	Parameters[2]
Antimony, dissolved	Iron[3], dissolved
Arsenic, dissolved	Lead, dissolved
Barium, dissolved	Manganese[3], dissolved
Beryllium, dissolved	Mercury, dissolved
Boron[3], dissolved	Nickel, dissolved
Cadmium, dissolved	Nitrate (as N), dissolved
Chloride, dissolved	Selenium, dissolved
Chromium, dissolved	Silver, dissolved
Cobalt, dissolved	Sulfate[3], dissolved
Copper, dissolved	Total Dissolved Solids (TDS) [3]
Cyanide, total	Thallium, dissolved
Fluoride, dissolved	Vanadium, dissolved
	Zinc, dissolved

7.2 Compliance Determination and Mitigation Requirements

Groundwater Management Zone (GMZ) compliance will be demonstrated by performing an annual trend analysis for each downgradient monitoring well for all of the monitored constituents listed in Table 4 and Table 5. The analysis shall be performed on a minimum of four (4) consecutive samples and use Sen's Estimate of Slope for compliance determination. Generally, if analyses for a parameter show an increasing trend at a down-gradient well, a Mann-Kendall analysis must be performed at a 95% confidence limit to determine whether the increasing trend is statistically significant. If there is a statistically significant increase, then an investigation determining that the statistically significant increasing trend is due to a superseding cause will be performed, and the Illinois EPA will be notified in writing, stating the cause of the increasing trend and the rationale used in its determination.

[2] Routine parameters are reported as dissolved (filtered) concentrations with the exception of the Field Monitoring Parameters and Cyanide, which are taken from total (unfiltered) samples.
[3] Mandatory monitoring parameter under 35 IAC 840.114(a).

If a statistically significant increasing trend continues to be observed over two or more consecutive monitoring periods and there is no superseding cause, a hydrogeologic investigation (and additional site investigation(s), if necessary) must be performed.

Based on the outcome of the additional activities, action must be taken to mitigate the statistically significant increasing trends that are causing, threatening or allowing exceedances of the GMZ groundwater quality standards. Any actions must be proposed as a modification to the post-closure care plan within 180 days after completion of the additional hydrogeologic and/or additional site investigations.

8. Time and Cost Estimates

8.1 Time to Complete Closure

Completion of the closure activities is dependent on weather and final approval of the closure plan and accompanying submittals by the Illinois EPA. However, they are expected to be completed during the 2015 construction season.

8.2 Time to Reach Hydrostatic Equilibrium of Groundwater

The Hydrogeologic Evaluation of Landfill Performance model (HELP Version 3.07) was used to estimate the time for groundwater levels within Ash Pond A to reach hydrostatic equilibrium following completion of the cap. Based on model results for four scenarios with initial moisture contents ranging from zero to 180 inches, the minimum and maximum times for hydraulic head to reach equilibrium ranged from 6 to 8 years. Three of the four scenarios resulted in modeled equilibriums ranging from 61 to 69 inches of head occurring in Year 6 following cap completion.

8.3 Model Predicted Time to Attain Groundwater Quality Standards

The number of years following closure for model predicted boron concentrations (NRT, 2014) in Ash Pond A, B, and C monitoring wells to attain the Class I groundwater standard is approximately 10 years (2025). Predicted boron concentrations will stabilize shortly after the closure plan is implemented in monitoring wells with low concentrations (wells MW5 and MW9), while other wells are predicted to take as long as 40 years to stabilize. Stabilization time is greater than time to comply with Class I groundwater standards at some wells because concentrations continue to decline for a period after the standard is attained.

8.4 Cost of Closure and Post-Closure Care (or Cost of Closure Alternative)

The cost for closure activities related to the closure of Ash Pond A, Ash Pond B, Ash Pond C, and the Bottom Ash Sluice Pond, as described in Section 4 of this Closure Plan and as detailed in the Plans and Specifications (Hanson, 2014d), is estimated to be $2,600,000. The cost for post-closure care activities related to the closure of Ash Pond A, Ash Pond B, Ash Pond C, and the Bottom Ash Sluice

Pond, as specified in the Post-Closure Care Plan (Hanson, 2014e) completed for this project, is estimated to be $63,000 annually. Total cost for closure and post-closure care under this alternative, which includes capital cost and O&M, is $2,600,000 (closure cost) + $630,000 (10-year post-closure care cost) = $3,230,000 (in 2014 dollars).

For comparison purposes, a clean closure alternative for the Ash Pond A, Ash Pond B, Ash Pond C, and the Bottom Ash Sluice Pond at the Site would exceed the $33,000,000 just for the disposal charges (tipping fees) at a permitted disposal facility, and does not include excavation, handling, and transportation to the disposal location. Along with the handling and disposal charges, large volumes of fill could be needed to return the Site to conditions that would promote positive site drainage. Estimated costs are highly dependent on costs associated with disposal of ash in a municipal waste landfill and upon the availability of local fill material. If the material is not suitable for disposal in a solid waste landfill, the disposal cost will be significantly higher than estimated. Due to unfavorable cost and the expected effectiveness of the chosen alternative, this option was not selected.

9. Construction Quality Assurance Program

As previously indicated, see the Construction Quality Assurance (CQA) Plan completed for this project (Hanson, 2014a), which describes the CQA program for the closure of Ash Ponds A, B, C and the Bottom Ash Sluice Pond.

The CQA Plan requires a scheduled program of CQA monitoring, inspection, sampling and testing to verify compliance with project plans and specifications. The goal of the program is to achieve a reasonable degree of certainty that the construction of the facility meets the specified designs.

The elements of the Plan include:

1. Responsibility and authority of project personnel, including: the owner (Ameren); design engineer; CQA personnel, including owner's representative retained as a CQA Officer and a document controller; testing and monitoring firms under the direction of the CQA officer, including the soil/concrete testing lab(s), surveyor, geosynthetics monitor and geosynthetics testing laboratory; and, contractors, suppliers and installers performing their designated portions of the work.
2. Project meetings, including preconstruction meetings, routine progress meetings and as needed, problem or work deficiency meetings.
3. In-progress acceptance of work by the geosynthetic installers and the vegetative cover installers to insure that the geosynthetic is not damaged.
4. Sampling and testing requirements. Prequalification and placement sampling/testing requirements for the various materials and construction activities.
5. Corrective measures. The CQA Officer shall reject and require replacement of all materials for which sampling, testing or inspection show that prequalification requirements are not met. The CQA Officer shall also reject workmanship (and require corrective rework) for which sampling, testing or inspection show that material placement requirements are not met.
6. Documentation of sampling, inspections, and testing, with daily inspection reports and weekly summary reports prepared by the CQA Officer or his designated representative.

7. Acceptance report prepared by the CQA Officer upon completion of the construction contract and submitted to the Illinois EPA. The acceptance report shall contain the following:
    - Certification by the CQA Officer that the construction has been prepared and constructed in accordance with the engineering design.
    - "As-built" drawings.
    - Weekly summary reports.
8. Construction management activities, including:
    - Procedures for requests for information (RFIs), clarification or interpretation of contract documents by the General Contractor or installer to the CQA Officer.
    - Review procedures of contractor submitted drawings, product data and samples by the CQA Officer in accordance with the requirements of the project specifications so as not to cause delay in project work.
    - Process by which the contractor shall prepare Field Change Order (FCO) requests to the CQA Officer and responsibilities of the CQA Officer for logging FCOs and updating project costs.
9. Procedures for document control and project records, including revisions of the CQA Plan, as necessary, by the CQA Officer, and issuance and maintenance of the CQA Plan and revisions to the CQA Plan by the Document Controller.

10. Licensed Professional Acknowledgement

I hereby affirm that all information and design contained in this Closure Plan is true and accurate to the best of my knowledge and belief in accordance with good engineering practice.

Steve M. Bishoff, P.E.
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Seal:

Expires 11/30/2015

Signature: _____ Date: 10-2-2014

11. References

Hanson, 2011a. "Closure of Ash Pond D, Hutsonville Power Station, Closure Plan, Ameren Energy Generating Company, Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL.

Hanson, 2011b. "Closure of Ash Pond D, Hutsonville Power Station, Groundwater Monitoring Plan, Ameren Energy Generating Company, Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL.

Hanson, 2011c. "Closure of Ash Pond D, Hutsonville Power Station, Plans and Specifications, Ameren Energy Generating Company, Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL.

Hanson, 2014a. "Ash Ponds Closure, Construction Quality Assurance Plan, AmerenEnergy Medina Valley Cogen, L.L.C., Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL.

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Hanson, 2014e. "Ash Ponds Closure, Post-Closure Care Plan, AmerenEnergy Medina Valley Cogen, L.L.C., Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL.

Hanson and NRT, 2014. "Ash Ponds Closure, Groundwater Management Zone Application, AmerenEnergy Medina Valley Cogen, L.L.C., Crawford County, Illinois". Hanson Professional Services Inc., Springfield, IL; Natural Resource Technology, Inc., Milwaukee, WI.

Illinois PCB, 2011. Rulemaking R2009-21 – "Ameren Ash Pond Closure Rules (Hutsonville Power Station): Proposed 35 Ill. Adm. Code Part 840.101 through 840.152 – Adopted Rule. Final Opinion and Order". Illinois Pollution Control Board, Springfield, IL, 80 pp.

Illinois PCB, 2013. Rulemaking R2014-10 "Coal Combustion Waste Surface Impoundments at Power Generating Facilities: Proposed New 35 Ill. Adm. Code Part 841 – Statement of Reason". Illinois Pollution Control Board, Springfield, IL, 305 pp + Appendices.

NRT, 2014. "Ash Ponds Closure, Modeling Report, AmerenEnergy Medina Valley Cogen, L.L.C., Crawford County, Illinois". Natural Resource Technology, Inc., Milwaukee, WI.

The Hanson 2014 documents, the Hanson/NRT 2014 document and the NRT 2014 document listed above are being submitted concurrently as part of and/or supporting this Closure Plan.