From:	Patrick Kennedy
To:	HALE, JOHN
Cc:	Russ Becker; Dan Dunn
Subject:	Former AEP Power Plant - Tanners Creek - Main Ash Pond
Date:	Friday, March 15, 2019 3:59:20 PM
Attachments:	2019-03-15 IDEM Letter for MAP RAI-signed.pdf

Good afternoon John,

Per our January 30, 2019 letter, attached is the Groundwater Monitoring Plan for the Main Ash Pond at the former AEP Power Plant in Lawrenceburg, Indiana. Additional site investigations are necessary prior to issuing responses to the specific comments provided by IDEM in a December 4, 2018 letter. EAG proposes to implement the installation of groundwater monitoring wells in accordance with the plan and collect groundwater samples quarterly for 2 years to collect additional site data. Please contact me if you have any questions or require any additional information at this time.

Thanks,

Patrick Kennedy, PE

EnviroAnalytics Group

PLEASE NOTE THE CHANGE IN ADDRESS
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EnviroAnalytics Group
Environmental Engineers

March 15, 2019

IDEM Solid Waste Permitting
ATTN: John Hale
IGCN 1101
100 North Senate Ave
Indianapolis, IN 46204-2251

RE: **Former AEP Power Plant**
Tanners Creek
Request for Additional Information
Main Ash Pond System
Response to Comments

Dear Mr. Hale,

Tanners Creek Development, LLC and EnviroAnalytics Group, LLC (EAG) received a copy of the Indiana Department of Environmental Management (IDEM) letter dated December 4, 2018 requesting additional information for the August 16, 2018 closure plan for the Main Ash Pond. The letter contained comments from both the engineering and geology review. On January 30, 2019, EAG requested additional time for document preparation to provide a response to the December 4, 2018 letter.

IDEM comments 1 through 5, inclusive, for the geology review were in regards to the Groundwater Monitoring Plan. The groundwater monitoring plan has been revised to address these comments. Enclosed with this letter is Revision 3 of the Groundwater Monitoring Plan for the Main Ash Pond. Specific responses to each of the comments in the geology review are discussed in greater detail later in this letter.

Additional site investigations are required to obtain sufficient data to provide responses to the specific IDEM engineering comments. It is proposed that the groundwater monitoring wells included in the Groundwater Monitoring Work Plan be installed to further investigate the site lithology and hydrogeology. Groundwater samples will be collected on a quarterly bases (2nd quarter and 4th quarter of each calendar year) for two years. Groundwater samples will be analyzed for the baseline sampling parameters discussed in the plan. Additional investigations (geotechnical soil sampling, pump testing, etc.) may be conducted in order to generate the data required to address the specific IDME comments. A site characterization report will be submitted after the groundwater monitoring wells have been installed and a report will be

submitted after the completion of each groundwater sampling event. The August 16, 2018 closure plan and the December 4, 2018 IDEM comments will be reviewed and addressed, respectively, following the completion of this proposed work.

Below is our response to the IDEM geology comments for the Main Ash Pond closure plan:

1. *Table 4-1 and Figure 1 of the Attachment II — Ground Water Monitoring Plan (GWMP) refer to proposed nested monitoring well locations. The spacing between the current proposed down-gradient nested monitoring well locations ranges from approximately 850 to 1050 feet. Due to the high hydraulic conductivity and unknown dispersivity potential of the sand and gravel aquifer, the facility needs to propose additional down-gradient nested monitoring well locations in order to achieve IDEM's recommended spacing in the range of 500 feet. Due to the prevailing northerly to westerly ground water flow directions at the facility, the proposed down-gradient nested monitoring wells should include at least two evenly spaced locations along the western end of the ash pond. We estimate the number of down-gradient nested monitoring well locations necessary to achieve these goals will increase from the current four locations to six or seven locations.*

The quantity and location of the groundwater monitoring wells in the plan has been revised. Figure 1 of the plan details groundwater monitoring well spacing of 500-feet on the plan north and plan west sides of the Fly Ash Pond.

2. *Table 4-1 and Figure 1 of the GWMP refer to two proposed nested up-gradient and/or background monitoring well locations. Both of these locations reside along the southern side of the ash pond. Based on the potentiometric maps provided in Figures 5 through 10 in the GWMP, the prevailing ground water flow direction at the ash pond varies from northward to westward. Therefore, to more fully monitor the varying direction of up-gradient and/or background ground water flow, the facility needs to install at least one additional set of nested monitoring wells at an appropriate location along the eastern side of the ash pond.*

   Please note that up-gradient and/or background ground water monitoring locations need to provide ground water quality samples that represent historical conditions unaffected by a coal combustion residuals (CCR) unit or facility activities that may contribute constituents of concern. Therefore, the facility needs to include suitable up-gradient and/or background monitoring locations in the proposed ground water monitoring system based on these technical specifications. Please note that based on the limited data provided, it is unclear if the currently proposed locations will meet these specifications.

The quantity and location of the groundwater monitoring wells in the plan has been revised. The plan proposes that 3 groundwater monitoring wells be installed on the south side of the

Main Ash Pond and that 2 groundwater monitoring wells be installed on the east side of the Main Ash Pond. The objective of the groundwater monitoring plan is to allow for collection of groundwater samples to evaluate potential impacts to the aquifer from the Main Ash Pond. Groundwater samples will be obtained immediately upgradient and immediately downgradient of the Main Ash Pond.

3. *Sections 4.4, 5.2.1, and 5.7 of the GWMP state the facility will develop ground water flow maps based on water level measurements obtained from all of the monitoring wells during each sampling event. Due to the hydraulic connection between the sand and gravel aquifer and the Ohio River, the ground water flow maps need to include the contemporaneous Ohio River water surface elevation adjacent to the ash pond in the determination of the potentiometric surface across the ash pond.*

The water surface elevation of the Ohio River will be measured and recorded during each sampling event. Surface water elevation data will be obtained from the river level gauge on the side of the facility screen house. This has been added to Section 3.2 of the Groundwater Monitoring Plan.

4. *Section 3.0 (Hydrogeologic Conditions) of the GWMP states that lithologic descriptions of borings drilled adjacent to the ash pond document soils of lean clay and silty clay overlie the sand and gravel aquifer. However, the GWMP does not contain documentation showing the lateral continuity and thickness of the clay layer across the interior of the ash pond. Knowing the lateral continuity and thickness of the underlying clay is essential for understanding potential contaminant migration pathways, and will benefit the design of any necessary closure measure involving the prevention of ground water infiltration into the ash pond. Therefore, the facility needs to document the lateral continuity and thickness of the clay layer across the interior of the ash pond either with adequate existing documentation or with an appropriate number of borings across the MAP with continuous lithologic sampling. The interior borings should include in-situ hydraulic conductivity testing and/or collection of Shelby tube samples of the clay layer for laboratory hydraulic conductivity testing.*

Soils will be logged during the installation of the proposed monitoring wells as part of the Groundwater Monitoring Plan. The data collected during these activities, combined with the historical site data and reports, will be used to develop a complete site conceptual model. EAG may complete additional site investigation activities as necessary to address this comment.

5. *The GWMP contains proposals for Phase I (Section 9.0) and Phase II (Section 10.0) ground water monitoring, and a Corrective Action Program (Section 12.0). The facility developed these proposals before the August 21, 2018 U.S. Court of Appeals decision referenced in the IDEM cover letter accompanying this geology enclosure. The MAP is now subject to the ground water monitoring and corrective action requirements found at 40 CFR 257.90 through 257.99. Therefore, the facility needs to revise sections 9.0, 10.0,*

12.0, and additional related sections, 11.0 (Increase Not Attributable to Landfill) and 13.0 (Ground Water Quality Standard) of the GWMP to comply with the applicable requirements found in 40 CFR 257.90 through 257.99.

The groundwater monitoring plan has been revised as requested.

6. *It is unclear whether ground water infiltrates the CCR of the Main Ash Pond or any contiguous contaminated soils up-gradient of the Main Ash Pond on a continual or periodic basis. Such infiltration may be a source of releases, even after dewatering, grading, and capping of the impoundment. Therefore, the facility needs to explain how they will meet the criteria under 40 CFR 257.102(d)(1). Additionally, please provide the elevations of the seasonal high and low water table, the elevation(s) of the bottom of the waste, and the lithologic composition of soils adjacent to and below the Main Ash Pond.*

Additional site investigation activities are required to address this specific comment. A response to this comment will be prepared once the proposed groundwater monitoring wells have been installed, EAG conducts further hydrogeologic evaluations, and groundwater samples collected and analyzed semi-annually for two (2) years.

The attached Groundwater Monitoring Plan for the Main Ash Pond is an appropriate plan to be included with Main Ash Pond Closure documents. Your review and approval of this document is requested. A work plan will be prepared prior to installation of the proposed wells and/or abandonment of any existing wells once the Groundwater Monitoring Plan is approved by IDEM. This work plan may contain additional site activities required to address the IDEM comments. This work plan will be submitted to IDEM prior to the start of the work and will describe the materials and methods to be used for the site investigations.

If you have any questions or require additional information at this time, please contact me at your convenience at 314-835-2822 or at pkennedy@enviroanalyticsgroup.com

Sincerely,

Patrick Kennedy

Patrick Kennedy, P.E.
Project Manager
EnviroAnalytics Group LLC

Solid Waste Land Disposal Facilities
Signatures and Certification Statements for Requested Additional Information

329 IAC 10-11-3(d) requires that the signatory of a solid waste land disposal facility permit application and of other information requested by or on behalf of the Commissioner (including the supplemental information requested by our office for your solid waste land disposal facility permit application) sign the following certification statement:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information."

APPLICANT'S SIGNATURE

3-15-19

DATE

THOMAS ROBERTS

APPLICANT'S NAME TYPED

Note: It is not necessary to submit this form if an equivalent signed certification statement is incorporated into your submittal.

GROUNDWATER MONITORING PLAN

FORMER AMERICAN ELECTRIC POWER TANNERS CREEK POWER PLANT – MAIN ASH POND

Lawrenceburg, Indiana

Prepared for:

Tanners Creek Development, LLC

Revision 3

EnviroAnalytics Group

Environmental Engineers

EnviroAnalytics Group
1515 Des Peres Road, Suite 300
St. Louis, Missouri 63131

EnviroAnalytics Group

ENGINEER CERTIFICATION

I hereby certify that these documents were prepared or approved by me, and that I am duly licensed professional engineer under the laws of the State of Indiana.

Signature: _____ Date: 3-15-19

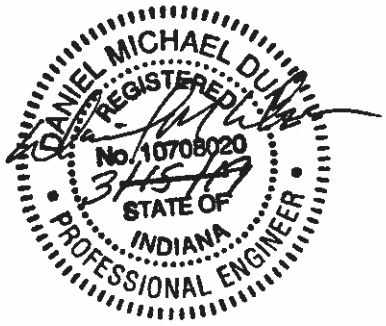
Name: Daniel M. Dunn

Address: 1515 Des Peres Road, Suite 300

St. Louis, Missouri 63131

Telephone Number: 314-835-2814

Professional Engineer Registration No.: 10708020



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TABLES

APPENDICES

1.0 INTRODUCTION

This Groundwater Monitoring Plan (GWMP) revision has been prepared on behalf of Tanners Creek Development, LLC for the monitoring of groundwater flow and constituents beneath the Main Ash Pond of the former Tanners Creek Power Plant. This groundwater monitoring plan is tailored specifically for the Main Ash Pond. Separate groundwater monitoring plans for the Type 1 Restricted Landfill and Fly Ash Pond have been, or will be, prepared.

The original GWMP for the Main Ash Pond was prepared for American Electric Power (AEP) in February 2014. TRC completed Revision 1 of the GWMP and was included as part of the closure plan submitted to the Indiana Department of Environmental Management (IDEM) on March 23, 2015. Revision 2 was completed by S&ME on behalf of the current owner of the property, Tanners Creek Development, LLC. These revisions were completed to address various requests for additional information from IDEM.

1.1 Location and Operational Background

The Tanners Creek Power Plant is located adjacent to the Ohio River on State Route 50 approximately one mile southwest of Lawrenceburg, Indiana. The first of four coal fired steam electric generating units at the facility came on-line in 1951 and power generation ceased in May of 2015. The plant, while active, was operated by the Indiana Michigan Power Company (a subsidiary of American Electric Power). Tanners Creek Development, LLC purchased Tanners Creek in October of 2016.

The Main Ash Pond is an above grade structure with dikes on all side and former dikes within. The facility was first constructed in the early 1950's as two ponds: the eastern 2/3rd of the Old Ash disposal area, and the north central portion of the Main Ash Pond. In the late 1950's, a third pond was constructed west, southwest, and south of the prior constructed ponds. In the mid-1960's, a fourth pond was constructed in the southern portion of the formal coal pile area.

The dikes of the original ponds were constructed of soil materials. The dikes were raised in 1973 and 1974 using bottom ash. The raising of the dikes was constructed by placing bottom ash both above and inside the original earthen dikes. Therefore, most of the bottom ash dike raising was constructed on the ash materials which were present in the pond at the time of the raising. The bottom ash raising separated the Old Ash

disposal area from the Main Ash Pond and was limited to the exterior dikes which subsequently cause the interior dikes to be buried in ash. In the mid-1990's the coal pile storage area was further reduced and a separate pond constructed to manage the coal pile runoff. The pond is located east of the Old Ash Disposal Area south of the current coal pile storage area.

Soil for the original dike construction is believed to have been obtained from within the interior of the ponds. The Markland Dam, which presently controls the lower water level of the Ohio River (El. 455) adjacent to the ash pond, was not present at the time of the original dike construction. Rather, the lower water level of this stretch of river (El. 433) was controlled by Lack and Dam No. 38 located downstream of the plant at McVille, Kentucky. The lower river level at the time the original pond construction allowed the bottom elevation of the pond to extend below the current river level.

Key elevations (nominal), post construction of the Markland Dam, for the Main Ash Pond are as follows:

- Crest of original soil dikes – approx. El. 475
- Crest of bottom ash raising – approx. El. 482
- Normal Pool Ohio River – approx. El. 455
- Ordinary High Water Level of River – approx. El. 462
- 100-year flood level – approx. El. 488.5

2.0 HYDROGEOLOGICAL CONDITIONS

The Tanners Creek Power Plant and peripherals are located in the Ohio River alluvial valley with the ground elevation varying between 470 and 518 feet North American Vertical Datum 1988 (NAVD88). A line of bluffs form the boundary of the alluvial valley to the northwest. An eroded highland province occurs outside of the alluvial valley. The topography of the site is generally flat except in locations modified by site development, e.g. dike construction for the FAP. Subsurface conditions are similar across the site; soils consist of alluvial deposits of the adjacent Ohio River and glacial outwash deposits.

Logs of borings drilled adjacent to the Main Ash Pond, Fly Ash Pond, and landfill document native soils of lean clay and silty clay soils overlying sands and gravels. The

sands and gravels reportedly terminate on shale bedrock with interbedded limestone layers identified as a member of the Cincinnatian series of Ordovician age. The sands and gravels appear to be continuous across the site and represent the aquifer below the ash ponds. The alluvial aquifer varies from 34 to 53 feet in thickness. The underlying shale bedrock represents the lower confining boundary of the aquifer.

The ground water in the aquifer generally flows to the west or northwest in response to the slight cone of depression generated by the well field west of the Fly Ash Pond. The well field is composed of municipal water supply wells owned and operated by the City of Aurora and the Lawrenceburg, Manchester, Sparta Water Conservancy District. Potentiometric maps documenting previous ground water monitoring by AEP indicate the sand and gravel aquifer is hydraulically connected to the west-northwest flowing Ohio River.

Additional background on the geology and hydrogeology of the site can be found in previous ground water studies including:

- A 1976 study for the Fly Ash Pond (Woodward-Clyde),
- A 1988 ground water monitoring program for the plant (AEP), and
- The ground water monitoring program for the Type I Restricted Waste Landfill at Tanners Creek Power Plant.

3.0 GROUNDWATER MONITORING SYSTEM

3.1 Objective

The objective of the groundwater monitoring system is to allow for collection of groundwater samples from the aquifer which represent the quality of, both, water unaffected by the Main Ash Pond (upgradient) and water at the monitoring boundary downgradient of the Main Ash Pond.

3.2 Monitoring Well Network & Evaluation

The groundwater monitoring network program for the Main Ash Pond is summarized in the following table.

Table 3-2 Summary of Monitoring Well System

ID	Status	Well Type	Designation	Sampled
MW-31S (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-31M (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-31D (deep)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-16RS (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-16RM (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-16RD (deep)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-32S (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-32M (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-32D (deep)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-33S (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-33M (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-33D (deep)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-34S (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-34M (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-34D (deep)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-35S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-35M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-35D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-36S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-36M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-36D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-37S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-37M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-37D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-38S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-38M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-38D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-39S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-39M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-39D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-40S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-40M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-40D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-41S (shallow)	Proposed	Monitoring Well	Down-Gradient	Yes
MW-41M (intermediate)	Proposed	Monitoring Well	Down-Gradient	Yes (1)
MW-41D (deep)	Proposed	Monitoring Well	Down-Gradient	Yes

Table 3-2 (cont.) Summary of Monitoring Well System

ID	Status	Well Type	Designation	Sampled
MW-42S (shallow)	Proposed	Monitoring Well	Up-Gradient	Yes
MW-42M (intermediate)	Proposed	Monitoring Well	Up-Gradient	Yes (1)
MW-42D (deep)	Proposed	Monitoring Well	Up-Gradient	Yes

1. The proposed intermediate "M" wells would only be installed if the saturated thickness of the aquifer at the well location exceeds about 35 feet. Additional information regarding the proposed well screen placement is included on Figure 2 of Appendix A

The locations of the wells are depicted on the Well Location Map Plan included as Figure 1 of Appendix A at the rear of this Plan. Well installation details are summarized on Figure 2 of Appendix A.

More groundwater monitoring wells than are listed in Table 3-2 or shown on Figure 1 of Appendix A are present at Tanners Creek. The other wells are utilized to monitoring the Type 1 Restricted Waste Landfill and/or the Fly Ash Pond. Future revisions of this Plan could include the monitoring of some of the other wells if needed and if appropriate.

Monitoring wells MW-13, MW-14, MW-15, MW-16, MW-17 were previously installed around the Main Ash Pond. These wells are not included as part of the groundwater monitoring well system and, if located, will be abandoned.

A surface water gauge for the Ohio River is located on the side of the screen house near the Main Ash Pond. The surface water elevation of the Ohio River at the screen house will be observed and recorded during each monitoring event.

3.3 New Wells and Well Abandonment

A Work Plan will be prepared prior to installation or abandonment of any wells. The Work Plan will be submitted to IDEM for review and comment prior to the start of work. The Work Plan will describe the materials and methods to be used for well installation or abandonment.

Ground water monitoring wells will be installed following the applicable requirements of Indiana Department of Environmental Management (IDEM), Indiana Department of Natural Resources (IDNR), and 329 IAC 10-21-4. Ground water monitoring wells will be

abandoned, if necessary, following the applicable requirements of IDNR, and 312 IAC 13-10-2.

3.4 System Adequacy Evaluation

Each ground water monitoring report (see Paragraph 5.7) will include a ground water flow map depicting the potentiometric surface of the aquifer using contour lines. The basis of the map will be the water level measurements obtained as part of the ground water sample collection (sampling event) being reported. The reports will include a general discussion of ground water flow and will specifically address any deviation from the well designations presented in this Plan (see Table 3-2).

3.5 Maintenance

Visual inspection of the wells will occur during each sampling event and routine maintenance, (lock replacement, removal of wasp nests, etc.) will be performed as needed. Inspections will be documented using the form included as Figure 2 of Appendix B. Additionally, sample collection field notes (see Figure 3 of Appendix B) will include description of the performance of the dedicated sampling pumps. Any maintenance performed or additional maintenance needed will be noted on the field sampling documentation forms.

3.6 Damage Notification

In the event a monitoring well is damaged, destroyed, or fails to function properly, IDEM will be notified of the defect within 10 days of discovery. An attempt will be made to correct any such defect. If the defect cannot be repaired, the well will be abandoned and replaced within 60 days of the notification, unless IDEM determines that the well is no longer needed as part of the monitoring system.

4.0 SAMPLING PROCEDURES

4.1 Objective

The objective of the sampling and analysis plan is to describe procedures that will provide appropriate and consistent monitoring, sampling, and analysis methods so that the groundwater samples collected yield an accurate representation of groundwater quality.

4.2 Water Level Elevation Measurements

Static water level elevations will be measured in each well during any sampling events. Sealed well caps will be installed on wells subject to flooding (top of casing elevation below 488-feet). The sealed well caps will be removed and the water level allowed to stabilize prior to obtaining water level measurements.

Depth to water will be measured in each well within a 24-hour period prior to purging or sampling any well and recorded. An additional water level measurement will be taken immediately before purging/sampling a well and will be recorded on that individual well's sampling log. Water levels will be measured and recorded to the nearest hundredth of a foot using a weighted water level measuring tape/probe. The precise static water level elevation will be calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. Based on these measurements recorded during each monitoring event, a potentiometric map will be generated contouring the groundwater elevations and depicting the direction of groundwater flow.

4.3 Sampling Sequence

The sampling sequence will generally start with the sampling of the up-gradient background wells based on the groundwater flow direction determined at the time of each sampling event. Sampling of the down-gradient compliance wells will proceed progressively by sampling from lower- to higher-impacted waters as determined by the previous sampling event's water quality data.

4.4 Well Purging and Sample Collection

All groundwater monitoring wells will be purged prior to sample collection. The date and time of purging, volume purged, and other relevant water quality stabilization details will be recorded. Purge water will be discarded at the ground surface near the sampled wells.

4.4.1 Monitoring Wells

Each well is (will be) equipped with a dedicated submersible sampling pumps and tubing for purging and sampling. Purging prior to sampling will be accomplished utilizing low-flow purging techniques generally in accordance with IDEM's 2012 Technical Guidance Document "The Micro-Purge Sampling Option". Low-flow purging will be completed at a flow rate in the range of 150 to 500 milliliters per minute (mL/min). The flow rate will be

adjusted to attempt to limit water column drawdown to approximately 0.33 feet (4 inches) or less because ideally the purge rate should not exceed the recharge rate of the well.

The depth to water levels and water quality parameters will be measured and recorded in 5-minute intervals during purging depending on flow rates. Water quality parameters will be measured with a closed flow-thru cell connected to a water quality probe/meter. The water quality parameters to be monitored are conductivity (specific conductance), temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP or Eh), and turbidity. Well purging will be considered complete once stabilization of the following indicator parameters has been achieved for three consecutive readings:

Table 4-4 Purging Water Quality Stabilization Parameters

Parameter	Stabilization Criteria
Temperature	+/- 3%
pH	+/- 0.1 standard unit
Conductivity	+/- 3%
Dissolved Oxygen	+/- 10% or +/- 0.2 mg/L (whichever is greater)
ORP or Eh	+/- 20 mV

Once well stabilization is achieved, the pump tubing will be removed from the flow-thru cell and immediately start the filling of the sample containers. The date and time of samples collected, well purging, total volume purged, and other relevant water quality data will be recorded on the field purging/sampling logs. Purged water will be collected and properly discarded.

4.4.2 Field Filtering

The fraction of the samples to be analyzed for metals will be field filtered using in-line, capsule, 0.45 micron disposable filters. A series of in-line filters concluding with the 0.45 micron filter may be used, if necessary, to avoid rapid plugging of the small pore filters.

The submersible pumps will be used to move water through the filter when sampling the monitoring wells. Water will be placed in clean, unpreserved, sample container; from there a peristaltic pump will be used to move the water from the container, through the filter, and into the sample container.

4.5 Field Data

Data associate with the field sampling will be recorded on a form at the time of sample collection. A sample form is included as Figure 3 of Appendix B. Field analysis will be completed concurrently with purging or sample collection as noted in Paragraph 5.2.2.
The following analysis will be completed in the field using portable equipment:

- Specific conductance,
- pH,
- Temperature
- Turbidity

4.6 Sample Containers

The analytical laboratory to perform the chemical analysis will provide the appropriate new or pre-cleaned sample containers. The laboratory will place the appropriate preservative in the appropriate containers before shipping the containers to the field personnel. At the time of sampling, preserved sample containers will be filled in a manner as to not rinse the preservative from the container. Preservation will be as identified on **Table 3**.

All sample containers will be appropriately labelled. At a minimum, each sample container label will contain the site ID, well/location ID, date and time of collection, preservative, analytical analysis, and initials of the sampler.

4.7 Decontamination

Each of the monitoring wells are (will be) equipped with dedicated pump systems, which eliminates the need for decontamination of the purging device. If pump failure is encountered, then an alternate means of sample recovery will be used until a new pump is acquired. New out-of-well tubing will be used for the sampling of each well during each sampling event. Any of the out-of-well tubing will not be reused. Filters will not be reused.

The water level meter and water quality measuring equipment will be decontaminated by thoroughly rinsing with de-ionized or distilled water prior to and again after each use.

Field sampling personnel will wear disposable Nitrile gloves (or similar). A new pair of gloves will be donned prior to purging/sampling any well.

4.8 Quality Assurance/Quality Control (QA/QC)

4.8.1 Field Duplicates

Field duplicate samples will be collected during each sampling event. Duplicate samples will represent at a minimum of 5% of all samples analyzed by the laboratory. Field duplicate samples will be collected from the wells simultaneously with the primary samples and will be analyzed for the same constituents as the primary sample.

4.8.2 Equipment Blanks

Each monitoring well will be equipped with its own dedicated pumping system which eliminates the need for an equipment blank from the sampling equipment. One equipment blank will be collected by pouring laboratory grade de-ionized water over the tip of the water level meter probe and into the sample container. The equipment blank sample will be analyzed for the same constituents as the monitoring well samples.

4.8.3 Equipment Calibration and Operation

Multiple or alternate equipment may be utilized for sampling and analysis during each monitoring event. All sampling and analysis equipment will be maintained, calibrated, and operated according to the manufacturer's specific recommendations.

4.8.4 Analytical Laboratory

All sample chemical analysis will be performed by a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory. The laboratory will follow the general testing and reporting requirements including:

- Samples exceeding hold times will not be analyzed (unless requested)
- All sample preparatory, laboratory instrument, and QA/QC procedures utilized will be in accordance with the specific analytical test method
- Various QC samples will be analyzed based on the test method
- At a minimum, analytical reports will include:
    - Sample ID
    - Laboratory specific sample ID
    - Sample collection date

- Sample received date
- Date of analysis
- Laboratory analysist
- Analysis result for each requested constituent
- Limit of Detection (LOD)
- Limit of Quantitation (LOQ)
- Sample extraction method
- Analytical method
- QA/QC results
- Qualifier and discussion of any non-conforming QA/QC results
- Chain of Custody

4.9 Sample Preservation & Shipment and Chain of Custody

Samples will be placed on ice in coolers, appropriately packaged and shipped within the coolers to be delivered as soon as practical to the certified chemical laboratory for analysis. Appropriate chain of custody documentation will accompany the samples at all times until received and logged at the laboratory.

Field sampling personnel are responsible for the custody of the samples until custody is transferred. Proper chain of custody documentation will be maintained at all times for the applicable samples. The chain of custody forms will be signed by the sampler followed by any and all subsequent personnel who take possession of the samples. At a minimum, the chain of custody will contain the exact same information as labeled on the sample containers (sample ID, date, time, etc.), the number of containers per sample, required sample analysis per sample, and the name and signature of the person who collected the samples.

4.10 Analytical Analysis

All samples will be sent to certified analytical laboratory for chemical analysis within the applicable holding times. All analyses will be performed according to the appropriate EPA SW-846 methods or EPA Methods for Chemical Analysis of Water and Waste (EPA 600/4-79-020). The applicable analytical methods and hold times are listed in **Table 3**.

5.0 GROUNDWATER MONITORING & REPORTING SCHEDULE

5.1 Groundwater Monitoring Reporting

A Groundwater Monitoring Report (GWMR) will be prepared following each sampling event and submitted to the appropriate division(s) of the IDEM within 60 days of the last sample collection date for that particular event. At a minimum, the GWMR will contain:

- Narrative discussion summarizing the sampling event and analytical results
- Discussion of any well issues and planned/completed maintenance/repairs
- Water level measurements
- Potentiometric map
- Summary of analytical results
- Field data sheets and purging/sampling logs
- Laboratory analytical reports and chain of custody documentation
- Statistical Evaluation (if applicable)
- Well installation/abandonment data since previous sampling event

5.2 Monitoring Schedule

This GWMP will be implemented immediately upon approval from the IDEM. Baseline monitoring will consist of the collection of groundwater samples on a quarterly basis from the proposed monitoring well locations for 2 years (8 quarterly sampling events). These quarterly events will be conducted in January, April, July and October. After the completion of the baseline monitoring (2 years of quarterly sampling events), detection monitoring will begin. The monitoring frequency for detection monitoring will be semi-annual. Semi-annual sampling events will occur during the second quarter and fourth quarter of each year so that normally high and normally low groundwater level conditions will be represented.

5.3 GWMP Termination/Suspension and Modifications

Sampling and analysis in accordance with this GWMP will continue throughout the post-closure period of the Main Ash Pond. Any GWMP modifications will need to be pre-approved by IDEM prior to implementation.

6.0 PREOPERATIONS CONDITIONS

Installation and development of the proposed monitoring wells identified in Table 3-2 will occur within 4 months of IDEM approval of this Plan. IDEM will be notified both in advance of well installation and again after the wells have been installed and developed. The first sampling event report (see Paragraph 5.7) submitted after well installation will include the following information for the newly installed wells:

- Installation dates
- Boring logs,
- Well completion diagrams,
- Development data,
- Decontamination procedures, and
- Surveyed locations (both coordinates and map).

7.0 STATISTICAL EVALUATION

Statistical analysis will be applied to the groundwater quality data and analytical results as part of each semi-annual monitoring event. The statistical evaluation will determine if there is a statistically significant increase (SSI) in certain constituents of the down-gradient wells when compared to the background up-gradient well(s) (i.e., inter-well comparison). After the initial 2 years of quarterly sampling (Baseline Sampling Program), the collective 8 (or more) results of each applicable constituent will be used to calculate an appropriate site background for the up-gradient and down-gradient wells. A Statistical Evaluation Plan (StEP) will be submitted to the IDEM for review and comment following the 8th quarterly monitoring event. Following IDEM's approval of the StEP, the StEP will be incorporated into this GWMP.

Statistical evaluation will commence as part of the first official semi-annual monitoring event (Detection Monitoring Program) after IDEM approval of the StEP. The statistical evaluation will compare each individual down-gradient well to background utilizing a 95% confidence limit. The specific statistical analysis method(s) used will be based on the nature of the data sets and deemed appropriate according to USEPA document 530-R-09-007 "Statistical Evaluation of Ground-Water Monitoring Data at RCRA Facilities"

(March 2009). The statistical evaluation will be applied to select parameters as specified in Section 8.1 of this GWMP.

8.0 BASELINE MONITORING PROGRAM

8.1 Baseline Monitoring Parameters

The Baseline Monitoring Program will begin within 90 days after the proposed groundwater monitoring wells are installed. Baseline samples will be conducted quarterly for a total of eight (8) quarters (2 years). Baseline monitoring will include chemical analysis for the constituents/parameters identified in the following Table 8-1.

Table 8-1 Baseline Monitoring Parameters

Parameter
FIELD PARAMETERS
Temperature
Conductivity
Turbidity
ORP
Dissolved Oxygen
pH
LABORATORY ANALYSIS
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chloride
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
pH
Sulfate
Total Dissolved Solids (TDS)
Radium 226 and 228 combined

9.0 DETECTION MONITORING PROGRAM

9.1 Detection Monitoring Parameters

Detection monitoring will begin after the completion of the Baseline Monitoring Program. Detection monitoring samples will be collected on a semi-annual basis (2nd and 4th

quarter of each calendar year). The samples collected for the Detection Monitoring Program will include chemical analysis for the constituents/parameters identified in the following Table 9-1 listed under detection monitoring parameters. In the event that a parameter is non-detect for eight sampling events and if there is no history of maximum contaminate level exceedance, the Owner may request or IDEM may direct, that individual parameters be deleted from the monitoring program.

Table 9-1 Detection Monitoring Parameters

Parameter	Statistical Evaluation
Field Measured Parameters	
Temperature	No
Conductivity	No
Turbidity	No
ORP	No
Dissolved Oxygen	No
pH	No
Detection Monitoring Parameters	
Boron	Yes
Calcium	Yes
Chloride	Yes
Fluoride	Yes
pH	Yes
Sulfate	Yes
Total Dissolved Solids (TDS)	Yes

9.2 Statistical Exceedance

A statistical exceedance is defined as a statistically significant increase (SSI) in one or more down-gradient wells for one or more parameters listed under the detection monitoring parameters in Table 8-1. The SSI will be determined based on the statistical analysis method(s) described in Section 7.0 of this GWMP. Procedures leading to Assessment Monitoring may be implemented whenever a statistical exceedance occurs during the semi-annual monitoring event.

Demonstration that the SSI was the result of a source other than the main ash pond unit or that the SSI resulted from sampling errors, analysis errors, statistical evaluation errors, or natural variation of groundwater quality may be completed prior to implementing Assessment monitoring. IDEM will be notified of the proposed path

forward (written demonstration of alternative source, potential sampling/analytical error, or establish assessment monitoring) within 7 days of identifying the SSI. The alternate source demonstration will be completed within 90 days of detecting the SSI. The Main Ash Pond will be subjected to the Assessment Monitoring program if the alternate source demonstration procedures do not allow a return to the Detection monitoring. The alternate source demonstration will be included in the annual groundwater monitoring report.

10.0 ASSESSMENT MONITORING PROGRAM

10.1 Assessment Monitoring Determination

Assessment Monitoring will be implemented in the event that a statistically significant increase over background levels has been detected for one or more constituents listed under the detection monitoring parameters in Table 8-1, and that the alternate source demonstration procedures do not allow a return to Detection Monitoring. The Main Ash Pond monitoring wells will be sampled within 90 days for all constituents listed under the assessment monitoring parameters in Table 8-1. This sampling will continue annually thereafter during the post-closure care period of the Main Ash Pond.

All main ash pond monitoring wells will be sampled on a semi-annual basis and analyzed for all parameters listed under detection monitoring in addition to any assessment monitoring constituents that were detected during the initial Assessment Monitoring event. Additionally, following the results of the initial Assessment Monitoring event, groundwater protection standards (GPS) will be established for all constituents detected during the initial Assessment Monitoring event. The resulting laboratory concentrations along with the established background concentrations and GPS values will be included in the subsequent annual groundwater monitoring report.

Each GPS value will be established for each detected constituent of the assessment monitoring parameters and shall be determined to be one of the following:

- The maximum contaminant level (MCL) for that constituent if an MCL has already been established;
- The established background concentration for that constituent for which an MCL has not been established; or

- The established background concentration for that constituent for which the background level is higher than its identified MCL.

Table 10-1 Detection and Assessment Monitoring Parameters

Parameter	MCL (mg/l)
Antimony	0.006
Arsenic	0.010
Barium	2.0
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Cobalt	0.006
Fluoride	4.0
Lead	0.015
Lithium	0.040
Mercury	0.002
Molybdenum	0.100
Selenium	0.05
Thallium	0.002
Radium 226 & 228	5 pCi/L

If for two consecutive sampling events the resulting concentrations of all constituents listed under the Detection and Assessment monitoring parameters are found to be statistically at or below the established background values, then the program may return to detection monitoring. However, if any of the resulting concentrations are statistically found above the established background values, but all concentrations are statistically below the established GPS values, then the program will continue under assessment monitoring.

10.2 Assessment Monitoring Exceedances

In the event that any constituents listed under the Assessment Monitoring parameters in Table 8-1 are detected at statistically significant levels above their respective established GPS in any sampling event, then the following will be performed:

i. Generation of a notification identifying those exceeding constituents;

ii. Characterization of the nature and extent of the contaminant plume including installation of additional monitoring wells as necessary, estimated quantities and

concentrations of constituents released, and sampling of all wells to characterization plume migration;

iii. Notification of any landowners whose land directly overlies any part of the released contamination plume if contaminants have migrated off-site; and,

iv. Within 90 days, either: (a) demonstrate an alternative source of the contamination other than the main ash pond, or that the SSI resulted from sampling/analysis/statistical evaluation errors or natural variation in groundwater quality; or, (b) initiate an assessment of corrective actions.

11.0 CORRECTIVE ACTIONS PROGRAM

In the event that a statistically significant level exceeding the GPS has been detected for any constituent listed under the assessment monitoring parameters in Table 8-1 and the alternate source demonstration procedures do not allow a return to Assessment Monitoring, then the facility will initiate an assessment of corrective actions and select a remedy.

11.1 Assessment of Corrective Actions

The assessment of corrective actions to prevent and remediate any contaminant releases will be initiated within 90 days of discovering any Table 8-1 assessment monitoring constituent has been detected at a statistically significant level exceeding the GPS. The assessment will be completed within 90 days unless a demonstration is made for an extension (not to exceed 60 additional days) due to site-specific conditions and/or circumstances. The assessment will include an analysis of the effectiveness of any potential corrective actions in fulfilling the objectives of the remedy addressing the following:

- The degree of reliability, performance standards, feasibility, and potential impacts of the potential remedies (i.e. safety impacts, cross-media impacts, and exposure control to any residual contamination);
- The timeline to initiate and complete the remedy; and,
- The regulatory requirements and/or other environmental/public health requirements that may significantly affect execution of the remedy.

The results of the corrective actions assessment will be discussed in a public meeting with any interested and affected parties at least 30 days prior to the selection of a remedy.

11.2 Selection of Remedy

As soon as feasible following the results of the corrective actions assessment, a remedy will be selected that meets the minimum following requirements:

i. Remedy will be protective of human health and the environment;

ii. Remedy will achieve the GPS;

iii. Remedy will control any sources of release in order to reduce/eliminate further releases of Assessment monitoring constituents in the environment;

iv. Remedy will remove as much of the released contaminated material as feasible from the environment; and,

v. Remedy will comply with waste management standards.

A semiannual report will be prepared describing the corrective action progress including the selection and design of the chosen remedy. Following the selection of a remedy, a final report will be prepared discussing the selected remedy and how it fulfills the requirements listed above.

11.3 Implementation of Corrective Actions

Remedial activities will begin within 90 days of selecting a remedy. Based on the established schedule for the implementation and completion of remedial actions, the following will be performed:

i. Establish and execute a corrective action groundwater monitoring program;

ii. Execute the corrective action remedy selected; and

iii. Provide any interim measures necessary to reduce/eliminate contaminants leaching from the main ash pond and potential exposures to human or ecological receptors.

The established corrective action groundwater monitoring program should, at a minimum, meet the requirements of assessment monitoring, document the effectiveness of the remedy, and demonstrate compliance with the GPS.

Interim measures will be consistent with the objectives and performance of the selected remedy to the greatest extent feasible. All CCR wastes and materials generated from corrective action remedies and/or interim measures will be managed in a manner that complies with any applicable RCRA requirements.

If at any time it is determined that compliance with the requirements listed in Section 10.2 is not being achieved through the selected remedy, then other actions will be implemented that could feasibly achieve compliance.

Following the completion of the remedy, a notification will be prepared stating that corrective actions have been completed. Completion certification will be obtained from a qualified professional engineer attesting that the remedy has been completed in compliance with the (3) requirements listed above.

FIGURES

EnviroAnalytics Group

Environmental Engineers

APPENDICES

EnviroAnalytics Group

Environmental Engineers

APPENDIX A

Maps and Summaries

EnviroAnalytics Group

Environmental Engineers

MW-3

MW-39 S/M/D

MW-13

MW-14

MW-38 S/M/D

MW-37 S/M/D

MW-36 S/M/D

MW-35 S/M/D

MW-40 S/M/D

MW-4

MW-29 S/M/D

GROUNDWATER FLOW

MW-41 S/M/D

MW-15

MW-8

MAIN ASH POND

MW-34 S/M/D

MW-17

MW-42 S/M/D

MW-33 S/M/D

PZ-09-14A

MW-31 S/M/D

MW-16

MW-16R S/M/D

PZ-09-15

MW-32 S/M/D

PZ-09-16

DEARBORN CO

BOONE CO

LEGEND

MW-22S/M/D	PROPOSED MONITORING WELL
PZ-C	EXISTING PIEZOMETER
MW-3	EXISTING SUPPLY WELL
MW-3	EXISTING MONITORING WELL
MW-3RS/M/D	ABANDONED MONITORING WELL
	LIMITS OF REGRADED ASH

0 300 600

GRAPHIC SCALE (IN FEET)

N

WELL LOCATION MAP

MAIN ASH POND GROUND WATER MONITORING
TANNERS CREEK PLANT
LAWRENCEBURG, INDIANA

SCALE: 1" = 300'

DATE: 3/15/2019

PROJECT NUMBER 7217-17-007B

FIGURE NO. 1

Drawing path: T:\Resources\Energy\Pwr Plant Project Data\Multi-Project Docs_TCS\CADD\7217-17-007B Main Ash Pond Closure\DWG\CONSTRUCTION\WELL LOCATION MAP.dwg

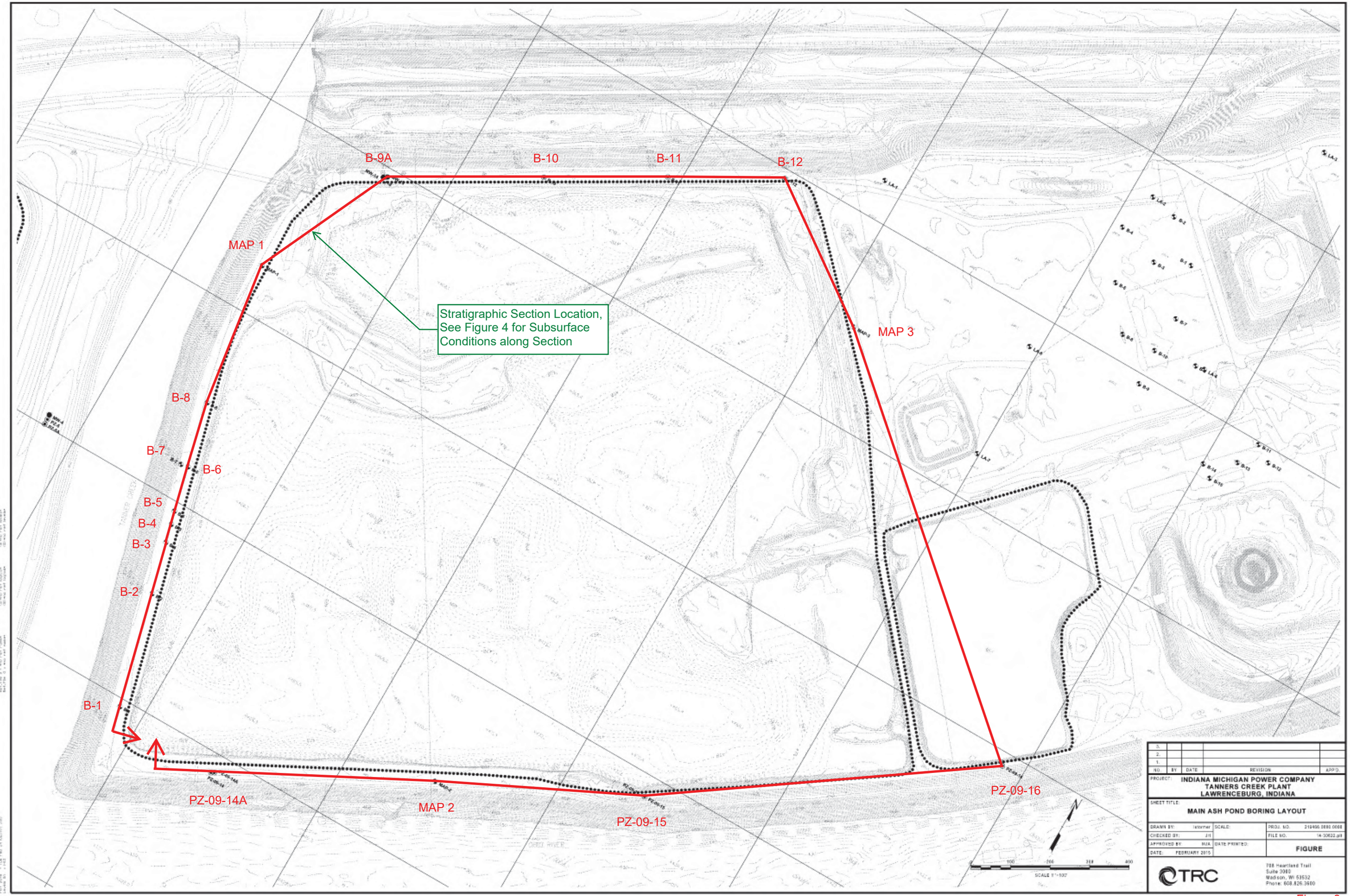
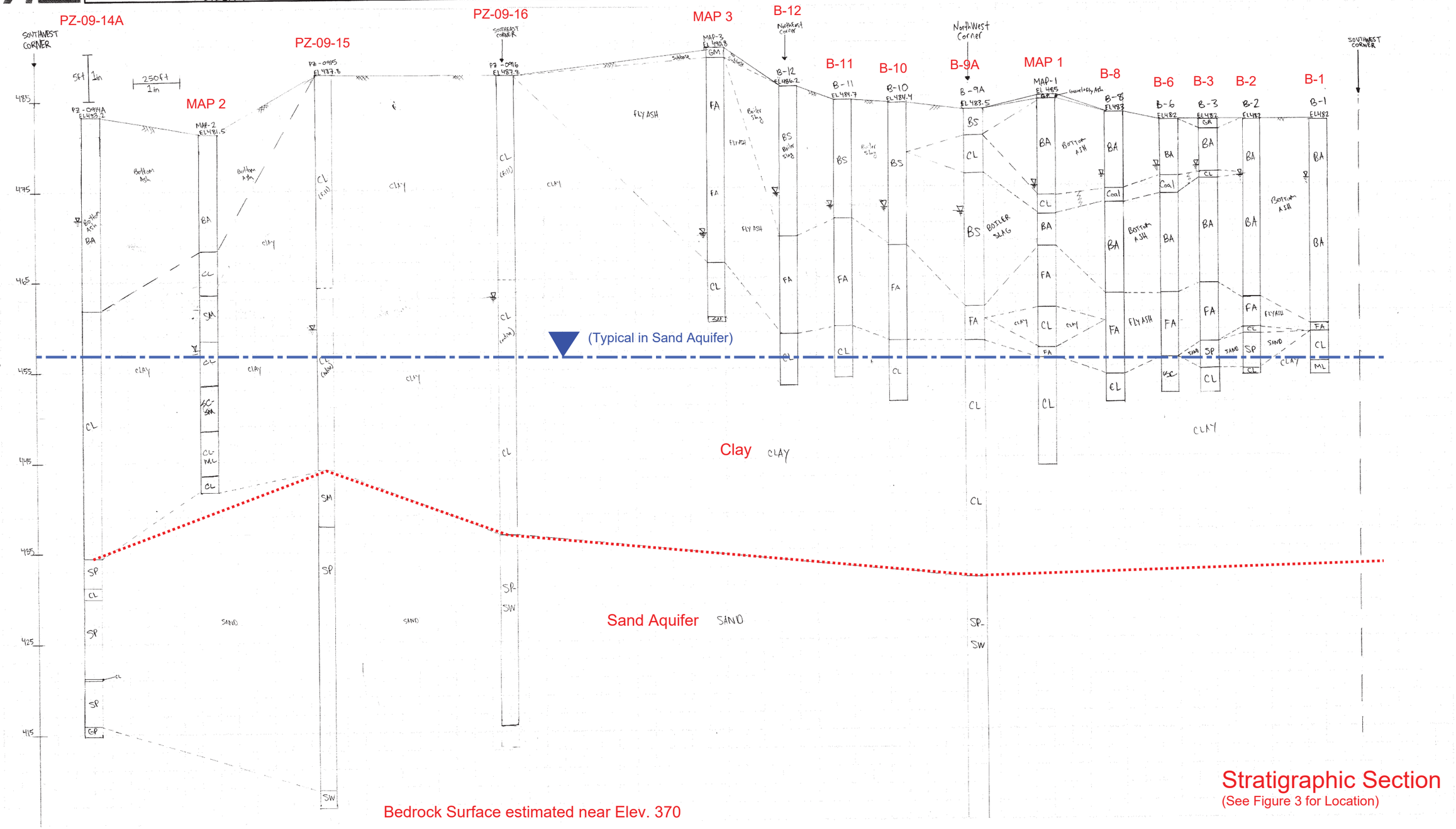

B-9A
B-10
B-11
B-12
MAP 1
MAP 3
Stratigraphic Section Location,
See Figure 4 for Subsurface
Conditions along Section
B-8
B-7
B-6
B-5
B-4
B-3
B-2
B-1
PZ-09-14A
MAP 2
PZ-09-15
PZ-09-16
INDIANA MICHIGAN POWER COMPANY
TANNERS CREEK PLANT
LAWRENCEBURG, INDIANA
MAIN ASH POND BORING LAYOUT
FIGURE
TRC
708 Heartland Trail
Suite 3060
Madison, WI 53532
Phone: 608.826.3600

Figure 3

708 Heartland Trail, Suite 3000, Madison, WI 53717 • www.TRCsolutions.com

SHEET _____ OF _____

PROJECT/PROPOSAL/LOCATION NAME: AEP Tanner's Creek Ash Pond Closure		PROJECT/PROPOSAL NUMBER: 219466.0000 Phase 2
SUBJECT: Bottom Ash Pond Complex (Main Ash Pond)		
PREPARED BY: M. Williams	DATE: September 26, 2014	FINAL ☐
CHECKED BY: J. ~~Hirstream~~	DATE: OCTOBER 17, 2014	REVISION ☐



Stratigraphic Section

(See Figure 3 for Location)

Figure 4

AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DEARBORN COUNTY
SAMPLED BY: DANIEL ROGERS (FMSM)
DATE/FIELD CONDITIONS: 12-16-08; LIGHT SNOW, 25 DEG F
STATIC WATER LEVELS MEASURED 12-16-08

WELL NO.	NORTHING	EASTING	TOP OF CASING FT. (A)	BOTTOM OF SCREEN FT. (B)	** FEET TO STATIC LEVEL (C)	STATIC WATER LEVEL FT.	*** PURGE WELL AMT (GAL)	ACTUAL AMT. PURGED (GAL)	FIELD pH (S.U.)	FIELD TEMP (DEG C)	FIELD COND (umhos)	FIELD TURBID (NTU)	TIME OF STATIC LEVEL MEAS.	TIME OF SAMPLING	NOTES
MW-1	1394668.22	552111.92	466.66	421.61	12.25	454.41	15.9	21.0	7.48	12.3	680	3.2	1252	1306	clear, no odor
MW-2	1395144.67	552506.15	481.98	424.95	27.36	454.62	14.4	16.0	7.68	12.2	590	0.28	1423	1440	clear, no odor
MW-3	1395676.75	553233.58	477.27	420.23	22.66	454.61	16.8	16.0	7.80	12.6	497	0.85	1610	1621	clear, no odor
MW-4	1395529.14	553913.72	468.83	423.53	12.64	456.19	15.9	16.0	7.39	13.7	630	39.9	1535	1553	clear, no odor
MW-5	1394726.00	552101.25	464.50	416.56	39.09	425.52	3.0	22.0	7.33	10.3	729	92.9	1210	1232	light brown, rotten eggs
MW-6	1394021.84	552584.96	465.56	416.16	13.57	455.09	18.0	21.5	7.07	9.9	775	126	1122	1142	light brown, no odor
MW-7	1394251.95	553136.56	471.46	426.59	15.64	455.82	14.4	20.0	7.29	10.0	780	26.0	923	1024	light brown, rotten, slow recharge
MW-8	1394754.32	553895.38	468.61	417.76	12.93	455.68	18.6	17.0	7.76	10.5	499	3.11	1505	1523	clear, mild rotten egg odor

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT
***(TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.

RECEIVED

Figure 5

GENERAL NOTES

OHIO RIVER STAGE 459.3 MEASURED 2/21/08 GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

THIS MAPPING CAME FROM INDIANA UNIVERSITY SPATIAL DATA PORTAL FOR 2005 TOPOGRAPHIC ELEVATIONS HTTP://WWW.INDIANA.EDU/~GISDATA/

LEGEND

x509.5	SPOT ELEVATION
	INTERMEDIATE CONTOUR
—500—	INDEX CONTOUR
	DEPRESSION CONTOUR
	TREES AND TREELINE
	STRUCTURE AND BUILDING
	FENCE
	POLE
	ROADS
	EDGE OF WATER
	MANHOLES / CATCH BASIN
	POWER POLE
	PIPES
	TOWER
	PIEZOMETER
	MONITORING WELL
	AURORA SUPPLY WELL
	BENCHMARK
—458.5—	POTENTIOMETRIC CONTOUR
	DIRECTION OF GROUND FLOW
	FACILITY BOUNDARY
	WASTE BOUNDARY

REFERENCE DRAWINGS

14-30205 FLY ASH LANDFILL- BORING LAYOUT

DATE	NO.	DESCRIPTION	APPD.
2/3/09	G	ADDED WELLS LMW7, LMW1, LSMW1, PZ1, PZ2. STATIC WATER LEVEL MEASURED ON DEC. 16, 2008.	RJA
12/15/08	F	STATIC WATER LEVEL MEASURED ON OCT. 28, 2008	PJA
10/27/08	E	STATIC WATER LEVEL MEASURED ON AUG. 26, 2008	PJA
10/26/08	D	STATIC WATER LEVEL MEASURED ON JUNE 17, 2008	PJA
10/25/08	C	STATIC WATER LEVEL MEASURED ON APRIL 24, 2008	PJA
10/24/08	B	STATIC WATER LEVEL MEASURED ON FEB. 20, 2008	PJA
10/23/08	A	ISSUED FOR PERMIT STATIC WATER LEVEL MEASURED ON DEC. 20, 2007	PJA

REVISIONS

INDIANA MICHIGAN POWER
TANNERS CREEK PLANT
LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP
2008 December

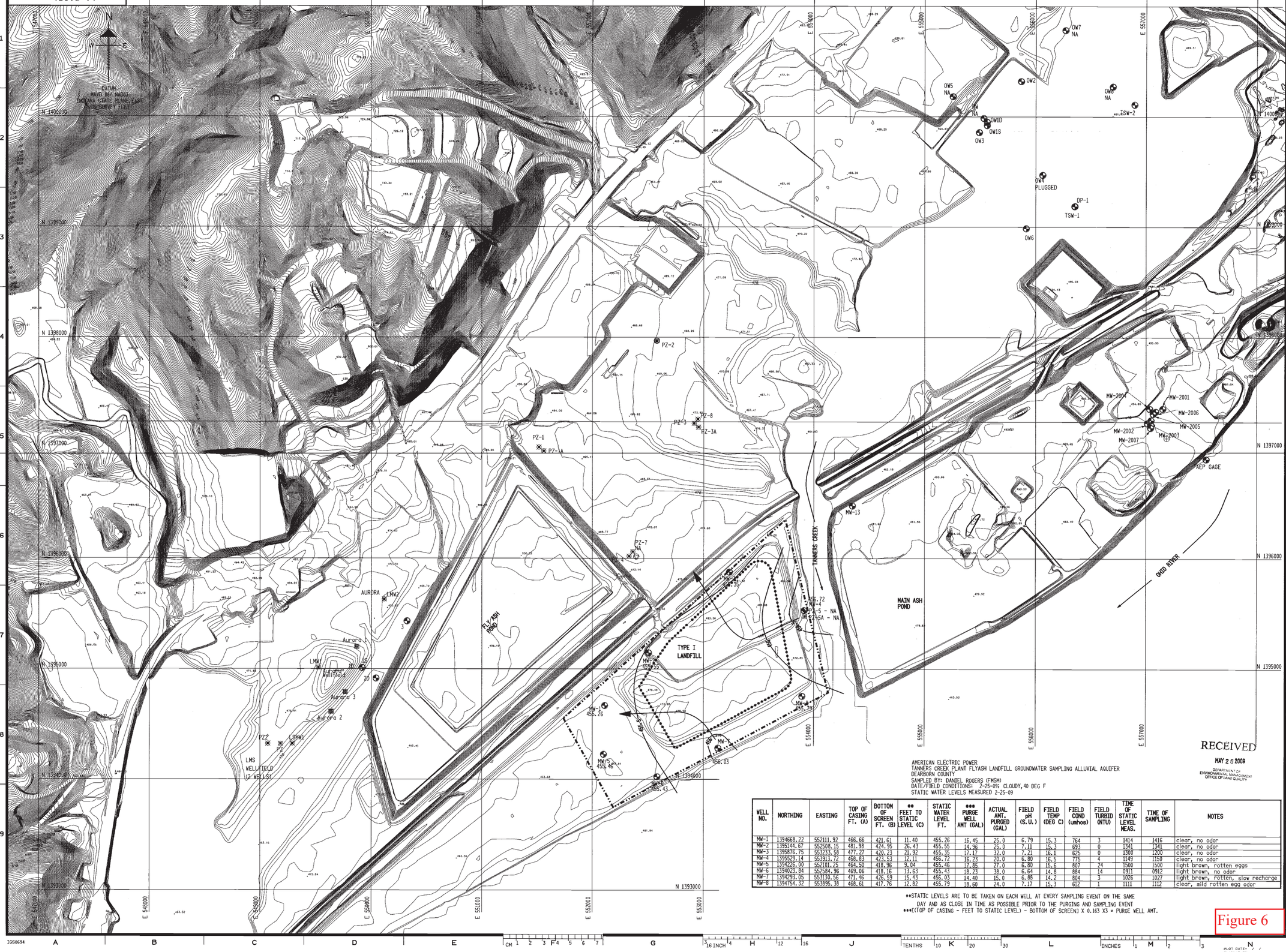
DWG. NO. 14-30251-G

CIVIL ENGINEERING

Thomas R. Zelina

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

DWG. NO. 14-30251



GENERAL NOTES

OHIO RIVER STAGE 459.3 MEASURED 2/21/08
GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

THIS MAPPING CAME FROM INDIANA UNIVERSITY SPATIAL DATA PORTAL FOR 2005 TOPOGRAPHIC ELEVATIONS
HTTP://WWW.INDIANA.EDU/~GISDATA/

LEGEND

- x509.5 — SPOT ELEVATION
- INTERMEDIATE CONTOUR
- 500 — INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER
- PIEZOMETER
- MONITORING WELL
- AURORA SUPPLY WELL
- BENCHMARK
- 458.5 — POTENTIOMETRIC CONTOUR
- DIRECTION OF GROUND FLOW
- FACILITY BOUNDARY
- WASTE BOUNDARY

REFERENCE DRAWINGS

14-30205 FLY ASH LANDFILL- BORING LAYOUT

DATE	NO.	DESCRIPTION	APPD.
02/03/09	H	STATIC WATER LEVEL MEASURED ON FEB. 25, 2009	PJA
12/15/08	G	ADDED WELLS LMW2, LMW1, LSMW1, PZ1, PZ2. STATIC WATER LEVEL MEASURED ON DEC. 16, 2008.	PJA
10/27/08	F	STATIC WATER LEVEL MEASURED ON OCT. 28, 2008	PJA
10/26/08	E	STATIC WATER LEVEL MEASURED ON AUG. 26, 2008	PJA
10/25/08	D	STATIC WATER LEVEL MEASURED ON JUNE 17, 2008	PJA
10/24/08	C	STATIC WATER LEVEL MEASURED ON APRIL 24, 2008	PJA
10/23/08	B	STATIC WATER LEVEL MEASURED ON FEB. 20, 2008	PJA
	A	ISSUED FOR PERMIT STATIC WATER LEVEL MEASURED ON DEC. 20, 2007	PJA

REVISIONS

s:\tc\14\gma_hydro_site\30250.dgn

RECEIVED
MAY 26 2009
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT OFFICE OF LAND QUALITY

AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DEARBORN COUNTY
SAMPLED BY: DANIEL ROGERS (FMSM)
DATE/FIELD CONDITIONS: 2-25-09: CLOUDY, 40 DEG F
STATIC WATER LEVELS MEASURED 2-25-09

WELL NO.	NORTHING	EASTING	TOP OF CASING FT. (A)	BOTTOM OF SCREEN FT. (B)	** FEET TO STATIC LEVEL (C)	STATIC WATER LEVEL FT.	*** PURGE WELL AMT (GAL)	ACTUAL AMT. PURGED (GAL)	FIELD pH (S.U.)	FIELD TEMP (DEG C)	FIELD COND (umhos)	FIELD TURBID (NTU)	TIME OF STATIC LEVEL MEAS.	TIME OF SAMPLING	NOTES
MW-1	1394668.22	552111.92	466.66	421.61	11.40	455.26	16.45	25.0	6.79	15.3	764	3	1414	1416	clear, no odor
MW-2	1395144.67	552508.15	481.98	424.95	26.43	455.55	14.96	25.0	7.11	15.3	693	0	1341	1341	clear, no odor
MW-3	1395876.75	553233.58	477.27	420.23	21.92	455.35	17.17	32.0	7.21	16.1	625	0	1300	1200	clear, no odor
MW-4	1395529.14	553915.72	466.83	423.53	12.11	456.72	16.23	20.0	6.80	16.5	775	4	1149	1150	clear, no odor
MW-5	1394226.00	552101.25	464.50	418.96	9.04	455.46	17.85	27.0	6.80	15.6	807	24	1500	1500	light brown, rotten eggs
MW-6	1394023.84	552384.96	469.06	418.16	13.63	455.43	18.23	38.0	6.64	14.8	884	14	0911	0912	light brown, no odor
MW-7	1394293.05	553130.56	471.46	426.59	15.43	455.03	14.40	15.0	6.88	14.2	804	3	1026	1027	light brown, rotten, slow recharge
MW-8	1394754.32	553895.38	468.61	417.76	12.82	455.79	18.60	24.0	7.17	15.3	612	1	1111	1112	clear, mild rotten egg odor

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT
***((TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.

Figure 6

INDIANA MICHIGAN POWER
TANNERS CREEK PLANT
LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP
2009 February

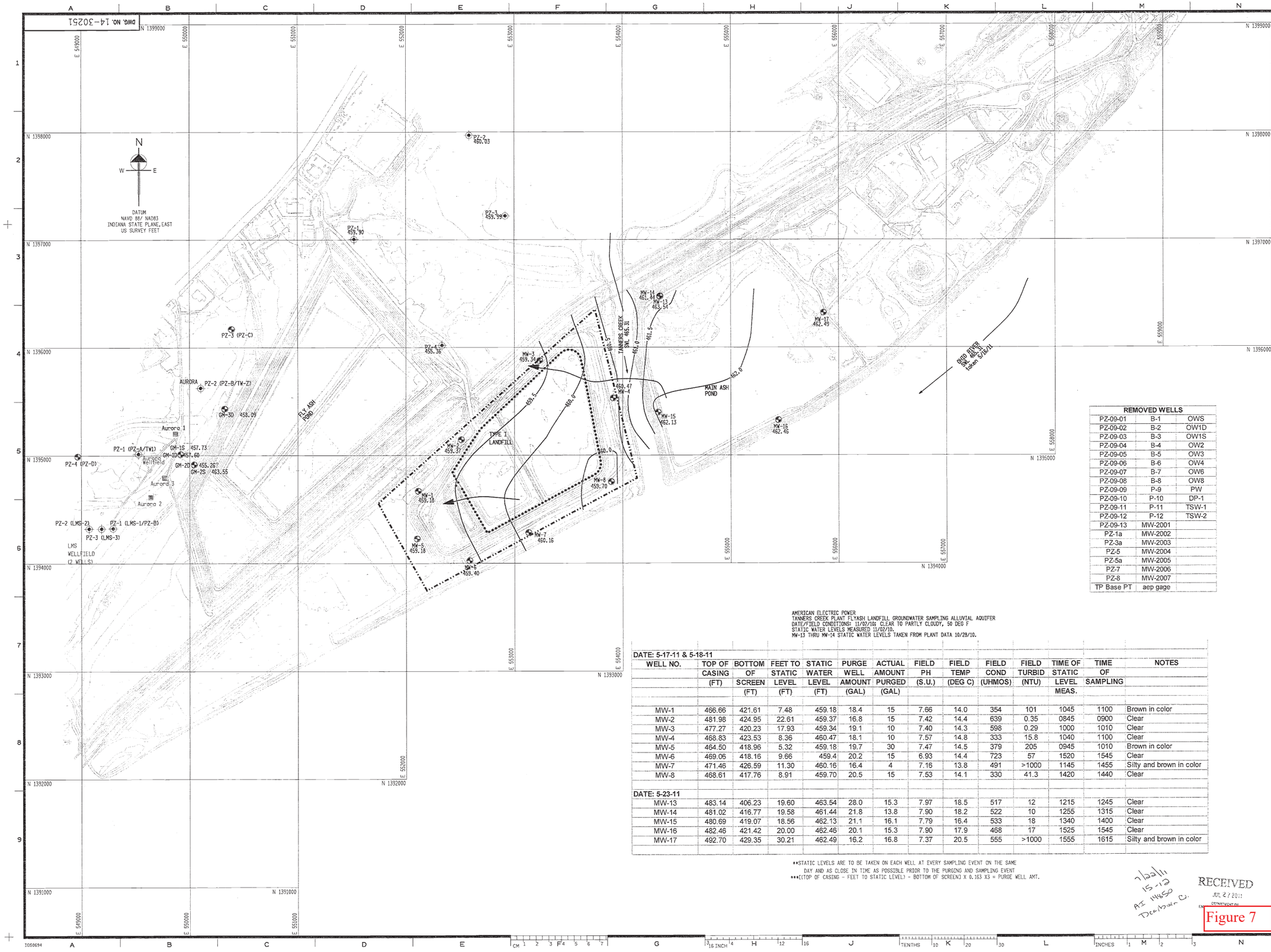
DWG. NO. 14-30251-H

SCALE: 1" = 300'
CIVIL ENGINEERING
DR: Amanda Gephart
CH: DMS
ENGR: JMK
PROJ ENGR: JMK
DATE: 10/23/08
APPROVED BY: Thomas R Zelina

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS0694
PLOT DATE= / /
PLOTTED BY=
SYSTEM DATE=4/14/2009
SYSTEM TIME=8:00:54 AM

DWG. NO. 14-30251



REMOVED WELLS		
PZ-09-01	B-1	OWS
PZ-09-02	B-2	OW1D
PZ-09-03	B-3	OW1S
PZ-09-04	B-4	OW2
PZ-09-05	B-5	OW3
PZ-09-06	B-6	OW4
PZ-09-07	B-7	OW6
PZ-09-08	B-8	OW8
PZ-09-09	P-9	PW
PZ-09-10	P-10	DP-1
PZ-09-11	P-11	TSW-1
PZ-09-12	P-12	TSW-2
PZ-09-13	MW-2001	
PZ-1a	MW-2002	
PZ-3a	MW-2003	
PZ-5	MW-2004	
PZ-5a	MW-2005	
PZ-7	MW-2006	
PZ-8	MW-2007	
TP Base PT	aep gage	

AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DATE/FIELD CONDITIONS: 11/02/10 CLEAR TO PARTLY CLOUDY, 50 DEG F
STATIC WATER LEVELS MEASURED 11/02/10.
MW-13 THRU MW-14 STATIC WATER LEVELS TAKEN FROM PLANT DATA 10/28/10.

DATE: 5-17-11 & 5-18-11													
WELL NO.	TOP OF CASING (FT)	BOTTOM OF SCREEN (FT)	FEET TO STATIC LEVEL (FT)	STATIC WATER LEVEL (FT)	PURGE WELL AMOUNT (GAL)	ACTUAL AMOUNT PURGED (GAL)	FIELD PH (S.U.)	FIELD TEMP (DEG C)	FIELD COND (UHMOS)	FIELD TURBID (NTU)	TIME OF STATIC LEVEL MEAS.	TIME OF SAMPLING	NOTES
MW-1	466.66	421.61	7.48	459.18	18.4	15	7.66	14.0	354	101	1045	1100	Brown in color
MW-2	481.98	424.95	22.61	459.37	16.8	15	7.42	14.4	639	0.35	0845	0900	Clear
MW-3	477.27	420.23	17.93	459.34	19.1	10	7.40	14.3	598	0.29	1000	1010	Clear
MW-4	468.83	423.53	8.36	460.47	18.1	10	7.57	14.8	333	15.8	1040	1100	Clear
MW-5	464.50	418.96	5.32	459.18	19.7	30	7.47	14.5	379	205	0945	1010	Brown in color
MW-6	469.06	418.16	9.66	459.4	20.2	15	6.93	14.4	723	57	1520	1545	Clear
MW-7	471.46	426.59	11.30	460.16	16.4	4	7.16	13.8	491	>1000	1145	1455	Silty and brown in color
MW-8	468.61	417.76	8.91	459.70	20.5	15	7.53	14.1	330	41.3	1420	1440	Clear
DATE: 5-23-11													
MW-13	483.14	406.23	19.60	463.54	28.0	15.3	7.97	18.5	517	12	1215	1245	Clear
MW-14	481.02	416.77	19.58	461.44	21.8	13.8	7.90	18.2	522	10	1255	1315	Clear
MW-15	480.69	419.07	18.56	462.13	21.1	16.1	7.79	16.4	533	18	1340	1400	Clear
MW-16	482.46	421.42	20.00	462.46	20.1	15.3	7.90	17.9	468	17	1525	1545	Clear
MW-17	492.70	429.35	30.21	462.49	16.2	16.8	7.37	20.5	555	>1000	1555	1615	Silty and brown in color

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT
***(TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.

GENERAL NOTES

GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

THIS AERIAL PHOTOGRAPH TAKEN 10/29/10.

LEGEND

- x509.5 SPOT ELEVATION
- INTERMEDIATE CONTOUR
- 500 INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER
- PIEZOMETER
- MONITORING WELL
- AEP STAFF GAGE
- AURORA SUPPLY WELL
- BENCHMARK
- 458.5 POTENTIOMETRIC CONTOUR
- DIRECTION OF GROUND FLOW
- FACILITY BOUNDARY
- WASTE BOUNDARY

REFERENCE DRAWINGS

14-30205 FLY ASH LANDFILL- BORING LAYOUT
14-30251B MONITORING WELL CONSTRUCTION DETAILS TABLE
14-30251C MONITORING WELL LOCATION PLAN

DATE	NO.	DESCRIPTION	APPD.
7/22/2011	M	DELETED PREVIOUS REVISON A-K. ADDED 2010 AERIAL TOPOGRAPHY. TABLE SHOWS REMOVED WELLS. ADDED STATIC WATER LEVEL FOR MW-13 THRU MW-17 MEASURED ON OCT. 28, 2010. LMW1, LMW2, LSMW1, PZ2, PZ, T3, AND T4 HAVE BEEN RENAMED TO MATCH PLANT NUMBERS PZ-1 (PZ-A/TW1), PZ-2 (PZ-B/TW2), PZ-1 (LMS-1/PZ-B), PZ-2 (LMS-2), PZ-3 (LMS-3), PZ-3 (PZ-C), & PZ-4 (PZ-D). STATIC WATER LEVEL MEASURED ON MAY 16, 2011. Amanda Gruber	AFF GFZ
12/15/10	L	STATIC WATER LEVEL MEASURED ON NOV. 02, 2010. EXCLUDES PIEZOMETER READINGS AROUND THE FLY ASH POND. Amanda Gruber	GFZ

REVISIONS

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INDIANA MICHIGAN POWER
TANNERS CREEK PLANT
LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP
2010 November

DWG. NO. 14-30251-M

SCALE: 1" = 200'	CIVIL ENGINEERING
DR: Amanda Gruber	APPROVED BY: Thomas R Zelina
CH: DMS	
ENGR: JMN	
PROJ ENGR: JMN	
DATE: 10/23/08	

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE: 7/22/2011
SYSTEM TIME: 8:14:13 AM

7/22/11
15-12
AI 144650
DeAnna C.

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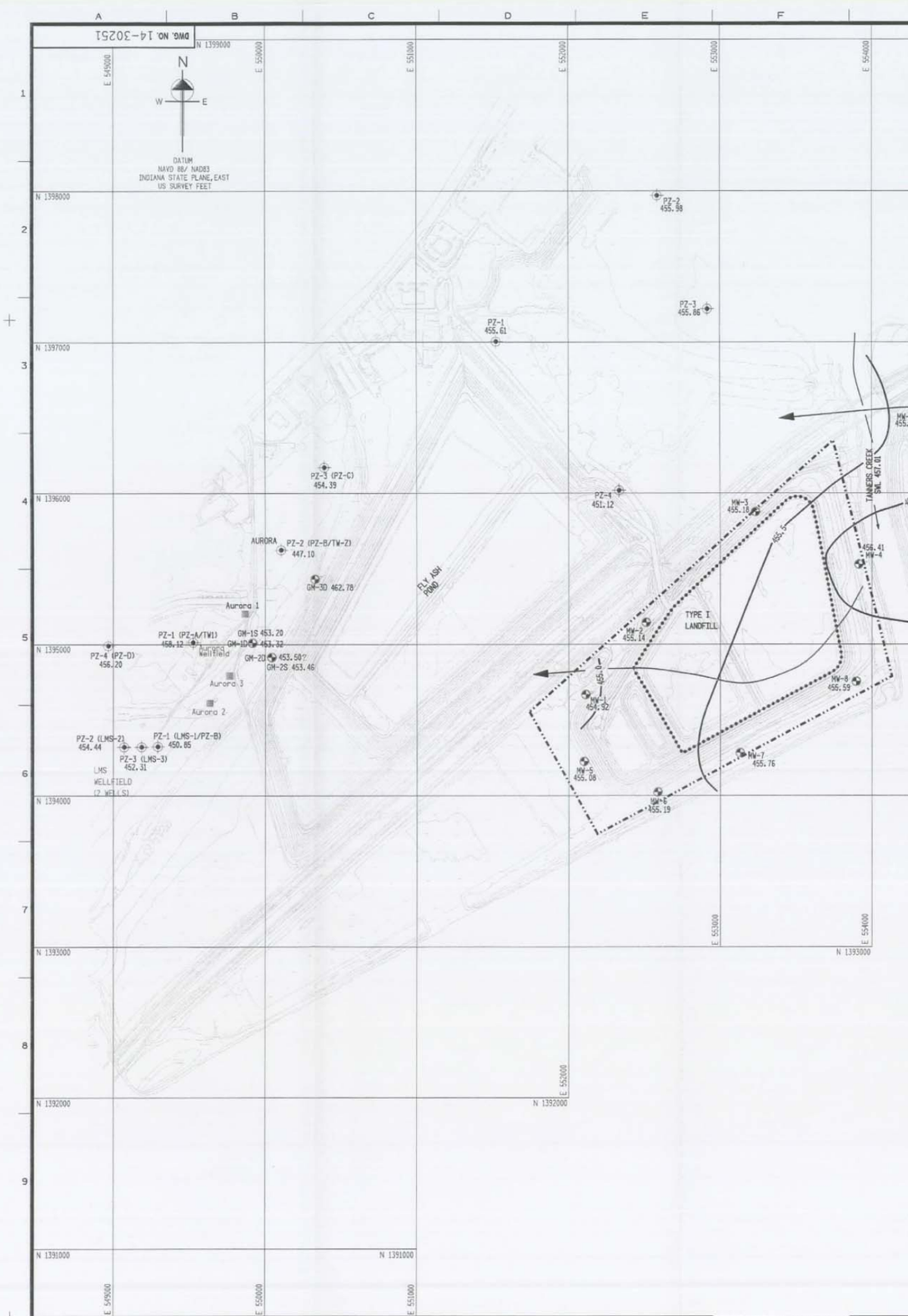
JUL 27 2011
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Figure 7

15-12

DWG. NO. 14-30251



GENERAL NOTES

GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

THIS AERIAL PHOTOGRAPH TAKEN 10/29/10.

LEGEND

- SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER
- PIEZOMETER
- MONITORING WELL
- AURORA SUPPLY WELL
- 458.5 — POTENTIOMETRIC CONTOUR
- DIRECTION OF GROUND FLOW
- FACILITY BOUNDARY
- WASTE BOUNDARY

REFERENCE DRAWINGS

14-30205 FLY ASH LANDFILL- BORING LAYOUT
14-30251A MONITORING WELL LOCATION PLAN
14-30251B MONITORING WELL CONSTRUCTION DETAILS TABLE

REMOVED WELLS

PZ-09-01	B-1	OW5
PZ-09-02	B-2	OW1D
PZ-09-03	B-3	OW1S
PZ-09-04	B-4	OW2
PZ-09-05	B-5	OW3
PZ-09-06	B-6	OW4
PZ-09-07	B-7	OW6
PZ-09-08	B-8	OW8
PZ-09-09	P-9	PW
PZ-09-10	P-10	DP-1
PZ-09-11	P-11	TSW-1
PZ-09-12	P-12	TSW-2
PZ-09-13	MW-2001	
PZ-1a	MW-2002	
PZ-3a	MW-2003	
PZ-5	MW-2004	
PZ-5a	MW-2005	
PZ-7	MW-2006	
PZ-8	MW-2007	
TP Base PT	aep gage	

AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DATE/FIELD CONDITIONS: 4/3/12; SUNNY, 78 DEG F
STATIC WATER LEVELS MEASURED 4/3/12.

DATE: 4-3-12 WELL NO.	TOP OF CASING (FT)	BOTTOM OF SCREEN (FT)	FEET TO STATIC LEVEL (FT)	STATIC WATER LEVEL (FT)	PURGE WELL AMOUNT (GAL)	ACTUAL AMOUNT PURGED (GAL)	FIELD PH (S.U.)	FIELD TEMP (DEG C)	FIELD COND (UHMOS)	FIELD TURBID (NTU)	TIME OF STATIC LEVEL MEAS.	TIME OF SAMPLING	NOTES
MW-1	466.66	421.61	11.74	454.92	16.3	40.0	7.16	15.2	881	8.73	1024	1030	Clear
MW-2	481.98	424.95	26.84	455.14	14.8	15.0	7.48	14.8	823	0.5	1103	1125	Clear
MW-3	477.27	420.23	22.09	455.18	17.1	20.0	7.41	15.7	754	0.24	1130	1139	Clear
MW-4	468.83	423.53	12.42	456.41	16.1	20.0	7.13	16.6	880	3.12	1350	1415	Clear
MW-5	464.50	418.96	9.42	455.08	17.7	30.0	7.30	16.2	614	9.6	945	1020	Clear
MW-6	469.06	418.16	13.87	455.19	18.1	35.0	6.80	15.9	1025	9.47	1530	1600	Clear
MW-7	471.46	426.59	15.70	455.76	14.3	5.0	7.21	17.6	715	187	1452	1515	Silty, light olive color
MW-8	468.61	417.76	13.02	455.59	18.5	20.0	7.40	16.0	752	7.91	1425	1442	Clear
DATE: 4-4-12 & 4-5-12													
MW-13	483.14	406.23	25.25	457.89	25.3	36.0	7.63	17.9	518	9.4	1230	1250	Clear
MW-14	481.02	416.77	25.40	455.62	19.0	36.0	7.44	18.2	577	8.8	1135	1210	Clear
MW-15	480.69	419.07	24.35	456.34	18.2	20.0	7.34	16.7	652	7.30	1300	1315	Clear
MW-16	482.46	421.42	25.96	456.50	17.2	20.0	7.80	18.4	561	7.3	1325.0	1335	Clear
MW-17	492.70	429.35	35.90	456.80	13.4	70.0	7.44	21.9	628	9.30	1100	1120	Clear
MW-18	486.54	397.14	33.32	453.22	27.4	70.0	7.58	17.3	405	592.0	1420	1500	Silty
MW-19	488.17	413.77	33.65	454.52	19.9	20.0	7.46	18.7	436	8.70	1510	1520	Silty
MW-20	488.75	414.35	33.24	455.51	20.1	30.0	7.40	23.6	403	9.3	1525	1540	Silty
MW-21	486.5	412.1	31.58	454.92	20.9	35.0	7.44	23.0	418	9.40	1545	1600	Silty

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT
***(TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.

DATE	NO.	DESCRIPTION	APPD.
5/30/12	0	STATIC WATER LEVEL MEASURED ON APRIL 2, 2012. ADDED WELLS MW-18 THRU 21.	MFZ
12/15/11	N	STATIC WATER LEVEL MEASURED ON OCT. 3, 2011.	GFZ
07/27/11	M	DELETED PREVIOUS REVISON A-K. ADDED 2010 AERIAL TOPOGRAPHY. TABLE SHOWS REMOVED WELLS. ADDED STATIC WATER LEVEL FOR MW-13 THRU MW-17 MEASURED ON OCT. 28, 2010. LMW1, LMW2, LSMW1, PZ2, PZ, T3, AND T4 HAVE BEEN RENAMED TO MATCH PLANT NUMBERS PZ-1 (PZ-A/TW1), PZ-2 (PZ-B/TW2),PZ-1 (LMS-1/PZ-B), PZ-2 (LMS-2), PZ-3 (LMS-3), PZ-3 (PZ-C), & PZ-4 (PZ-D). STATIC WATER LEVEL MEASURED ON MAY 16, 2011.	GFZ
12/15/10	L	STATIC WATER LEVEL MEASURED ON NOV. 02,2010. EXCLUDES PIEZOMETER READINGS AROUND THE FLY ASH POND.	GFZ

REVISIONS

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INDIANA MICHIGAN POWER

TANNERS CREEK PLANT

LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP

2012 April

DWG. NO. 14-30251-0

SCALE: 1" = 300'

CIVIL ENGINEERING

DRN: Amanda Graphics CHK: DMS ENGR: JMB PROJ. ENGR: JMB DATE: 06/25/08

APPROVED BY: Thomas R Zelina

AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

15-12

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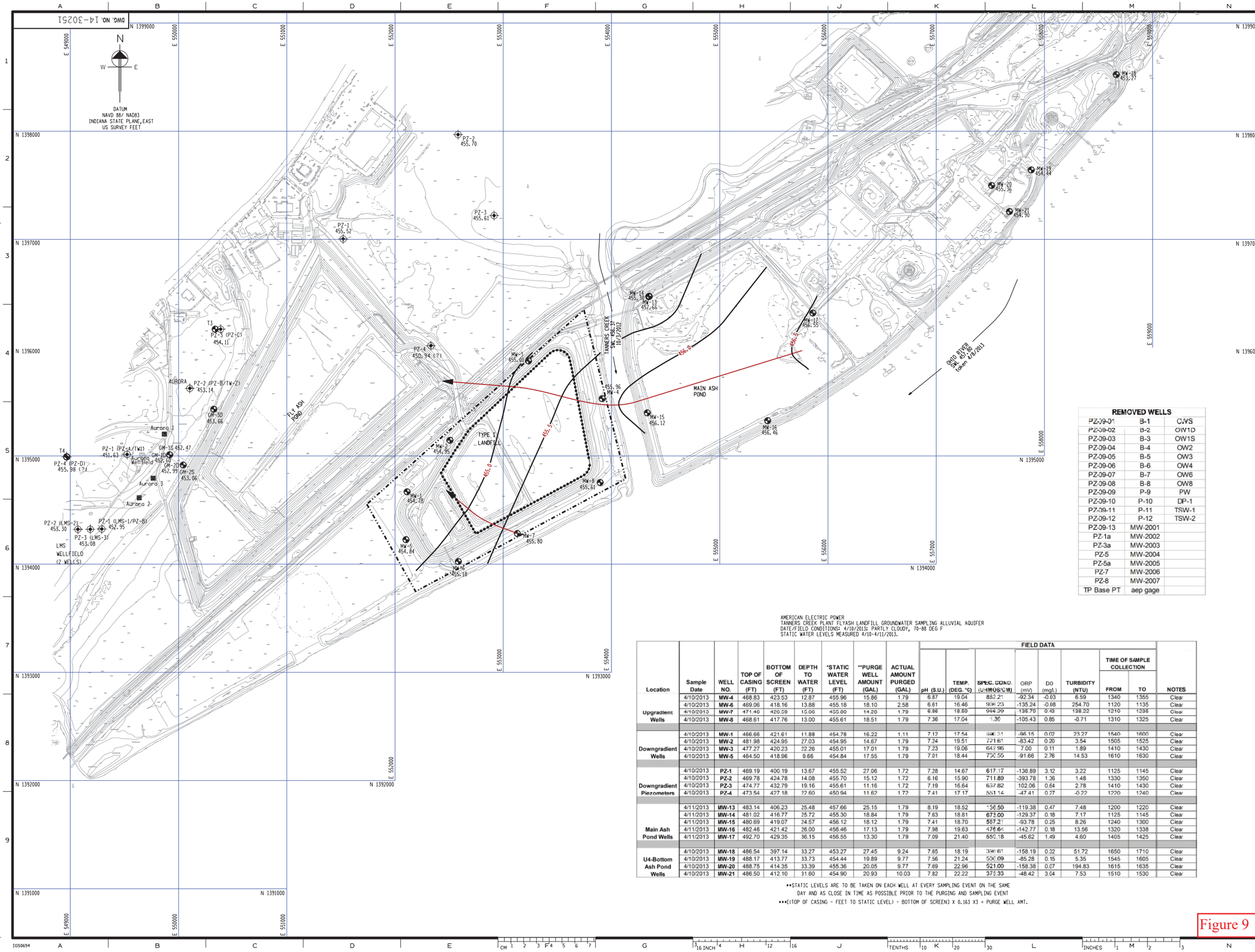
JUN 06 2012
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

Figure 8

15-13

DWG. NO. 14-30251



GENERAL NOTES

GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

THIS AERIAL PHOTOGRAPH TAKEN 10/29/10, EXCEPT FOR THE BUBBLED AREA WHICH HAS BEEN UPDATED WITH 11/08/11.

LEGEND

- SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER
- PIEZOMETER
- MONITORING WELL
- AURORA SUPPLY WELL
- POTENTIOMETRIC CONTOUR
- DIRECTION OF GROUND FLOW
- FACILITY BOUNDARY
- WASTE BOUNDARY

REFERENCE DRAWINGS

14-30205	FLY ASH LANDFILL- BORING LAYOUT
14-30251A	MONITORING WELL LOCATION PLAN
14-30251B	MONITORING WELL CONSTRUCTION DETAILS TABLE

REMOVED WELLS

PZ-09-01	B-1	OW5
PZ-09-02	B-2	OW1D
PZ-09-03	B-3	OW1S
PZ-09-04	B-4	OW2
PZ-09-05	B-5	OW3
PZ-09-06	B-6	OW4
PZ-09-07	B-7	OW6
PZ-09-08	B-8	OW8
PZ-09-09	P-9	PW
PZ-09-10	P-10	DP-1
PZ-09-11	P-11	TSW-1
PZ-09-12	P-12	TSW-2
PZ-09-13	MW-2001	
PZ-1a	MW-2002	
PZ-3a	MW-2003	
PZ-5	MW-2004	
PZ-5a	MW-2005	
PZ-7	MW-2006	
PZ-8	MW-2007	
TP Base PT	aep gage	

AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DATE/FIELD CONDITIONS: 4/10/2013; PARTLY CLOUDY, 70-88 DEG F
STATIC WATER LEVELS MEASURED 4/10-4/11/2013.

Location	Sample Date	WELL NO.	TOP OF CASING (FT)	BOTTOM OF SCREEN (FT)	DEPTH TO WATER (FT)	*STATIC WATER LEVEL (FT)	**PURGE WELL AMOUNT (GAL)	ACTUAL AMOUNT PURGED (GAL)	FIELD DATA							
									pH (S.U.)	TEMP. (DEG. °C)	SPEC. COND. (UHMOS/CM)	ORP (mV)	DO (mg/L)	TURBIDITY (NTU)	TIME OF SAMPLE COLLECTION FROM	TIME OF SAMPLE COLLECTION TO	NOTES
Upgradient Wells	4/10/2013	MW-4	468.83	423.53	12.87	455.96	15.86	1.79	6.87	19.04	882.21	-92.34	-0.03	6.59	1340	1355	Clear
	4/10/2013	MW-6	469.06	418.16	13.88	455.18	18.10	2.58	6.61	16.46	906.23	-135.24	-0.08	254.70	1120	1135	Clear
	4/10/2013	MW-7	471.40	426.59	15.00	455.80	14.20	1.79	6.86	18.60	954.26	-136.70	0.43	138.22	1210	1236	Clear
	4/10/2013	MW-8	468.61	417.76	13.00	455.61	18.51	1.79	7.36	17.04	1.36	-105.43	0.85	-0.71	1310	1325	Clear
Downgradient Wells	4/10/2013	MW-1	466.66	421.61	11.88	454.78	16.22	1.11	7.12	17.54	886.51	-96.15	0.02	23.27	1540	1600	Clear
	4/10/2013	MW-2	481.98	424.95	27.03	454.95	14.67	1.79	7.24	19.51	721.61	-83.42	0.20	3.54	1505	1525	Clear
	4/10/2013	MW-3	477.27	420.23	22.26	455.01	17.01	1.79	7.23	19.06	642.96	7.00	0.11	1.89	1410	1430	Clear
	4/10/2013	MW-5	464.50	418.96	9.66	454.84	17.55	1.79	7.01	18.44	750.55	-91.66	2.76	14.53	1610	1630	Clear
Downgradient Piezometers	4/10/2013	PZ-1	469.19	400.19	13.67	455.52	27.06	1.72	7.28	14.67	617.17	-136.89	3.12	3.22	1125	1145	Clear
	4/10/2013	PZ-2	469.78	424.78	14.08	455.70	15.12	1.72	6.16	15.90	711.89	-393.78	1.36	1.48	1330	1350	Clear
	4/10/2013	PZ-3	474.77	432.79	19.16	455.61	11.16	1.72	7.19	16.64	637.82	102.06	0.64	2.78	1410	1430	Clear
	4/10/2013	PZ-4	473.54	427.18	22.60	450.94	11.62	1.72	7.41	17.17	551.14	-47.41	0.27	-0.22	1220	1240	Clear
Main Ash Pond Wells	4/11/2013	MW-13	483.14	406.23	25.48	457.66	25.15	1.79	8.19	18.52	436.50	-119.38	0.47	7.48	1200	1220	Clear
	4/11/2013	MW-14	481.02	416.77	25.72	455.30	18.84	1.79	7.63	18.81	673.00	-129.37	0.18	7.17	1125	1145	Clear
	4/11/2013	MW-15	480.69	419.07	24.57	456.12	18.12	1.79	7.41	18.70	587.21	-93.78	0.25	8.26	1240	1300	Clear
	4/11/2013	MW-16	482.46	421.42	26.00	456.46	17.13	1.79	7.98	19.63	476.64	-142.77	0.18	13.56	1320	1338	Clear
	4/11/2013	MW-17	492.70	429.35	36.15	456.55	13.30	1.79	7.09	21.40	555.18	-45.62	1.49	4.60	1405	1425	Clear
U4-Bottom Ash Pond Wells	4/10/2013	MW-18	486.54	397.14	33.27	453.27	27.45	9.24	7.65	18.19	346.61	-158.19	0.32	51.72	1650	1710	Clear
	4/10/2013	MW-19	488.17	413.77	33.73	454.44	19.89	9.77	7.56	21.24	506.09	-85.28	0.15	5.35	1545	1605	Clear
	4/10/2013	MW-20	488.75	414.35	33.39	455.36	20.05	9.77	7.69	22.96	521.00	-158.38	0.07	194.83	1615	1635	Clear
	4/10/2013	MW-21	486.50	412.10	31.60	454.90	20.93	10.03	7.82	22.22	375.33	-48.42	3.04	7.53	1510	1530	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT

***(TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.

DATE	NO.	DESCRIPTION	APPD.
06/04/12	Q	STATIC WATER LEVEL MEASURED ON APRIL 8, 2013.	GFZ
11/28/12	P	ADDED WELL T3 & T4. PARTIAL UPDATED MAPPING. STATIC WATER LEVEL MEASURED ON OCT 1, 2012.	GFZ
05/30/12	O	STATIC WATER LEVEL MEASURED ON APRIL 2, 2012. ADDED WELLS MW-18 THRU 21.	GFZ
12/15/11	N	STATIC WATER LEVEL MEASURED ON OCT. 3, 2011.	GFZ
07/22/11	M	DELETED PREVIOUS REVISON A-K. ADDED 2010 AERIAL TOPOGRAPHY. TABLE SHOWS REMOVED WELLS. ADDED STATIC WATER LEVEL FOR MW-13 THRU MW-17 MEASURED ON OCT. 26, 2010. LMW1, LMW2, LSMW1, PZ2, PZ, T3, AND T4 HAVE BEEN RENAMED TO MATCH PLANT NUMBERS PZ-1 (PZ-A/TW1), PZ-2 (PZ-B/TW2), PZ-1 (LMS-1/PZ-B), PZ-2 (LMS-2), PZ-3 (LMS-3), PZ-3 (PZ-C), & PZ-4 (PZ-D). STATIC WATER LEVEL MEASURED ON MAY 16, 2011.	GFZ
12/15/10	L	STATIC WATER LEVEL MEASURED ON NOV. 02, 2010. EXCLUDES PIEZOMETER READINGS AROUND THE FLY ASH POND.	GFZ

REVISIONS

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INDIANA MICHIGAN POWER

TANNERS CREEK PLANT

LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP
2013 April

DWG. NO. 14-30251-Q

SCALE: 1" = 300'

CIVIL ENGINEERING

DR: Amanda Gaydos
CH: DMG
ENGR: JAN
PROJ ENGR: JAN
DATE: 10/23/08

APPROVED BY: Thomas R Zelina

AEP AMERICAN ELECTRIC POWER

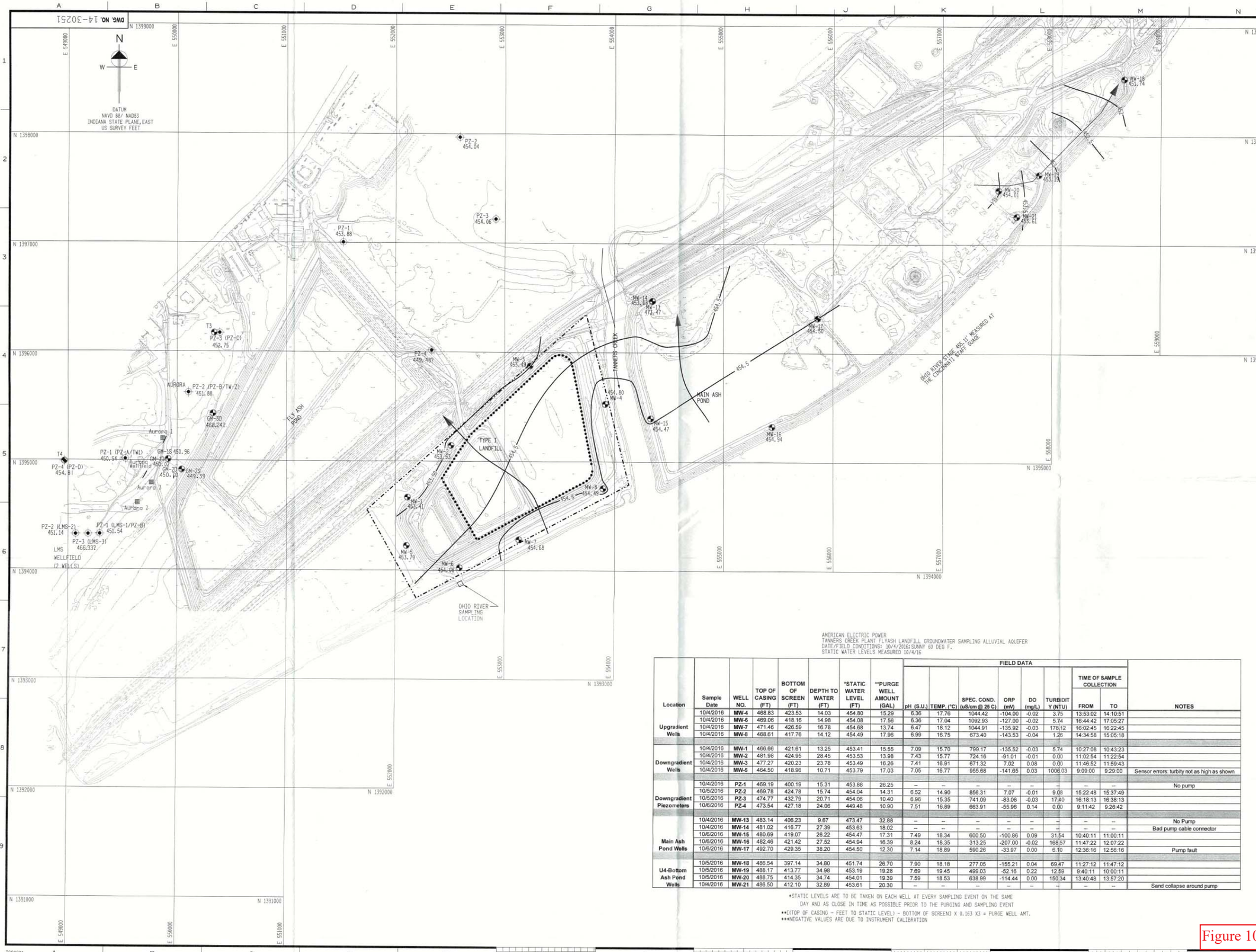
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE: 9/16/2013
SYSTEM TIME: 12:06:56 PM

Figure 9

IOS0694

DWG. NO. 14-30251



AMERICAN ELECTRIC POWER
TANNERS CREEK PLANT FLYASH LANDFILL GROUNDWATER SAMPLING ALLUVIAL AQUIFER
DATE/FIELD CONDITIONS: 10/4/2016/ SUNNY 60 DEG F.
STATIC WATER LEVELS MEASURED 10/4/16

Location	Sample Date	WELL NO.	TOP OF CASING (FT)	BOTTOM OF SCREEN (FT)	DEPTH TO WATER (FT)	*STATIC WATER LEVEL (FT)	**PURGE WELL AMOUNT (GAL)	FIELD DATA								NOTES
								pH (S.U.)	TEMP. (°C)	SPEC. COND. (uS/cm @ 25 C)	ORP (mV)	DO (mg/L)	TURBIDITY (NTU)	TIME OF SAMPLE COLLECTION FROM	TIME OF SAMPLE COLLECTION TO	
Upgradient Wells	10/4/2016	MW-4	468.83	423.53	14.03	454.80	15.29	6.36	17.76	1044.42	-104.00	-0.02	3.75	13:53:02	14:10:51	
	10/4/2016	MW-6	469.06	418.16	14.98	454.08	17.56	6.36	17.04	1092.93	-127.00	-0.02	5.74	16:44:42	17:05:27	
	10/4/2016	MW-7	471.46	426.59	16.78	454.68	13.74	6.47	18.12	1044.91	-135.92	-0.03	178.12	16:02:45	16:22:45	
	10/4/2016	MW-8	468.61	417.76	14.12	454.49	17.96	6.99	16.75	673.40	-143.53	-0.04	1.26	14:34:58	15:05:18	
Downgradient Wells	10/4/2016	MW-1	466.66	421.61	13.25	453.41	15.55	7.09	15.70	799.17	-135.52	-0.03	5.74	10:27:08	10:43:23	
	10/4/2016	MW-2	481.98	424.95	28.45	453.53	13.98	7.43	15.77	724.16	-91.01	-0.01	0.00	11:02:54	11:22:54	
	10/4/2016	MW-3	477.27	420.23	23.78	453.49	16.26	7.41	16.91	671.32	7.02	0.08	0.00	11:46:52	11:58:43	
	10/4/2016	MW-5	464.50	418.96	10.71	453.79	17.03	7.05	16.77	955.68	-141.65	0.03	1008.03	9:09:00	9:29:00	Sensor errors: turbity not as high as shown
Downgradient Piezometers	10/4/2016	PZ-1	469.19	400.19	15.31	453.88	26.25	--	--	--	--	--	--	--	--	No pump
	10/5/2016	PZ-2	469.78	424.78	15.74	454.04	14.31	6.52	14.90	856.31	7.07	-0.01	9.08	15:22:48	15:37:49	
	10/5/2016	PZ-3	474.77	432.79	20.71	454.06	10.40	6.96	15.35	741.09	-83.06	-0.03	17.40	16:18:13	16:38:13	
	10/6/2016	PZ-4	473.54	427.18	24.06	449.48	10.90	7.51	16.89	663.91	-55.96	0.14	0.00	9:11:42	9:26:42	
Main Ash Pond Wells	10/4/2016	MW-13	483.14	406.23	9.67	473.47	32.88	--	--	--	--	--	--	--	--	No Pump
	10/4/2016	MW-14	481.02	416.77	27.39	453.63	18.02	--	--	--	--	--	--	--	--	Bad pump cable connector
	10/6/2016	MW-15	480.69	419.07	26.22	454.47	17.31	7.49	18.34	600.50	-100.86	0.09	31.54	10:40:11	11:00:11	
	10/6/2016	MW-16	482.46	421.42	27.52	454.94	16.39	8.24	18.35	313.25	-207.00	-0.02	168.57	11:47:22	12:07:22	
	10/6/2016	MW-17	492.70	428.35	38.20	454.50	12.30	7.14	18.89	590.26	-33.97	0.00	6.10	12:36:16	12:56:16	Pump fault
U4-Bottom Ash Pond Wells	10/5/2016	MW-18	486.54	397.14	34.80	451.74	26.70	7.90	18.18	277.05	-155.21	0.04	69.47	11:27:12	11:47:12	
	10/5/2016	MW-19	488.17	413.77	34.98	453.19	19.28	7.69	19.45	499.03	-52.16	0.22	12.59	9:40:11	10:00:11	
	10/5/2016	MW-20	488.75	414.35	34.74	454.01	19.39	7.59	18.53	638.99	-114.44	0.00	150.34	13:40:48	13:57:20	
	10/4/2016	MW-21	486.50	412.10	32.89	453.61	20.30	--	--	--	--	--	--	--	--	Sand collapse around pump

*STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT ON THE SAME DAY AND AS CLOSE IN TIME AS POSSIBLE PRIOR TO THE PURGING AND SAMPLING EVENT
**((TOP OF CASING - FEET TO STATIC LEVEL) - BOTTOM OF SCREEN) X 0.163 X3 = PURGE WELL AMT.
***NEGATIVE VALUES ARE DUE TO INSTRUMENT CALIBRATION

GENERAL NOTES

GROUNDWATER FLOW DIRECTIONS WILL LIKELY CHANGE DEPENDANT ON THE ELEVATION OF THE OHIO RIVER AND LMS/AURORA WELLFIELD DRAW DOWN. THEREFORE, WHETHER A WELL IS UPGRADIENT OR DOWN GRADIENT WILL DEPEND ON THE ELEVATION OF THE OHIO RIVER AND WELLFIELD DRAW DOWN ON THE DATE OF SAMPLING

LEGEND

- SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER
- PIEZOMETER
- MONITORING WELL
- AURORA SUPPLY WELL
- POTENTIOMETRIC CONTOUR
- DIRECTION OF GROUND FLOW
- FACILITY BOUNDARY
- WASTE BOUNDARY
- OHIO RIVER SAMPLING LOCATION

REFERENCE DRAWINGS

14-30205	FLY ASH LANDFILL- BORING LAYOUT
14-30251A	MONITORING WELL LOCATION PLAN
14-30251B	MONITORING WELL CONSTRUCTION DETAILS TABLE

DATE	NO.	DESCRIPTION	APPD.
11/21/16	X	STATIC WATER LEVEL MEASURED ON 10/4/2016.	TJZ

REVISIONS

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INDIANA MICHIGAN POWER
TANNERS CREEK PLANT
LAWRENCEBURG INDIANA

POTENTIOMETRIC MAP
2016 October

DWG. NO. 14-30251-X

SCALE: 1" = 30'

CIVIL ENGINEERING

DSN: Amanda Graphics
CHK: DMS
ENGR: JMN
PROJ: JMN
DATE: 10/25/16

APPROVED

Thomas R Zelina

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

Figure 10

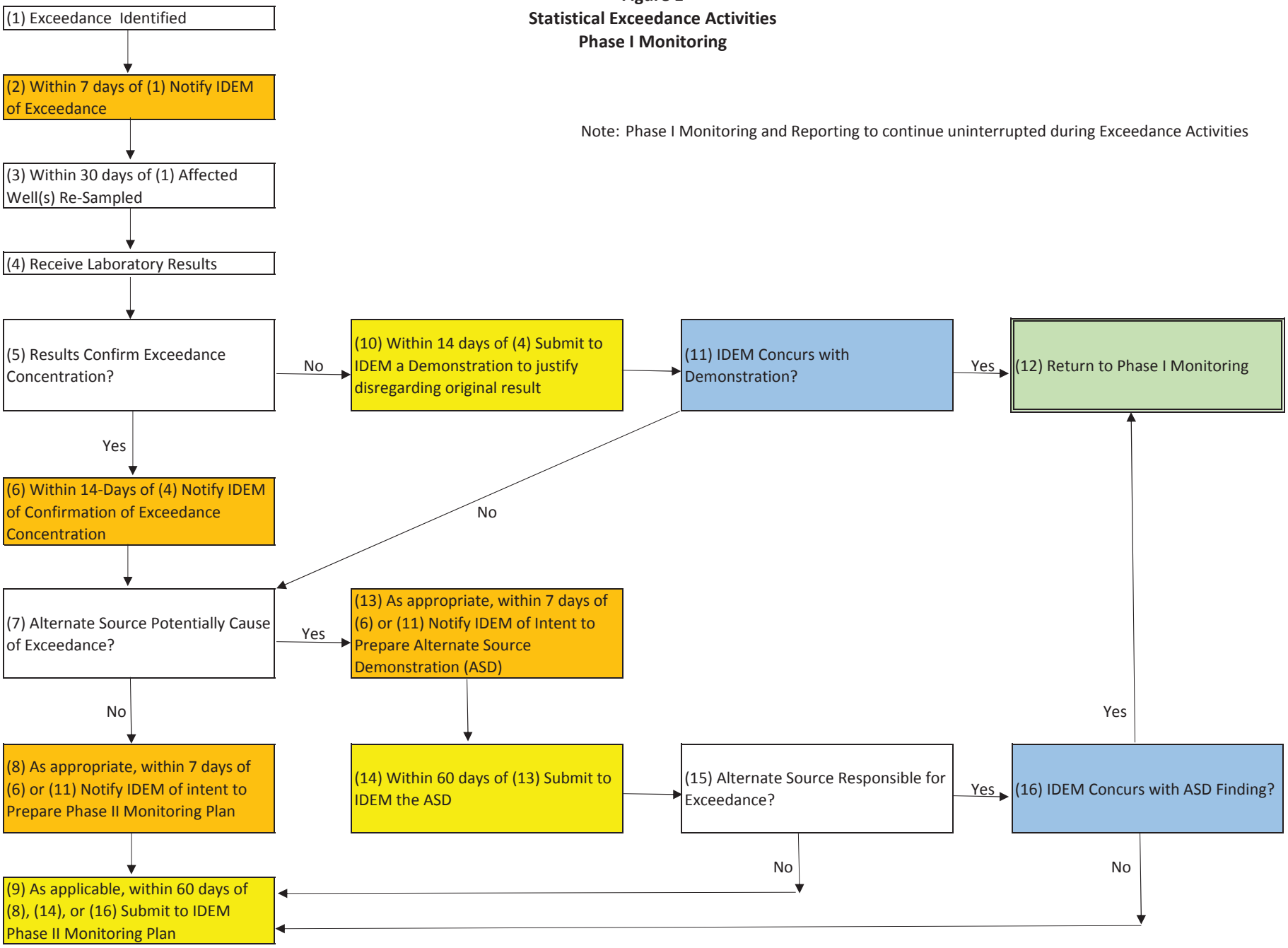
APPENDIX B

Miscellaneous Information

EnviroAnalytics Group

Environmental Engineers

Figure 1
Statistical Exceedance Activities
Phase I Monitoring



Note: Phase I Monitoring and Reporting to continue uninterrupted during Exceedance Activities

EnviroAnalytics Group

Groundwater Monitoring Well Sampling Log

Well ID:

General Information

Project Name/Client:	
Site Name:	**Date:**
Site Location:	**Time Duration:**
Operator(s):	**Weather:**

Well Information

Well Diameter (in):	**Water Level Instrument:**
Casing Type:	**Initial DTW (ft):**
Measuring Point:	**Total Depth (ft):**
Screen Depth (ft BTOC):	**Water Column Height (ft):**
Pump Intake (ft BTOC):	**Volume in Well (gal):**

Monitoring Well Purge Summary

Purging Device:	**Water Quality Meter:**

	Time	DTW (ft)	Drawdown (ft)	pH (s.u.)	Temp (°C)	Spec Conductivity (µS/cm)	RDO (mg/L)	Turbidity (NTU)	ORP (mV)
Stabilization Settings				+/- 0.1	+/- 1.0	+/- 3%	+/-1 or 10%	+/-10 or 10%	+/- 20
Last 5 Readings									
Variance in Last 3 Readings									

Estimated Total Volume Purged (gal): **Purge Rate (mL/min):** **Sample Rate (mL/min):**

NOTES:

Final Field Sample Data

Physical Appearance:	**Odor:**

Sample Time	Final DTW (ft)	Final Drawdown (ft)	pH (s.u.)	Temp (°C)	Spec Cond (µS/cm)	RDO (mg/L)	Turbidity (NTU)	ORP (mV)	

Laboratory Analysis

Sample ID	Parameter/Method	Container Size/Type	Preservative

Laboratory Used: **Notes:**

Figure 4
Laboratory Analytical Methods, Sample Preservation, and Holding Times

Parameter	Tech	Matrix[1]	EPA Approved Method[2]	SW846 Method[3]	Rec. Volume	Bottle Type	Preservative[4]	Temp	Holding Time	Holding Time Units
Bacteria										
Chlorophyll A/Pheophytin A	Spec	NPW	SM10200H	NA	1L	Amber Glass	None	0 - 6°C	72	Hours
Coliform, Total	MF. MUG	NPW	SM9222B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
E. Coli	MUG	NPW	SM9223B, Colilert	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Enterococci		NPW	ASTM D6503-99, Enterolert	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Fecal Coliform	MF. MUG	NPW	SM9222D	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Fecal Coliform	MPN	NPW	SM9221C/E	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Heterotropic Plate Count	Pour Plate	NPW	9215B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Salmonella	MPN	NPW	SM9260D	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Inorganic Classic										
Acidity	Spec	NPW	SM2310B, ASTM D1067	NA	250ml	HDPE	None	0 - 6°C	14	Days
Alkalinity	Titr	NPW	SM2320B	NA	500ml	HDPE	None	0 - 6°C	14	Days
Alkalinity	Spec	NPW	310.2	NA	500ml	HDPE	None	0 - 6°C	14	Days
Ammonia Nitrogen	Spec	NPW	350.1, SM4500NH_3G	NA	500ml	HDPE	H_2SO_4+$Na_2S_2O_3$	0 - 6°C	28	Days
Ammonia, distilled/titration (4500)	Elec	NPW	SM4500NH_3C	NA	500ml	HDPE	H_2SO_4+$Na_2S_2O_4$	0 - 6°C	28	Days
Asbestos	TEM	NPW	100.1	NA	1L	Glass	None	0 - 6°C	48	Hours
BOD/CBOD (Total & Soluble)	Probe	NPW	SM5210B	NA	1L	HDPE	None	0 - 6°C	48	Hours
Bromide	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Carbon Dioxide	Calc	NPW	SM4500CO2 D	NA	1L	HDPE	None	0 - 6°C	15	Min
Chemical Oxygen Demand (COD)	Spec	NPW	410.4, SM5220D	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Chemical Oxygen Demand (COD), Soluble	Spec	NPW	410.4, SM5220D	NA	250ml	HDPE	None	0 - 6°C	28	Days
Chloride	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Chlorine, residual	Spec	NPW	SM4500Cl-G	NA	250ml	HDPE	None	0 - 6°C	15	Min
Color	PtCo	NPW	SM2120B	NA	250ml	HDPE	None	0 - 6°C	48	Hours
CTAS Surfactants	Spec	NPW	SM5540D	NA	1L	HDPE	None	0 - 6°C	48	Hours
Cyanide - Total	Spec	NPW	335.4, SM4500CNE	9012	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide - Total	Kelada	NPW	Kelada-01	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Amenable	Spec	NPW	SM4500CNG	9012	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Free	Spec	NPW	SM4500CNE	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Weak Acid Dissoc.	Spec	NPW	SM4500CN-I	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Dissolved Organic Carbon (DOC)	Comb/ oxi	NPW	SM5310B	9060	250ml	Amber Glass	None	0 - 6°C	28	Days
Ferrous Iron	Spec	NPW	SM3500FeB	NA	250ml	Amber Glass	HCl	0 - 6°C	15	Min
Fluoride	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Hardness	Calc	NPW	200.7, SM2340B	NA	250ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	Spec	NPW	130.1	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	Titr	NPW	SM2340C	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Iodide	Titr	NPW	345.1	NA	250ml	HDPE	None	0 - 6°C	Immed	
Kjeldahl Nitrogen, TKN	Spec	NPW	351.2, SM4500NorgB/C	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Methylene Blue Active Subst. (MBAS)	Spec	NPW	SM5540C	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Nitrate	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	48	Hours
Nitrate + Nitrite	Spec	NPW	353.2, SM4500NO_3F	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Nitrite	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	48	Hours
Oil & Grease (Hexane Extr)	Grav HEM	NPW	1664A, SM5520B	9070	1L	Glass	HCl	0 - 6°C	28	Days
Oil & Grease, Free	Grav	NPW	1664A	9070	1L	Amber Glass	None	0 - 6°C	28	Days
Organic Nitrogen	Calc	NPW	351.2 - 350.1	NA	500ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Oxygen, dissolved (DO)	Probe	NPW	SM4500O C, SM4500O G	NA	125ml	HDPE	None	0 - 6°C	15	Min
pH	Elec	NPW	SM4500H B	9040	125ml	HDPE	None	0 - 6°C	15	Min
Phenols (Total) by 4AAP	Spec	NPW	420.1, 420.4	9066	250ml	Amber Glass	H_2SO_4	0 - 6°C	28	Days
Phosphate, Ortho	Spec	NPW	365.1, SM4500P-E	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Phosphorus, Total	Spec	NPW	365.1, SM4500P-B.5	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Residue, Filterable (TDS)	Grav	NPW	SM2540C	NA	250ml	HDPE	None	0 - 6°C	7	days
Residue, non-Filterable (TSS)	Grav	NPW	SM2540D	NA	1L	HDPE	None	0 - 6°C	7	Days
Residue, Settleable (SS)	Grav	NPW	SM2540F	NA	1L	HDPE	None	0 - 6°C	48	Hours
Residue, Total (TS)	Grav	NPW	SM2540B	NA	250ml	HDPE	None	0 - 6°C	7	Days
Specific Conductance (Conductivity)	Cond.	NPW	120.1, SM2510B	9050	250ml	HDPE	None	0 - 6°C	28	Days
Sulfate	IC	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Sulfide	Titr	NPW	NA	9030, 9034	500ml	HDPE	NaOH+ZnAc	0 - 6°C	7	Days
Sulfide	Spec	NPW	SM4500S^2D	NA	500ml	HDPE	NaOH+ZnAc	0 - 6°C	7	Days

Figure 4
Laboratory Analytical Methods, Sample Preservation, and Holding Times

Parameter	Tech	Matrix[1]	EPA Approved Method[2]	SW846 Method[3]	Rec. Volume	Bottle Type	Preservative[4]	Temp	Holding Time	Holding Time Units
Sulfide, Dissolved	Spec	NPW	SM4500S^2D	NA	125ml	Amber Glass	NaOH+ZnAc	0 - 6°C	7	Days
Sulfite	Titr	NPW	SM4500SO_3B	NA	250ml	HDPE	None	0 - 6°C	15	Min
Tannins and Lignins	Spec	NPW	SM5550B	NA	250ml	HDPE	None	0 - 6°C	NA	
Temperature	Therm	NPW	SM2550B	NA	onsite		None	0 - 6°C	15	Min
Total Organic Carbon (TOC)	Comb/ oxi	NPW	SM53010B	9060	250ml	Amber Glass	HCl	0 - 6°C	28	Days
Total Organic Halides (TOX)	MC Titr	NPW	450.1, SM5320B	NA	1L	Amber Glass	H_2SO_4	0 - 6°C	28	Days
Turbidity	Neph	NPW	180.1, SM2130B	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Volatile Solids (VS)	Grav	NPW	160.4	NA	250ml	HDPE	None	0 - 6°C	7	Days
Volatile Susp. Solids (VSS)	Grav	NPW	SM2540E	NA	500ml	HDPE	None	0 - 6°C	7	Days
Inorganic Metals										
Chromium, Hexavalent - Cr^{+6}	Spec	NPW	SM3500CrB	7196	250ml	HDPE	None	0 - 6°C	24	Hours
Chromium, Hexavalent - Cr^{+6}	IC	NPW	SM3500CrC	7199	250ml	HDPE	None	0 - 6°C	24	Hours
Chromium, Hexavalent - Cr^{+6}	IC	NPW	218.6, SM3500CrC	NA	125ml	HDPE	$(NH_4)_2SO_4$	0 - 6°C	28[5]	Days
Mercury (Dissolved)	CVFAA	NPW	245.1	7470	500ml	HDPE	None	0 - 6°C	28	Days
Mercury (Total)	CVFAA	NPW	245.1	7470	500ml	HDPE	HNO_3	0 - 6°C	28	Days
Metals (Dissolved) ICP	ICP	NPW	200.7	6010	500ml	HDPE	None	NA	180	Days
Metals (Dissolved) ICPMS	ICPMS	NPW	200.8	6020	500nl	HDPE	None	NA	180	Days
Metals (Total) ICP	ICP	NPW	200.7	6010	500ml	HDPE	HNO_3	NA	180	Days
Metals (Total) ICPMS	ICPMS	NPW	200.8	6020	500ml	HDPE	HNO_3	NA	180	Days
Physical										
Flashpoint/ignitability (Closed Cup)	PM	NPW	ASTM 93-07	1010	1L	Glass	None	0 - 6°C	14	Days
Flashpoint/ignitability (Open Cup)	PM	NPW	ASTM 92-05A	NA	1L	Glass	None	0 - 6°C	14	Days
Organic - Semivolatiles										
Base/Neutral/Acid (BNA)	GCMS	NPW	NA	8270	1L or 100mL	Amber Glass	None	0 - 6°C	7	Days
Base/Neutral/Acid (BNA)	GCMS	NPW	625, SM6410B	NA	1L or 100mL	Amber Glass	$Na_2S_2O_3$	0 - 6°C	7	Days
Diesel Range Organics	GC	NPW	NA	8015	1L, 100mL, or 40mL	Amber Glass	HCl	0 - 6°C	7	Days
Dioxin	HR GCMS	NPW	1613	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6°C	1	Year
EDB/DBCP	GC	NPW	NA	8011	2 x 40 ml	Glass	$Na_2S_2O_3$	0 - 6°C	7	Days
Formaldehyde	HPLC	NPW	NA	8315	1L	Amber Glass	None	0 - 6°C	3	Days
Herbicides	GC	NPW	1658, SM6640B	8151	1L	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH)	GC/MS	NPW	625, SM640B	8270	1L, 100mL, or 40mL	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH-SIM)	GC/MS	NPW	NA	8270	1L, 100mL, or 40mL	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH)	HPLC	NPW	610, SM6440B	8310	1L	Amber Glass	None	0 - 6°C	7	Days
Pesticides - Organophos Comp	GC	NPW	614, 622, 1657	8141	1L	Amber Glass	None	0 - 6°C	7	Days
Pesticides & PCB's	GC	NPW	608, SM6630B, SM6630C	8081, 8082	1L or 100mL	Amber Glass	None	0 - 6°C	7	Days
Organic - Volatiles										
Meetac - Methanol and Ethanol	GCMS	NPW	NA	EPA 8015 Mod	40ml	Amber Glass	HCl	0 - 6°C	14	Days
Methane, Ethane, Ethene, Propane	GC	NPW	RSK-175	NA	40ml	Amber Glass	HCl	0 - 6°C	14	Days
BTEX (water)	GC	NPW	602, SM6200C	8021	2 x 40 ml	Amber Glass	HCl	0 - 6°C	14	Days
BTEX (water)	GC	NPW	602, SM6200C	8021	2 x 40 ml	Amber Glass	None	0 - 6°C	7	Days
Gasoline Range Organics (GRO)	GC	NPW	NA	8015	2 x 40 ml	Amber Glass	HCl	0 - 6°C	14	Days
VOC's	GC/MS	NPW	624, SM6200B	8260	2 x 40 ml	Amber Glass	HCl	0 - 6°C	14	Days
VOC's	GC/MS	NPW	624, SM6200B	8260	2 x 40 ml	Amber Glass	none	0 - 6°C	7	Days
Radiochemistry										
Rad - Gross alpha		NPW	900	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Gross beta		NPW	900	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Radium 226		NPW	903.1	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Radium 228		NPW	904	na	1L	Plastic	HNO_3	0 - 6°C	180	Days

Footnotes:

1) Matrix - NPW=Nonpotable Water, PW= Potable Water, SS=Solids

2) EPA Approved Method - Where applicable EPA methods are listed. Compounds/programs not regulated by EPA will have methods appropriate to their regulatory oversight.

3) SW846 Method - Where one exists, the appropriate Solid Waste method will be listed

4) Preservative Key

$(NH_4)_2SO4$ = Ammonium Sulfate

AcAcid = Acetic Acid

Figure 4
Laboratory Analytical Methods, Sample Preservation, and Holding Times

Parameter	Tech	Matrix[1]	EPA Approved Method[2]	SW846 Method[3]	Rec. Volume	Bottle Type	Preservative[4]	Temp	Holding Time	Holding Time Units

CH_3Cl = Methylene Chloride
H_2SO_4 = Sulfuric Acid
HCl= Hydrochloric Acid
HNO_3 = Nitric Acid
MeOH = Methanol
$Na_2S_2O_3$ = Sodium Thiosulfate
$NaHSO_4$ = Sodium Bisulfate
NH_4Cl = Ammonium Chloride
TSP = Trisodium Phosphate
ZnAc = Zinc Acetate

5) Must be field filtered to achieve the extended holding time.
6) Must be received by lab within 7 days of sampling for solvent addition.
7) Must be received by lab within 4 days of sampling for solvent addition.
8) Must be received by lab within 48 hours of sampling for freezing.
9) Must be received by lab within 72 hours of sampling for solvent addition.