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INFRASTRUCTURE ENGINEERING & ENVIRONMENTAL SERVICES

LETTER OF TRANSMITTAL

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ENVIRONMENTAL REGULATORY SPECIALIST
HOLLAND BOARD OF PUBLIC WORKS
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HOLLAND, MICHIGAN 49423

DATE: JANUARY 31, 2018
NTH PROJ. No: 73-160017-04
CLIENT PROJ. No:

RE: 2018 ANNUAL REPORT

WE ARE SENDING YOU ☒ **ATTACHED** ☐ **UNDER SEPARATE COVER (VIA _____) THE FOLLOWING:**
☒ **REPORTS** ☐ **PRINTS** ☐ **SAMPLES** ☐ **SPECIFICATIONS**
☐ **COPY OF LETTER** ☐ **PLANS** ☐ **OTHER _____**

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1	-	01/30/2018	2018 ANNUAL GROUNDWATER REPORT FOR JAMES DEYOUNG POWER PLANT

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REMARKS:

THE ANALYTICAL DATA RESULTS FOR RADIUM ARE STILL PENDING. ONCE THIS DATA IS RECEIVED, WE WILL UPDATE AND REVISE THIS ANNUAL REPORT.

COPY To:

By:


MARY L. SIEGAN, P.E., PROJECT ENGINEER

2018 Annual Groundwater Report



CCR Surface Impoundment System

James DeYoung Power Plant–Holland, Michigan

Holland Board of Public Works

Holland, Michigan

January 31, 2018

NTH Project No. 73-160017-04

NTH Consultants, Ltd.
41780 Six Mile Road, 200
Northville, MI 48168





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1.0 INTRODUCTION

Holland Board of Public Works (BPW) owns and operates the James DeYoung (JDY) power 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 shutdown and retired all generation units at JDY. When Units 3-5 were operating, bottom ash from these boilers was sluiced to the first of three surface impoundments located to the south of the plant, as shown on Figure 1 (Appendix A). These surface impoundments 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.

2.0 PURPOSE AND OBJECTIVES

Groundwater monitoring and corrective action requirements for existing CCR units are contained in 40 CFR §257.90 through §257.98. 40 CFR Part §257.90 (e) establishes the requirement to prepare an initial annual groundwater monitoring and corrective action report. Consistent with this requirement, this report:

- documents the status of the groundwater monitoring and corrective action program for the CCR unit,
- summarizes actions completed,
- describes problems encountered,
- discusses actions to resolve the problems, and
- describes key activities for the upcoming year.



3.0 STATUS OF THE GROUNDWATER MONITORING PROGRAM

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 work plan pre-dated the final federal CCR rules and had the purpose of satisfying a request by Michigan Department of Environmental Quality to determine whether the presence of bottom ash lagoons (CCR units) may 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 a period of three years. The results of the subsequent investigation identified that certain metals were present in the groundwater above the U.S. EPA's Safe Drinking Water Act's maximum contaminant level (MCL) established in 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.

Based on the groundwater sampling along with anticipated retirement of the plant combined with the CCR Rule requirements, 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, an 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.



4.0 ACTIONS COMPLETED

4.1 Development of Sampling and Analysis Plan

Consistent with the requirements of 40 CFR §257.93, a Groundwater Sampling and Analysis Plan (SAP) was developed in October 2017 to evaluate background and downgradient groundwater quality within the JDY plant property (Site), and confirm compliance with the groundwater monitoring and corrective action requirements.

As discussed previously, 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. The SAP was developed to collect necessary information to confirm clean closure.

4.2 Update to Groundwater Monitoring System

To comply with the requirements of 40 CFR §257.93, NTH designed an updated groundwater monitoring system that is representative of groundwater potentially affected by the CCR units. West Michigan Drilling installed three monitoring wells on November 27, 2017, with oversight by NTH Consultants, Ltd. (NTH) personnel, using a CME 550 ATV drill rig. The wells were installed using 4.25-inch hollow-stem augers to the following depths and corresponding elevations:

Well	Depth (feet below ground surface)	Screen Tip Elevation (ft)
MW-1	14	571.21
MW-2	13	569.54
MW-3	15	566.98

Split spoon samplers were used to collect and classify soil layers in the field based on visual observation. The wells were constructed of two-inch diameter polyvinyl chloride casings and well screens. The well screens were 5-feet long with 0.01-inch slot thickness.

All of the monitoring wells were finished with an above ground metal protective casing and concrete pad. Well construction details, including casing and screen material, diameter, length of well casing, length and position of slotted casing, thickness, position and composition of surface



seal, sanitary seal, and sand pack, etc. is provided on the well installation logs, which are included in Appendix B. The logs also provide well survey information, including top of casing elevation, ground surface elevation, and well screen tip elevation.

A review of information regarding the hydrogeologic conditions of the site available at the time the SAP was developed, indicates that groundwater generally flows east-to-west across the site and discharges to the Macatawa River/Lake Macatawa. Based on this information, existing piezometer PZ-1 is located hydraulically upgradient of the former CCR bottom ash lagoons. PZ-1 was previously identified and sampled as monitoring well MW-7. Groundwater samples from this well represent background groundwater quality that has not been affected by the CCR units. Therefore, PZ-1 was redeveloped and used as an upgradient monitoring well. Figure 2 provides the location of the monitoring wells.

The downgradient monitoring wells labeled as MW-1, MW-2, and MW-3 on Figure 2, were installed at locations that represent the quality of groundwater passing the waste boundary of the former CCR units. Groundwater monitoring wells are screened at elevations between 567 and 576 ft in the upper portion of the unconfined uppermost water-bearing zone.

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

4.3 Groundwater Sample Collection

On January 10, 2018, representatives from NTH Consultants, Ltd. (NTH) collected the first of what will initially be quarterly groundwater samples collected for assessment monitoring from the groundwater monitoring system at the Site. The samples were submitted to the analytical laboratory for analysis of constituents listed in Appendix III and IV of 40 CFR §257.95.

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



The wells were gauged on the same day 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 was measured from established and surveyed top of casing reference points. Groundwater levels, well conditions, and pertinent observations were recorded on a groundwater-sampling log. Appendix C includes copies of the sampling logs. The water level data obtained has been used to develop a groundwater contour map (Groundwater Flow Map – Figure 3), which presents the site's groundwater flow direction.

Sampling personnel collected groundwater samples from the monitoring wells using low-flow (minimal drawdown) groundwater sampling procedures (US EPA, 1996, rev. 2010). Tubing connected to a peristaltic pump was installed to a depth representing the middle of the saturated screen interval. The polyethylene tubing discharge line from the peristaltic pump was connected to a flow-cell and multi-meter to collect water quality indicator parameters during well purging to determine water quality stabilization.

The pump was operated at a rates less than 0.25 gallons per minute to ensure low volatilization and low well disturbance. Water quality indicator parameters and depth to water were recorded at 3 to 5 minute intervals during the purging process and recorded on the groundwater sampling log. Purging and sampling proceeded at a low pumping rate such that the water column in the well was not lowered more than 0.3 feet (4 inches) below the initial static depth to water measurement. The wells were sampled when three consecutive water quality measurements for pH, temperature, and conductivity met stabilization criteria. We note that stabilization criteria could not be met for turbidity in any of the monitoring wells. Prior to the next sampling event these wells will be redeveloped, which may allow the turbidity measurements to stabilize during future sampling events. Likewise, piezometer PZ-1 could not be stabilized due to excessive drawdown; therefore, three well volumes were removed using the peristaltic pump, prior to sample collection.

Samples were collected immediately following stabilization of three of the four field parameters or at PZ-1, after three well volumes were removed. Groundwater samples were collected into laboratory provided sample containers required for the specified analyses. The groundwater samples were collected from the discharge tubing upstream of the water quality meter flow cell.



Care was taken to allow for a non-turbulent filling of laboratory containers. Samples were not 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 were labelled, stored, and transported to the laboratory under proper chain-of-custody. Following collection, samples were immediately labelled, logged on the chain-of-custody, and placed in a cooler with ice prior to delivery to the laboratory with a signed Chain-of-Custody. The chain-of-custody provides documentation of actual sample storage and transport, and contains the dates and times of collection, laboratory receipt, and acknowledgment of analyses to be completed.

Quality assurance/quality control (QA/QC) samples were 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. One field duplicate, one matrix spike, one matrix spike duplicate, one field blank, and one equipment blank were collected for QA/QC purposes.

4.4 Groundwater Sample Analysis and Data Evaluation

Groundwater samples were submitted to ALS Environmental Laboratory, in Holland, Michigan, for the analyses specified in Appendix III and IV to Part 257. The laboratory results, corresponding analytical methods, and practical quantitation limits for each constituent are provided in the analytical report included in Appendix C. Note that the results for Radium 226 and 228 are not yet available from the analytical laboratory. We will amend this report to include the analytical results for Radium 226 and 228, once available. We also note that for some of the constituents analyzed the laboratory's reporting limit are higher than the limits stated in the SAP. Therefore, the laboratory reported concentration at or above the method detection limits, which are significantly lower than the reporting limits.

The results of the quarterly groundwater sampling events 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 noted in 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 where the statistically developed background level is higher than the MCL, the groundwater protection standard will be the statistically developed background concentration.

As discussed in the facility’s SAP and in accordance with 40 CFR §257.93, the data collected from the 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 for the statistically calculated background concentrations. 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, once an appropriate number of data has been collected.

For the current sampling event, we completed a preliminary evaluation of the data by comparing the results to the current MCL, as summarized on Table 1. A review of the results indicate that, in general, most of the Appendix IV constituents are below the current MCL with the exception of arsenic, which was reported above the MCL of 0.01 mg/L in upgradient piezometer PZ-1 (0.045 mg/L), and in downgradient monitoring well MW-1 (0.023 mg/L). We note that groundwater in upgradient piezometer PZ-1, which represents background groundwater quality that has not been affected by CCR units, has higher concentration of arsenic than downgradient monitoring well MW-1; this indicates that background levels of arsenic are higher than the MCL. Note also, that for a few other constituents with no established MCLs, the concentrations in upgradient well PZ-1 are higher than the downgradient monitoring wells. As discussed previously, where background levels are higher than MCL, or for constituents without established MCLs, we will statistically develop groundwater protection standards in accordance with 40 CFR §257.91.



5.0 PROBLEMS ENCOUNTERED

As discussed previously, piezometer PZ-1 was purged using a volumetric procedure (removal of three well volumes) due to excessive drawdown. Additionally, stabilization criteria for turbidity could not be achieved in any of the monitoring wells. No additional problems were encountered with the implementation of the groundwater-monitoring program at the facility.

6.0 ACTIONS TO RESOLVE THE PROBLEM

Monitoring well PZ-1 will be redeveloped using the surge and purge method to remove excess suspended solids present in the well prior to the next sampling event. If redevelopment is not effective in allowing for the use of low-flow technique, sample collection will proceed when three of the four stabilization criteria are met, and/or volumetric procedures utilized.

7.0 KEY ACTIVITIES FOR THE UPCOMING YEAR

During the initial assessment monitoring period, the facility will continue to collect quarterly groundwater samples from the existing groundwater monitoring well network. Consistent with the requirements of the SAP, samples will be collected in April, July, and October of 2018, and January of 2019. The results of these sampling events will be provided in the update to the annual groundwater report by January 31, 2019.

8.0 RECORDKEEPING, NOTIFICATION, AND POSTING TO THE INTERNET


Consistent with the requirements of 40 CFR §257.105 (h), this groundwater monitoring and corrective action report, will be placed in the Site's operating record by January 31, 2018. In accordance with 40 CFR §257.106 (h), BPW will notify the State Director that this report has been developed, 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).

APPENDIX




1. Figures




NTH PROJECT No.: 62-160017 DESIGNED BY: SLG DRAWN BY: SLG CHECKED BY: DRL	CAD FILE NAME: 160017-JDY PLOT DATE: 9/28/2016 DRAWING SCALE: 1" = 200' INCEPTION DATE: 9/7/2016	 NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services	<p>SITE LOCATION PLAN</p> <p>JAMES DEYOUNG POWER PLANT HOLLAND, MI</p>	FIGURE: <div>1</div>
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LEGEND

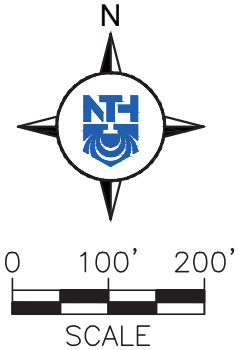
 MW-1


MONITORING WELL LOCATION

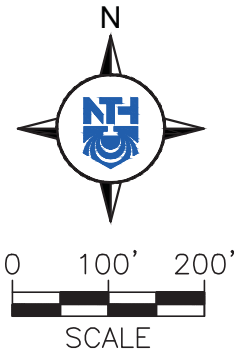
 PZ-1

EXISTING PIEZOMETER
(UPGRADIENT MONITORING WELL)

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



MONITORING WELL LOCATION MAP	NTH CONSULTANTS, LTD. Infrastructure Engineering and Environmental Services			
				
JAMES DEYOUNG POWER PLANT HOLLAND, MICHIGAN	NTH PROJECT No.:	73-160017	CAD FILE NAME:	160017-MWLM
	DESIGNED BY:	KWO	PLOT DATE:	1/23/2018
	DRAWN BY:	CRD	DRAWING SCALE:	1" = 200'
	CHECKED BY:	KWO	INCEPTION DATE:	10/13/2017
FIGURE:		2		



LEGEND

- MW-1 MONITORING WELL LOCATION
- PZ-1 EXISTING PIEZOMETER (UPGRADIENT MONITORING WELL)
- 582 — GROUNDWATER ELEVATION CONTOURS

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

GROUNDWATER FLOW MAP JANUARY 10, 2018 JAMES DEYOUNG POWER PLANT HOLLAND, MICHIGAN	NTH PROJECT No.: 73-160017	CAD FILE NAME: 160017-GWFM
	DESIGNED BY: KWO	PLOT DATE: 1/25/2018
FIGURE: 3	DRAWN BY: CRD	DRAWING SCALE: 1" = 200'
	CHECKED BY: KWO	INCEPTION DATE: 10/13/2017

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

APPENDIX



1. Well Installation Logs

HOLLAND BOARD OF PUBLIC WORKS - JAMES DeYOUNG POWER PLANT

TABLE 1
SUMMARY OF LABORATORY ANALYTICAL RESULTS
ANNUAL GROUNDWATER REPORT

PARAMETER		Units	Upgradient Well	Downgradient Wells				Groundwater Protection Standard
			PZ-1 ⁺	MW-1	MW-1 ⁽¹⁾	MW-2	MW-3	Maximum Contaminant Level ^[2]
			1/10/18	1/10/18	1/10/18	1/10/18	1/10/18	
APPENDIX IV TO CFR PART 257	Antimony	mg/L	0.0025	0.00022	0.00019	ND	ND	0.006
	Arsenic	mg/L	0.045	0.023	0.022	0.0018	ND	0.01
	Barium	mg/L	0.045	0.34	0.33	0.2	0.034	2
	Beryllium	mg/L	ND	ND	ND	ND	0.00016	0.004
	Cadmium	mg/L	0.00015	ND	ND	ND	ND	0.005
	Chromium	mg/L	0.0067	ND	ND	0.00088	ND	0.1
	Cobalt	mg/L	0.0009	0.00042	0.00039	0.00035	0.00048	—
	Fluoride*	mg/L	1.4	ND	ND	ND	ND	4
	Lead	mg/L	0.044	ND	ND	ND	ND	0.015
	Lithium	mg/L	0.0034	0.14	0.13	0.0094	ND	—
	Mercury	mg/L	0.0001	0.000052	0.000055	0.00003	0.00003	0.002
	Molybdenum	mg/L	0.12	0.0021	0.0022	0.00037	0.00036	—
	Selenium	mg/L	0.0019	ND	ND	ND	ND	0.05
	Thallium	mg/L	ND	ND	ND	ND	ND	0.002
APPENDIX III TO CFR PART 257	Boron	mg/L	0.23	1.1	1.1	0.69	0.79	—
	Calcium	mg/L	38	140	130	81	320	—
	Chloride	mg/L	91	280	300	56	200	250 ^[3]
	Fluoride*	mg/L	1.4	ND	ND	ND	ND	4
	pH	s.u.	8.35	6.84	6.89	7.08	6.4	6.5-8.5
	Sulfate	mg/L	18	62	57	ND	1200	250 ^[3]
	Total Dissolved Solids	mg/L	1200	1100	980	1300	2300	500 ^[3]

1) Duplicate Sample

2) Maximum Contaminant Level (MCL) promulgated by the USEPA pursuant to the provisions of Section 1412 of the Safe Drinking Water Act (40 CFR 141.151)

3) Secondary drinking water standards established for aesthetic purposes

4) ⁺ - PZ-1 was previously identified and sampled with the MW-7 identifier.

ND = parameter not detected at or above laboratory method detection limit

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A NEYER, TISEO & HINDO COMPANY

41780 SIX MILE ROAD • NORTHVILLE, MI 48168

LOG OF WELL INSTALLATION

PROJECT NAME: HOLLAND BPW

PROJECT NO: 73-160017

DATE : 11/27/2017

WELL NUMBER: MW-1

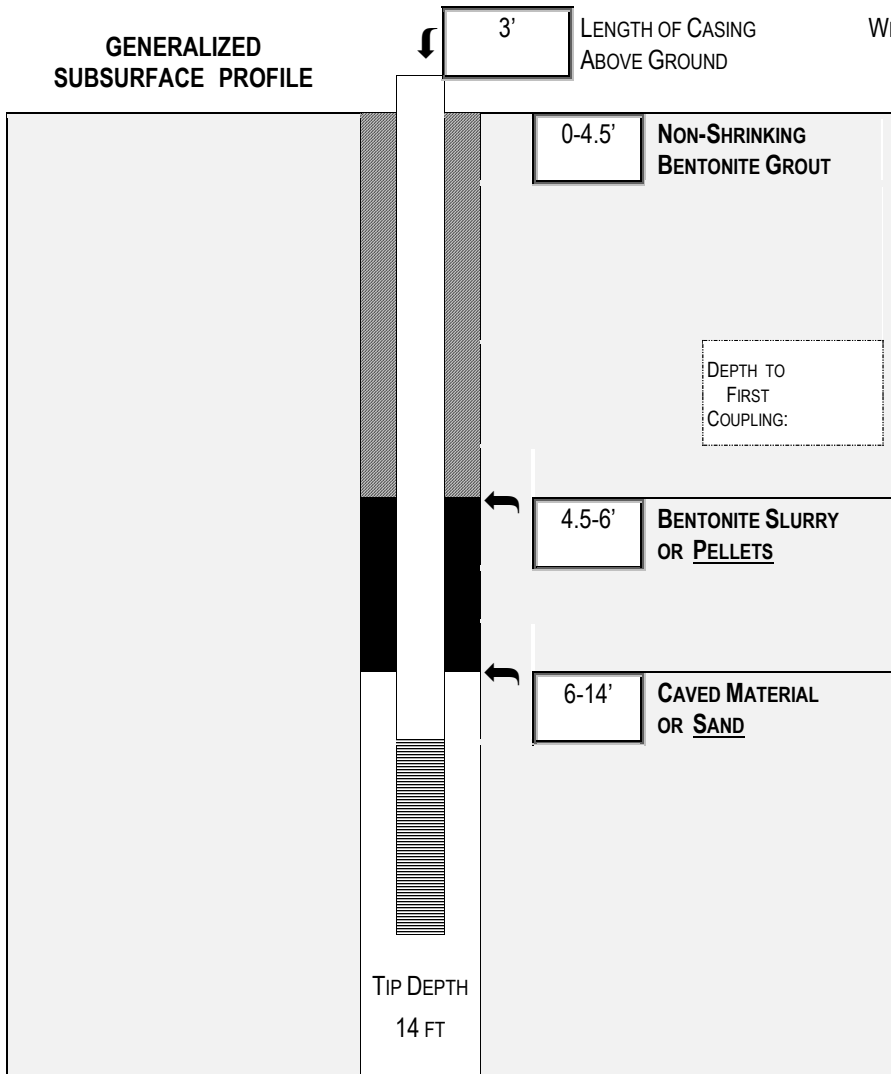
DATES OF INSTALLATION: 11/27/2017

TOP OF CASING ELEVATION: 588.53

GROUND SURFACE ELEVATION: 585.21

WELL SCREEN TIP ELEVATION: 571.21

GENERALIZED SUBSURFACE PROFILE



WELL CASING

DIAMETER: 2IN
TOTAL LENGTH: 12'
MATERIAL: SCH 40 PVC
CAP? (Y/N): YES

WELL SCREEN

DIAMETER: 2IN
LENGTH: 5'
MESH: 0.010'
MATERIAL: SCH 40 PVC
PLUG? (Y/N): YES

PROTECTIVE CASING

MATERIAL: STEEL
DIAMETER: 4IN SQUARE
TOTAL LENGTH: 4.5'
LENGTH ABOVE GROUND: 3'
LOCK? (Y/N): YES

INSPECTOR: COURTNEY DANIOT & MIKE McNAMARA

CONTRACTOR: WEST MICHIGAN DRILLING

DRILLER: GARRICC STRAUCH

EQUIPMENT: CME 550 OFF ROAD

WELL TYPE: 2IN MONITORING

FIELD NOTES

BAGS OF SAND: 2.5

BAGS OF CEMENT: N/A

LBS OF BENTONITE: PELLETS OR POWDER

OTHER WELL MATERIALS: _____

WATER LEVEL INFORMATION

DATE	ELEVATION/COMMENT
11/28/17	6.18

FINAL LOG NOTES

N: 476261.95 – E: 12654179.45

CHECKED BY: MRM

NTH CONSULTANTS, LTD.

A NEYER, TISEO & HINDO COMPANY

41780 SIX MILE ROAD Φ NORTHVILLE, MI 48168

LOG OF WELL INSTALLATION

PROJECT NAME: HOLLAND BPW

PROJECT No: 73-160017

DATE : 11/28/2017

WELL NUMBER: MW-2

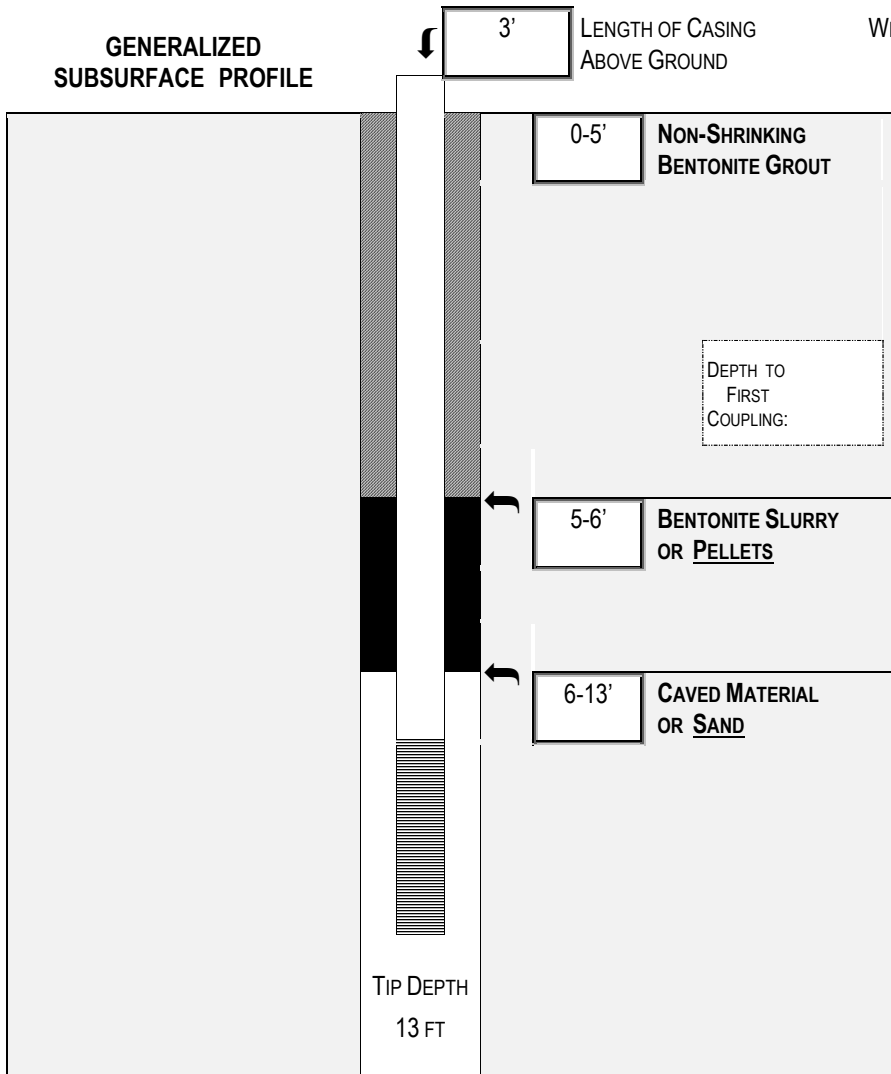
DATES OF INSTALLATION: 11/28/2017

TOP OF CASING ELEVATION: 585.49

GROUND SURFACE ELEVATION: 582.54

WELL SCREEN TIP ELEVATION: 569.54

GENERALIZED SUBSURFACE PROFILE



WELL CASING

DIAMETER: 2IN
TOTAL LENGTH: 11'
MATERIAL: SCH 40 PVC
CAP? (Y/N): YES

WELL SCREEN

DIAMETER: 2IN
LENGTH: 5'
MESH: 0.010'
MATERIAL: SCH 40 PVC
PLUG? (Y/N): YES

PROTECTIVE CASING

MATERIAL: STEEL
DIAMETER: 4IN SQUARE
TOTAL LENGTH: 4.5'
LENGTH ABOVE GROUND: 3'
LOCK? (Y/N): YES

INSPECTOR: COURTNEY DANIOT & MIKE McNAMARA

CONTRACTOR: WEST MICHIGAN DRILLING

DRILLER: GARRICC STRAUCH

EQUIPMENT: CME 550 OFF ROAD

WELL TYPE: 2IN MONITORING

FIELD NOTES

BAGS OF SAND: 2.5

BAGS OF CEMENT: N/A

LBS OF BENTONITE: PELLETS OR POWDER

OTHER WELL MATERIALS: _____

WATER LEVEL INFORMATION

DATE	ELEVATION/COMMENT
11/28/17	3.99

FINAL LOG NOTES

N: 476290.81 – E: 12653897.91

CHECKED BY: MRM

NTH CONSULTANTS, LTD.

A NEYER, TISEO & HINDO COMPANY

41780 SIX MILE ROAD • NORTHVILLE, MI 48168

LOG OF WELL INSTALLATION

PROJECT NAME: HOLLAND BPW

PROJECT NO: 73-160017

DATE : 11/27/2017

WELL NUMBER: MW-3

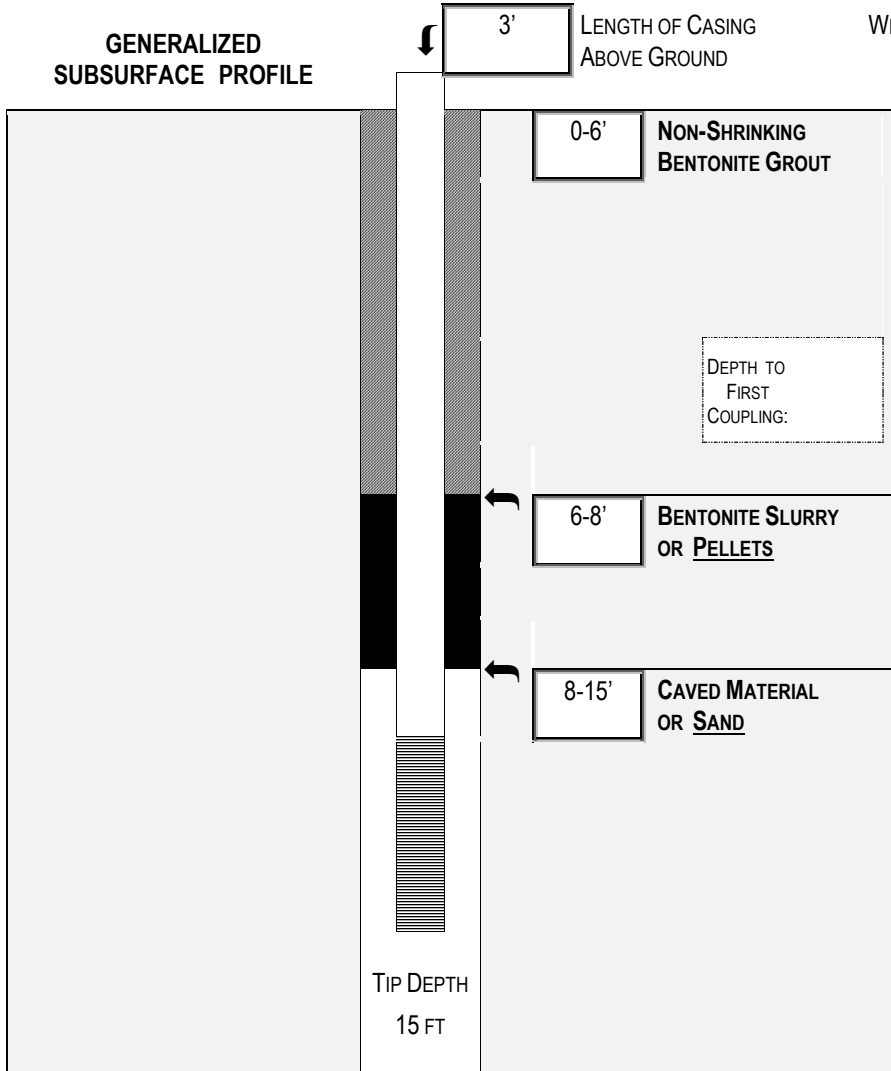
DATES OF INSTALLATION: 11/27/2017

TOP OF CASING ELEVATION: 585.30

GROUND SURFACE ELEVATION: 581.98

WELL SCREEN TIP ELEVATION: 566.98

GENERALIZED SUBSURFACE PROFILE



WELL CASING

DIAMETER: 2IN
TOTAL LENGTH: 13'
MATERIAL: SCH 40 PVC
CAP? (Y/N): YES

WELL SCREEN

DIAMETER: 2IN
LENGTH: 5'
MESH: 0.010'
MATERIAL: SCH 40 PVC
PLUG? (Y/N): YES

PROTECTIVE CASING

MATERIAL: STEEL
DIAMETER: 4IN SQUARE
TOTAL LENGTH: 4.5'
LENGTH ABOVE GROUND: 3'
LOCK? (Y/N): YES

INSPECTOR: COURTNEY DANIOT & MIKE McNAMARA

CONTRACTOR: WEST MICHIGAN DRILLING

DRILLER: GARRICC STRAUCH

EQUIPMENT: CME 550 OFF ROAD

WELL TYPE: 2IN MONITORING

FIELD NOTES

BAGS OF SAND: 3

BAGS OF CEMENT: N/A

LBS OF BENTONITE: PELLETS OR POWDER

OTHER WELL MATERIALS: _____

WATER LEVEL INFORMATION

DATE	ELEVATION/COMMENT
11/28/17	4.55

FINAL LOG NOTES

N: 476607.46 – E: 12654048.16

CHECKED BY: MRM

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.

Project: Holland Board of Public Works (73-160017-04)

Sample ID: MW-3

Collection Date: 1/10/2018 01:50 PM

Work Order: 1801438

Lab ID: 1801438-01

Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	U		0.000030	0.00020	mg/L	1	1/24/2018 15:45
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	U		0.00017	0.0050	mg/L	1	1/18/2018 20:31
Arsenic	U		0.00087	0.0050	mg/L	1	1/18/2018 20:31
Barium	0.034		0.0022	0.0050	mg/L	1	1/19/2018 14:14
Beryllium	0.00016	J	0.00012	0.0020	mg/L	1	1/18/2018 20:31
Boron	0.79		0.0018	0.020	mg/L	1	1/18/2018 20:31
Cadmium	U		0.000050	0.0020	mg/L	1	1/18/2018 20:31
Calcium	320		0.86	5.0	mg/L	10	1/19/2018 14:19
Chromium	U		0.00065	0.0050	mg/L	1	1/18/2018 20:31
Cobalt	0.00048	J	0.00014	0.0050	mg/L	1	1/18/2018 20:31
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:31
Lithium	U		0.037	1.0	mg/L	100	1/22/2018 13:11
Molybdenum	0.00036	J	0.00031	0.0050	mg/L	1	1/18/2018 20:31
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:31
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:31
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	200	J	56	1,000	mg/L	100	1/12/2018 13:39
Fluoride	U		9.3	10	mg/L	10	1/12/2018 13:20
Sulfate	1,200		220	1,000	mg/L	100	1/12/2018 13:39
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	6.40		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	2,300		12	20	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.

Project: Holland Board of Public Works (73-160017-04)

Sample ID: MW-2

Collection Date: 1/10/2018 03:20 PM

Work Order: 1801438

Lab ID: 1801438-02

Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	U		0.000030	0.00020	mg/L	1	1/24/2018 15:53
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	U		0.00017	0.0050	mg/L	1	1/18/2018 20:36
Arsenic	0.0018	J	0.00087	0.0050	mg/L	1	1/18/2018 20:36
Barium	0.20		0.0022	0.0050	mg/L	1	1/18/2018 20:36
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:36
Boron	0.69		0.0018	0.020	mg/L	1	1/18/2018 20:36
Cadmium	U		0.000050	0.0020	mg/L	1	1/18/2018 20:36
Calcium	81		0.086	0.50	mg/L	1	1/18/2018 20:36
Chromium	0.00088	J	0.00065	0.0050	mg/L	1	1/18/2018 20:36
Cobalt	0.00035	J	0.00014	0.0050	mg/L	1	1/18/2018 20:36
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:36
Lithium	0.0094	J	0.0037	0.10	mg/L	10	1/22/2018 13:16
Molybdenum	0.00037	J	0.00031	0.0050	mg/L	1	1/18/2018 20:36
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:36
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:36
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	56		2.8	50	mg/L	5	1/12/2018 14:56
Fluoride	U		4.6	5.0	mg/L	5	1/12/2018 13:58
Sulfate	U		11	50	mg/L	5	1/12/2018 13:58
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	7.08		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	1,300		12	20	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.
Project: Holland Board of Public Works (73-160017-04)
Sample ID: Equipment Blank
Collection Date: 1/10/2018 03:30 PM

Work Order: 1801438
Lab ID: 1801438-03
Matrix: WATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	U		0.000030	0.00020	mg/L	1	1/24/2018 15:56
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	U		0.00017	0.0050	mg/L	1	1/18/2018 20:38
Arsenic	U		0.00087	0.0050	mg/L	1	1/18/2018 20:38
Barium	U		0.0022	0.0050	mg/L	1	1/19/2018 14:26
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:38
Boron	0.0089	J	0.0018	0.020	mg/L	1	1/18/2018 20:38
Cadmium	0.00023	J	0.000050	0.0020	mg/L	1	1/18/2018 20:38
Calcium	0.10	J	0.086	0.50	mg/L	1	1/18/2018 20:38
Chromium	U		0.00065	0.0050	mg/L	1	1/18/2018 20:38
Cobalt	U		0.00014	0.0050	mg/L	1	1/18/2018 20:38
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:38
Lithium	U		0.00037	0.010	mg/L	1	1/19/2018 14:26
Molybdenum	U		0.00031	0.0050	mg/L	1	1/18/2018 20:38
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:38
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:38
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	U		0.56	10	mg/L	1	1/12/2018 15:15
Fluoride	U		0.93	1.0	mg/L	1	1/12/2018 15:15
Sulfate	U		2.2	10	mg/L	1	1/12/2018 15:15
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	7.29		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	U		6.1	10	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.
Project: Holland Board of Public Works (73-160017-04)
Sample ID: Field Blank
Collection Date: 1/10/2018 03:40 PM

Work Order: 1801438
Lab ID: 1801438-04
Matrix: WATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	U		0.000030	0.00020	mg/L	1	1/24/2018 15:58
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	U		0.00017	0.0050	mg/L	1	1/18/2018 20:39
Arsenic	U		0.00087	0.0050	mg/L	1	1/18/2018 20:39
Barium	U		0.0022	0.0050	mg/L	1	1/19/2018 14:27
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:39
Boron	U		0.0018	0.020	mg/L	1	1/18/2018 20:39
Cadmium	0.00025	J	0.000050	0.0020	mg/L	1	1/18/2018 20:39
Calcium	0.10	J	0.086	0.50	mg/L	1	1/18/2018 20:39
Chromium	U		0.00065	0.0050	mg/L	1	1/18/2018 20:39
Cobalt	U		0.00014	0.0050	mg/L	1	1/18/2018 20:39
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:39
Lithium	U		0.00037	0.010	mg/L	1	1/19/2018 14:27
Molybdenum	U		0.00031	0.0050	mg/L	1	1/18/2018 20:39
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:39
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:39
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	U		0.56	10	mg/L	1	1/12/2018 15:34
Fluoride	U		0.93	1.0	mg/L	1	1/12/2018 15:34
Sulfate	U		2.2	10	mg/L	1	1/12/2018 15:34
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	6.84		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	U		6.1	10	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.

Project: Holland Board of Public Works (73-160017-04)

Sample ID: MW-1

Collection Date: 1/10/2018 04:25 PM

Work Order: 1801438

Lab ID: 1801438-05

Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	0.000052	J	0.000030	0.00020	mg/L	1	1/24/2018 16:01
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	0.00022	J	0.00017	0.0050	mg/L	1	1/18/2018 20:45
Arsenic	0.023		0.00087	0.0050	mg/L	1	1/18/2018 20:45
Barium	0.34		0.0022	0.0050	mg/L	1	1/18/2018 20:45
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:45
Boron	1.1		0.018	0.20	mg/L	10	1/22/2018 13:17
Cadmium	U		0.000050	0.0020	mg/L	1	1/18/2018 20:45
Calcium	140		0.086	0.50	mg/L	1	1/18/2018 20:45
Chromium	U		0.00065	0.0050	mg/L	1	1/18/2018 20:45
Cobalt	0.00042	J	0.00014	0.0050	mg/L	1	1/18/2018 20:45
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:45
Lithium	0.14		0.0037	0.10	mg/L	10	1/22/2018 13:17
Molybdenum	0.0021	J	0.00031	0.0050	mg/L	1	1/18/2018 20:45
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:45
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:45
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	280		14	250	mg/L	25	1/15/2018 12:26
Fluoride	U		0.93	1.0	mg/L	1	1/15/2018 12:07
Sulfate	62	J	54	250	mg/L	25	1/15/2018 12:26
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	6.84		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	1,100		12	20	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.

Project: Holland Board of Public Works (73-160017-04)

Sample ID: PZ-1

Collection Date: 1/10/2018 04:50 PM

Work Order: 1801438

Lab ID: 1801438-06

Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	0.00010	J	0.000030	0.00020	mg/L	1	1/24/2018 16:03
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	0.0025	J	0.00017	0.0050	mg/L	1	1/18/2018 20:47
Arsenic	0.045		0.00087	0.0050	mg/L	1	1/18/2018 20:47
Barium	0.045		0.0022	0.0050	mg/L	1	1/19/2018 15:20
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:47
Boron	0.23		0.0018	0.020	mg/L	1	1/19/2018 15:20
Cadmium	0.00015	J	0.000050	0.0020	mg/L	1	1/18/2018 20:47
Calcium	38		0.086	0.50	mg/L	1	1/18/2018 20:47
Chromium	0.0067		0.00065	0.0050	mg/L	1	1/18/2018 20:47
Cobalt	0.00090	J	0.00014	0.0050	mg/L	1	1/18/2018 20:47
Lead	0.044		0.00033	0.0050	mg/L	1	1/18/2018 20:47
Lithium	0.0034	J	0.00037	0.010	mg/L	1	1/19/2018 15:20
Molybdenum	0.12		0.00031	0.0050	mg/L	1	1/18/2018 20:47
Selenium	0.0019	J	0.00090	0.0050	mg/L	1	1/18/2018 20:47
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:47
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	91	J	5.6	100	mg/L	10	1/15/2018 13:04
Fluoride	1.4		0.93	1.0	mg/L	1	1/15/2018 12:45
Sulfate	18		2.2	10	mg/L	1	1/15/2018 12:45
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	8.35		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	1,200		12	20	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

ALS Group, USA

Date: 26-Jan-18

Client: NTH Consultants, Ltd.

Project: Holland Board of Public Works (73-160017-04)

Sample ID: Field Duplicate

Collection Date: 1/10/2018

Work Order: 1801438

Lab ID: 1801438-07

Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY BY CVAA							
			Method: SW7470A		Prep: SW7470 / 1/24/18		Analyst: RSH
Mercury	0.000055	J	0.000030	0.00020	mg/L	1	1/24/2018 16:14
METALS BY ICP-MS							
			Method: SW6020A		Prep: SW3005A / 1/16/18		Analyst: JF
Antimony	0.00019	J	0.00017	0.0050	mg/L	1	1/18/2018 20:49
Arsenic	0.022		0.00087	0.0050	mg/L	1	1/18/2018 20:49
Barium	0.33		0.0022	0.0050	mg/L	1	1/18/2018 20:49
Beryllium	U		0.00012	0.0020	mg/L	1	1/18/2018 20:49
Boron	1.1		0.0018	0.020	mg/L	1	1/19/2018 15:21
Cadmium	U		0.000050	0.0020	mg/L	1	1/18/2018 20:49
Calcium	130		0.086	0.50	mg/L	1	1/18/2018 20:49
Chromium	U		0.00065	0.0050	mg/L	1	1/18/2018 20:49
Cobalt	0.00039	J	0.00014	0.0050	mg/L	1	1/18/2018 20:49
Lead	U		0.00033	0.0050	mg/L	1	1/18/2018 20:49
Lithium	0.13		0.00037	0.010	mg/L	1	1/19/2018 15:21
Molybdenum	0.0022	J	0.00031	0.0050	mg/L	1	1/18/2018 20:49
Selenium	U		0.00090	0.0050	mg/L	1	1/18/2018 20:49
Thallium	U		0.00016	0.0050	mg/L	1	1/18/2018 20:49
ANIONS BY ION CHROMATOGRAPHY							
			Method: E300.0				Analyst: EE
Chloride	300		14	250	mg/L	25	1/15/2018 13:43
Fluoride	U		0.93	1.0	mg/L	1	1/15/2018 13:23
Sulfate	57	J	54	250	mg/L	25	1/15/2018 13:43
PH (LABORATORY)							
			Method: A4500-H B-11				Analyst: ED
pH (laboratory)	6.89		0.10	0.100	s.u.	1	1/12/2018 14:20
TOTAL DISSOLVED SOLIDS							
			Method: A2540 C-11		Prep: FILTER / 1/17/18		Analyst: MT
Total Dissolved Solids	980		12	20	mg/L	1	1/17/2018 13:13

Note: See Qualifiers page for a list of qualifiers and their definitions.

PRELIMINARY

APPENDIX



1. Groundwater Sampling Data



GROUNDWATER SAMPLE COLLECTION LOG

GENERAL INFORMATION

Project Name: JDY PP HOLLAND BFW Date: 01-10-2018
Project #: 73-160017-04 Field Personnel: P. HEROUT
Site Location: HOLLAND MI Well Const.: SCH 40 PVC
Well ID: MW-1 Casing Diameter: 2.0"
Sample ID: MW-1 Screened Interval: 9.0'-14.0' Bas
(ft. from TOC) (12.0' - 17.0')

PURGING DATA

Time: 10:50 Start: 10:50 Finish: 12:50

Purging Volume	Casing Diameter (in)	Casing Vol. Gal./Ft.	3 Casing Vol. Gal./Ft.
Depth to Water (ft. from TOC) = <u>6.6</u>	1.5	0.10	0.30
Total Well Depth (ft. from TOC) = <u>16.93</u>	2	0.16	0.48
Height of Water in Well (ft.) = <u>10.33</u>	3	0.36	1.08
One Well Volume (gallons) = <u>1.65</u>	4	0.63	1.89

Gallons Purged: ≈ 5.0 (4.95) Purging Method: PERISTALTIC
Well Volumes Purged: 3 Purging Rate (gal./min.) 0.25
Was Well Purged Dry? Yes ~ No ~

FIELD MONITORING PARAMETERS

Accum. Volume Purged (gal)	<u>≈ 1.2 gal</u> <u>4:00 PM</u>	<u>1.25 gal</u> <u>4:05 PM</u>	<u>2.5 gal</u> <u>4:10 PM</u>	<u>3.75 gal</u> <u>4:15 PM</u>	<u>5.0 gal</u> <u>4:20 PM</u>	FINAL SAMPLE ^{4:25}
pH (STU)	<u>6.83</u>	<u>6.81</u>	<u>6.82</u>	<u>6.83</u>	<u>6.84</u>	<u>6.83</u>
Temperature (C)	<u>6.9</u>	<u>6.8</u>	<u>6.9</u>	<u>6.9</u>	<u>6.8</u>	<u>6.8</u>
Conductivity (umhos)	<u>1899</u>	<u>1906</u>	<u>1894</u>	<u>1906</u>	<u>1896</u>	<u>1898</u>
ORP (mv)	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Dissolved Oxygen (ppm)	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Appearance/Color	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Odor	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Turbidity (NTu)	<u>2.3</u>	<u>5.4</u>	<u>7.3</u>	<u>11.4</u>	<u>15.7</u>	<u>16.3</u>

SAMPLING DATA

Time: Start: 4:25 Finish: 4:30

Sample Collection Device: PERISTALTIC

Pump Rate (gpm): 0.2 Packer Used? Yes ~ No ~

Sample Collection Depth (ft. from TOC): ≈ 12.0 FT

Weather Conditions: OVERCAST/RAIN/SNOW Air Temperature (F): 26-38°F
Wind Speed/Direction: 0-10 MPH
Other: NA



GROUNDWATER SAMPLE COLLECTION LOG

GENERAL INFORMATION

Project Name: JDY PP HOLLAND BPW Date: 01-10-2019
Project #: 73-160017-04 Field Personnel: P. HEROUT
Site Location: HOLLAND, MI Well Const.: SCH 40 PVC
Well ID: MW-2 Casing Diameter: 2.0"
Sample ID: MW-2 Screened Interval: 8.0'-13.0' BGS
(ft. from TOC) (14.0' - 19.0')

PURGING DATA

Time:	Start: <u>2:30</u>	Finish: <u>3:15</u>	
Purging Volume	Casing Diameter (in)	Casing Vol. Gal./Ft.	3 Casing Vol. Gal./Ft.
Depth to Water (ft. from TOC) = <u>4.4</u>	1.5	0.10	0.30
Total Well Depth (ft. from TOC) = <u>16.2</u>	2	0.16	0.48
Height of Water in Well (ft.) = <u>11.8</u>	3	0.36	1.08
One Well Volume (gallons) = <u>1.88</u>	4	0.63	1.89
Gallons Purged: <u>~5.70 (5.66)</u>	Purging Method: <u>PERISTALTIC</u>		
Well Volumes Purged: <u>3</u>	Purging Rate (gal./min.) <u>0.13</u>		
Was Well Purged Dry? Yes ~ <u>No</u>			

FIELD MONITORING PARAMETERS

Accum. Volume Purged (gal)	<u>2:30 0</u>	<u>0.65</u>	<u>1.3</u>	<u>1.95</u>	<u>2.6</u>	FINAL <u>5.8</u>
pH (STU)	<u>6.95</u>	<u>6.97</u>	<u>6.97</u>	<u>6.96</u>	<u>6.95</u>	<u>6.98</u>
Temperature (C)	<u>7.6</u>	<u>7.5</u>	<u>7.6</u>	<u>7.7</u>	<u>7.8</u>	<u>8.1</u>
Conductivity (umhos)	<u>2560</u>	<u>2559</u>	<u>2562</u>	<u>2560</u>	<u>2558</u>	<u>2557</u>
ORP (mv)	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Dissolved Oxygen (ppm)	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Appearance/Color	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Odor	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Turbidity (NTu)	<u>50</u>	<u>54</u>	<u>130</u>	<u>180</u>	<u>204</u>	<u>310</u>

SAMPLING DATA

Time:	Start: <u>3:20</u>	Finish: <u>3:25</u>
Sample Collection Device: <u>PERISTALTIC</u>		
Pump Rate (gpm): <u>0.23</u>	Packer Used? Yes ~ No ~	
Sample Collection Depth (ft. from TOC): <u>13 FT</u>		
Weather Conditions: <u>OVERCAST / RAIN / SNOW</u>	Air Temperature (F): <u>26-38°F</u>	
	Wind Speed/Direction: <u>0-10 mph S</u>	
	Other: <u>NA</u>	



GROUNDWATER SAMPLE COLLECTION LOG

GENERAL INFORMATION

Project Name: JDY PP HOLLAND BPW Date: 01-10-2019
 Project #: 73-160017-04 Field Personnel: P. HEROUT
 Site Location: HOLLAND, MI Well Const.: SCH 40 PVC
 Well ID: MW-3 Casing Diameter: 2.0"
 Sample ID: MW-3 Screened Interval: 10.0'-15.0' BGS
 (ft. from TOC) (13.0'-18.0')

PURGING DATA

Time: 40 min Start: 1:00 Finish: 1:40

Purging Volume	Casing Diameter (in)	Casing Vol. Gal./Ft.	3 Casing Vol. Gal./Ft.
Depth to Water (ft. from TOC) = <u>4.8'</u>	1.5	0.10	0.30
Total Well Depth (ft. from TOC) = <u>18.2'</u>	2	0.16	0.48
Height of Water in Well (ft.) = <u>13.4'</u>	3	0.36	1.08
One Well Volume (gallons) = <u>2.14</u>	4	0.63	1.89

Gallons Purged: ≈ 6.5 (6.43) Purging Method: PERISTALTIC
 Well Volumes Purged: 3 Purging Rate (gal./min.) 0.16
 Was Well Purged Dry? Yes ~ No

FIELD MONITORING PARAMETERS

Accum. Volume Purged (gal)	1:07	1:12	1:17	1:22	1:27	FINAL SAMPLE 1:40
pH (STU)	6.19	6.18	6.17	6.16	6.15	6.14
Temperature (C)	10.5	10.6	10.6	10.8	10.8	10.8
Conductivity (umhos)	3131	3130	3130	3133	3132	3135
ORP (mv)	—	—	—	—	—	—
Dissolved Oxygen (ppm)	—	—	—	—	—	—
Appearance/Color	—	—	—	—	—	—
Odor	—	—	—	—	—	—
Turbidity (NTu)	100	86	70	63	55	48

SAMPLING DATA

Time: Start: 1:40 Finish: 1:55

Sample Collection Device: _____

Pump Rate (gpm): 0.15 Packer Used? Yes ~ No ~

Sample Collection Depth (ft. from TOC): ≈ 15.0'

Weather Conditions: OVERCAST / RAIN / SNOW Air Temperature (F): 26-33°F
 Wind Speed/Direction: 0-10 MPH S
 Other: NA



GROUNDWATER SAMPLE COLLECTION LOG

GENERAL INFORMATION

Project Name: JDY RP HOLLAND BPW Date: 01-10-2018
Project #: 73-160017-04 Field Personnel: P. HEROUT
Site Location: HOLLAND ME Well Const.: PVC
Well ID: PZ-1 Casing Diameter: 2"
Sample ID: PZ-1 Screened Interval: BOTTOM, NA
(ft. from TOC) NA

PURGING DATA

Time:	Start:	Finish:	
Purging Volume	Casing Diameter (in)	Casing Vol. Gal./Ft.	3 Casing Vol. Gal./Ft.
Depth to Water (ft. from TOC) = <u>10.3</u>	<u>1.5</u>	<u>0.10</u>	<u>0.30</u>
Total Well Depth (ft. from TOC) = <u>13.6</u>	<u>2</u>	<u>0.16</u>	<u>0.48</u>
Height of Water in Well (ft.) = <u>3.3</u>	<u>3</u>	<u>0.36</u>	<u>1.08</u>
One Well Volume (gallons) = <u>0.528</u>	<u>4</u>	<u>0.63</u>	<u>1.89</u>
Gallons Purged: <u>1.6 (1.58)</u>	Purging Method: <u>PERISTALTIC</u>		
Well Volumes Purged: <u>3</u>	Purging Rate (gal./min.) <u>0.13</u>		
Was Well Purged Dry? Yes ~ <u>No</u>	DRAW DOWN EXCEEDED PLAN LOW FLOW EXCEEDED DRAW-DOWN, PURGE 3 VOL, RETURN IN PM. SPOLS. → 3X, RETURN TO SAMPLE		

FIELD MONITORING PARAMETERS

Accum. Volume Purged (gal)	<u>0.5 GAL</u>	<u>1.5 GAL</u>				FINAL SAMPLE
pH (STU)	<u>8.2</u>	<u>8.2</u>				
Temperature (C)	<u>5.7</u>	<u>10.2</u>				
Conductivity (umhos)	<u>1876</u>	<u>1938</u>				
ORP (mv)						
Dissolved Oxygen (ppm)						
Appearance/Color						
Odor						
Turbidity (NTu)	<u>9.7</u>	<u>30.9</u>				

SAMPLING DATA

Time: Start: <u>4:40</u> Finish: <u>4:50</u>	
Sample Collection Device: <u>PERISTALTIC</u>	
Pump Rate (gpm): <u>0.25 ±</u>	Packer Used? Yes ~ No ~
Sample Collection Depth (ft. from TOC): <u>≈ 11.5 FT RAS</u>	
Weather Conditions: <u>OVERCAST/RAIN/SNOW</u>	Air Temperature (F): <u>26-38°F</u>
	Wind Speed/Direction: <u>0-10 mph S</u>
	Other: <u>NA</u>