Sampling and Analysis Plan

# CCR Surface Impoundment System

# James DeYoung Power Plant–Holland, Michigan

# Holland Board of Public Works

## Holland, Michigan

**October 17, 2017** **NTH Project No. 73-160017-04**

NTH Consultants, Ltd.
41780 Six Mile Road
Northville, MI 48168

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# Appendices

# 1.0 INTRODUCTION

The Holland Board of Public Works (BPW) owns and operates the James DeYoung (JDY) plant located in Holland, Michigan, on the eastern end of Lake Macatawa. JDY was initially built in 1939 with a generating capacity of 15 megawatts (MW). Between 1953 and 1968, three new boilers were added. From the late 1970's to the early 2000's, the plant consisted of three coal-fired boilers capable of producing up to 62.5 MW. On May 20, 2016, BPW discontinued the use of Unit 3; and on June 1, 2017, BPW officially shut down and retired all generation units at JDY. When Units 3-5 were operating on coal, bottom ash from these boiler units was sluiced to the first of three surface impoundments located to the south of the plant, as shown on Figure 1, in Appendix A. These surface impoundments, permitted pursuant to NPDES permit No. MI0001473, became subject to 40 CFR Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments upon promulgation on April 17, 2015.

40 CFR Part 257 requires the preparation of a Groundwater Sampling and Analysis Plan (SAP) to evaluate background and downgradient groundwater quality within the JDY plant property (Site), and confirm compliance with the groundwater monitoring and corrective action requirements. The methodologies outlined in this SAP are consistent with the regulations, general federal and state guidance, and industry standards.

As discussed in subsequent sections of this plan, BPW conducted groundwater monitoring prior to the effective date of the CCR rules and elected to proceed with CCR removal and clean closure at the site. This SAP will be used to collect necessary information to confirm clean closure.

# 2.0 PURPOSE AND OBJECTIVES

The groundwater monitoring and corrective action compliance requirements for existing CCR units are set forth in 40 CFR §257.90 through §257.98. The groundwater sampling and analysis requirements are established in 40 CFR §257.93, and require the development of a SAP that details the sampling and analysis procedures that will be utilized to provide an accurate representation of groundwater quality at the background and downgradient wells. Per 40 CFR

§257.93(a) this SAP includes a description of the procedures and techniques that will be implemented for:

- Sample collection
- Sample preservation and shipment
- Analytical procedures
- Chain-of-custody control
- Quality assurance and quality control

## 3.0 BACKGROUND INFORMATION

A limited hydrogeological investigation work plan was developed for the site in 2009 that established a groundwater detection monitoring program to address the requirements of Michigan Administrative Code R 323.2237(4) of Michigan's Natural Resources and Environmental Protection Act, 1994 Public Act 451, as amended (Act 451). The investigation work plan pre-dated the final federal CCR rules with the purpose of satisfying a request by the Michigan Department of Environmental Quality to determine whether the presence of the bottom ash lagoons (CCR units) might have affected groundwater quality in the surrounding area. The results of this investigation were inconclusive and additional investigative activities were merited.

In 2011, BPW completed subsequent investigation activities at the Site, including the installation of additional monitoring wells, collection of groundwater elevation data, and collection of groundwater samples for the analysis of a subset of metals on a quarterly basis, for three years. The results of the subsequent investigation identified that certain metals were present in the groundwater above the EPA's Safe Drinking Water Act's maximum contaminant level (MCL) established under 40 CFR §141.62, and concluded that the groundwater quality in the surrounding area may have been affected by the historical use of the CCR units.

## 4.0 CORRECTIVE MEASURES

Based on the groundwater sampling, BPW decided to close the CCR units through removal of CCR and decontamination of the CCR units, in accordance with 40 CFR §257.102; and initiate an assessment of corrective measures, in accordance with 40 CFR §257.96. Final closure of the CCR

units is currently being completed in substantial conformance with 40 CFR §257.101 and 40 CFR §257.103 and the written closure plan prepared by NTH Consultants, Ltd., (NTH) dated October 17, 2016. BPW initiated removal of CCR material from the CCR units in June 2017. Two of the existing downgradient monitoring wells were removed during closure of the CCR units. Additionally, based on previous investigation findings, the upgradient monitoring well used during the 2011 study may not have been installed at a location that provided a true background determination for the area around JDY, and was also removed during closure of the CCR units.

NTH has designed an updated groundwater monitoring system that will be representative of groundwater potentially affected by the CCR units. To do this, BPW will install new downgradient wells and utilize this SAP to comply with the requirements of 40 CFR §257.91 and the CCR units Closure Plan.

Once removal of the CCR material and decontamination of the CCR units have been completed, three additional downgradient wells will be installed at appropriate locations and depths to yield representative groundwater samples from the uppermost aquifer. Table 1 includes an estimated groundwater monitoring and implementation schedule.

In accordance with 40 CFR §257.91, the number, spacing, and depths of the groundwater monitoring wells were selected based on characterization of the site-specific hydrogeologic conditions. Groundwater monitoring wells will be screened in the upper portion of the unconfined uppermost water-bearing zone, which generally occurs at depths of approximately 10 to 15 feet below ground surface.

The proposed well locations are shown on Figure 2, Groundwater Sampling Plan, included in Appendix A. Based on information regarding the hydrogeologic conditions of the site available at the time this plan was developed, existing piezometer PZ-1 is located hydraulically upgradient of the former CCR bottom ash lagoons. Groundwater samples from this well represent background groundwater quality that has not been affected by the CCR units. Therefore, PZ-1 will be redeveloped and used as an upgradient monitoring well.

**TABLE 1**
**HOLLAND BOARD OF PUBLIC WORKS**
**JAMES DEYOUNG PLANT**
**SAMPLING AND ANALYSIS PLAN**
**GROUNDWATER MONITORING AND IMPLEMENTATION SCHEDULE**

| Task | Jun. 2017 | July. 2017 | Aug. 2017 | Sept. 2017 | Oct. 2017 | Nov. 2017 | Dec. 2017 | Jan. 2018 | Feb. 2018 | Mar. 2018 | Apr. 2018 | May. 2018 | Jun. 2018 | July. 2018 | Aug. 2018 | Sept. 2018 | Oct. 2018 | Nov. 2018 | Dec. 2018 | Jan. 2019 | Feb. 2019 | Mar. 2019 | Apr. 2019 | May. 2019 | Jun. 2019 | July. 2019 | Aug. 2019 | Sept. 2019 | Oct. 2019 | Nov. 2019 | Dec. 2019 | Jan. 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavation and Removal of CCR material | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clean Closure Verification | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Groundwater Monitoring System Installation* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Groundwater Sampling, Evaluation, and Analysis** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Annual groundwater monitoring and corrective action report | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Certification Report*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Confirmation of Clean Closure | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Completion of closure activities and groundwater monitoring well installation will be dependent on seasonal variations, climatic factors, the amount of time required to dewater, the geology and terrain surrounding the CCR units that will affect the amount of material needed to close the CCR units.
** Groundwater evaluation will be conducted as necessary during the closure period. Closure completion will be dependent on groundwater cleanup/confirmation samples. Evaluation of the data will be completed after each sampling event, and if the results are appropriate to determine statistical background, less samples will be collected.

Three downgradient monitoring wells will be installed at locations that represent the quality of groundwater passing the waste boundary of the former CCR units. These three proposed well locations are labeled as MW-1 through MW-3 on Figure 2. Based on historic hydrogeologic information, groundwater generally flows east-to-west across the site and discharges to the Macatawa River/Lake Macatawa. A seawall borders the site at the shoreline and presumably impedes the groundwater discharge. Groundwater is likely diverted toward both ends of the seawall. Therefore, monitoring wells are proposed to be located near the north (MW-3) and south (MW-2) ends of the seawall. One additional well (MW-1) will be placed at an intermediate location along the south property boundary between the former CCR units and the seawall. This well is intended to monitor groundwater that may flow southwesterly from the CCR units.

Based on data obtained from the proposed monitoring wells following installation and subsequent sampling, hydrogeologic conditions will be re-evaluated to confirm groundwater flow direction and to ensure the effectiveness of the monitoring well system.

Groundwater samples will be collected from the monitoring system and analyzed for constituents listed in Appendix IV of 40 CFR §257.95 along with Appendix III parameters boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids (TDS). Results of the groundwater samples will be compared to applicable groundwater standards for determination of clean closure.

The groundwater protection standards for each constituent in Appendix IV will be established in accordance with 40 CFR §257.95(h). For constituents for which MCLs have been established under 40 CFR §141.62 and 40 CFR §141.66, the groundwater protection standard will be the MCL for that constituent. Where MCLs have not been established for the Appendix III constituents, the groundwater protection standard will be the statistically developed background concentration for that constituent in accordance with 40 CFR §257.91, or as previously referenced from the preamble to the rule “in excess of Agency-recommended limits or factors.” It should be noted that Michigan’s groundwater cleanup criteria developed according to Part 201 of Act 451 will be considered by BPW when evaluating potential “Agency recommended limits or factors.” For those constituents for which the statistically developed background level is higher than the MCL, the groundwater protection standard will be the statistically developed background concentration.

To evaluate the effectiveness of the corrective measures, a minimum of eight (8) background samples will be collected. The sampling events will be spaced appropriately (on a quarterly basis) so that they can be considered statistically independent and evaluation of the data will be completed after each sampling event. If the results are appropriate to determine statistical background, fewer samples will be collected. After background samples have been collected and statistically evaluated, if merited, the groundwater sampling will continue on an annual basis, until groundwater protection standards are met.

Closure will be considered complete when the concentrations of the Appendix IV constituents are below MCL or background levels for two consecutive sampling events, using the statistical procedures and performance standards in 40 CFR § 257.93 (f) and (g). Once clean closure is achieved, the units are exempt from groundwater monitoring and any other post-closure requirements as stated in the Preamble to 40 CFR 257 and 40 CFR §257.104 (a)(2).

Resampling of a well due to an anomalous result, either relative to data collected from other monitoring wells of similar type, or relative to other time-series data at an individual monitoring well, may be completed at any time. The timing of a re-sampling event and the reason for additional data collection will determine if events are statistically dependent and inform the appropriate method for addressing interpretation or inclusion of data. Additional constituents may also be analyzed pending the results of the quarterly monitoring events (in accordance with Section §257.94(e)). This document does not cover collection and analysis of such additional data.

# 5.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

The following sections address the methods and procedures associated with the collection and handling of groundwater samples at the Site.

## 5.1 Groundwater Elevations

Groundwater level data will be collected from each monitoring well during each sampling event, prior to sample collection. Upon arrival at the site, each monitoring well will be opened and allowed to equilibrate with ambient air pressures prior to measuring the depths to water. Groundwater level measurements will then be taken to the nearest 0.01 foot from the entire

monitoring well network prior to sampling. The entire monitoring well network will be gauged on the same day in order to provide an interpretative groundwater flow map and to minimize temporal bias of measured groundwater elevation changes for the monitoring well network.

Depth to water will be measured from established top of casing reference points as referenced in the record survey drawing. Groundwater levels, well conditions, and any pertinent observations will be recorded on a groundwater-sampling log, provided in Appendix B.

The calculated hydraulic gradient will be used along with previously completed hydraulic conductivity testing to determine the apparent groundwater flow velocity and direction during each sampling event.

### 5.2 Groundwater Sample Collection

Groundwater samples will be collected from the monitoring wells using low-flow (minimal drawdown) groundwater sampling procedures (US EPA, 1996). Low-flow sampling will commence with the installation of either a peristaltic, stainless-steel 12-volt submersible impeller pump, or bladder pump to a depth representing the middle of the saturated screen interval. An appropriate length of polyethylene tubing will be connected to the pump discharge prior to pump placement. The discharge line will be connected to a flow-cell and multi-meter to collect water quality indicator parameters (described below) during well purging to determine water quality stabilization.

The pump will be operated at a flow rate that ensures low volatilization and low well disturbance. Water quality indicator parameters and depth to water will be recorded at 3 to 5 minute intervals during the purging process and recorded on the groundwater sampling log provided in Appendix B. Purging and sampling will proceed at a low pumping rate, expected to be between approximately 0.1 and 0.5 liters per minute or less, such that the water column in the well is not lowered more than 0.3 feet (4 inches) below the initial static depth to water measurement. The well will be considered ready to sample when three consecutive water quality measurements meet the stabilization criteria for pH, conductivity, temperature, and turbidity presented below.

| Parameter | Stabilization Criteria |
|---|---|
| pH | 3 readings within +/- 0.1 standard units (SU) |
| Specific Conductance | 3 readings within +/- 3% millisiemens per centimeter (mS/cm) |
| Temperature | +/-0.2 degrees |
| Turbidity | +/- 10% Nephelometric Turbidity Unit (NTU) |

Additional field measured parameters, (oxygen reduction potential and dissolved oxygen), may be collected to assist in data evaluation. Prior to use, all equipment will be calibrated in accordance with the manufacturer's recommendations.

### 5.3 Sample Preservation and Shipment

Samples will be collected immediately following stabilization of field parameters. Groundwater samples will be collected into laboratory provided sample containers required for the analyses specified in the following section. The groundwater samples will be collected from the discharge tubing upstream of the water quality meter flow cell. Care will be taken to allow for a non-turbulent filling of laboratory containers. Routine samples will not be filtered in the field to provide a measure of total recoverable metals that will include both the dissolved and particulate fractions of metals in natural waters, consistent with 40 CFR §257.93 (h)(2)(i).

The samples will be labelled, stored, and transported to the laboratory under proper chain-of-custody. Following collection, samples will be immediately labelled, logged on the chain-of-custody, and placed in a cooler with ice. Sample coolers transported to the laboratory via overnight or next day airfreight will be sealed with packing tape and a signed Chain-of-Custody seal. Sample coolers transported to the laboratory directly must be secured to ensure sample integrity is maintained. The use of chain-of-custody procedures will provide documentation of actual sample storage and transport. A laboratory provided chain-of-custody record will contain the dates and times of collection, laboratory receipt, and acknowledgment of analyses to be completed on a particular set of samples. The laboratory will return a copy of the chain-of-custody with the analytical report.

### 5.4 Quality Assurance/Quality Control (QA/QC)

Quality assurance/quality control (QA/QC) samples will be collected to ensure sample containers are free of analytes of interest, assess the variability of the sampling and laboratory methods, and

monitor the effectiveness of decontamination protocols. The following QA/QC samples will be collected during each groundwater-sampling event:

- Field duplicates will be collected at a frequency of one duplicate sample per 10 groundwater samples. The field duplicates will be collected at the same time and in the same manner as the original sample. The duplicates will be labeled as a blind sample and noted on the sampling form of the designated well.

- Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one MS/MSD sample per 20 groundwater samples. Duplicate and MS/MSD samples will be collected from different monitoring wells.

- Field blanks will be collected at a frequency of one field blank per 20 groundwater samples.

- Equipment blanks will be collected at a frequency of one equipment blank per 10 groundwater samples. The equipment blank will be collected by pouring distilled or deionized water over the decontaminated static water level meter or low flow pump and into the laboratory supplied containers.

The groundwater monitoring system at JDY will consist of 4 monitoring wells; therefore, a total of 1 field duplicate, 1 MS/MSD, 1 field blank, and 1 equipment blank will be collected during each sample event. The QA/QC samples will be submitted to the laboratory for the routine analyses specified in Section 6 and in Appendix IV to 40 CFR Part 257. The laboratory will provide adequate documentation of laboratory reporting and QA/QC procedures.

**5.5 Equipment Decontamination Procedures**

All non-dedicated equipment will be decontaminated prior to use and between samples. Non-dedicated equipment includes a water level meter and low flow sampling pump (submersible). Each item will be cleaned using distilled or deionized water, and when necessary, non-phosphate detergent wash followed by a distilled or deionized water rinse. When a peristaltic pump is used for low flow sampling, decontamination is not required; only replacement of the pump head tubing is required.

The flow-cell and water quality multi-meter (sonde) will be decontaminated at the completion of low-flow sampling. All sample collection will occur upstream of this device and will not affect groundwater sample analytical results.

### 5.6 Investigation Derived Waste (IDW)

Waste created during monitoring well sampling will remain on site. Purge water from wells installed within the CCR Units will be discharged back onto the ground near the well that is being purged. Purge water from wells installed outside of a CCR Units will be discharged to the ground in a manner that it does not directly enter a surface water or drain.

### 5.7 Field Documentation

Information pertinent to the field activities and sampling efforts will be recorded in the groundwater-sampling log or notebook, following appropriate documentation procedures. At a minimum, entries in the sample logs will include the following:

- Property details and location
- Number and volume of samples taken
- Sampling methodology
- Date and time of collection
- Sample identification number(s)
- Field observations including weather
- Any field measurements made (for example, pH, temperature, water depth and air monitoring data)
- Personnel present

Records shall contain sufficient information so that the sampling activity can be reconstructed without relying on the collector's memory. The sample logs will be preserved in electronic format.

# 6.0 CONSTITUENT LIST AND PROCEDURES FOR ANALYSIS

Groundwater samples collected at the JDY property will be submitted to ALS Environmental Laboratory, or another qualified, accredited laboratory, for the analyses specified in Appendix III and IV to Part 257. The analytical methods and practical quantitation limits for each constituent are summarized below. If required, and in consultation with the laboratory, a comparable analytical method may be substituted for the analytical method recommended below. Analytical methods may also be modified to incorporate newer versions of the stated methods. If any analyses are subsequently subcontracted to another accredited laboratory, the samples will be shipped using appropriate methods and COC documentation. All analyses will be performed within required hold times and consistent with the data quality objectives of this SAP.

**Appendix III to Part 257 – Constituents**

| Constituent | Analytical method | Preservation | Hold Time (Days) | Reporting Limit (µg/L) |
|---|---|---|---|---|
| Boron | EPA 6020B | $HNO_3$, pH <2 | 180 | 20 |
| Calcium | EPA 6020B | $HNO_3$, pH <2 | 180 | 1,000 |
| Chloride | EPA 300.0 | None, <6°C | 28 | 1,000 |
| Fluoride# | EPA 300.0 | None | 28 | 1,000 |
| pH | Stabilized field measurement | NA | NA | 0.1 standard units |
| Sulfate | EPA 300.0 | None, <6°C | 28 | 2,000 |
| Total Dissolved Solids | SM 2540C | None, <6°C | 7 | 1,000 |

*$HNO_3$ – Nitric acid*
*NA – Not applicable*

**Appendix IV to Part 257 – Constituents**

| Constituent | Analytical method | Preservation | Hold Time (Days) | Reporting Limit (µg/L) |
|---|---|---|---|---|
| Antimony | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Arsenic | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Barium | EPA 6020B | $HNO_3$, pH <2 | 180 | 5 |
| Beryllium | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Cadmium | EPA 6020B | $HNO_3$, pH <2 | 180 | 0.2 |
| Chromium, total | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Cobalt | EPA 6020B | $HNO_3$, pH <2 | 180 | 15 |
| Fluoride# | EPA 300 | None, <6°C | 28 | 1,000 |
| Lead | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Lithium | EPA 6020B | $HNO_3$, pH <2 | 180 | 10 |
| Mercury | EPA 7470A | $HNO_3$, pH <2 | 28 | 0.2 |
| Molybdenum | EPA 6020B | $HNO_3$, pH <2 | 180 | 5 |
| Selenium | EPA 6020B | $HNO_3$, pH <2 | 180 | 1 |
| Thallium | EPA 6020B | $HNO_3$, pH <2 | 180 | 2 |
| Radium 226 and 228 combined^ | EPA 903.1/904.0 | $HNO_3$, pH <2 | None | 1 picocurie per liter |

*# Listed in both Appendix III and Appendix IV*

*^Requires a larger sample volume (minimum 2 liter)*

# 7.0 DATA EVALUATION

In accordance with 40 CFR §257.93, data collected from eight samples from each background monitoring well will be used to calculate background concentrations for each constituent. If appropriate and supported by the data distribution, fewer samples may be utilized. Background concentrations for each constituent will be calculated using an appropriate statistical method for each background monitoring well, selected based on the distribution of the data in accordance with 40 CFR §257.93.

The data collected from background and downgradient monitoring wells will be compared using an appropriate statistical method. The statistical method will be determined based on the data distribution for each constituent at each location, to assess whether downgradient concentrations are consistent with background concentrations. The statistical method used for this analysis will be one, or a combination, of the four statistical methods described below and in 40 CFR §257.93(f) and will meet the performance standards outlined in 40 CFR §257.93(g).

A combination of statistical methods may be applied depending on the statistical distribution observed for each specified constituent in each monitoring well. The four specific statistical procedures provided in 40 CFR §257.93(f) are: (1) a parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination; (2) an analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination; (3) a tolerance or prediction interval procedure; and (4) a control chart approach.

The potential for seasonal and spatial variability as well as temporal trends will be considered when selecting the statistical method for comparison. If merited, adjustment of the data for seasonal variation may be completed prior to statistical analysis. Data may also be displayed graphically to aid in interpretation of the statistical analysis.

To select the appropriate method for statistical analysis for each constituent at each monitoring well, the distribution type for each constituent/well pair will be calculated. Normally distributed data will use parametric methods for comparisons, and non-normally distributed data will use non-parametric methods, consistent with the requirements outlined in 40 CFR §257.93(g). Where merited, data transformation may be completed.

Statistical comparisons will be performed using a confidence level of 99 percent (alpha of 0.01) for comparisons of individual data point to background concentrations, and a confidence level of 95 percent (alpha of 0.05) where multiple data points will be compared to background, consistent with 40 CFR §257.93(g)

## 8.0 ANNUAL REPORTING

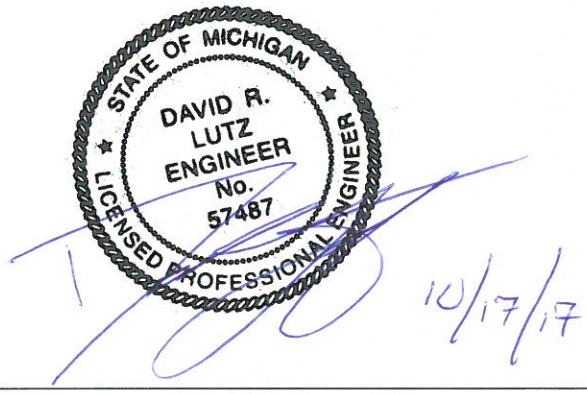
In accordance with 40 CFR §257.90 (e), a groundwater monitoring and corrective action report will be prepared for the Site no later than January 31, 2018, and annually thereafter; and placed in the facility's operating record, as required by §257.105(h)(1). The annual report will document the status of the groundwater monitoring and corrective action program for the CCR units, will provide a summary of activities completed, and describe activities proposed for the upcoming year.

# 9.0 RECORDKEEPING, NOTIFICATION, AND POSTING TO THE INTERNET

Consistent with the requirements of 40 CFR §257.105 (h), this SAP, which documents the design of the groundwater monitoring system, and details the initiation of assessment of corrective measures, will be placed in the Site's operating record by October 17, 2017. In accordance with 40 CFR §257.106 (h), BPW will notify the State Director that, as discussed in this SAP, it has initiated an assessment of corrective measures, and that this information has been placed in the operating record and on the owner or operator's publicly accessible internet site, in accordance with 40 CFR §257.107 (h).

## 10. STATEMENT OF CERTIFICATION

I, David R. Lutz, a Professional Engineer registered in the State of Michigan, certify[1] that, NTH Consultants, Ltd has prepared the sampling and analysis plan (SAP) for the Holland Board of Public Works James DeYoung Power Plant (Site) in Holland, Michigan CCR surface impoundments (Ash Ponds 1-3), presented above. To the best of my knowledge and belief, the SAP presented in this report for the CCR surface impoundments at the aforementioned Site, meet the intent of the requirements of 40 CFR §257.90 (b)(ii) – Initial Timeframe for Groundwater Monitoring, and 40 CFR §257.96 (a) - Assessment of Corrective Measures, subject to the limitations and modifications identified in this report. The development and implementation of this SAP, which includes the design of an updated groundwater monitoring system, the basis supporting this design, and initiation of assessment of corrective measures, are consistent with the plan for closure by removal of the CCR and decontamination of the CCR units, as established in the Closure Plan (prepared By NTH Consultants, Ltd., dated October 17, 2016), for the Site.



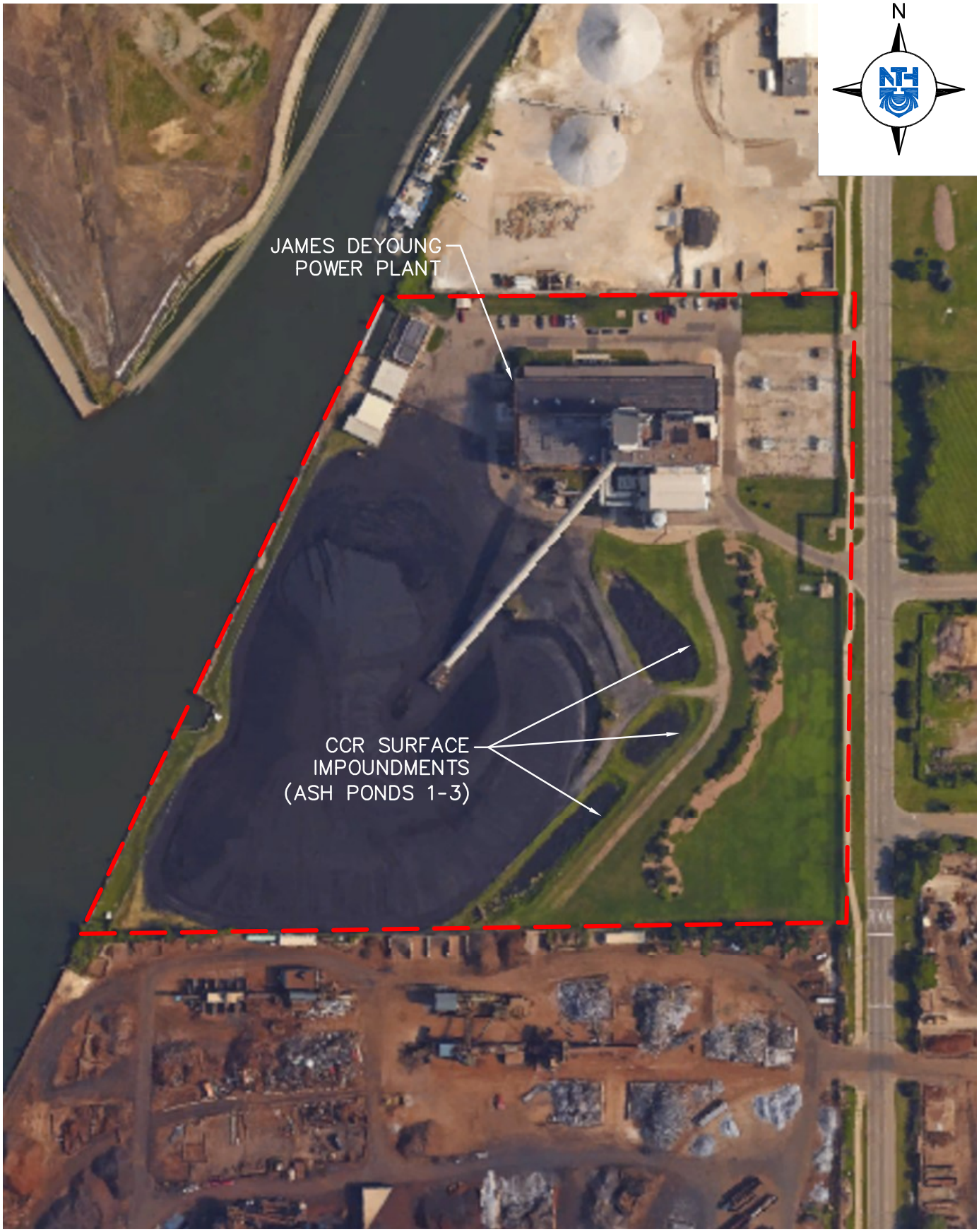

David R. Lutz, P.E.
State of Michigan Professional Engineer
Registration No. 57487

(1) I am rendering my professional opinion based on the information available to me at the time of this report writing. This certification does not comprise a guarantee or warranty that certain conditions exist, nor does it relieve any other party of their requirements to abide by all applicable local, state, and federal regulations, and to honor all express or customary guarantees and warranties associated with their work.

# APPENDIX A

1. Site Location Plan

2. Groundwater Sampling Plan



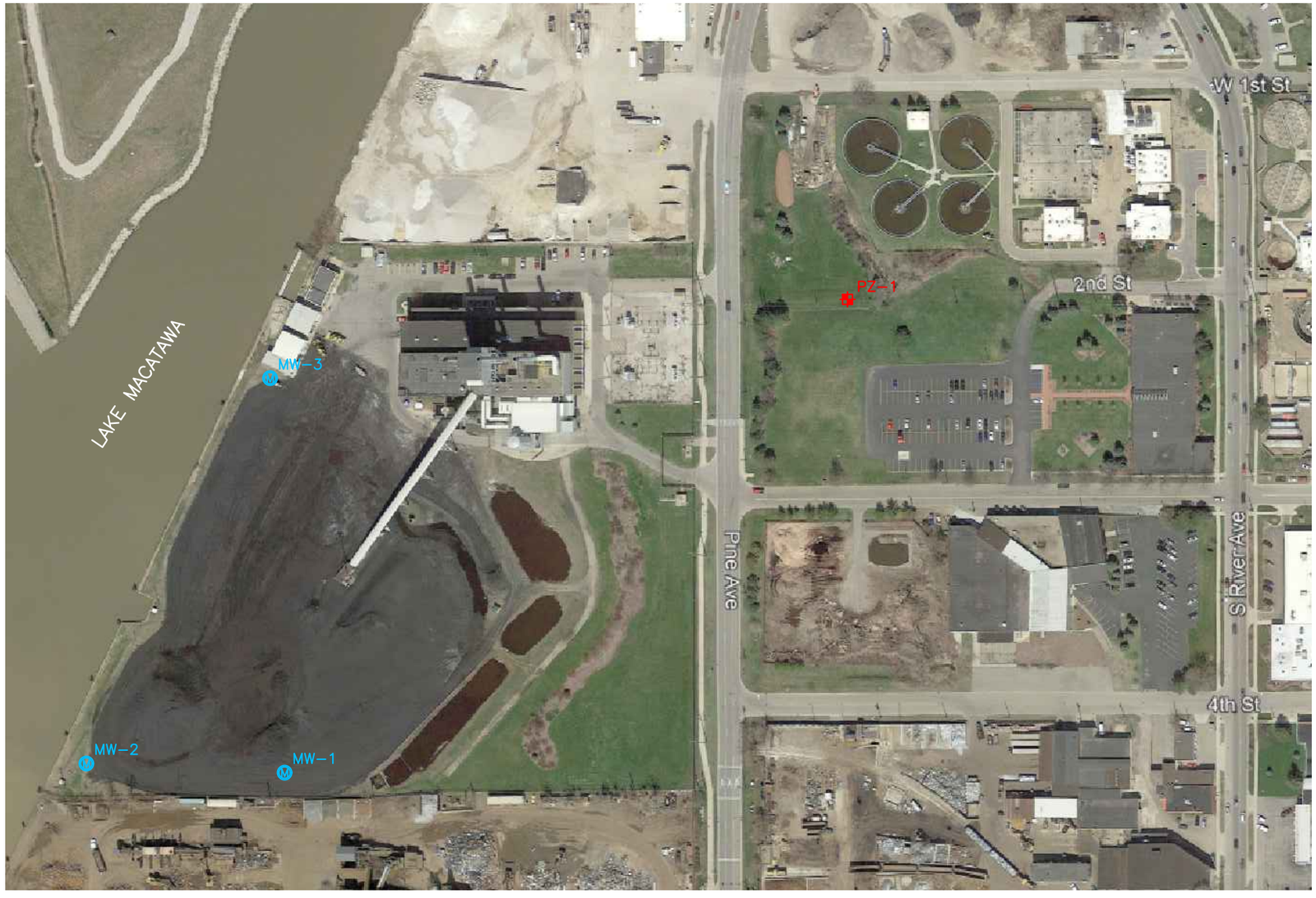

| | |
|---|---|
| NTH PROJECT No.: 62-160017 | CAD FILE NAME: 160017-JDY |
| DESIGNED BY: SLG | PLOT DATE: 10/4/2016 |
| DRAWN BY: SLG | DRAWING SCALE: 1" = 200' |
| CHECKED BY: DRL | INCEPTION DATE: 9/7/2016 |

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

# SITE LOCATION PLAN

JAMES DEYOUNG POWER PLANT
HOLLAND, MI

FIGURE: 1




N

0 100' 200'

SCALE

## LEGEND

| | |
|---|---|
| MW–1 | PROPOSED MONITORING WELL LOCATION |
| PZ–1 | EXISTING PIEZOMETER (PROPOSED UPGRADIENT MONITORING WELL) |

NOTE: LOCATIONS AND DIMENSIONS ARE APPROXIMATE. NOT A LEGAL SURVEY.

**NTH Consultants, Ltd.**
Infrastructure Engineering
and Environmental Services

| | | | |
|---|---|---|---|
| NTH PROJECT No.: 73–160017–01 | CAD FILE NAME: 160017–GWSP | | |
| DESIGNED BY: KO | PLOT DATE: 10/17/2017 | | |
| DRAWN BY: KVL | DRAWING SCALE: 1" = 200' | | |
| CHECKED BY: KO | INCEPTION DATE: 10/13/2017 | | |

GROUNDWATER SAMPLING PLAN

JAMES DEYOUNG POWER PLANT
HOLLAND, MICHIGAN

FIGURE:
2

# APPENDIX B

1. Groundwater Collection Log

# GROUNDWATER SAMPLE COLLECTION LOG

| GENERAL INFORMATION | |
|---|---|
| Project Name:_____ | Date: _____ |
| Project #:_____ | Field Personnel: _____ |
| Site Location:_____ | Well Const.:_____ |
| **Well ID**:_____ | Casing Diameter:_____ |
| Sample ID (if different than Well ID):_____ | Screened Interval:_____ (ft. from TOC) |

**PURGING DATA**

**Time:** **Start:** **Finish:**

| **Purging Volume** | **Casing Diameter (in)** | **Casing Vol. Gal./Ft.** | **3 Casing Vol. Gal./Ft.** |
|---|---|---|---|
| | 1 | 0.04 | 0.12 |
| Total Well Depth (ft. from TOC) = | 1.5 | 0.10 | 0.30 |
| Depth to Water (ft. from TOC) = | 2 | 0.16 | 0.48 |
| Height of Water in Well (ft.) = | 3 | 0.36 | 1.08 |
| One Well Volume (gallons) = | 4 | 0.63 | 1.89 |

Gallons Purged:_____

Well Volumes Purged: _____

Was Well Purged Dry? Yes ~ No ~

Purging and Sampling Device: _____

Purging Rate (g.p.m.)_____

**Note**: Average low flow rate of 0.13 g.p.m. (500 mL/min) on a 2-inch well typically results in a drawdown of 0.5 ft or less

**FIELD MONITORING PARAMETERS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Elapsed time (minutes)** | | | | | | | | | |
| **Accum. Volume Purged (gal)** | | | | | | | | | |
| **Drawdown (ft)** | | | | | | | | | |
| **pH** | | | | | | | | | |
| **Temperature (C)** | | | | | | | | | |
| **Conductivity (mS/cm)** | | | | | | | | | |
| **ORP (mV)** | | | | | | | | | |
| **Dissolved Oxygen (mg/L)** | | | | | | | | | |
| **Turbidity (NTU)** | | | | | | | | | |
| **Odor** | | | | | | | | | |
| **Appearance and/or Color** | | | | | | | | | |

| SAMPLING DATA | |
|---|---|
| **Time: Start: _____Finish:_____** | **Pump Rate (g.p.m.):_____** |
| **Sample Collection Depth (ft. from TOC): _____** | |
| **Weather Conditions: Air Temperature (F):_____ Wind Speed/Direction:_____** | |
| **Other:_____** | |

| SAMPLES COLLECTED (PARAMETERS AND PRESERVATIONS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Analysis** | **Container Type** | **Container Volume (ml)** | **How Many** | **Field Filtered (Filter Type)** | **Preservative** | | |
| | | | | | **Volume** | **Type** | **pH** |
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**Analytical Laboratory:_____ COC**

**No.:_____**

**Method of Shipment:_____ Shipment**

**Date:_____**

**Other**

**Notes:_____**

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