NIPSCO
A NiSource Company

October 30, 2020

Submitted via email

Mr. Andrew Wheeler, Administrator US EPA
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

Re: Northern Indiana Public Service Company (NIPSCO)
RM Schahfer Generating Station
Wheatfield, IN
Demonstration of Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain

Dear Administrator Wheeler:

Northern Indiana Public Service Company (NIPSCO) is providing the enclosed *Demonstration of Site-Specific Alternative Deadline to Initiate Closure of CCR Surface Impoundment Due to Permanent Cessation of Coal-Fired Boilers by a Date Certain* (Demonstration) as provided in 257.103(f)(2), for approval by the U.S. Environmental Protection Agency (US EPA). Approval of this Demonstration by US EPA will allow NIPSCO to continue use of an ash pond located at the RM Schahfer Generating Station located in Wheatfield, IN, after April 11, 2021. The approximately 80-acre pond will complete closure no later than October 17, 2028, as provided in the enclosed Demonstration.

Following US EPA guidance, the Demonstration was submitted via email to Richard Huggins, Frank Behan and Kirsten Hillyer. The Demonstration has been formatted with Adobe Acrobat and makes use of the navigation tool bookmark feature to assist in navigating within the document. With the bookmark viewing pane open the user can survey content and easily navigate between sections of the report, tables, figures and appendices. I may be contacted at (219) 680-8628 or mturman@nisource.com with questions or comments regarding the Demonstration. I look forward to hearing from you soon.

Sincerely,

Maureen Turman

Maureen Turman
NiSource Director Environmental Policy and Sustainability

Enclosure

CC: Richard Huggins, US EPA
Frank Behan, US EPA
Kirsten Hillyer, US EPA

GOLDER

Northern Indiana Public Service Company LLC
R.M. Schahfer Generating Station
Wheatfield, Indiana

Demonstration of Site-Specific Alternative Deadline to Initiate Closure of CCR Surface Impoundment Due to Permanent Cessation of Coal-Fired Boilers by a Date Certain

Pursuant to 40 CFR Part 257.103(f)(2)

Submitted to:

Northern Indiana Public Service Company LLC
801 East 86th Avenue
Merrillville, IN 46410

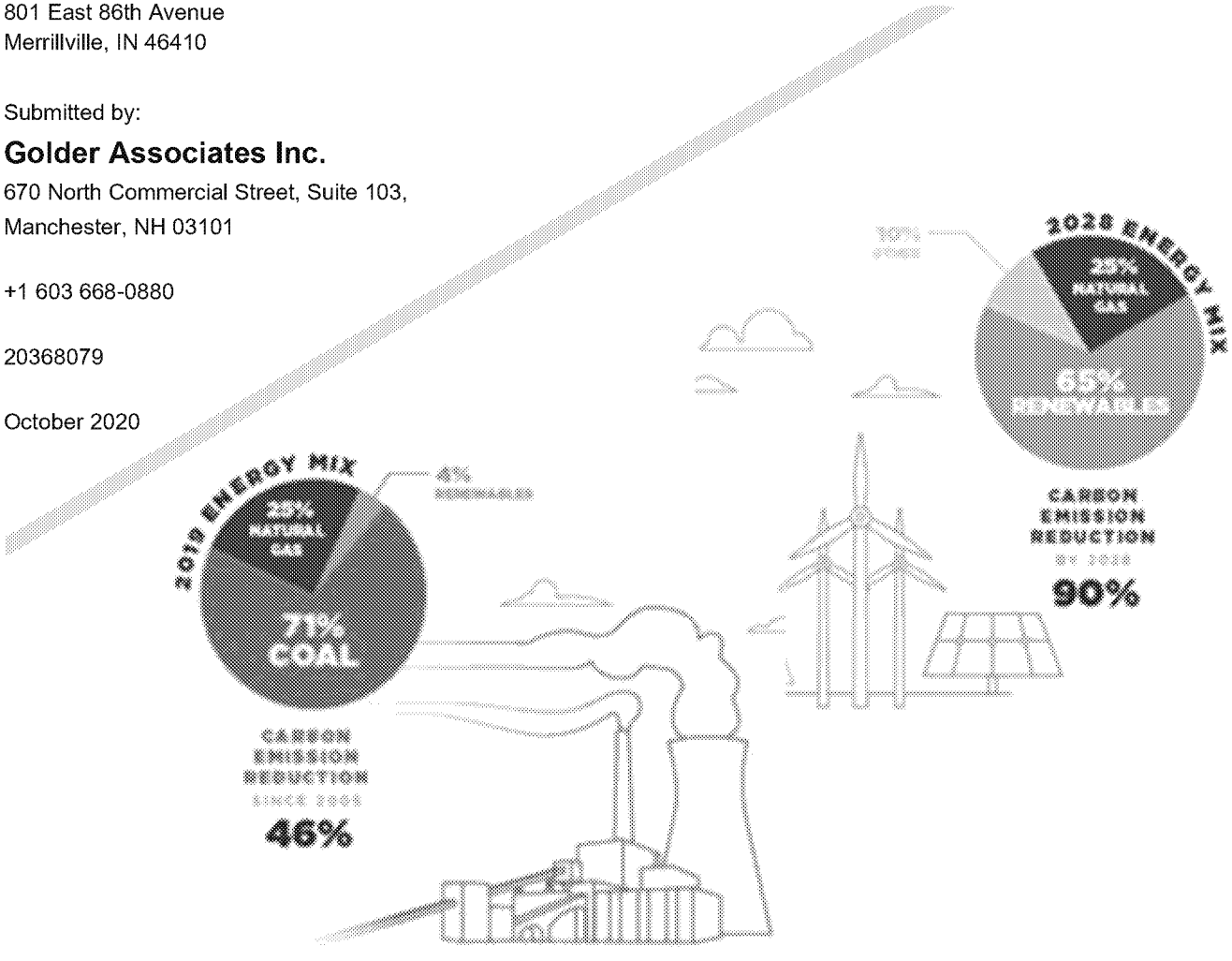
Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103,
Manchester, NH 03101

+1 603 668-0880

20368079

October 2020



NIPSCO - Leaving things better – YOUR ENERGY, YOUR FUTURE

EXECUTIVE SUMMARY

In accordance with the provisions of 40 CFR §257.103(f)(2), permanent cessation of coal-fired boiler(s) by a date certain and alternative deadline to initiate closure of coal combustion residuals (CCR) surface impoundment(s), Northern Indiana Public Service Company LLC (NIPSCO LLC) R. M. Schahfer Generating Station (RMSGS, Site) is presenting this "NIPSCO LLC RMSGS Demonstration of Site-specific Alternative Deadline to Initiate Closure of CCR Surface Impoundment Due to Permanent Cessation of Coal-Fired Boilers by a Date Certain" (hereinafter Demonstration) for review and approval by the United States Environmental Protection Agency (U.S. EPA). Golder Associates Inc. (Golder) prepared the Demonstration in collaboration with and on behalf of NIPSCO LLC. Due to a lack of alternative disposal options on- and off-Site for the high-volume waste streams generated by RMSGS, the Demonstration substantiates the basis for continued receipt and management of CCR and/or non-CCR influent in RMSGS' single remaining operational CCR surface impoundment beyond the otherwise mandatory April 11, 2021 cease receipt and initiate closure deadline.

To meet existing grid reliability-related electricity supply needs in accordance with the requirements of the Midcontinent Independent System Operator (MISO), NIPSCO LLC is planning to operate RMSGS until 2023 when permanent shutdown of coal-fired electricity generation is scheduled. As outlined herein, RMSGS' ability to sustain coal-based generation and to manage the associated power production waste streams is dependent upon continued availability of a single 80-acre CCR surface impoundment referred to as the Waste Disposal Area (WDA). The WDA is the only currently available management option on- and off-Site for several high-volume (e.g., up to 9.1 million gallons per day) influent waste streams until coal-fired generation and production of the residual CCR and non-CCR wastes related to typical power plant operation, shutdown and closure processes cease. Cessation of coal-fired generation is scheduled to begin in Q1 2023 and be completed within six months, providing approximately two and a half years to a) complete boiler shutdown processes, some of which are expected to generate significant volumes of CCR and non-CCR waste streams, b) reduce and/or eliminate other ongoing influent streams, and c) optimize the closure plan and gain regulatory agency approval for the WDA closure approach. Following these steps, NIPSCO estimates a timeframe of approximately three years to achieve final closure of the WDA including the professional engineer's certification, completing it by September 17, 2028.

In accordance with 40 CFR §257.103(f)(2) and the August 28, 2020 preamble to the proposed rulemaking, this Demonstration:

- addresses all applicable Part A regulatory requirements
- demonstrates that qualifying criteria have been met, and
- provides the following information:
  - evaluation of alternative disposal capacity options and availability
  - risk mitigation plan, including potential receptor identification and response(s), to allow continued operation of the WDA should a release occur
  - NIPSCO LLC certification of RMSGS facility-wide CCR Rule compliance
  - WDA-specific geologic/hydrogeologic groundwater monitoring compliance data, and
  - closure plan as required by 40 CFR §257.102(b) and a narrative with justification for a cease receipt of waste date.

Given the compliance and information requirements of 40 CFR §257.103(f)(2), NIPSCO LLC has developed the following reference table/checklist that serves as a reviewer's "roadmap." The checklist identifies all applicable 40 CFR §257.103(f)(2) regulatory requirements being addressed, accompanied by a brief description of the information being provided in the package and the location(s) of requisite supporting data in the Demonstration.

Compliance Check List
Site-Specific Alternative Deadline to Initiate Closure of a CCR Surface Impoundment – 40 CFR Part 257.103(f)(2)

Description									Report Section	Page Number
257	**Criteria for Classification of Solid Waste Disposal Facilities and Practices**									
	103	**Alternative Closure requirements**								
		(a)	CCR Landfills (1) No Alternative CCR Disposal Capacity						N/A	
		(b)	CCR Landfills (1) Permanent Cessation of a Coal-Fired Boiler						N/A	
		(c)	Required Notices and Progress Reports for CCR Landfills						N/A	
		(d)	CCR Landfill Record Keeping						N/A	
		(e)	Reserved						N/A	
		(f)	**Site-Specific Alternative Deadlines to Initiate Closure of CCR Surface Impoundments**							
			(1)	Development of Alternative Capacity is Technically Infeasible					N/A	
			(2)	**Permanent Cessation of a Coal-Fired Boiler by a Certain Date**					Sec 1 and 2	6/12
				(i)	No Alternative Disposal Capacity				Sec 3	17
				(ii)	Mitigation of Potential Risk to Human Health and the Environment				Sec 4	22
				(iii)	Facility Compliance				Sec 5	28
				(iv)	Coal-Fired Boiler Cessation/Impoundment Closure				Sec 2.4/6	15/36
				(v)	Documentation of Criteria Met				Sec 3-6	
					(A)	Alternative Disposal Capacity Narrative of Considerations			Sec 3	17
					(B)	Risk Mitigation Plan			Sec 4	22
						(1)	Measures to Limit Future Releases		Sec 4.1	23
						(2)	Ground Water Monitoring Data/Receptors/Response		Sec 4.2/5.3	24/33
						(3)	Plume Containment Plan		Sec 4.3	28
					(C)	Demonstrate Facility Compliance			Sec 5	28
						(1)	Facility Certification of Compliance		Sec 5.1	29
						(2)	Hydrogeologic Information		Sec 5.2	30
							(i)	Monitoring Well Locations	Sec 5.2.1	32
							(ii)	Well Logs	Sec 5.2.1	32
							(iii)	Groundwater Flow	Sec 5.2	30
						(3)	Tabulated Constituent Concentrations		Sec 5.3	33
						(4)	Site Hydrogeology		Sec 5.2	30
						(5)	Corrective Measures Assessment §257.96		Sec 5.4	35
						(6)	Remedy Selection §257.97(a)		Sec 5.5	35
						(7)	Most Recent Structural Stability Assessment §257.73(d)		Sec 5.6	35
						(8)	Most Recent Safety Factor Assessment §257.73(e)		Sec 5.7	35
					(D)	Closure Plan §257.102(b)			Sec 6	36
				(vi)	Responsibility for Demonstration				Sec 7	36
				(vii)	Recordkeeping, Notification and Posting Compliance §257.105(i), §257.106(i) and §257.107(i)				Sec 7	36
				(viii)	Facility Operating Record of Submission				Sec 7	36
				(ix)	Facility Operating Record of Decision				Sec 7	36
				(x)	Annual Progress Reporting and Posting				Sec 7	36
			(3)	Process to Obtain Authorization						
				(i)	Deadlines for Submission					
					(A)	Feasibility of Alternative Capacity §257.103(f)(1)			N/A	
					(B)	Submitting a New Demonstration of Feasibility			N/A	
					(C)	Demonstration of No Alternative Capacity §257.73(f)(2) – November 30, 2020			N/A	

Table of Contents

1.0 INTRODUCTION 6

1.1 Background 6

1.2 Facility Overview 8

1.3 Generation Role in Midcontinent Independent System Operations 8

1.4 Planned Cessation of Operations 9

1.5 Demonstration Approach and Contents 10

2.0 DESCRIPTION OF CCR UNIT 12

2.1 Construction and Operation 12

2.2 Overview of Waste Streams Managed 12

2.3 CCR Rule Groundwater Monitoring 14

2.4 Cessation of Operation and Closure 15

3.0 EVALUATION OF ALTERNATIVE DISPOSAL CAPACITY, 257.103(F)(2)(V)(A) 17

3.1 Evaluation Criteria 17

3.2 Alternative Disposal Management 18

3.3 Evaluation of Alternatives 20

3.4 Demonstration of Alternative Disposal Capacity 21

4.0 CONTINUED OPERATION RISK MITIGATION PLAN, 257.103(F)(2)(V)(B) 22

4.1 Measures to Limit Future Releases 23

4.2 Groundwater Monitoring Results, Receptors and Mitigation 24

4.2.1 Plume Delineation 24

4.2.2 Identification of Nearby Receptors 26

4.2.3 Potential Receptor Mitigation 27

4.3 Contaminant Plume Containment 28

5.0 CCR RULE REGULATORY COMPLIANCE, 257.103(F)(2)(V)(C) 28

5.1 Certification of Facility Status 29

5.2 Hydrogeologic Information 30

5.2.1 Monitoring System Design 32

5.3 Groundwater Monitoring Results 33

5.3.1 Monitoring Program Status 33

5.4 Corrective Measures Assessment 35

5.5 Remedy Selection 35

5.6 Structural Stability Assessment 35

5.7 Safety Factor Assessment 35

6.0 CLOSURE PLAN, 257.103(F)(2)(V)(D) 36

7.0 OPERATOR RESPONSIBILITY 36

8.0 CLOSING 37

9.0 REFERENCES 37

TABLES

Table 1: Vertical Groundwater Flow Calculation

Table 2: Monitoring Well Construction Details

Table 3: Monitoring Well Installation Date and Purpose

Table 4: Unit-Specific Groundwater Protection Standards

Table 5: Dates and Purposes of each Monitoring Event

FIGURES

Figure 1:Site Location Map

Figure 2: Facility Site Plan

Figure 3: Operation and Closure Schedule

Figure 4: Waste Disposal Area- Approximate Ash Thickness

Figure 5: RMSGS Water Flow Diagram

Figure 6: Monitoring Well Location Map

Figure 7: Surface Water Sampling Location Map

Figure 8: September 2019 Groundwater Elevation Contours

Figure 9: April 2020 Groundwater Elevation Contours

Figure 10: Hydrogeological Cross-Section A-A'

Figure 11: Hydrogeological Cross-Section B-B'

Figure 12: Hydrogeological Cross-Section C-C'

APPENDICES

Appendix A: Location Restriction Certification Report, NIPSCO R.M. Schahfer Generating Station Impoundments 40 CFR Part §257.60-64, dated October 17, 2018

Appendix B: Risk Assessment for the Waste Disposal Area- Haley & Aldrich, Inc- October 2020

Appendix C: Waste Disposal Area Analytical Data 40 CFR Part §257.103(f)(2)(v)(C)(3)

Appendix D: Certification of Facility Compliance 40 CFR Part §257. 103(f)(2)(v)(C)(1)

Appendix E: Soil Borings and Monitoring Well Logs 40 CFR Part §257.103(f)(2)(v)(C)(2)(ii)

Appendix F: Slug Test Results

Appendix G: 2019 Annual Groundwater Monitoring and Corrective Action Report- Waste Disposal Area - January 2020

Appendix H: Waste Disposal Area Alternative Source Demonstration - November 2018

Appendix I: Waste Disposal Area Alternative Source Demonstration - May 2019

Appendix J: Waste Disposal Area Alternative Source Demonstration Recertification- November 2019

Appendix K: Waste Disposal Area Alternative Source Demonstration - June 2020

Appendix L: Structural Stability and Safety Factor Assessment Waste Disposal Area 40 CFR Part §257.73(d) and (e), dated October 5, 2016

Appendix M: Fifth Annual RCRA CCR Unit Inspection Report Waste Disposal Area - Surface Impoundment 40 CFR Part §257.73(d), dated January 2, 2020

Appendix N: WDA Closure Plan- Version # 5- Golder Associates, Inc. - October 2020

1.0 INTRODUCTION

Newly effective CCR Rule Part A regulations at 40 CFR § 257.103 provide for site-specific alternative deadlines to complete closure of coal combustion residuals (CCR) surface impoundments. Specifically, notwithstanding the applicable provisions of 40 CFR § 257.101(a) and (b)(1), CCR surface impoundments may continue to receive CCR and non-CCR waste streams pursuant to § 257.103(f)(2), provided the owner/operator submits an acceptable demonstration by no later than November 30, 2020.

As described herein, Northern Indiana Public Service Company LLC (NIPSCO LLC, the owner/operator) maintains and operates the Waste Disposal Area (WDA), an approximately 80-acre active CCR surface impoundment (the CCR Unit) at its R. M. Schahfer Generating Station (RMSGS, Site) near Wheatfield, Indiana (see Figure 1). The WDA (see Figure 2) receives on average roughly 7.7 million gallons per day (MGD) of influent including both CCR and non-CCR waste streams. Wastewater managed in the impoundment is produced from a) coal-fired boilers that are scheduled for permanent cessation of generation by the end of Q2 2023, b) other day-to-day activities normally associated with generating station operations (e.g., boiler wash, air heater wash, boiler room sump discharge, stormwater management, etc.), some of which will continue beyond the coal-fired cessation date to maintain the physical plant and for operations/maintenance personnel safety reasons, and c) shutdown activities that will begin in Q1 2023 and proceed for a currently estimated six months following cessation of coal-fired generation. Within 30 days following the date upon which the final receipt of CCR and/or non-CCR waste streams occurs, NIPSCO LLC will commence closure of the subject impoundment, completing such closure construction and certification activities by September 17, 2028.

In accordance with the provisions of 40 CFR § 257.103(f)(2) on behalf of NIPSCO LLC, Golder Associates Inc. (Golder) prepared this "NIPSCO LLC RMSGS Demonstration of Site-Specific Alternative Deadline to Initiate Closure of CCR Surface Impoundment Due to Permanent Cessation of Coal-Fired Boilers by a Date Certain" (Demonstration) for RMSGS' WDA CCR surface impoundment (CCR Unit). NIPSCO LLC is submitting this Demonstration well ahead of the November 30 deadline, requesting the United States Environmental Protection Agency's (U.S. EPA's) expedited review in order to provide for NIPSCO LLC/Golder an opportunity to address any questions or requests for additional information or documentation by U.S. EPA.

1.1 Background

As described in Section 1.2, NIPSCO LLC operates the approximately 1943-megawatt (MW) nameplate capacity coal-fired RMSGS, producing electricity and associated waste streams that are managed in four currently active unlined CCR Rule regulated surface impoundments. The Multi-Cell Unit (MCU) comprises three of the impoundments, and the fourth impoundment is the WDA. The WDA surface impoundment is the subject of this Demonstration. These surface impoundments, including the WDA, did not successfully demonstrate compliance with the Location Restriction requirements of 40 CFR § 257.60(a) and as such, are ultimately subject to closure in

accordance with the requirements of 40 CFR §257.102(b). The certified Location Restriction Report dated October 17, 2018 for all RMSGS CCR surface impoundments is attached in Appendix A (Golder 2018a). As discussed below, three of the impoundments are in the early stages of closure (i.e., most influent streams are being directed to other waste management units, NIPSCO LLC plans to fully cease discharge to them by October 31, 2020, and detailed closure plans are under review by Indiana Department of Environmental Management [IDEM], the state regulatory agency responsible for approving surface impoundment closures), leaving the WDA as the single remaining operational RMSGS CCR surface impoundment.

To meet existing grid reliability-related electricity supply needs in accordance with the requirements of the Midcontinent Independent System Operator (MISO), NIPSCO LLC must continue to operate RMSGS until May 2023 date when permanent shutdown of coal-fired electricity generation is scheduled. Until shutdown, RMSGS' ongoing coal-fired generation and associated waste stream management activities are, in turn, dependent upon continued operation of the WDA. Consistent with the objective to reduce its reliance on multiple unlined surface impoundments for waste stream management, NIPSCO LLC is in the process of initiating closure of the MCU. In advance of the mandatory April 11, 2021 cease receipt date, NIPSCO plans to stop discharging influent to these impoundments by October 31, 2020, leaving only the WDA as the remaining operational CCR surface impoundment.

Cessation of coal-fired generation is scheduled to begin during Q1 2023, providing approximately two and a half years to a) perform shutdown/decommissioning processes (which are expected to generate CCR and non-CCR waste streams) and b) cease generation or re-direct the other ongoing wastewater and stormwater streams. Following completion of these activities, the WDA will no longer receive waste stream influent. This will allow approximately three years to complete closure of the WDA, ensuring closure is completed by the 40 CFR § 257.103(f)(2) October 17, 2028 deadline. As detailed herein and as shown on the coal-fired cessation, boiler shutdown and impoundment closure timeline, (see Sections 1.4 and 2.4, and Figure 3), the Demonstration substantiates the need for receipt and management of CCR and/or non-CCR waste streams by the WDA due to a lack of alternative disposal options on- and off-Site.

Since a 2018 announcement that electric generation would cease at RMSGS effective 2023, NIPSCO LLC has been taking the necessary preparatory steps to retire the boilers. In December 2018, NIPSCO LLC gained Indiana Utility Regulatory Commission approval to mitigate the effects of a significant customer rate increase due to the accelerated retirement dates for coal-fired electric generation by adjusting depreciation to allow for cessation of coal-fired generation at RMSGS consistent with its Integrated Resource Plan (IRP) process. In very early 2019, on behalf of NIPSCO LLC, Golder conducted research pursuant to and prepared documentation in accordance with the requirements of 40 CFR § 257.103(b)(1), permanent cessation of a coal-fired boiler(s) by a date certain. In February 2019, NIPSCO LLC prepared and filed in the RMSGS operating record its documentation of Notice of Intent and Certification to Comply with Alternative Closure Requirements of 40 CFR § 257.103(b)(1) and in February 2020, prepared and filed in the operating record an annual review and progress report documenting RMSGS efforts to identify and utilize alternative capacity options, none of which were determined to be technically feasible. On August 28, 2020 U.S. EPA published the CCR Rule Part A regulations, that upon their September 28, 2020 effective date replaced the existing no alternative capacity demonstration requirements of 40 CFR § 257.103(b)(1), with which RMSGS had previously complied. By way of this Demonstration, NIPSCO LLC is complying with the new requirements outlined in 40 CFR § 257.103(f)(2), permanent cessation of a coal-fired boiler(s) by a date certain, which serve as the framework for this Demonstration.

In anticipation of and in planning for the reduction of influent waste streams to the WDA and final closure by September 17, 2028, NIPSCO LLC has or is currently engaging in several activities, including:

- The wastewater piping re-direct project is scheduled for completion by the end of October 2020, resulting in cessation of waste stream discharges to the MCU. CCR waste streams are redirected to the WDA and non-CCR waste streams are redirected to other on-Site waste management units.
- A 2019-20 detailed assessment of WDA solids (i.e., ash) content including the presence and type of CCR, relative thickness, and location/extent, the results of which were summarized in a report prepared to support closure design initiatives.
- Ongoing preparation of and negotiations regarding a beneficial reuse permitting application with IDEM. Approval of the permit application would allow NIPSCO LLC to excavate and beneficially reuse 250,000 cubic yards or more of WDA bottom ash as a) a protective layer above the geomembrane composite liner and, b) as a landfill final cover drainage layer, instead of virgin natural resources (i.e., native sand) from off-Site. If approved, the amount of remaining material in the WDA would be significantly less, allowing for a faster closure by removal.
- Cessation of coal-fired generation and completion of boiler shutdown/decommissioning activities, and thus, permanent elimination of those directly produced and resulting waste streams by Q3 2023.
- Completion of closure activities for the MCU by Q4 2025 and, as part of this action, elimination of CCR-impacted dewatering streams as influent to the WDA by Q3 2025.
- Conceptual planning for a second wastewater piping re-direct project which would eliminate current (or remaining post-generation) boiler room sump and yard drain stormwater flows to the WDA by Q4 2024.

1.2 Facility Overview

RMSGS is a coal-fired, steam electric generation facility occupying roughly 3,000 acres in a mixed agricultural, wooded, and rural residential area northeast of Wheatfield, in Jasper County, Indiana approximately one (1) mile east of State Road 49 on County Road 1500 (Figure 1). RMSGS began generating operations in 1976. Four coal-fired units (Units 14, 15, 17, and 18) and two natural gas-fired peaking units (Units 16A and B) yield a total nameplate production capacity for the station of approximately 1943 megawatts (MW).

On-Site surface impoundments and landfills were constructed beginning in the early 1970s and expanded in succeeding years to accommodate waste streams from plant operations and/or NIPSCO LLC's regional ash management needs. Two landfill phases and four surface impoundments are currently active and subject to the Federal CCR Rule. However, the WDA is the only one of the four surface impoundments not in the initial stages of closure processes.

1.3 Generation Role in Midcontinent Independent System Operations

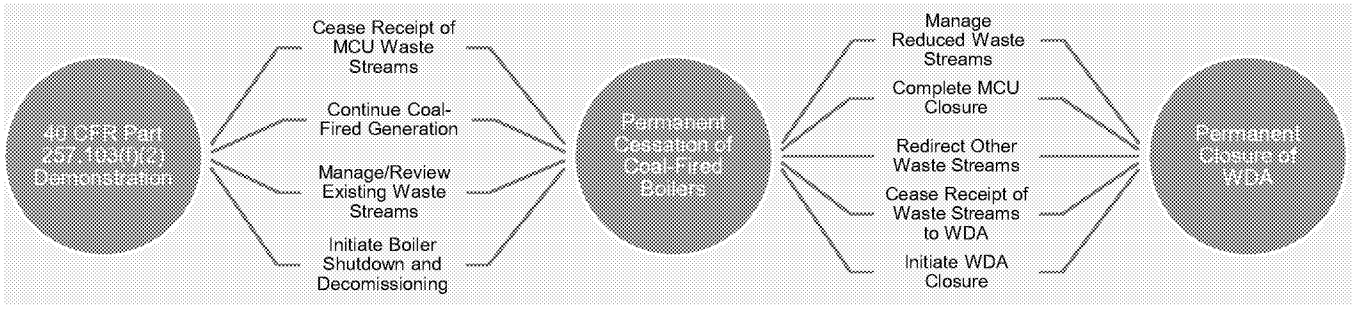
NIPSCO LLC is a member of MISO and RMSGS plays a substantial role in its success. MISO is an Independent System Operator (ISO) and Regional Transmission Organization (RTO) ensuring the reliable delivery of electricity in the United States and Canada to 42 million consumers. Both ISOs and RTOs are organizations formed with the

approval of the Federal Energy Regulatory Commission (FERC) to coordinate, control, and monitor the use of the electric transmission system by utilities, generators, and marketers. ISOs and RTOs operating in North America manage the systems that serve two-thirds of the customers in the U.S. and over half the population of Canada. MISO approved NIPSCO LLC's plan to retire RMSGS in 2023 but that was only one step in a highly complex process to enable the retirement and replacement of generation assets. On the state regulatory front, NIPSCO secured Indiana Utility Regulatory Commission (IURC) approval in December 2019 of an electric base rate case, to support its generation strategy, with new depreciation schedules related to the early retirement of coal-fired generation. In addition, NIPSCO is also executing on a number of important transmission system upgrades.

NIPSCO's coal-fired generation will be replaced with lower-cost, reliable and cleaner options. In December 2019, FERC approved NIPSCO's applications for Rosewater, one of three wind projects announced early in the year. The IURC had previously approved the joint venture and ownership agreement for Rosewater, as well as applications for two other projects – Jordan Creek and Roaming Bison. While Roaming Bison has since been cancelled due to local zoning restrictions, construction is underway on both Rosewater and Jordan Creek, which are expected to be in service by the end of 2020. The IURC in early 2020 also approved NIPSCO's application for a fourth wind project, Indiana Crossroads, a joint venture with EDP Renewables North America. Indiana Crossroads is expected to be in operation by the end of 2021. Our Indiana electric team is also working to identify additional resources to replace our retiring coal generation capacity ensuring the transition to lower-cost, clean energy generation.

1.4 Planned Cessation of Operations

MISO approved NIPSCO LLC's plan to retire RMSGS in 2023. As summarized in the embedded figure below, waste generation activities, individually and collectively, impact and require continued use of the WDA, the Site's only remaining active CCR Rule-regulated surface impoundment, for the next several years. The embedded figure below summarizes the planned reduction of influent waste stream activities to achieve cessation of the coal-fired boilers and permanent closure of the WDA.



Planned Cessation of WDA Operations

In the Demonstration, NIPSCO LLC/Golder identified and evaluated discharge flows into the WDA on a waste stream-specific basis for on- and off-Site treatment and disposal alternatives. Future annual progress reports will be produced following the same waste stream-by-waste stream basis. Most of these discharge flows are high in volume, yet based on sampling of ash and the saturated zone within the WDA, confirmed to be low in relative contaminant loading (i.e., concentrations of 40 CFR § 257 Appendix III and IV constituents). As a practical matter, reduction, or permanent elimination of waste streams, particularly those of significant volume, will be NIPSCO LLC's primary focus, corresponding largely with cessation of coal-fired generation and completion of boiler

shutdown activities. Beginning in early 2023, NIPSCO LLC expects to achieve significant reductions in influent volume and by the end of Q3 2025, ultimately eliminate waste stream discharges to the WDA.

These and related activities with specific focus on the WDA are discussed in Section 2.4 and depicted on the facility closure timeline provided therein (Figure 3).

1.5 Demonstration Approach and Contents

The approach to and preparation of the Demonstration is based on the final CCR Rule Part A regulations as found in 40 CFR § 257.103(f)(2). The Demonstration has been prepared to address all applicable regulatory requirements, demonstrate that qualifying criteria have been met, and provide an evaluation of alternative disposal capacity options and availability, a risk mitigation plan for continued operation, facility-wide CCR compliance certification, WDA-specific groundwater monitoring compliance data, and a 30% design closure plan with narrative.

Following this Introduction, Section 2.0 summarizes key information about the WDA including:

- construction, historical and current operations, and current conditions of the CCR Unit
- overview of CCR and non-CCR wastes managed by the WDA, including source and flow volume tabulated on a waste stream-specific basis and depicted on a facility water flow diagram
- high-level summary of the historical and current CCR groundwater monitoring programs, including current CCR Rule monitoring phase, and
- description of the sequence of cessation of coal-fired generation, boiler shutdown activities, reduction/elimination of all waste streams into the CCR Unit, and planned closure, including a Gantt chart that depicts key actions and milestones (Figure 3)

Section 3.0 provides an identification and evaluation of existing alternative disposal options for influent into the WDA including:

- identification and discussion of the evaluation criteria
- consideration of alternative disposal management
- evaluation of alternatives, and
- assessment of alternative disposal capacity

Section 4.0 addresses potential risk to human health and the environment from continued operation of the surface impoundment prior to a final cease receipt date and closure, addressing various topics including:

- discussion of measures NIPSCO LLC can take to limit any future releases to groundwater during ongoing operation until the cease receipt date
- review of WDA monitoring results collected from downgradient locations relative to background concentrations and alternate sources, including current CCR Rule groundwater monitoring program phase plus identified statistically significant increases (SSIs) and statistically significant levels (SSLs) of Appendix III and Appendix IV constituents
- delineation of a plume related to any releases from and groundwater impacts from the WDA

- identification of nearby receptors that may be exposed to current or future groundwater impacts from the WDA
- discussion of how such exposures could be promptly mitigated, and
- plans to expedite and maintain the containment of any contaminant plume present or identified during continued operation of the WDA

Section 5.0 provides information relative to CCR Rule regulatory compliance, with emphasis on groundwater monitoring and response requirements, including:

- certification of RMSGS' compliance with all applicable 40 CFR §§ 257.60-107 requirements, signed by an authorized representative of NIPSCO LLC
- visual representation of hydrogeologic information at and in the vicinity of the WDA supporting the design, construction, and installation of the groundwater monitoring system
- figure showing groundwater monitoring well locations in relation to the WDA
- well construction diagrams and drilling logs for WDA groundwater monitoring wells
- potentiometric surface maps characterizing the direction of groundwater flow accounting for seasonal variations
- tabulated groundwater monitoring data for each monitoring well for each CCR Rule monitoring event
- description of Site hydrogeology including stratigraphic cross-sections from the location of the WDA
- any corrective measures assessment required in accordance with 40 CFR § 257.96
- progress reports on remedy selection and design and the report of final remedy selection required at 40 CFR § 257.97(a)
- most recent structural stability assessment performed pursuant to 40 CFR § 257.73(d)
- most recent safety factor assessment performed pursuant to 40 CFR § 257.73(e)

Section 6.0 provides the current closure plan, a narrative that explains and justifies the date by which RMSGS will cease receipt into the WDA in order to meet the Q3 2025 closure construction start schedule date and construction completion date of September 17, 2028, design plans, and a timeline of key milestones and planned activities occurring between the development of WDA Final Closure Construction Plans (Q2 2024) and Closure Certification (Q3 2028).

Section 7.0 discusses the owner/operator compliance responsibilities NIPSCO LLC will fulfill subsequent to the Demonstration's submission to U. S. EPA and Section 8.0 provides the attestation of Golder, the preparer of the Demonstration, as to its accuracy and conclusions regarding the availability of no alternative disposal capacity, followed by Section 9.0 which provides references used in the preparation of the document. Supporting tables, figures, and appendices follow the Demonstration text.

Refer to the tabulated Compliance Check List provided in the Foreword for specific regulatory requirements being addressed and the location(s) of corresponding information in the Demonstration document.

2.0 DESCRIPTION OF CCR UNIT

This section of the Demonstration provides unit-specific details about the WDA including a background of its construction and operation; an explanation and summary of the source, type, and volumes of waste streams managed in the WDA; an overview of the CCR Rule-required groundwater monitoring well network and monitoring phases; and a discussion of key activities related to reduction of influent and other actions to be taken prior to cessation of waste receipt and final closure.

2.1 Construction and Operation

The WDA was designed by Sargent & Lundy Engineers of Chicago, Illinois and constructed in 1982. The CCR Unit, located in the southwest area of RMSGS station operations, is unlined and formed by an approximately 17-foot high perimeter earth-fill dike with slurry trench core that encloses an area of approximately 80 acres. The east side of the WDA is common with the west side of the adjacent Recycle Basin (RB) and it is adjoined to the north by the Inactive Retired Waste Disposal Basin (IRWDB). The WDA embankment crest has a nominal elevation of 681 feet mean sea level (msl).

According to construction drawings provided by NIPSCO LLC, the perimeter berm around the WDA and RB (excluding the common berm separating the WDA and RB) was constructed with a minimum one-foot wide slurry wall component (core) that extends from just below the top of the berm to the underlying shale bedrock located approximately 30 to 35 feet below ground surface (ft bgs). The slurry wall functions as a perimeter hydraulic barrier from ground surface to the underlying bedrock. Monitoring data indicate water elevations as measured within the WDA are typically 15+ feet higher than groundwater surface elevations as measured in perimeter groundwater monitoring wells outside the slurry wall.

The WDA receives both CCR (historically bottom ash/boiler slag and sluice water as the predominant CCR influents and, beginning only recently, an FGD stream) and non-CCR waste streams from the generating station. All flow to the WDA is pumped through primarily subsurface lines which daylight and discharge directly into the northern end of the CCR Unit. As determined by bathymetric surveys and overwater drilling programs, most of the deposited ash/slag is in the northern half of the WDA. Due to size of the unit, percentage of solids to liquids in the influent, location of ash discharge outfalls, and settling/depositional properties of the materials, preliminary studies have shown little ash/slag is present in the southern half of the WDA. Figure 4 shows the estimated thickness of CCR materials based on borings collected by Golder in 2019. Results of this analysis are included in the R. M. Schahfer Generating Station Ash Pond Assessment Report (Golder 2020b).

Water is conveyed from the WDA to the RB via an overflow weir (inlet structure) located at the southern end of the east side of the WDA. The WDA and the RB are hydraulically connected and the water level within these impoundments will seek equilibrium when the water level is above the invert elevation of the WDA inlet structure (manageable with removable stop logs) connecting the impoundments. An auxiliary spillway, designed to convey the peak flow rate associated with the inflow design flood, is located near the northwest corner of the WDA. In 2017 NIPSCO LLC completed engineered improvements to the auxiliary spillway with the removal of the original closed-circuit spillway and construction of a concrete open-channel spillway with a concrete down-chute and riprap armoring at the toe of the embankment.

2.2 Overview of Waste Streams Managed

As noted, the WDA receives both CCR and non-CCR waste streams. At the time of this Demonstration, NIPSCO LLC provided waste stream data including point source category descriptions (40 CFR § 423.11), a Facility Water

Flow Diagram, and estimated average daily flows. The point source categories (RMSGS color-coding) and associated RMSGS designations for the waste streams managed at the WDA include:

- Low Volume Waste pursuant to 40 CFR § 423.11(b) ◆
  - Unit 14 Boiler Room Sump (Non-CCR)
  - Unit 15 Boiler Room Sump (Non-CCR)
  - Yard Drain (Non-CCR)
- Flue Gas Desulfurization (FGD) Wastewater pursuant to 40 CFR § 423.11(n) ◆
  - Unit 17/18 FGD Filter Building North Sump (CCR)
  - Unit 17/18 FGD Filter Building South Sump (CCR)
- Ash Transport Water pursuant to 40 CFR § 423.11(p) ◆
  - Unit 17 Bottom Ash Sluice (CCR)
  - Unit 18 Bottom Ash Sluice (CCR)
- Combustion Residual Leachate pursuant to 40 CFR § 423.11(r) ◆
  - MCU Closure Dewatering (CCR)[1]

The waste stream from Units 14 and 15 Boiler Room Sumps include boiler drains and some other service water systems collected in the 14 or 15 sumps inside the main building. These waste streams are pumped through sump pumps to the WDA. The Yard Drain waste stream is from an outdoor sump that collects outdoor drainage water, as well as some water that comes from the Unit 14 boiler and some other service systems. This waste stream is pumped through sump pumps to the WDA. The waste stream from 17/18 FGD Filter Building North/South Sumps includes wastewater and slurry from the FGD process that cannot be filtered. This waste stream is pumped through either the North or South sump pumps inside FGD to the WDA. These waste streams were redirected to the WDA as part of the MCU wastewater piping re-direct project and in anticipation of closure of the MCU. The waste stream from Units 17 and 18 Bottom Ash Sluice includes bottom ash (or slag) that must be removed from the bottom holding tank of the boiler. Service water is used as a sluicing medium to transport the ash from the holding tank (bottom ash hopper), through pumps inside the main building to the WDA.

In addition to the above streams, NIPSCO LLC's MCU closure application, which is currently undergoing IDEM review, includes the removal of interstitial water (i.e., dewatering) and discharge of this project-specific CCR waste stream to the WDA. The selected remedial contractor may use well points or other dewatering equipment to extract the interstitial water, allowing excavation of the ash from within the MCU. The water may be pumped into the abandoned Unit 15 sluice line that runs parallel and to the west of the MCU and discharges in the northwest corner of the WDA. Dewatering and discharge to the WDA in compliance with the facility's NPDES permit is currently scheduled to begin in Q4 2023 and be required for virtually the duration of the closure project.

Following cessation of coal-fired generation, requisite Units 14, 15, 17, and 18 boiler decommissioning activities are expected to also generate Unit-specific washdown streams of approximately 3.5 to 5.0 million gallons per

[1] Development of the closure plan for the Multi-Cell Unit (MCU, [Material Storage Runoff Basin, Metal Cleaning Waste Basin, and Drying Area]), estimates that dewatering activities will generate a waste stream of approximately 1.42 MGD for a duration of approximately six months.

Unit, per decommissioning event. Given the existing RMSGS wastewater piping layout, discharge of these streams will be directed to the WDA prior to its cease receipt date and initiation of closure construction activities.

A comprehensive summary of the Facility units and associated waste streams is illustrated in Figure 5 – RMSGS Water Flow Diagram. Based on the data provided by NIPSCO LLC, the embedded table below summarizes the estimated average daily flows managed during normal operation of the WDA until cessation of the coal-fired boilers. As shown, the estimated average daily flows of the individual waste streams (CCR and non-CCR) range between 0.34 million gallons per day (MGD) to 2.88 MGD, with a combined daily total of 9.1 MGD. At this time, the washdown generated waste streams are only projections based on NIPSCO LLC's experience performing similar activities and are, therefore, not included in the combined waste stream summary.

WDA Managed Waste Stream Flows

Description	Estimated Average Daily Flow (MGD)	Category
Unit 14 Boiler Room Sump	2.88	◆ Non-CCR
Unit 15 Boiler Room Sump	2.16	◆ Non-CCR
Yard Drain	0.86	◆ Non-CCR
Unit 17/18 FGD Filter Building North Sump	0.55	◆ CCR
Unit 17/18 FGD Filter Building South Sump	0.55	◆ CCR
Unit 17 Bottom Ash Sluice	0.34	◆ CCR
Unit 18 Bottom Ash Sluice	0.34	◆ CCR
Combined Sub-Total Waste Steam	**7.68**	
MCU Closure Dewatering	1.42	◆ CCR
Combined Total Waste Steam	**9.10**	

2.3 CCR Rule Groundwater Monitoring

Starting in 2016, following the installation of a groundwater monitoring system certified by a qualified professional engineer to be consistent with the design and construction requirements of 40 CFR § 257.91, and throughout calendar year 2017, Golder collected background groundwater samples and performed Detection Monitoring around the WDA pursuant to the requirements of 40 CFR § 257.94. The monitoring system initially consisted of two background and six downgradient monitoring wells. In 2018, Golder performed the first and second Assessment Monitoring sampling events pursuant to the requirements of 40 CFR § 257.95, following which, ten additional downgradient monitoring wells (including six monitoring wells on the property boundary) were installed. In 2019, consistent with evolution of the Conceptual Site Model (CSM), nine additional downgradient monitoring wells (including five additional monitoring wells on the property boundary) were installed. Based upon groundwater monitoring results collected pursuant to the CCR Rule to date, corrective measures program requirements are neither required nor have they been implemented at this CCR Unit. The current monitoring well network is summarized in the embedded table below and shown on Figure 6.

Well Installation Purpose	Well ID
Background Monitoring Wells	GAMW03 and GAMW03B
Downgradient Monitoring Wells	GAMW01, GAMW01B, GAMW12, GAMW12B, GAMW13, GAMW13B, GAMW14, and GAMW14B
Assessment Monitoring Wells	GAMW51, GAMW51B, GAMW59, GAMW59B, GAMW60, and GAMW60B
Property Boundary Wells	GAMW42, GAMW42B, GAMW42C, GAMW43, GAMW43B, GAMW44, GAMW44B, GAMW57, GAMW57B, GAMW58, and GAMW58B

2.4 Cessation of Operation and Closure

Because of the design and operation of the generating station and as a result of other compliance-driven projects completed ahead of the CCR Rule Part A revisions, virtually all remaining flows into the WDA are high-volume waste streams, limiting available alternatives for their management prior to cessation of coal-fired generation by the end of Q2 2023. Reduction in current waste stream inflows, cease receipt of all influent, and initiation of closure of the WDA are linked inextricably to several other major activities being undertaken as elements of RMSGS' ongoing closure and decommissioning plans including, but not limited to:

- cessation of coal-fired generation and, thus, permanent elimination of those directly produced waste streams
- completion of boiler shutdown/decommissioning activities and, following such, permanent elimination of the resulting waste streams
- redirect other non-CCR waste streams, and
- dewatering and closure of other CCR surface impoundments in accordance with IDEM approvals

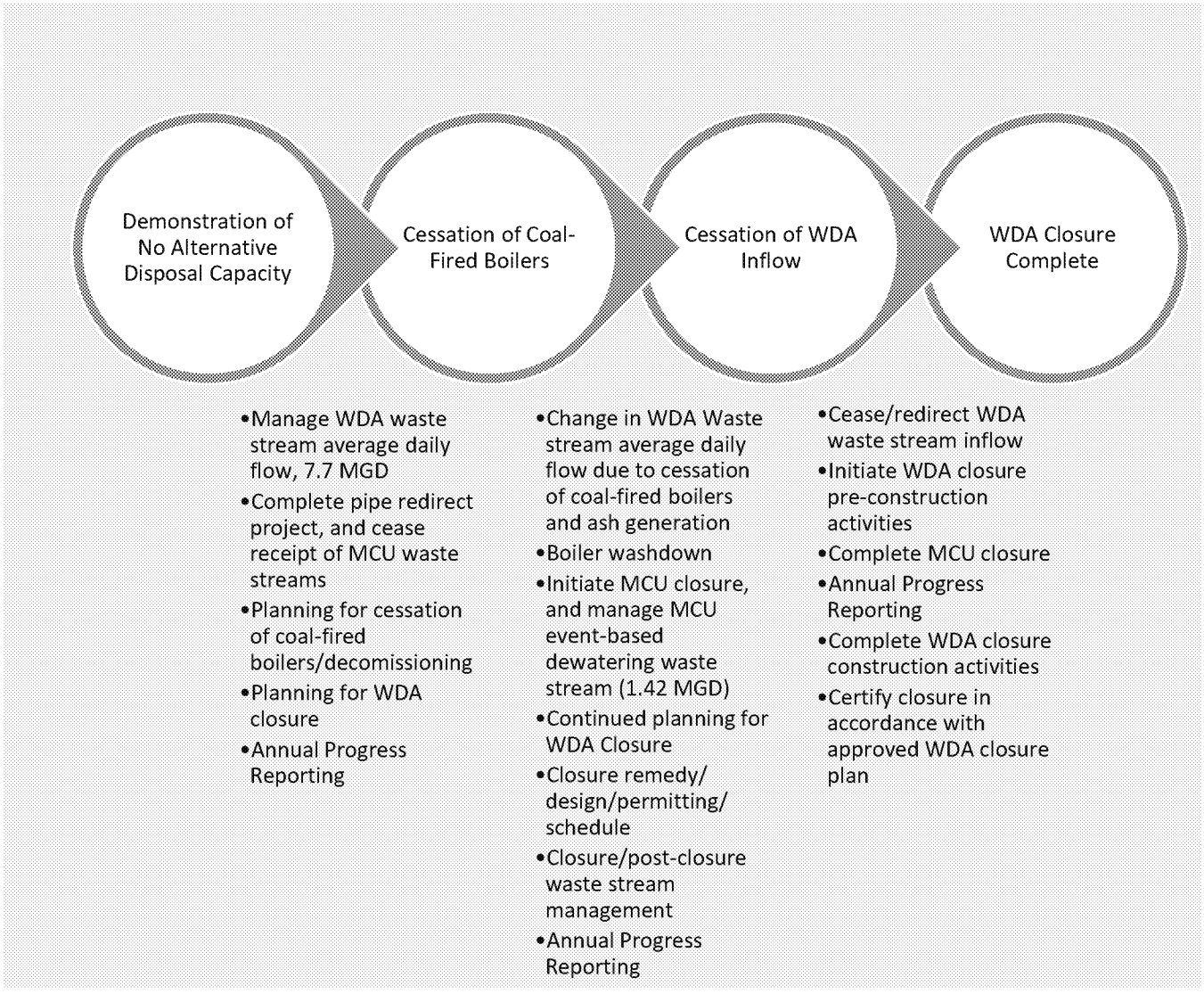
NIPSCO LLC will reduce influent into the WDA and the need for management on- or off-Site due to the Q2 2023 permanent elimination of high-volume waste streams following the cessation of coal-fired generation and the closure of the MCU, scheduled to be completed no later than Q4 2025. Following the cessation of coal-fired generation, NIPSCO LLC will systematically implement a final boiler shutdown and washdown process, which will produce CCR and non-CCR waste streams on a boiler-by-boiler basis. As each boiler is shut down and cleaned prior to demolition, these waste streams (washdown streams referenced in Section 2.2) will also be permanently eliminated as influents to the WDA.

Beginning as early as 2021 NIPSCO LLC expects to achieve significant reductions in influent volume and current waste materials inventory, and by Q3 2025, ultimately eliminate discharges to the WDA by completing the following actions:

- 2021 (pending acceptance by IDEM) – contingent upon regulatory approval of a CCR beneficial reuse proposal, NIPSCO LLC will begin to permanently remove 250,000 cubic yards or more of bottom ash currently in the WDA, substituting it for virgin materials as a geomembrane liner protectant and drainage underlayment in the final cover system for the on-Site landfill

- Mid 2023 – cessation of coal-fired generation, followed by permanent elimination of bottom ash and sluice water waste streams
- Late 2023 – shutdown, cleaning, and washdown of the former boilers and ancillary equipment in anticipation of plant demolition, permanently eliminating these waste streams
- Late 2025 – redirect other non-CCR waste steams to other surface impoundments, permanently eliminating these waste streams
- Late 2025 – completion of dewatering activities associated with the MCU closure and permanent elimination of this waste stream

The following schematic of operation and closure activities outlines the process NIPSCO LLC will follow to achieve decreasing reliance upon the WDA, systematic reduction/elimination of influent waste streams, and final closure of the CCR Unit by September 17, 2028. A detailed timeline for these concurrent and sequential activities is presented in Figure 3.



Operation and Closure Activities

3.0 EVALUATION OF ALTERNATIVE DISPOSAL CAPACITY, 257.103(f)(2)(v)(A)

40 CFR §257.103(f)(2) outlines specific conditions that must be met to qualify for continued operation and alternative deadlines to initiate closure of the WDA, without consideration of increase in costs or inconvenience to NIPSCO LLC. Pursuant to 40 CFR §257.103(f)(2)(v)(A) the objective of the following sections is to document the options considered to evaluate the availability of existing alternative disposal capacity for CCR and non-CCR waste streams both on and off-site that are currently managed in the WDA. To satisfy the evaluation requirements, this section 1) establishes the basis of alternative disposal criteria, 2) identifies alternative waste stream management options, 3) considers adequacy of alternative disposal capacity, and 4) provides findings of alternative disposal capacity evaluation.

3.1 Evaluation Criteria

Prior to evaluating the availability of existing alternative disposal capacity options for the waste streams dependent upon the capacity and operation of the WDA, criteria were established to form a basis of measure and comparison. All criteria will support and demonstrate compliance with the requirements of the Rule (40 CFR §257.103(f)(2)(i)) which asserts: *no alternative disposal capacity is available on or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification under this section*, and further defined in 40 CFR §257.103(f)(2)(v)(A) stating: *to demonstrate that the criteria in paragraph (f)(2)(i) of this section have been met the owner or operator must submit a narrative that explains the options considered to obtain alternative capacity for CCR and/or non-CCR waste streams both on and off-site.*

The following site-specific criteria were established and utilized as a basis of measure in consideration of each alternative disposal capacity option:

- Capacity – Based on current WDA inflow waste stream estimates (as summarized in Section 2.2), alternative disposal options required to provide capacity between 0.34 MGD and 2.88 MGD for individual waste streams and/or a combined total capacity of 9.1 MGD
- Systems – Alternative CCR disposal systems shall be Rule compliant pursuant to 40 CFR § 257.50 - § 257.107. Industrial wastewater transport and treatment systems shall be compliant with all applicable State and Federal regulations to handle, manage and dispose of industrial wastewaters
- Environmental Impact/Risk – Alternative disposal options shall consider direct and/or tangential impacts relative to continued and sustainable protection of human health and the environment
- Operational Reliance – The evaluation of alternative disposal options shall consider and/or acknowledge changes in operation (e.g., on-Site treatment capacity, post-cessation waste stream volume, redirect other waste streams) that significantly affect reliance on the capacity within the WDA. While the site-specific details of these operational variations may not be known at this time, these types of changes are expected to be more fully developed throughout the cessation of operation and closure planning, and addressed in subsequent annual progress reporting in demonstration of continued lack of alternative capacity and the progress towards closure (40 CFR § 257.103(f)(2)(x))

3.2 Alternative Disposal Management

The status of the current and forecasted operations and activities was considered in the evaluation of alternative disposal capacity. Specifically, operational milestones were identified in an effort to evaluate the change in operation in comparison to change in waste stream generation, and reliance on disposal within the WDA. As illustrated in the schematics above and attached Figure 3, throughout the process from coal-fired generation to closure of the WDA, several operational milestones will influence waste stream generation and reliance on the disposal capacity of the WDA.

Operational Phases and Milestones

Milestone	Operational Phase	Timeline
Demonstration of Site-Specific Alternative Deadline to Initiate Closure of CCR Surface Impoundment 40 CFR §257.103(f)(2)		**Q4 2020**
	Coal-Fired Generation	
	Decommissioning and Closure Planning	
	Annual Progress Reporting	
Cease Coal-Fired Boiler Operation		**Q2 2023**
	Boiler Washdown	
	MCU Closure	
	Manage Other Waste Streams	
	Closure Planning	
	Annual Progress Reporting	
Cease Receipt of Waste Streams and Initiate Closure		**Q3 2025**
	Initiate WDA Closure Activities	
	Annual Progress Reporting	
WDA Closure Construction Complete		**Q3 2028**

While this initial evaluation for alternative disposal capacity is primarily focused on the current estimated average daily flows produced during coal-fired generation of both CCR and non-CCR waste streams, the following milestones and/or systems are highlighted to forecast system changes that at this time are not fully-quantifiable, but may require consideration in subsequent annual progress reporting to demonstrate continued lack of alternative capacity and progress towards closure.

- Cessation of Coal-Fired Boiler Operation – NIPSCO LLC is currently developing the strategy and details for the cessation of power generation from the coal-fired boiler units by the end of Q2 2023. The initial evaluation for alternative disposal capacity is focused primarily on the estimated average daily flows during coal-fired generation (prior to cessation of coal-fired boilers) of the individual waste streams (CCR and non-CCR) which range between 0.34 MGD to 2.88 MGD, with a combined daily total flow of 9.1 MGD. Once the post-cessation details are determined, along with the advancement of WDA closure plan, subsequent annual progress reporting will consider and demonstrate alternative capacity and progress towards closure relative to the site-specific change in operation and WDA closure schedule.
- MCU Closure Project – NIPSCO LLC is currently developing plans for the closure of the MCU, a management unit for both CCR and non-CCR waste streams and located north of the WDA. In preparation for closure of the MCU, NIPSCO LLC has commenced a piping redirect project to separate and convey the MCU waste streams to alternative units for disposal, including the WDA, which will accept CCR effluent from Unit 17/18 FGD Filter Building sumps. As part of the closure project NIPSCO LLC has estimated a project-specific CCR waste stream (MCU Dewatering) will be directed to the WDA for virtually the duration of the closure project. The piping redirect project began in Q1 2020 and is projected to be placed in service by October 31, 2020. MCU Closure is currently estimated to begin in Q4 2023 and be completed no later than Q4 2025. Throughout the MCU Closure activities, subsequent annual progress reporting will consider and demonstrate alternative capacity and progress towards closure relative to the site-specific change in operation.
- Cessation of Waste Stream Inflow to WDA – Throughout the cessation of operations and closure process NIPSCO LLC will be strategizing and planning for the eventual redirection and/or cessation of both CCR and non-CCR waste stream inflow to the WDA. During this planning phase, along with the advancement of WDA closure plan, subsequent annual progress reporting will consider and demonstrate alternative capacity and progress towards closure relative to the site-specific change in operation and associated waste stream effluent.
- On Site WWTP – NIPSCO LLC operates a wastewater treatment plant (WWTP) on-Site with a design capacity of 165 gallons per minute (0.24 MGD) to manage and treat inflow from Units 14 and 15 FGD blowdown and landfill leachate. WWTP effluent is discharged into the Final Settling Basin and ultimately the Kankakee River. Actual treatment capacity of the WWTP varies based on the chemical and solids loading of the wastewater influent and the current demands on the WWTP vary on a daily basis. Following the cessation of Units 14 and 15, daily demands on the WWTP will likely decrease. Subsequent annual progress reporting will consider and demonstrate alternative capacity and progress towards closure relative to the site-specific change in operation and the potential for on-Site alternative disposal capacity and capability for the remaining waste streams.
- Existing Infrastructure – Conveyance of the waste streams influent to the WDA generally consists of pumped collection sumps at each source, a network of primarily buried conveyance pipelines and pumped lifting stations, and a multi-pipe penetration discharge headwall in the northwest corner of the WDA embankment. Presently there is not alternative infrastructure to facilitate waste stream loadout and/or transfer at any of the source locations. Subsequent annual progress reporting will consider and demonstrate alternative capacity and progress towards closure relative to the site-specific change in operation and the potential for alternative disposal infrastructure for the remaining waste streams.

3.3 Evaluation of Alternatives

40 CFR § 257.103(f)(2)(i) indicates that NIPSCO must demonstrate that there is no available existing on-Site or off-Site disposal options that could accept the current and future CCR and/or non-CCR waste streams that are discharged into to WDA. This section discusses the on-Site and off-Site disposal options considered for this demonstration as required by 40 CFR § 257.103(f)(2)(v)(A) stating: to demonstrate that the criteria in paragraph (f)(2)(i) of this section have been met the owner or operator must submit a narrative that explains the options considered to obtain alternative capacity for CCR and/or non-CCR waste streams both on and off-site.

Existing Capacity in on-Site Surface Impoundments - Golder has evaluated the existing on-Site impoundment systems (i.e., Final Settling Pond, MCU, Recycle Basin (RB), Landfill Stormwater Runoff Basin, Intake Settling Basin, Stormwater & Runoff Retention Basin) and found that there is no existing impoundment system meeting the applicable requirements of 40 CFR § 257.50 - § 257.107 for the Disposal of Coal Combustion Residuals in Surface Impoundments. Specifically, the existing on-Site impoundment systems do not meet the liner design criteria for existing CCR surface impoundments as required by 40 CFR § 257.71 or the location restriction requirement as outlined by 40 CFR § 257.60(a). In addition, all but the MCU are not regulated under the CCR Rule, are not in compliance with those regulatory requirements, and, as such, cannot receive CCR waste streams.

Existing on-Site Treatment – Golder has assessed the existing on-Site WWTP that currently manages and treats inflow from Units 14 and 15 FGD blowdown and landfill leachate as an alternative on-Site disposal option for CCR and/or non-CCR waste streams that are currently being discharged into to WDA. The on-Site WWTP was designed to treat 165 gallons per minute (0.24 MGD) of wastewater from Units 14 and 15 FGD and landfill leachate. Due to the daily variation in the waste stream loading influent to the WWTP (i.e., high solids, fly ash in the water, high ammonia content, etc.) and the inherent operational variability of the treatment equipment, the WWTP is more reliably able to treat only 100 to 120 gallons per minute (gpm). Daily operations and therefore volume demands of the WWTP are variable, NIPSCO LLC have indicated that at times they have had to slow treatment to 60 gpm to manage operational solids loading. Both the daily FGD and leachate generation demands vary such that the WWTP may need to operate 24 hours per day to manage the demand or conversely, it may have some available treatment capacity if daily operational flows are low. Additionally, the existing WWTP is being managed to treat the chemical and solids loading profiles currently present in the Units 14 and 15 FGD blowdown and landfill leachate wastewater. The addition of a new waste stream will alter the chemical makeup and concentrations of the inflow and require modifications to the treatment process, likely lowering the available treatment capacity of the system. Therefore, the existing WWTP does not have a consistent or reliable capacity available to treat additional waste streams from the WDA.

Existing Infrastructure – Golder has evaluated the existing infrastructure (e.g., pipe network) used to convey CCR and non-CCR wastewater to the WDA. The existing infrastructure generally consists of collection sumps at the source that are pumped to a network of primarily buried conveyance pipelines that discharge in the northwest corner of the WDA. Presently there is not alternative infrastructure to facilitate waste stream redirection, loadout and/or transfer at any of the source locations.

Off-Site Transport - Golder has evaluated off-Site transport of various quantities of WDA wastewater ranging from the smallest individual waste stream of 0.34 MGD to the combined daily total flow of 9.10 MGD. Golder assumed off-Site transport could be accomplished via wastewater tanker trucks or rail tank cars. Capacity of tanker trucks can vary from approximately 3,000 to 12,000 gallons. Commercially available tanker trucks in this region typically carry approximately 5,500 gallons per truck and therefore, truck count estimates described below are based on

5,500 gallons per truck. Additionally, the estimate assumes that the wastewater will be trucked to regional facilities with a maximum 3-hour round-trip travel duration for truck transport. Similarly, rail was also considered as a mode of off-Site disposal. Rail tank cars are estimated to carry up to 34,500 gallons per tank. Based on the volume of wastewater generated for individual waste stream and total combined flow, tanker truck and rail car tank capacity, and hauling turnaround time, Golder estimates the following off-loading rates to achieve off-Site transport and disposal objectives.

- 0.34 MGD (minimum individual waste stream) would require off-loading 62 trucks per day at a rate of 1 truck every 23 minutes. Alternately, if you assume a turnaround time of 3 hours for each treatment facility, 1 truck can make 8 round-trips in 1 day (24 hours). Therefore, at least 8 trucks would need to haul continuously (24 hours per day, 7 days per week) to accommodate the average daily flow volume of the smallest individual waste stream discharging into the WDA. If the individual waste stream was off-loaded via rail tank cars, approximately 10 tank cars per day be would be required to manage the average daily flow volume of the smallest individual waste stream discharging into the WDA.
- 9.1 MGD (combined total daily flow) would require off-loading 1,655 trucks per day or a rate of more than 1 truck every minute. Alternately, if you assume a turnaround time of 3 hours for each treatment facility, 1 truck can make 8 round-trips in 1 day (24 hours). Therefore, more than 200 trucks would need to haul continuously (24 hours per day, 7 days per week) to manage the combined total daily flow volume discharging into the WDA. If the combined total daily waste stream was off-loaded via rail tank car, approximately 264 tank cars per day would be required to manage the combined total daily flow volume discharging into the WDA.

Off-Site Disposal/Treatment - Regional wastewater treatment facilities located approximately 40 to 65 miles from RMSGS (i.e., Covanta Environmental Solutions in Portage, IN; Integrated Water Systems in Dolton, IL; Klean Waters in Griffith, IN; and Envirite of IL in Harvey, IL) were considered to evaluate the regional capacity available to treat and dispose wastewater currently flowing to the WDA. The available treatment capacity of each facility varies throughout the day and over the course of the week. However, based on discussions with NIPSCO LLC's third-party off-Site wastewater treatment vendor, US Ecology, it is estimated that regional facilities could likely handle up to 55,000 gallons per day (10 trucks per day). This results in a regional alternative off-Site disposal capacity of approximately 220,000 gallons per day (0.22 MGD), which is less that the smallest individual waste stream (0.34 MGD) currently discharging into the WDA. Regional treatment capacity estimates are for information only. Actual capacity would require acceptance of analytical results and an agreement between NIPSCO LLC and the facility.

3.4 Demonstration of Alternative Disposal Capacity

In consideration of the criteria and parameters described above, the following section summarizes the findings of the evaluation relative to the demonstration of alternative disposal capacity for CCR and non-CCR waste streams reliant on the operation of the WDA surface impoundment. There is/are:

- No existing on-Site impoundment system that can accept partial or total flows of CCR waste streams that are currently discharging into the WDA because the existing containment structures do not meet the liner design criteria for existing CCR surface impoundments as required by 40 CFR §257.71 or the location restriction requirements as outlined by 40 CFR §257.60(a)
- No alternative disposal available for CCR and non-CCR waste streams in the existing on-Site WWTP because there is currently not a consistent or reliable treatment capacity available

- No existing off-loading or conveyance piping infrastructure to support on- or off-Site alternative disposal of CCR or non-CCR waste streams currently conveyed to the WDA
- Not enough commercial tanker trucks in the region to support off-Site transport for alternative disposal of the combined total daily flow of CCR or non-CCR waste streams currently conveyed to the WDA
- An employee and public health and safety risk associated with off-Site disposal due to the additional truck traffic both on-Site and on the public roads as well as an increased carbon footprint with added truck traffic
- An increased risk of release that could harm the environment every time the wastewater is handled (i.e., pumped for off-Site transport, pumped to the on-Site WWTP)
- Neither existing railcar loading systems at RMSGS nor railcar infrastructure at the regional treatment/disposal facilities to support off-Site alternative disposal of wastewater currently conveyed to the WDA, and
- Not enough regional treatment capacity available for off-Site treatment of CCR and/or non-CCR waste streams that are discharged into to WDA. Current regional treatment capacity estimates are approximately 0.22 MGD. That correlates to only a 2.4% reduction in the 9.1 MGD disposal capacity needed for the current waste streams discharged into the WDA, resulting in a continued 97.6% reliance on the WDA.

With continued development and progression towards the cessation of operation and closure, NIPSCO LLC expects that subsequent annual progress reporting will be utilized to consider and demonstrate continued lack of alternative capacity and progress towards closure relative to site-specific changes in operation and conditions that may differ from the basis of evaluation provided herein.

Based on the parameters and extent of the evaluation of alternative disposal described herein, it is Golder's opinion that no alternative disposal capacity currently exists for CCR and non-CCR waste streams both on- and off-site, pursuant to 40 CFR § 257.103(f)(2)(v)(A). Therefore, and without consideration of increase in costs or inconvenience to NIPSCO LLC, the RMSGS WDA surface impoundment qualifies for continued operation and an alternative deadline to initiate closure.

4.0 CONTINUED OPERATION RISK MITIGATION PLAN, 257.103(f)(2)(v)(B)

As discussed in Section 3.4, ongoing management of waste from RMSGS coal-fired generation and, following cessation of such generation, the requisite boiler cleaning and washdown activities that are necessary prior to facility demolition, rely on continued operation of the WDA. However, a requirement for continued use of the CCR Unit and establishment of an alternative deadline to complete closure, which is otherwise subject to a cease receipt and closure deadline of April 11, 2021, is the preparation of a risk mitigation plan as described in this section.

A primary facet of successful risk mitigation relies on the CCR Unit's construction and safe day-to-day operation, supplemented by an appropriately designed and implemented groundwater monitoring system. Although the WDA is not lined, the perimeter berms were constructed with a minimum one-foot wide slurry wall component (core) that extends from just below the top of the berms to the underlying shale bedrock located approximately 30 to 35 feet below ground surface (ft bgs). The slurry wall functions as a perimeter hydraulic barrier from ground surface to the underlying bedrock. As evidence of the slurry wall's integrity, monitoring data indicate water surface elevations measured within the WDA are typically 15+ feet higher than groundwater surface elevations measured in perimeter monitoring wells outside the slurry wall.

As discussed in Sections 4.2 and 5.0, although NIPSCO LLC is performing Assessment Monitoring at the WDA, evaluation of groundwater monitoring data collected during Detection and Assessment Monitoring events indicates that *prima facie* groundwater impacts actually result from a) the natural variability of native soils and groundwater chemistry, which account for the natural variability in groundwater concentrations (Golder 2019a), and b) influence on groundwater quality downgradient of the WDA by one or more alternative sources, including a nearby former waste management unit that is now closed (Golder 2020a). Therefore, there is no evidence of a current or historical release from the WDA. The design of the unit (i.e., slurry walls constructed within the core of the perimeter berms through unconsolidated materials to underlying bedrock) is working as intended to prevent such releases. NIPSCO LLC will continue groundwater monitoring in accordance with the requirements of 40 CFR § 257.95 as an early indicator of changes in downgradient groundwater quality and, by extension, potential releases from the WDA.

In addition to performance of CCR Rule-compliant groundwater monitoring along with ongoing and potential operational measures described herein, NIPSCO LLC retained Haley & Aldrich, Inc. (Haley & Aldrich) to conduct a risk assessment (RA) specific to the WDA (Appendix B). The RA evaluates whether the groundwater and surface water potentially impacted by the WDA may pose a threat to human health or the environment. This evaluation consisted of a comparison of data collected from groundwater monitoring wells, facility production wells supplying industrial and potable water, representative tap locations, and nearby surface water data to effects-based criteria (e.g., Federal drinking water standards and ecological effects benchmarks). Findings and conclusions of the RA summarized in Section 4.2.2 and discussed in detail in the RA demonstrate there are no anticipated adverse impacts to human health or ecological receptors from groundwater downgradient of the WDA.

4.1 Measures to Limit Future Releases

The WDA currently receives several high-volume (e.g., up to 2.88 MGD average flow) waste streams including bottom ash sluice water, boiler room sump discharge, and stormwater from throughout the power block. From the perspective of overall potential contaminant loading to the WDA, chemical treatment of such streams would not appreciably reduce the contaminant mass nor the volume of wastewater being discharged to the CCR Unit, even if treatment capacity was readily available (which, as shown in Section 3.0, it is not). Designing and constructing new treatment capacity to address such high-volume, low concentration waste streams is not consistent with either future operational plans for RMSGS, which is scheduled to shut down all coal-fired generation by the end of Q2 2023, or the regulatory intent of 40 CFR § 257.103(f)(2).

Regarding chemical or physical measures to limit the potential for future releases from the WDA, NIPSCO LLC has already implemented or will evaluate a suite of risk mitigation measures including the following:

- At intervals not exceeding seven days, conduct inspections of the WDA for structural integrity issues in accordance with the requirements of 40 CFR § 257.83(a)(1).
- On an annual basis, have the design, construction, operation, and maintenance of the WDA reviewed by a qualified Indiana-registered professional engineer in accordance with the requirements of 40 CFR § 257.83(b)(1).
- Maintain the WDA static operating water level at approximately 677.0 ft msl, which is two feet below the top elevation of the slurry wall and four feet lower than the crest elevation of the perimeter berm.

- By no later than October 2021, conduct hazard potential classification, structural stability, and safety factor periodic assessments in accordance with the requirements of 40 CFR §§ 257.73(a)(2), 257.73(d), and 257.73(e).
- Review the possibility of further lowering operating static water levels to reduce hydraulic head within the impoundment and lessen the driving force of impounded water against the perimeter slurry wall.
- Consistent with a planned ash beneficial reuse projects that is contingent on IDEM regulatory approval, remove boiler slag/bottom ash source material from the WDA.

4.2 Groundwater Monitoring Results, Receptors and Mitigation

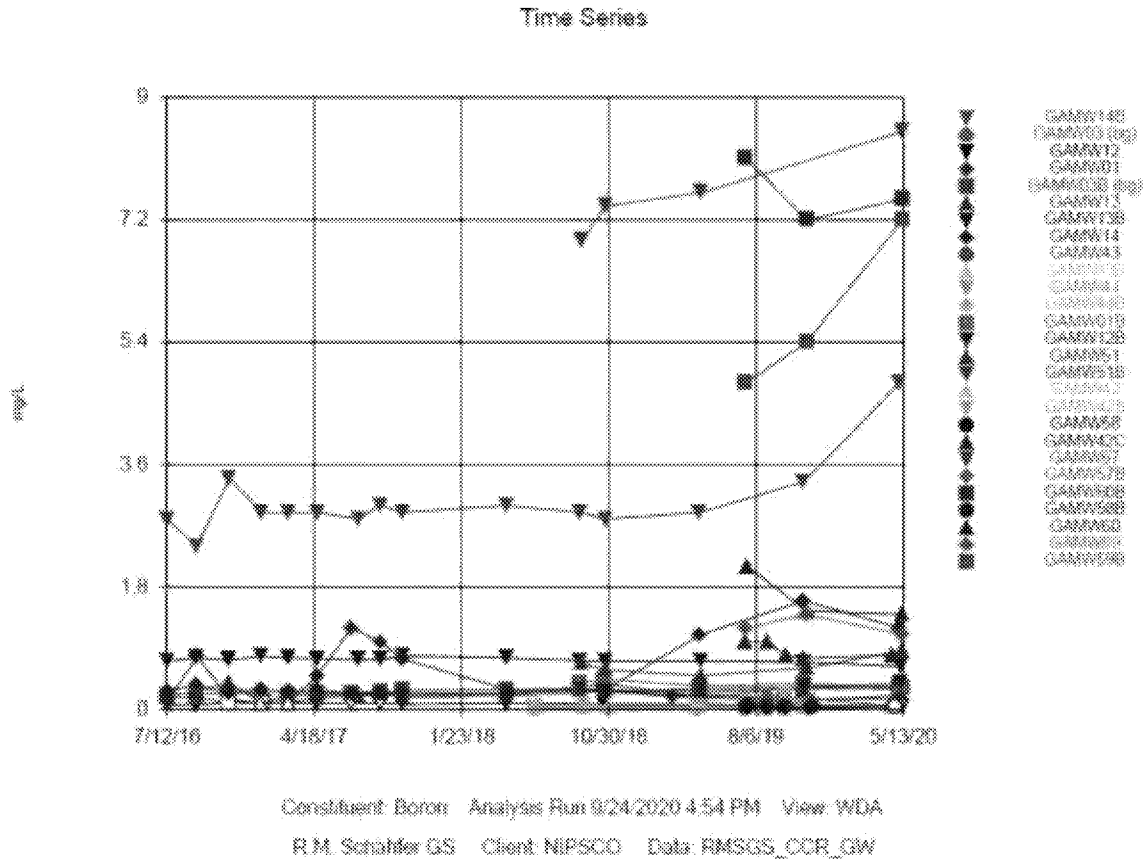
As described in Section 5.3.1 of the Demonstration, due to determination of SSIs of Appendix III constituents in groundwater during Detection Monitoring NIPSCO LLC is conducting Assessment Monitoring at background locations, the downgradient waste management boundary, and in additional downgradient locations between the CCR Unit, toward and including the western and northern property boundaries (see Figure 7). Supplementing the CCR Rule groundwater monitoring network results, NIPSCO LLC has installed staff gauges and collected surface water samples upstream of, adjacent to, and downstream of the WDA in a nearby channelized stream, Davis Ditch (see Figure 7) to measure surface water levels, evaluate potential groundwater-surface water interface issues including groundwater-to-surface water discharge, and determine surface water quality downgradient of the WDA.

Based on downgradient boundary well and surface water monitoring results, as explained in Sections 4.2.1 and 4.2.2 and detailed in the RA, NIPSCO LLC has confirmed there are no off-Site impacts associated with a release from the WDA. As also discussed in Section 4.2.2, NIPSCO LLC undertook proactive measure beginning in 2018 that are consistent with the requirements of 40 CFR § 257.103(f)(2)(v)(B)(2). These include identifying the locations of nearby receptors (i.e., private water supply wells) that might be exposed to future groundwater contamination based on current understanding of groundwater flow direction. In Section 4.2.3, NIPSCO LLC outlines its response plan in the event future off-Site groundwater contamination from the WDA is discovered.

4.2.1 Plume Delineation

Groundwater elevation data indicate that groundwater in the uppermost aquifer near the WDA flows to the north and northwest (with a slight northeast component). Representative groundwater contour maps are included for the most recent Spring (April 2020) and Fall (September 2020) sampling events (Figure 8 and Figure 9). Groundwater flow direction is influenced by the slurry walls that surround the WDA and adjacent non-regulated RB collectively, and the CCR Rule non-regulated IRWDB individually. Hydraulic heads measured inside the slurry wall that surrounds the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates that the slurry wall is functioning as a hydraulic barrier.

The CCR Rule Appendix III parameters are common indicator parameters for CCR material and, depending upon site conditions, can be indicative of the presence of CCR material in the media of interest. Indicator parameters, including boron, chloride, sulfate, and total dissolved solids, have been observed at higher concentrations in groundwater samples collected from downgradient deep monitoring well GAMW-14B (and to a lesser extent, GAMW-13B) than in the background monitoring wells (see the boron trend chart, embedded below).



Boron is a recognized CCR indicator parameter that has high mobility in groundwater. As such, its presence in downgradient monitoring wells is expected to represent the farthest extent of groundwater impacts originating from CCR. Accordingly, this constituent was chosen as a representative indicator of water quality in and around the WDA. For completeness and in accordance with 40 CFR § 257.103(f)(2)(v)(C)(3), all CCR Rule analytical data collected to date for the WDA are presented in Appendix C. A summary of boron concentrations in groundwater up- and downgradient of the WDA and from the saturated zone within the CCR Unit is as follows:

- Concentrations detected at background monitoring wells (GAMW-03 and GAMW-03B) ranged from non-detect (<0.2 milligrams per liter (mg/L)) to 0.35 mg/L.
- Concentrations at GAMW-42C (screened in shale) range from 0.75 to 1 mg/L, indicating the shale may be a natural source of boron at the Site.
- Concentrations detected in porewater at GAPIEZ04 (impounded water in direct contact with CCR materials) ranged from 0.71 to 0.86 mg/L.
- Concentrations at WDA Detection Monitoring downgradient wells (GAMW01, GAMW01B, GAMW12, GAMW12B, GAMW13, GAMW13B, GAMW14, and GAMW14B) ranged from non-detect (<0.2 mg/L) to 4.8 mg/L. The highest of these relatively low boron concentrations were observed in samples from the deep downgradient monitoring wells GAMW14B (2.4 to 4.8 mg/L) and GAMW-13B (0.69 to 0.79 mg/L). Although the boron concentrations in GAMW14B are higher than background concentrations, these concentrations are also higher than WDA porewater concentrations, which are representative of source materials. Furthermore,

fly ash (typically a primary source of boron) was not historically discharged to the WDA nor was it found in extensive core sampling of impounded bottom ash/boiler slag (which are not typically considered significant sources of boron) or underlying materials. Therefore, the presence of boron in these deep wells can be attributed to another source.

- Concentrations at Assessment Monitoring wells (GAMW51, GAMW51B, GAMW59, GAMW59B, GAMW60, GAMW60B) ranged from non-detect (<0.2 mg/L) to 8.5 mg/L, with the highest concentrations (4.8 to 8.5 mg/L) in the deep monitoring wells. These highest concentrations are higher than boron concentrations at hydraulically upgradient Detection Monitoring wells (i.e., GAMW13B and GAMW14B) located on the CCR Unit waste management boundary, indicating they a) do not represent a plume, and b) can be attributed to another source.
- Boron concentrations at the property boundary wells (GAMW-42, GAMW-42B, GAMW-43, GAMW-43B, GAMW-44, GAMW-44B, GAMW-57, GAMW-57B, GAMW-58, and GAMW-58B) are all less than 0.22 mg/L, which is less than or equal to the background concentrations, indicating these wells are outside any area of groundwater impact.

In summary, the groundwater analytical results collected from the WDA monitoring well network are not indicative of a groundwater plume associated with a release from this CCR Unit.

In accordance with CCR Rule regulations and its operator obligations associated with this Demonstration, NIPSCO LLC will continue to monitor groundwater at all wells that are part of the groundwater monitoring network on at least a semi-annual basis. In the event a release from the WDA is confirmed, NIPSCO LLC will take immediate action as outlined in this risk mitigation plan.

4.2.2 Identification of Nearby Receptors

The CSM in the RA (Appendix B) identified potential human and ecological receptors that could come into contact with impacts to groundwater and surface water associated with the WDA. For human health, the most sensitive (i.e., highly exposed) receptor scenarios included on-Site use of potable groundwater (employees), off-Site use of groundwater (residents), and exposures to surface water within Davis Ditch (recreational users/trespassers). Other receptors, such as Site visitors, are considered to have less exposures, and therefore, lower risk. For the human health scenarios, ingestion of and dermal contact with groundwater are the primary pathways of exposure. Because the constituents of concern associated with waste streams managed in the WDA are inorganics, vapor intrusion and inhalation are not viable exposure pathways considered herein.

To evaluate potential human receptors on-Site, the RA evaluated data collected from varied sources: the downgradient monitoring wells, assessment monitoring wells, two of NIPSCO LLC's production wells, and tap water samples collected from sinks in the on-site domestic water house. The production wells are the source of potable water for the generating station and are located approximately 1.6 miles downgradient of the WDA and about 1.5 miles downgradient of the WDA Assessment Monitoring wells. All data were compared to drinking water standards (state and Federal maximum contaminant levels (MCLs) and U. S. EPA Regional Screening Levels (RSLs) and exceedances were evaluated using alternative source demonstrations (ASD). Based on the evaluation in the RA, no exceedances of health-based standards for any Appendix IV constituent were attributed to impacts from the WDA. The RA concluded that impacts to groundwater from coal ash management practices are not anticipated to adversely affect human health under the most conservative receptor scenarios (drinking water).

For evaluating human health impacts in the surface water of Davis Ditch, surface water samples were collected upgradient, adjacent, and downgradient to the WDA (see Figure 7). In addition to drinking water standards, site-specific risk-based screening levels (RBSLs) were calculated assuming reduced ingestion and dermal contact based on recreational exposures (swimming and wading). As provided in the RA, surface water data within Davis Ditch were not above these criteria and the constituent concentrations were similar between upstream and downstream samples. Therefore, the RA concluded that no adverse health effects were anticipated for human health exposures to surface water.

Regarding potential human receptors off-Site, NIPSCO LLC installed monitoring wells on the downgradient property boundaries (i.e., west and north portions of the property boundary) and have monitored these wells semi-annually since their installation as required by 40 CFR § 257.95(g)(1). In addition, a pair of monitoring wells were installed to address groundwater flow adjacent to the southern edge of the WDA. No Appendix IV constituent concentrations were detected above the GWPS in any of these wells, and no Appendix IV detections above MCLs were associated with a release from the CCR Unit (i.e., these detections were limited to arsenic and cobalt which were determined to be elevated due to natural variation and/or naturally-occurring sources. In addition to property boundary well installation and monitoring, in 2018 Golder prepared a location map of all groundwater well locations (i.e., residential, irrigation, industrial) within a one-mile radius of RMSGS based on the Indiana Department of Natural Resources (IDNR), Division of Water state database. According to IDNR records, the closest off-site well is located 600 ft to the south, and upgradient in terms of regional groundwater flow, of the WDA. Should future downgradient monitoring results indicate a plume migrating from a release from the WDA, NIPSCO LLC will use this GIS map as an initial step to identify and contact potentially impacted well users.

Ecological receptors could include flora or fauna found in Davis Ditch, which is adjacent to and downgradient of the WDA and the nearest location of potential groundwater-to-surface water discharge. For these receptors, NIPSCO LLC evaluated the groundwater-to-surface water discharge pathway by collecting surface water samples upstream, adjacent to, and downstream of the WDA within Davis Ditch (Figure 7) and comparing the results, both total and filtered, to ecological benchmarks. In this comparison, no exceedances of the available benchmarks were observed in the surface water dataset. In addition to the direct comparison of measured data within Davis Ditch, the RA included the calculation of Surface Water Dilution Attenuation Factor (SW-DAF) for determining the groundwater concentrations that would result in surface water exceedances of the ecological benchmarks (Appendix B of the RA). Applying these SW-DAF to the benchmarks indicated that groundwater concentrations adjacent to Davis Ditch would need to be at least an order of magnitude higher than those currently observed at the Site to adversely impact ecological receptors within the creek.

4.2.3 Potential Receptor Mitigation

In the event of a groundwater release from the WDA and off-Site migration of a plume that could potentially impact human receptors (i.e., COCs are detected at the property boundary above MCLs or other appropriate health-based standards), NIPSCO LLC will implement the following actions:

- Using the IDNR well location map/figure described in Section 4.2.2, identify off-Site private wells nearest the detected area of release or downgradient extent of plume.
- Notify the Jasper County Health Department and potentially affected property owners.
- Verify groundwater flow direction and groundwater quality upgradient of potentially impacted private wells.

- Based on the results of these additional investigations, seek permission to perform private well water quality sampling for Appendix III and IV constituents and/or offer alternative potable water supplies.

4.3 Contaminant Plume Containment

In the event a release from the WDA is detected in groundwater during continued operation of the CCR Unit, 40 CFR § 257.103(f)(2)(v)(B) requires a plan to expedite and maintain the containment of any contaminant plume generated by the release. Based on Golder's assessment of the Site hydrogeology, evaluated a) as an integral component of the CSM process for design and construction of the CCR Rule-compliant groundwater monitoring systems, and b) during groundwater modeling as part of the Selection of Remedy process for the nearby MCU, hydraulic control using a groundwater pump-and-treat system would be an effective method of containment. Pump-and-treat would also likely be the quickest and easiest method of plume containment to implement, based on groundwater monitoring results to date and assuming a release from a single area of the impoundment.

Golder conducted an aquifer test at the Site in 2019 (Golder 2020) to gather additional data for the evaluation of potential groundwater remediation alternatives. The aquifer tests included assessments of hydraulic conductivity and storativity, as well as potential flow influences attributable to the effect(s) of impoundment slurry walls. Golder then used the aquifer test results along with existing Site hydrological data to develop a groundwater model of the Site. Based on a) the similar soil profile identified in various locations on-Site, and b) similar groundwater gradients compared to the aquifer test area, the groundwater model is applicable to the WDA area. Using the groundwater model results for the area, Golder determined that extraction wells spaced at approximately 250-foot intervals and removing 1,000 cubic feet per day (about 5 gallons per minute) each are capable of generating sufficient drawdown to contain downgradient groundwater migration.

In the event of a detection of a release from the WDA, NIPSCO LLC could utilize the above information and existing downgradient Detection Monitoring and Assessment Monitoring wells to extract groundwater and contain the plume on a temporary basis. NIPSCO LLC would equip the wells indicating a release and those immediately adjacent with submersible pumps capable of pumping at least 5 gpm under the existing hydrologic conditions (e.g., Grundfos RediFlo 2) with the discharge being pumped back into the WDA. This initial response is intended only as a temporary method to contain the plume generated by the release until the release can be more fully assessed and a full-scale pump-and-treat system can be designed and constructed.

The full-scale pump-and-treat system would be constructed to contain the release and would consist of new extraction wells installed and screened to the full depth of the aquifer (approximately 35 feet bgs). The number of wells needed would be determined based upon the extent of the Appendix IV constituent release and the location and number of downgradient assessment wells with detections above the groundwater protection standard (GWPS). The extracted groundwater would be pumped to a new treatment building located to the northwest of the WDA. Treatment technologies selected and other design parameters would be established based on the COCs requiring a response action.

5.0 CCR RULE REGULATORY COMPLIANCE, 257.103(f)(2)(v)(C)

As generally discussed in Section 1.0, RMSGS operates a landfill and surface impoundments regulated in accordance with the CCR Rule, as amended. As outlined in this Demonstration, NIPSCO LLC is committed to permanent cessation of coal-fired generation at RMSGS by Q2 2023 but must continue to use the WDA impoundment beyond the otherwise applicable April 11, 2021 mandatory cease receipt date due to the absence of alternative disposal capacity on- and off-Site. Per 40 CFR §257.103(f)(2), such continued use of surface impoundments for management of CCR and non-CCR waste streams is allowable, contingent upon RMSGS

meeting certain criteria related both to facility-wide and CCR unit-specific regulatory compliance, and the approval by U.S. EPA of this Demonstration.

This section of the Demonstration addresses two aspects of the regulatory compliance requirements in accordance with 40 CFR §257.103(f)(2)(iii). Section 5.1 identifies and briefly describes RMSGS' CCR Rule-regulated waste management units, summarizes their regulatory program status, and provides a certification of facility-wide (i.e., the entirety of RMSGS CCR Rule-regulated operations and activities) compliance with all applicable 40 CFR Part 257, Subpart D regulations, pursuant to §257.103(f)(2)(v)(C)(1). Sections 5.2 through 5.8 summarize and append information and supporting data detailing the status of only the WDA with respect to Demonstration requirements for hydrogeologic setting and characterization, and the groundwater monitoring network, quality, and flow direction; status of corrective measures assessment and remedy selection; and structural stability and safety factor assessments, pursuant to 40 CFR §257.103(f)(2)(v)(C)(2-8).

5.1 Certification of Facility Status

In accordance with 40 CFR §257.103(f)(2)(iii), this section of the Demonstration substantiates compliance with all other applicable requirements of 40 CFR §257. RMSGS includes three waste management areas subject to CCR Rule regulation (see Figure 2), two of which NIPSCO LLC will continue to operate for the foreseeable future and one of which is slated for closure in the near term. These include the WDA, which is the primary focus of this Demonstration; Landfill Phases V, VI, and VII; and the Material Storage Runoff Basin (MSRB), Metal Cleaning Waste Basin (MCWB), and Drying Area (DA), collectively the Multi-Cell Unit (MCU).

NIPSCO LLC has certified that the entire facility complies with the applicable requirements of the CCR Rule (Appendix D). The following independent certifications have been completed by a qualified professional engineer in accordance with the content and schedule requirements of the CCR Rule:

- Location restriction §257.60(a), 257.61(a), 257.62(a), 257.63(a), and 257.64(a) (applicable to all CCR units, Appendix A)
- Design and construction certifications §257.70(e) and (f) (only applicable to the Landfill Phase VII)
- Documentation of liner type §257.71(b) (only applicable to surface impoundments)
- Hazard potential classification §257.73(a)(2) (only applicable to surface impoundments)
- Structural stability assessment §257.73(d) and Safety factor assessments §257.73(e) (only applicable to the WDA, also included as Appendix L)
- Fugitive dust control plan §257.80(c)
- Run-off control system plans §257.81(c) (only applicable to the Landfill)
- Design flood control system plan §257.82(c) (only applicable to surface impoundments)
- Periodic inspection report §257.83(b)(2) and §257.84(b)(2) (only applicable to the WDA and the Landfill)
- Groundwater system certifications §257.91(f) (applicable to all CCR Units)
- Statistical method certification §257.93(f)(6) (applicable to all CCR Units)
- Assessment of corrective measures §257.96(a) (only applicable to the MCU)

- ASDs for the Landfill Phases V and VI, Detection Monitoring §257.94(e)(2), and the WDA, Assessment Monitoring §257.95(c)(3)

5.2 Hydrogeologic Information

RMSGS is located in the physiographic region of Indiana known as the Northern Moraine and Lake Region (Indiana Handbook of Geology). This region is covered by deposits from Wisconsinan glaciations and has variable topographic relief. The Site is located in the Lowland Kankakee River Valley and is bounded by the Valparaiso and Iroquois moraines to the north and south, respectively. The region is characterized by broad marshes, which mark lacustrine plains, separated by low sand ridges. These lacustrine deposits make up a thin veneer which covers thick till deposits from the Wisconsin glacial epoch. Guthrie et al. of the Indiana Department of Conservation note that there are almost no bedrock outcrops in northern Jasper County, and that glacial drift thickness is frequently measured in hundreds of feet.

Underlying the unconsolidated sediments, sedimentary bedrock dips relatively uniformly to the northeast and is characterized by a transgressive marine sequence of angular non-conformities formed by several dissimilar dipping sedimentary layers. According to Fennelon more than 4,000 feet of sedimentary rocks overlie Precambrian granitic bedrock. This assemblage is part of the north side of the Kankakee Arch, the major structural feature in the Kankakee River Basin. The first 3,500 feet of sedimentary rocks overlying the granitic bedrock are Cambrian and Ordovician in age. The uppermost 300 feet of Ordovician rocks are composed of shale and minor limestones and are referred to as the Maquoketa Group. The Maquoketa Group underlies Silurian, Devonian and Mississippian rocks and consist of a wide variety of sedimentary layers ranging from shaley to coarse-grained carbonate rocks. This carbonate sequence is overlain by a series of shales including the Antrim Shale, a brownish-black, noncalcareous shale (Fennelon, 1994).

The Site is underlain by unconsolidated, upper-Pleistocene (post-Wisconsin) fine-grained sand and silt and outwash deposits of the Atherton Formation, occasionally overlain by alluvial and lacustrine deposits of the Martinsville Formation (Schneider and Keller, 1970). According to Fraser and Bleur (1991), during the late Pleistocene, the Site was occupied by a post-glacial lake followed by a broad, low-gradient outwash stream that deposited sand uniformly across the basin to form the Kankakee-Valparaiso Formation. Golder's interpretation of the Site geology is based on soil borings, attached in Appendix E, bedrock geology maps, prior reports, CCR Rule-related well installation activities, and geotechnical borings advanced within the WDA. Golder's interpretation of the Site Geology is presented in three cross-sections (Figure 10, Figure 11, and Figure 12) and includes:

- Brown fine to medium-gained sand from the ground surface to approximately 14 ft bgs.
- Grayish-brown fine to medium sand from approximately 14 ft bgs to 36 ft bgs (coarsens with depth).
- Black to dark gray shale with planar cleavage. Depth to bedrock is approximately 36 ft bgs near the WDA.

Groundwater elevation data collected to-date indicate that groundwater in the uppermost aquifer near the WDA generally flows to the north and northwest (with a possible northeast component, immediately adjacent to the WDA). Groundwater flow direction is influenced by the presence of slurry walls surrounding the WDA and adjacent non-CCR Rule regulated Recycle Basin and IRWDB. Hydraulic heads measured inside the slurry walls surrounding the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates the slurry walls significantly impede lateral flow of impounded water from the CCR Unit to the uppermost aquifer (Figure 8 and Figure 9).

The calculated horizontal hydraulic gradient near the CCR units ranges from approximately 0.0007 ft/ft to 0.0020 ft/ft. A review of the groundwater elevation data indicates that groundwater flow in the shallow unconfined aquifer is primarily horizontal, and that there is not a significant vertical component of groundwater flow.

Golder performed hydraulic conductivity testing (slug testing) in eight monitoring wells (two tests per well) in accordance with procedures in the Groundwater Monitoring Program Implementation Manual (GMPIM, Golder 2017c). Golder field personnel used a pressure transducer and data logger to obtain the slug test data. Golder used Hvorslev and Bower, and Rice Methods to calculate the hydraulic conductivity values. The slug test measurement data and calculations are provided in Appendix F. The average hydraulic conductivity for the wells installed in the upper and lower portions of the uppermost aquifer is 3.3×10^{-2} centimeters per second (cm/sec) and 9.69×10^{-3} cm/sec, respectively. The calculated hydraulic conductivity values appear to be consistent with anticipated values for glacial outwash deposits.

Golder calculated the hydraulic gradient for the unconfined aquifer in the vicinity of the CCR units at 1.17E-03 foot per foot as shown below using average groundwater elevation data from June 2016 to April 2017.

$$i_{gw} = \left({}^{h_L}/_{L}\right)$$

Where: h_L = head loss (elevation difference - foot)
L = length (horizontal distance - foot)

Using an assumed effective porosity value of 30%, and the average hydraulic conductivity from slug tests for the shallow unconfined aquifer of 93.5 ft/day, and the calculated gradient, the average rate of groundwater flow (V_{gw}) in the unconfined aquifer was calculated using the algorithm below.

$$V_{gw} = K\, i\, \left({}^{1}/_{n_e}\right)$$

Where: V_{gw} = Groundwater velocity
K = Hydraulic conductivity
i = Hydraulic gradient
n_e = Effective porosity
V_{gw}= [(93.5 ft/day) x (1.17E-03)] / 0.30
V_{gw}= 0.365 ft/day, or 133 ft/year

As calculated above, the estimated horizontal rate of groundwater flow in the shallow unconfined aquifer beneath the study area is expected to average approximately 133 feet per year.

Golder assessed groundwater elevation data for the 13 well couplets located near the WDA (Figure 6). Vertical gradients (up or down) varied across the Site and near individual units. In the majority of well pairs (all but four), both upward and downward vertical gradients have been measured (Table 1). Overall average downward gradients were observed near well pairs GAMW03/03B (located upgradient and west of the WDA, -6.24E-04), GAMW14/14B (located downgradient and east of the WDA, -1.83E-03), and GAMW44/44B (located on the eastern property boundary, -5.48E-04). Upward vertical gradients were observed in the other ten well pairs associated with the WDA and ranged from 1.13E-02 (GAMW01/01B) to 9.5E-05 (GAMW57/57B). The groundwater flow in the shallow unconfined aquifer has a moderate vertical component of groundwater flow in both upward and downward directions, depending upon location.

5.2.1 Monitoring System Design

Design of the CCR Rule-compliant WDA monitoring system considered the size and configuration of the impoundment, operational history, hydraulic influence of the slurry walls on the groundwater flow regime, likelihood and anticipated location of potential impacts to groundwater, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer. As shown in Figure 2, the WDA is an approximately 80-acre impoundment located in the southwest portion of the RMSGS property. The WDA receives primarily bottom ash/boiler slag slurried from two coal-fired boilers. Most of the ash/slag is deposited in the northern half of the WDA where the slurry lines discharge. Due to size of the unit and settling/depositional properties of the CCR materials, very little, if any, ash/slag is present in the southern half of the WDA (Figure 4). Therefore, NIPSCO LLC's approach to monitor groundwater quality downgradient of the WDA focuses on the northern portion of the unit.

At the time of the initial WDA groundwater monitoring system design, the competence and full impact of the perimeter slurry wall on the groundwater flow regime had not been investigated. Nevertheless, NIPSCO LLC/Golder recognized a substantial difference in the elevation of the water within the impoundment and the potentiometric surface of the groundwater in existing monitoring wells outside the impoundment. Therefore, depending upon the degree of contact between the bottom surface of the slurry walls and the shale, the higher hydraulic head observed in the WDA (i.e., within the slurry walls) may have resulted in the discharge of impounded water beneath the slurry walls. Based upon the above hypothesis, NIPSCO LLC's monitoring approach for the CCR surface impoundment featured the installation of well pairs including shallow (approximately 15 ft bgs) and deep (approximately 35 ft bgs – to the top of shale [signified with a "B" in Figure 6]) couplets at each background and downgradient monitoring well location outside of the perimeter slurry walls as shown in Figure 6. Deep monitoring wells, which are designed to monitor potential flow beneath the slurry wall into the aquifer, supplement the shallow wells, which are located to intersect a release should the slurry walls not be functioning as designed.

The monitoring well network contains the following wells:

- Existing Wells: Two previously existing monitoring wells (GAMW01 and GAMW03) that are appropriately located and constructed to serve as CCR Rule-compliant monitoring wells.
- 2016 Wells: Installation of six monitoring wells designated GAMW03B, GAMW12, GAMW13, GAMW13B, GAMW14, and GAMW14B upgradient and/or at the WDA waste boundary.
- 2018 Wells: Installation of two deep wells (GAMW01B and GAMW12B) to supplement the monitoring network near the WDA. The new deep wells were co-located with existing shallow wells (GAMW01 and GAMW12) near the waste boundary. In addition, Golder installed one new assessment monitoring well pair designated GAMW51/51B further downgradient of the WDA and IRWDB to assess the extent of potential groundwater impacts detected during Assessment Monitoring and to monitor for potential releases from the non-regulated IRWDB installed and three assessment monitoring well pairs designated GAMW42/42B, GAMW43/43B, and GAMW44/44B along the property boundary in accordance with §257.95(g).
- 2019 Wells: Installation of nine new assessment monitoring wells to further assess the nature and extent and overall groundwater quality downgradient of the WDA and the IRWDB including: two well pairs designated GAMW59/59B and GAMW60/60B downgradient of existing assessment monitoring well pair GAMW51/51B; five new wells, including a deep monitoring well screened in the shale (designated

GAMW42C and installed adjacent to existing well pair GAMW42/42B); and two new well pairs designated GAMW57/57B and GAMW58/58B to the north of the of the existing property boundary wells.

Prior to collecting any groundwater samples, Golder measures water levels to assess groundwater flow direction and calculate hydraulic gradients from each monitoring well and piezometer as summarized in the table embedded below:

	WDA
Background Monitoring Wells	GAMW03 and GAMW03B
Downgradient Monitoring Wells	GAMW01, GAMW01B, GAMW12, GAMW12B, GAMW13, GAMW13B, GAMW14, and GAMW14B
Assessment Monitoring Wells	GAMW42, GAMW42B, GAMW42C, GAMW43, GAMW43B, GAMW44, GAMW44B, GAMW51, GAMW51B, GAMW57, GAMW57B, GAMW58, GAMW58B, GAMW59, GAMW59B, GAMW60, and GAMW60B
Piezometer (non-CCR Monitoring Wells)	GAMW02 and GAMW05

A summary of the well construction information is provided in Table 2 and a summary of the dates and purpose of installation is provided in Table 3. The boring and well construction logs are provided in Appendix E. The monitoring well locations are shown in Figure 6.

5.3 Groundwater Monitoring Results

Starting in July 2016 on behalf of NIPSCO LLC, in accordance with the requirements of the CCR Rule Golder has performed monitoring of each well in the WDA groundwater monitoring network on at least a semi-annual basis. The monitoring well network is described below in Section 5.3.1 and shown in Figure 6. A compilation of all groundwater data collected as part of the CCR program for the WDA is provided in Appendix C. The most recent annual report (2019 Annual Report, submitted January 2020) for the WDA is provided in Appendix G.

5.3.1 Monitoring Program Status

Between July 2016 and August 2017, Golder collected eight independent background groundwater samples from each background and downgradient well, as required by 40 CFR §257.94. The results of the background monitoring phase were used to develop appropriate, statistically-valid background values for each constituent/monitoring well. Following completion of the eight background monitoring events, Golder collected the first Detection Monitoring groundwater samples in October 2017 and compared the results to the calculated prediction limits to determine statistically significant increases (SSIs). Based on these results, NIPSCO LLC established an Assessment Monitoring program in January 2018.

Golder performed the first Assessment Monitoring event in March 2018 (with verification sampling in April 2018). Following receipt and validation of laboratory results, Golder evaluated the results of the first Assessment Monitoring sampling event to determine the concentration of Appendix IV constituents relative to CCR Unit-specific calculated groundwater protection standards (GWPSs). The GWPS is the MCL, if an MCL exists, or the unit-specific background concentration for each analyte using a tolerance/prediction limit procedure. The unit-specific GWPSs are summarized in Table 4. Based on this statistical analysis, Golder concluded that the only

constituent demonstrating an apparent SSL was molybdenum. The calculated GWPS (unit-specific background concentration) for molybdenum was 0.009 milligrams per liter (mg/L). However, the detected groundwater molybdenum concentrations did not exceed the new U. S. Environmental Protection Agency (USEPA) risk-based level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and which became effective August 29, 2018 (CCR Rule, Part 1 Phase 1 Addendum). Golder completed an ASD in November 2018 concluding that the molybdenum SSLs identified in August 2018 are not due to a release from the WDA (Appendix H, Golder 2018b). The key supporting lines of evidence described in the ASD indicate that the molybdenum detected in monitoring wells downgradient of the WDA is naturally-occurring, and not due to a release from the WDA.

Golder performed the second Assessment Monitoring event in October 2018 by collecting groundwater samples from each background and downgradient monitoring well, including the additional Assessment Monitoring wells, per 40 CFR §257.95. Golder performed the statistical evaluation in February 2019 and concluded that the only constituents demonstrating apparent SSLs were arsenic, in GAMW01, and cobalt, in GAMW14. Golder completed an ASD in May 2019 in which the key supporting lines of evidence indicated that the source of the arsenic and cobalt is natural variation, not the WDA (Appendix I, Golder 2019a).

Golder performed the third Assessment Monitoring event in April 2019 and the statistical evaluation in August 2019 and concluded that the only constituent demonstrating an apparent SSL was arsenic in well GAMW01. Golder recertified the previously submitted ASD in November 2019 indicating that this SSL is due to natural variation (Appendix J, Golder 2019d).

Golder performed the fourth Assessment Monitoring event in October/November 2019 and the statistical evaluation in March 2020. SSLs were evaluated according to the RMSGS GMPIM which indicates that confidence intervals are used to evaluate for potential SSLs and confidence intervals are required to be calculated based on a minimum of four independent observations (Golder 2017c). As such, the statistical evaluation completed in March 2020 is the first to include the monitoring wells installed in May/June 2018 (see Section 5.2.1) including Assessment Monitoring wells GAMW51 and GAMW51B. Applying the risk-based standards of 0.1 mg/L and 0.04 mg/L for molybdenum and lithium, respectively, as the GWPSs, the results of the statistical evaluation indicate an apparent SSL for molybdenum in well GAMW51B. Three of the four samples collected from GAMW51B also include detections of lithium above the GWPS; however, the results of the statistical evaluation do not indicate an apparent SSL for lithium (i.e., the upper confidence interval exceeds the GWPS, but the lower confidence interval does not). Golder completed an ASD in June 2020 in which key supporting lines of evidence indicated that the source of the molybdenum and lithium in GAMW51B are associated with another source rather than a release from the CCR Unit (Appendix K, Golder 2020a).

Golder performed the fifth Assessment Monitoring event in April/May 2020 and the statistical analysis in September 2020 and concluded that the only constituents demonstrating an apparent SSL are molybdenum and lithium in GAMW51B. The results of the April/May 2020 sampling event are similar to historical data. Golder will recertify the previously submitted ASD in December 2020. Golder performed the sixth Assessment Monitoring event in October/November 2020 and will submit this data as part of the 2020 Annual Report. A summary of the dates and purposes of each monitoring event is presented in Table 5 and a complete compilation of all analytical data is provided in Appendix C.

5.4 Corrective Measures Assessment

Based upon groundwater monitoring results collected pursuant to the CCR Rule to date, corrective measures program requirements have neither been triggered nor implemented at this CCR Unit. In compliance with 40 CFR §257.95, NIPSCO LLC will continue groundwater monitoring on a semi-annual basis, evaluating results and performing statistical analyses of collected data. Should NIPSCO LLC detect exceedances of the GWPS that indicate releases attributable to the WDA, an Assessment of Corrective Measures (ACM) will be implemented pursuant to the requirements of 40 CFR §257.96.

5.5 Remedy Selection

Based upon groundwater monitoring results collected pursuant to the CCR Rule to date, exceedances of GWPS attributable to the WDA have not been detected nor has the requirement to conduct an ACM been triggered. Accordingly, remedy selection requirements pursuant to 40 CFR §§257.97 or 257.98 are not applicable nor have they been implemented at the CCR Unit at this time. Should an ACM be necessary, NIPSCO LLC will complete it in accordance with the timeframes outlined in 40 CFR §257.96, following which NIPSCO LLC will implement the remedy detailed evaluation and selection processes.

5.6 Structural Stability Assessment

Golder completed the initial Structural Stability and Safety Factor Assessment for the WDA in October 2016 as required by 40 CFR §257.73(d) and 40 CFR §257.73(e) (Appendix L). This assessment concluded that, based on the information provided by NIPSCO LLC, onsite observations, and the results of the structural stability assessment, one structural deficiency was identified in the WDA surface impoundment. As a result, it was recommended that NIPSCO LLC remedy the deficiency by improving the size of the auxiliary spillway, operationally controlling the water level in the WDA. The improved auxiliary spillway construction was completed in 2017 and Golder inspected the spillway and concluded that the auxiliary spillway can adequately convey the peak flow rate associated with the inflow design flood without additional attenuation within the WDA (Golder 2017a). The most recent certified annual inspection report (Fifth Annual RCRA CCR Unit Inspection Report Waste Disposal Area - Surface Impoundment) is attached in Appendix M. As required by 40 CFR §257.83(b)(1), the WDA has been visually inspected annually for structural stability. This assessment concludes that based on information provided by NIPSCO LLC and on Golder's on-site visual inspection, the overall condition of the WDA is acceptable. The assessment was certified by a qualified professional engineer licensed in the State of Indiana on January 2, 2020.

5.7 Safety Factor Assessment

Golder completed the initial Structural Stability and Safety Factor Assessment for the WDA in October 2016 as required by 40 CFR §257.83(b)(1). The ground acceleration used in the seismic analysis was 0.1472g, which is the Maximum Considered Earthquake (MCE) ground motion of 0.2 second spectral response, and 2 percent exceedance in 50 years. This assessment concludes that, based on the information provided by NIPSCO LLC, onsite observations, and the results of Golder's analyses (static and pseudo static [seismic]), the calculated factor of safety through the critical cross section in the WDA surface impoundment meets or exceeds the minimum values listed in 40 CFR §257.73(e)(1)(i)-(iv). In addition to safety factor, multiple stability-type assessments have been completed for the WDA including:

- A hazard potential classification assessment was conducted for the WDA pursuant to 40 CFR §257.73(a)(2), which resulted in a high hazard classification (Golder 2016a)

- A seismic impact zone assessment was conducted for RMSGS pursuant to 40 CFR §257.63, which determined a peak horizontal ground acceleration (PGA) to be approximately 0.06g and therefore, the WDA was not located within a seismic impact zone (Golder 2018a)

The Safety Factor Assessment is provided in Appendix L and was certified by a qualified professional engineer licensed in the State of Indiana on October 5, 2016.

6.0 CLOSURE PLAN, 257.103(f)(2)(v)(D)

As discussed in Sections 1.4 and 2.4 above, NIPSCO LLC has outlined a planned cessation of operation and closure for the Site. The current reliance on the WDA is tied to the ongoing generating activities and dewatering and closure of other CCR surface impoundments with a period of sequential cessation of waste streams from Q2 2023 until Q3 2025. Cessation of coal-fired generation is scheduled by the end of Q2 2023 and closure of the MCU is scheduled to be completed no later than Q4 2025, reducing the reliance on the WDA due to the elimination of these waste streams. Following the cessation of coal-fired generation, NIPSCO LLC will systematically shutdown the boilers, which will produce an action-specific need for the WDA due to cessation washdown streams forecasted until Q4 2023. Identification and redirection of other waste streams, currently forecasted between Q1 and Q3 of 2025, will be completed prior to final cease receipt of WDA streams (Q3 2025). WDA closure construction is scheduled to begin in Q4 2025 and will be completed by October 17, 2028.

On the behalf of NIPSCO LLC, Golder completed a CCR Closure Plan Update (Version #5) which addresses the requirements of 40 CFR §257.102(b) *Criteria for conducting the closure or retrofit of CCR units*. The plan describes the WDA CCR Unit, and provides a closure remedy, steps required to close the CCR Unit, design plans and a schedule for closure. The plan calls for closure of the impoundment by removal of the CCR and decontamination of the CCR Unit. A copy of the latest Closure Plan update is included in Appendix N – Closure Plan.

The final cease receipt of waste streams to the WDA is scheduled to occur in Q3 2025 providing sufficient time for planned cessation of operations reliant on inflow to the WDA and allowing for the forecasted sequence and schedule of closure activities within the regulatory closure deadline.

7.0 OPERATOR RESPONSIBILITY

As addressed in this section, after preparation of the Demonstration and submittal on or before November 30, 2020, additional requirements must be met by NIPSCO LLC relative to the 40 CFR §257.102(f)(2) regulations. In addition to compliance with requirements as outlined in 40 CFR §257.103(f)(2)(vi), following submission of the Demonstration to U. S. EPA NIPSCO LLC will comply with the recordkeeping requirements specified in §257.105(i), the notification requirements specified in §257.106(i), and the internet posting requirements in §257.107(i), as applicable and as detailed below.

In accordance with the requirements of 40 CFR §257.103(f)(2)(viii), NIPSCO LLC will upon submission of the Demonstration prepare and place in the RMSGS operating record and on its publicly accessible CCR internet site a notification of intent to comply with the site-specific alternative to initiation of closure due to permanent cessation of a coal-fired boiler(s) by a date certain. This notification will include a reference to the submission date along with a copy of the Demonstration.

Pursuant to the requirements of 40 CFR §257.103(f)(2)(ix), upon receipt from U. S. EPA of its decision as described in §257.103(f)(3) NIPSCO LLC will place a copy of the approved or denied decision in the RMSGS

operating record and the NIPSCO LLC publicly accessible CCR internet site. In addition, NIPSCO LLC will prepare a notification of the availability of the U. S. EPA decision.

Per the requirements of 40 CFR §257.103(f)(2)(x), NIPSCO LLC will prepare an annual progress report documenting continued lack of alternative capacity and progress towards the closure of the WDA. Successful completion of the progress report will be documented by its placement in the RMSGS operating record. NIPSCO LLC will also prepare a notification of the availability of the annual progress report and place a copy of the report on the NIPSCO LLC publicly available CCR internet site.

8.0 CLOSING

It is Golder's opinion that the information contained herein is true, accurate and has been prepared in accordance with good engineering practices and that the documentation provided for continued operation and alternative deadlines to initiate closure of the WDA, without consideration of increase in costs or inconvenience to NIPSCO LLC, in accordance with §257.103(f)(2), demonstrates that there is presently no existing alternative disposal capacity on- or off-Site that could accept the flow currently being impounded in the WDA at RMSGS.

9.0 REFERENCES

Golder Associates (2016a), NIPSCO R.M. Schahfer Generating Station, Hazard Potential Classification Assessment and Visual Inspection Report – RCRA CCR Units, Pursuant to 40 CFR § 257.73, September 2016.

Golder Associates (2016b), NIPSCO R.M. Schahfer Generating Station, CCR Surface Impoundment Inflow Design Flood Control System Plan, Pursuant to 40 CFR § 257.82, October 2016.

Golder Associates (2017a), Amendment to the R. M. Schahfer Generating Station Inflow Design Flood Control System Plan- Hydraulic Evaluation of the Waste Disposal Area Auxiliary Spillway, November 16, 2017.

Golder Associates (2017b), NIPSCO R. M. Schahfer Generating Station, Amendment to the R.M. Schahfer Generating Station Inflow Design Flood Control System Plan – Hydraulic Evaluation of the Waste Disposal Area Auxiliary Spillway, November 16, 2017.

Golder Associates (2017c), NIPSCO R. M. Schahfer Generating Station, CCR Groundwater Monitoring Program Implementation Manual, October 2017.

Golder Associates (2018a), Location Restrictions Certification Report, NIPSCO R.M. Schahfer Generating Station Impoundments, Pursuant to 40 CFR Part §257.60-64, October 17, 2018

Golder Associates (2018b), NIPSCO R. M. Schahfer Generating Station, Waste Disposal Area, Alternative Source Demonstration, November 2018.

Golder Associates (2019a), Alternative Source Demonstration- Waste Disposal Area, May 2019.

Golder Associates (2019b), NIPSCO R. M. Schahfer Generating Station, CCR Surface Impoundment No Alternative Disposal Capacity Documentation, Pursuant to 40 CFR § 257.103(b)(1), February 2019.

Golder Associates (2019c), NIPSCO R. M. Schahfer Generating Station, CCR Groundwater Monitoring System Design Manual Revision 2.0, December 2019.

Golder Associates (2019d), Recertification of R. M. Schahfer Waste Disposal Area Alterative Source Demonstration, November 26, 2019.

Golder Associates (2020a), Alternative Source Demonstration- Waste Disposal Area, June 2020.

Golder Associates (2020b), R. M. Schahfer Generating Station Ash Pond Assessment Report, Revised June 2020.

Fenelon, J.M., K.E. Bombay, et al., 1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water Resources Investigations, Report 92-4142, 1994.

Fraser, G.S., Bleuer, N. K., 1991, Geologic framework of the aquifers in the Kankakee River lowland: Indiana Geological Survey Occasional Paper 60, 10 p., 9 fig

Indiana Department of Environmental Management, Virtual File Cabinet document #82673058, Variance determination, NIPSCO, R.M. Schahfer Generating Station, correspondence dated January 11, 2019.

NiSource Environmental, Indiana Department of Environmental Management NIPSCO Request for a Variance Pursuant to Ind. Code 13-14-8-8 From a Deadline in the Coal Combustion Residuals Rule, R.M. Schahfer Generating Station, correspondence dated December 20, 2018.

NiSource Environmental, Indiana Department of Environmental Management NIPSCO Request for a Variance Pursuant to Ind. Code 13-14-8-8 From a Deadline in the Coal Combustion Residuals Rule, R.M. Schahfer Generating Station, correspondence dated December 3, 2018.

Schneider, A.F. and Keller, S.J., Geologic Map of the Chicago Quadrangle, Indiana, Illinois, and Michigan; Indiana Geologic Survey, Bloomington. 1970

Tables

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				June 13, 2016				July 11, 2016				September 6, 2016			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	9.00	659.23	NA	NA	9.26	658.97	NA	NA	8.91	659.32	NA	NA
GAMW01B	665.2	667.87	26	36	31	636.87	NA	NA			NA	NA			NA	NA		
GAMW03	665.14	668.2	5	15	10	658.20	7.40	660.80	4.99E-04	Up	8.43	659.77	4.99E-04	Up	7.39	660.81	9.98E-04	Up
GAMW03B	665.29	668.16	25	35	30	638.16	7.35	660.81			8.38	659.78			7.33	660.83		
GAMW12	664.35	667.29	5	15	10	657.29	8.40	658.89	NA	NA	8.65	658.64	NA	NA	8.23	659.06	NA	NA
GAMW12B	664.23	666.81	25	35	30	636.81	NA	NA			NA	NA			NA	NA		
GAMW13	664.31	667.24	5	15	10	657.24	8.61	658.63	4.97E-04	Up	8.87	658.37	-4.97E-04	Down	8.25	658.99	0.00E+00	Up
GAMW13B	664.23	667.12	25	35	30	637.12	8.48	658.64			8.76	658.36			8.13	658.99		
GAMW14	664.76	667.96	5	15	10	657.96	9.47	658.49	5.00E-04	Up	9.72	658.24	0.00E+00	Up	8.83	659.13	9.99E-04	Up
GAMW14B	664.62	667.94	25	35	30	637.94	9.44	658.50			9.70	658.24			8.79	659.15		
GAMW42	663.12	665.8	5	15	10	655.80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW42B	663.15	665.66	26	36	31	634.66	NA	NA			NA	NA			NA	NA		
GAMW43	663.14	665.59	5	15	10	655.59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW43B	663.12	665.53	16	26	21	644.53	NA	NA			NA	NA			NA	NA		
GAMW44	664.11	666.31	5	15	10	656.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW44B	664.11	666.25	26	36	31	635.25	NA	NA			NA	NA			NA	NA		
GAMW51	666.15	668.77	5	15	10	658.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW51B	666.03	668.79	27	37	32	636.79	NA	NA			NA	NA			NA	NA		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			NA	NA		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			NA	NA		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			NA	NA		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			NA	NA		

Notes:

ft-bgs = Feet below ground surface

ft-msl = Feet above mean sea level

ft-btoc = Feet below top of casing

ft/ft = Feet/Feet

NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				November 7, 2016				January 4, 2017				February 27, 2017			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	7.90	660.33	NA	NA	8.31	659.92	NA	NA	8.71	659.52	NA	NA
GAMW01B	665.2	667.87	26	36	31	636.87	NA	NA			NA	NA			NA	NA		
GAMW03	665.14	668.2	5	15	10	658.20	7.27	660.93	2.99E-03	Up	6.17	662.03	-2.00E-03	Down	6.13	662.07	4.99E-04	Up
GAMW03B	665.29	668.16	25	35	30	638.16	7.17	660.99			6.17	661.99			6.08	662.08		
GAMW12	664.35	667.29	5	15	10	657.29	7.00	660.29	NA	NA	7.62	659.67	NA	NA	7.96	659.33	NA	NA
GAMW12B	664.23	666.81	25	35	30	636.81	NA	NA			NA	NA			NA	NA		
GAMW13	664.31	667.24	5	15	10	657.24	7.06	660.18	-4.97E-04	Down	7.61	659.63	0.00E+00	Up	7.89	659.35	-4.97E-04	Down
GAMW13B	664.23	667.12	25	35	30	637.12	6.95	660.17			7.49	659.63			7.78	659.34		
GAMW14	664.76	667.96	5	15	10	657.96	8.40	659.56	1.50E-03	Up	8.31	659.65	-3.00E-03	Down	8.57	659.39	5.00E-04	Up
GAMW14B	664.62	667.94	25	35	30	637.94	8.35	659.59			8.35	659.59			8.54	659.40		
GAMW42	663.12	665.8	5	15	10	655.80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW42B	663.15	665.66	26	36	31	634.66	NA	NA			NA	NA			NA	NA		
GAMW43	663.14	665.59	5	15	10	655.59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW43B	663.12	665.53	16	26	21	644.53	NA	NA			NA	NA			NA	NA		
GAMW44	664.11	666.31	5	15	10	656.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW44B	664.11	666.25	26	36	31	635.25	NA	NA			NA	NA			NA	NA		
GAMW51	666.15	668.77	5	15	10	658.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW51B	666.03	668.79	27	37	32	636.79	NA	NA			NA	NA			NA	NA		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			NA	NA		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			NA	NA		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			NA	NA		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			NA	NA		

Notes:

ft-bgs = Feet below ground surface

ft-msl = Feet above mean sea level

ft-btoc = Feet below top of casing

ft/ft = Feet/Feet

NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				April 24, 2017				June 26, 2017				August 21, 2017			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	8.43	659.80	NA	NA	8.85	659.38	NA	NA	9.05	659.18	NA	NA
GAMW01B	665.2	667.87	26	36	31	636.87	NA	NA			NA	NA			NA	NA		
GAMW03	665.14	668.2	5	15	10	658.20	5.08	663.12	-4.99E-04	Down	7.62	661.15	-2.84E-02	Down	8.07	660.13	0.00E+00	Up
GAMW03B	665.29	668.16	25	35	30	638.16	5.05	663.11			7.58	660.58			8.03	660.13		
GAMW12	664.35	667.29	5	15	10	657.29	7.76	659.53	NA	NA	8.32	660.69	NA	NA	8.55	658.74	NA	NA
GAMW12B	664.23	666.81	25	35	30	636.81	NA	NA			NA	NA			NA	NA		
GAMW13	664.31	667.24	5	15	10	657.24	7.77	659.47	0.00E+00	Up	8.52	658.72	0.00E+00	Up	8.77	658.47	4.97E-04	Up
GAMW13B	664.23	667.12	25	35	30	637.12	7.65	659.47			8.40	658.72			8.64	658.48		
GAMW14	664.76	667.96	5	15	10	657.96	8.39	659.57	9.99E-04	Up	9.42	658.54	9.99E-04	Up	9.70	658.26	2.50E-03	Up
GAMW14B	664.62	667.94	25	35	30	637.94	8.35	659.59			9.38	658.56			9.63	658.31		
GAMW42	663.12	665.8	5	15	10	655.80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW42B	663.15	665.66	26	36	31	634.66	NA	NA			NA	NA			NA	NA		
GAMW43	663.14	665.59	5	15	10	655.59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW43B	663.12	665.53	16	26	21	644.53	NA	NA			NA	NA			NA	NA		
GAMW44	664.11	666.31	5	15	10	656.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW44B	664.11	666.25	26	36	31	635.25	NA	NA			NA	NA			NA	NA		
GAMW51	666.15	668.77	5	15	10	658.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW51B	666.03	668.79	27	37	32	636.79	NA	NA			NA	NA			NA	NA		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			NA	NA		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			NA	NA		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			NA	NA		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			NA	NA		

Notes:
ft-bgs = Feet below ground surface
ft-msl = Feet above mean sea level
ft-btoc = Feet below top of casing
ft/ft = Feet/Feet
NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				October 2, 2017				March 12, 2018				April 18, 2018			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	9.36	658.87	NA	NA	8.28	659.95	NA	NA	8.58	659.65	1.98E-01	Up
GAMW01B	665.2	667.87	26	36	31	636.87	NA	NA			NA	NA			4.00	663.87		
GAMW03	665.14	668.2	5	15	10	658.20	8.92	659.28	-5.67E-15	Down	4.02	664.18	9.98E-04	Up	4.44	663.76	0.00E+00	Up
GAMW03B	665.29	668.16	25	35	30	638.16	8.88	659.28			3.96	664.20			4.40	663.76		
GAMW12	664.35	667.29	5	15	10	657.29	8.76	660.69	NA	NA	7.85	659.44	NA	NA	8.08	659.21	1.76E-01	Up
GAMW12B	664.23	666.81	25	35	30	636.81	NA	NA			NA	NA			4.00	662.81		
GAMW13	664.31	667.24	5	15	10	657.24	8.96	658.28	1.49E-03	Up	8.90	658.34	4.97E-02	Up	8.14	659.10	9.94E-04	Up
GAMW13B	664.23	667.12	25	35	30	637.12	8.81	658.31			7.78	659.34			8.00	659.12		
GAMW14	664.76	667.96	5	15	10	657.96	9.92	658.04	5.00E-04	Up	8.30	659.66	2.00E-03	Up	8.70	659.26	9.99E-04	Up
GAMW14B	664.62	667.94	25	35	30	637.94	9.89	658.05			8.24	659.70			8.66	659.28		
GAMW42	663.12	665.8	5	15	10	655.80	NA	NA	NA	NA	NA	NA	NA	NA	NM	NM	NA	NA
GAMW42B	663.15	665.66	26	36	31	634.66	NA	NA			NA	NA			NM	NM		
GAMW43	663.14	665.59	5	15	10	655.59	NA	NA	NA	NA	NA	NA	NA	NA	NM	NM	NA	NA
GAMW43B	663.12	665.53	16	26	21	644.53	NA	NA			NA	NA			NM	NM		
GAMW44	664.11	666.31	5	15	10	656.31	NA	NA	NA	NA	NA	NA	NA	NA	7.20	659.11	1.90E-03	Up
GAMW44B	664.11	666.25	26	36	31	635.25	NA	NA			NA	NA			7.10	659.15		
GAMW51	666.15	668.77	5	15	10	658.77	NA	NA	NA	NA	NA	NA	NA	NA	NM	NM	NA	NA
GAMW51B	666.03	668.79	27	37	32	636.79	NA	NA			NA	NA			NM	NM		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			NA	NA		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			NA	NA		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			NA	NA		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			NA	NA		

Notes:
ft-bgs = Feet below ground surface
ft-msl = Feet above mean sea level
ft-btoc = Feet below top of casing
ft/ft = Feet/Feet
NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				June 12, 2018				August 27, 2018 - August 28, 2018				October 22, 2018 - October 24, 2018			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	8.94	659.29	1.99E-01	Up	9.25	658.98	-4.68E-04	Down	9.00	659.23	0.00E+00	Up
GAMW01B	665.2	667.87	26	36	31	636.87	4.32	663.55			8.90	658.97			8.64	659.23		
GAMW03	665.14	668.2	5	15	10	658.20	6.40	661.80	-9.98E-04	Down	8.40	659.80	2.00E-03	Up	7.95	660.25	2.99E-03	Up
GAMW03B	665.29	668.16	25	35	30	638.16	6.38	661.78			8.32	659.84			7.85	660.31		
GAMW12	664.35	667.29	5	15	10	657.29	8.40	658.89	1.76E-01	Up	8.65	658.64	9.77E-04	Up	8.45	658.84	-4.59E-02	Down
GAMW12B	664.23	666.81	25	35	30	636.81	4.32	662.49			8.15	658.66			8.91	657.90		
GAMW13	664.31	667.24	5	15	10	657.24	8.50	658.74	-9.94E-04	Down	8.88	658.36	2.98E-03	Up	8.52	658.72	-9.94E-04	Down
GAMW13B	664.23	667.12	25	35	30	637.12	8.40	658.72			8.70	658.42			8.42	658.70		
GAMW14	664.76	667.96	5	15	10	657.96	9.40	658.56	5.00E-03	Up	9.75	658.21	5.00E-04	Up	8.41	659.55	-5.24E-02	Down
GAMW14B	664.62	667.94	25	35	30	637.94	9.28	658.66			9.72	658.22			9.44	658.50		
GAMW42	663.12	665.8	5	15	10	655.80	NM	NM	NA	NA	7.60	658.20	4.73E-04	Up	7.40	658.40	4.73E-04	Up
GAMW42B	663.15	665.66	26	36	31	634.66	NM	NM			7.45	658.21			7.25	658.41		
GAMW43	663.14	665.59	5	15	10	655.59	7.13	658.46	3.62E-03	Up	7.60	657.99	-5.42E-03	Down	7.43	658.16	-5.42E-03	Down
GAMW43B	663.12	665.53	16	26	21	644.53	7.03	658.50			7.60	657.93			7.43	658.10		
GAMW44	664.11	666.31	5	15	10	656.31	7.93	658.38	0.00E+00	Up	8.52	657.79	4.75E-04	Up	8.36	657.95	-1.90E-03	Down
GAMW44B	664.11	666.25	26	36	31	635.25	7.87	658.38			8.45	657.80			8.34	657.91		
GAMW51	666.15	668.77	5	15	10	658.77	3.10	665.67	1.23E-02	Up	10.55	658.22	7.73E-03	Up	10.35	658.42	7.28E-03	Up
GAMW51B	666.03	668.79	27	37	32	636.79	2.85	665.94			10.40	658.39			10.21	658.58		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			NA	NA		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			NA	NA		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			NA	NA		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			NA	NA		

Notes:
ft-bgs = Feet below ground surface
ft-msl = Feet above mean sea level
ft-btoc = Feet below top of casing
ft/ft = Feet/Feet
NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				February 25, 2019				April 16, 2019				September 25, 2019			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	8.50	659.73	2.81E-03	Up	8.12	660.11	1.87E-03	Up	9.30	658.93	-9.83E-03	Down
GAMW01B	665.2	667.87	26	36	31	636.87	8.08	659.79			7.72	660.15			9.15	658.72		
GAMW03	665.14	668.2	5	15	10	658.20	4.93	663.27	1.05E-02	Up	4.18	664.02	-4.99E-04	Down	8.93	659.27	-4.99E-04	Down
GAMW03B	665.29	668.16	25	35	30	638.16	4.68	663.48			4.15	664.01			8.90	659.26		
GAMW12	664.35	667.29	5	15	10	657.29	7.95	659.34	3.42E-03	Up	7.73	659.56	2.44E-03	Up	8.65	658.64	9.77E-04	Up
GAMW12B	664.23	666.81	25	35	30	636.81	7.40	659.41			7.20	659.61			8.15	658.66		
GAMW13	664.31	667.24	5	15	10	657.24	8.03	659.21	1.49E-02	Up	7.81	659.43	4.97E-04	Up	8.89	658.35	9.94E-04	Up
GAMW13B	664.23	667.12	25	35	30	637.12	7.61	659.51			7.68	659.44			8.75	658.37		
GAMW14	664.76	667.96	5	15	10	657.96	8.71	659.25	-7.99E-03	Down	8.30	659.66	9.99E-04	Up	9.82	658.14	-9.99E-04	Down
GAMW14B	664.62	667.94	25	35	30	637.94	8.85	659.09			8.26	659.68			9.82	658.12		
GAMW42	663.12	665.8	5	15	10	655.80	6.60	659.20	4.73E-04	Up	6.33	659.47	-4.73E-04	Down	7.68	658.12	4.73E-04	Up
GAMW42B	663.15	665.66	26	36	31	634.66	6.45	659.21			6.20	659.46			7.53	658.13		
GAMW43	663.14	665.59	5	15	10	655.59	6.50	659.09	-9.04E-04	Down	6.15	659.44	9.04E-04	Up	7.76	657.83	-1.03E-14	Down
GAMW43B	663.12	665.53	16	26	21	644.53	6.45	659.08			6.08	659.45			7.70	657.83		
GAMW44	664.11	666.31	5	15	10	656.31	7.36	658.95	5.40E-15	Up	7.03	659.28	-4.75E-04	Down	8.60	657.71	-9.50E-04	Down
GAMW44B	664.11	666.25	26	36	31	635.25	7.30	658.95			6.98	659.27			8.56	657.69		
GAMW51	666.15	668.77	5	15	10	658.77	9.52	659.25	7.73E-03	Up	9.10	659.67	7.28E-03	Up	10.70	658.07	5.46E-03	Up
GAMW51B	666.03	668.79	27	37	32	636.79	9.37	659.42			8.96	659.83			10.60	658.19		
GAMW57	670.46	672.985	5	15	10	662.99	NA	NA	NA	NA	NA	NA	NA	NA	15.43	657.56	-6.65E-04	Down
GAMW57B	670.45	672.895	35	45	40	632.90	NA	NA			NA	NA			15.36	657.54		
GAMW58	664.99	667.555	5	15	10	657.56	NA	NA	NA	NA	NA	NA	NA	NA	10.03	657.53	1.00E-03	Up
GAMW58B	664.88	667.605	25	35	30	637.61	NA	NA			NA	NA			10.06	657.55		
GAMW59	665.93	668.505	5	15	10	658.51	NA	NA	NA	NA	NA	NA	NA	NA	10.40	658.11	-1.60E-03	Down
GAMW59B	665.95	668.565	30	40	35	633.57	NA	NA			NA	NA			10.50	658.07		
GAMW60	665.08	667.515	5	15	10	657.52	NA	NA	NA	NA	NA	NA	NA	NA	9.40	658.12	8.00E-04	Up
GAMW60B	665.06	667.515	30	40	35	632.52	NA	NA			NA	NA			9.38	658.14		

Notes:
ft-bgs = Feet below ground surface
ft-msl = Feet above mean sea level
ft-btoc = Feet below top of casing
ft/ft = Feet/Feet
NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				November 4, 2019				March 13, 2020				April 16, 2020			
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction
GAMW01	664.9	668.23	5	15	10	658.23	8.44	659.79	2.81E-03	Up	8.61	659.62	4.68E-04	Up	8.80	659.43	2.81E-03	Up
GAMW01B	665.2	667.87	26	36	31	636.87	8.02	659.85			8.24	659.63			8.38	659.49		
GAMW03	665.14	668.2	5	15	10	658.20	6.62	661.58	-9.98E-04	Down	4.92	663.28	-9.98E-04	Down	5.42	662.78	-9.98E-04	Down
GAMW03B	665.29	668.16	25	35	30	638.16	6.60	661.56			4.90	663.26			5.40	662.76		
GAMW12	664.35	667.29	5	15	10	657.29	7.99	659.30	3.42E-03	Up	8.09	659.20	3.91E-03	Up	8.24	659.05	2.93E-03	Up
GAMW12B	664.23	666.81	25	35	30	636.81	7.44	659.37			7.53	659.28			7.70	659.11		
GAMW13	664.31	667.24	5	15	10	657.24	8.07	659.17	0.00E+00	Up	8.07	659.17	-1.29E-02	Down	8.40	658.84	1.49E-03	Up
GAMW13B	664.23	667.12	25	35	30	637.12	7.95	659.17			8.21	658.91			8.25	658.87		
GAMW14	664.76	667.96	5	15	10	657.96	8.56	659.40	9.99E-04	Up	8.80	659.16	2.00E-03	Up	9.10	658.86	1.50E-03	Up
GAMW14B	664.62	667.94	25	35	30	637.94	8.52	659.42			8.74	659.20			9.05	658.89		
GAMW42	663.12	665.8	5	15	10	655.80	6.80	659.00	4.73E-04	Up	6.74	659.06	0.00E+00	Up	6.94	658.86	5.38E-15	Up
GAMW42B	663.15	665.66	26	36	31	634.66	6.65	659.01			6.60	659.06			6.80	658.86		
GAMW43	663.14	665.59	5	15	10	655.59	6.80	658.79	1.81E-03	Up	6.64	658.95	3.62E-03	Up	6.88	658.71	1.81E-03	Up
GAMW43B	663.12	665.53	16	26	21	644.53	6.72	658.81			6.54	658.99			6.80	658.73		
GAMW44	664.11	666.31	5	15	10	656.31	7.70	658.61	-4.75E-04	Down	7.42	658.89	-9.50E-04	Down	7.65	658.66	-4.75E-04	Down
GAMW44B	664.11	666.25	26	36	31	635.25	7.65	658.60			7.38	658.87			7.60	658.65		
GAMW51	666.15	668.77	5	15	10	658.77	9.24	659.53	4.09E-03	Up	9.60	659.17	7.73E-03	Up	9.95	658.82	7.73E-03	Up
GAMW51B	666.03	668.79	27	37	32	636.79	9.17	659.62			9.45	659.34			9.80	658.99		
GAMW57	670.46	672.985	5	15	10	662.99	14.46	658.53	-3.32E-04	Down	14.15	658.84	3.32E-04	Up	14.38	658.61	3.32E-04	Up
GAMW57B	670.45	672.895	35	45	40	632.90	14.38	658.52			14.05	658.85			14.28	658.62		
GAMW58	664.99	667.555	5	15	10	657.56	9.15	658.41	1.00E-03	Up	9.12	658.44	1.50E-03	Up	9.32	658.24	1.50E-03	Up
GAMW58B	664.88	667.605	25	35	30	637.61	9.18	658.43			9.14	658.47			9.34	658.27		
GAMW59	665.93	668.505	5	15	10	658.51	8.91	659.60	-4.56E-15	Down	9.30	659.21	1.60E-03	Up	9.65	658.86	4.01E-04	Up
GAMW59B	665.95	668.565	30	40	35	633.57	8.97	659.60			9.32	659.25			9.70	658.87		
GAMW60	665.08	667.515	5	15	10	657.52	7.98	659.54	1.20E-03	Up	8.37	659.15	1.20E-03	Up	8.68	658.84	0.00E+00	Up
GAMW60B	665.06	667.515	30	40	35	632.52	7.95	659.57			8.34	659.18			8.68	658.84		

Notes:

ft-bgs = Feet below ground surface

ft-msl = Feet above mean sea level

ft-btoc = Feet below top of casing

ft/ft = Feet/Feet

NA- not applicable, well was not yet installed

Table 1 Vertical Groundwater Flow Calculation
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Monitoring Well Locations	Ground Surface Elevation (ft-msl)	Top of Casing Elevation (ft-msl)	Screen Interval				May 27, 2020				July 16, 2020				August 28, 2020				Average Vertical Gradient	Flow Direction
			Top (ft-bgs)	Bottom (ft-bgs)	Center (ft bgs)	Center (ft msl)	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction	Depth To Water (ft-btoc)	Groundwater Elevation (ft-msl)	Vertical Gradient (ft/ft)	Flow Direction		
GAMW01	664.9	668.23	5	15	10	658.23	8.45	659.78	4.21E-03	Up	8.75	659.48	3.28E-03	Up	9.28	658.95	2.34E-03	Up	3.13E-02	Up
GAMW01B	665.2	667.87	26	36	31	636.87	8.00	659.87			8.32	659.55			8.87	659.00				
GAMW03	665.14	668.2	5	15	10	658.20	4.10	664.10	4.99E-04	Up	7.45	660.75	-4.99E-04	Down	8.74	659.46	-9.98E-04	Down	-6.24E-04	Down
GAMW03B	665.29	668.16	25	35	30	638.16	4.05	664.11			7.42	660.74			8.72	659.44				
GAMW12	664.35	667.29	5	15	10	657.29	7.98	659.31	4.88E-03	Up	8.30	658.99	1.95E-03	Up	8.69	658.60	4.88E-03	Up	2.58E-02	Up
GAMW12B	664.23	666.81	25	35	30	636.81	7.40	659.41			7.78	659.03			8.11	658.70				
GAMW13	664.31	667.24	5	15	10	657.24	8.06	659.18	1.99E-03	Up	8.55	658.69	4.97E-04	Up	8.88	658.36	4.97E-04	Up	2.53E-03	Up
GAMW13B	664.23	667.12	25	35	30	637.12	7.90	659.22			8.42	658.70			8.75	658.37				
GAMW14	664.76	667.96	5	15	10	657.96	8.50	659.46	1.50E-03	Up	9.38	658.58	-9.99E-04	Down	9.85	658.11	-2.50E-03	Down	-1.83E-03	Down
GAMW14B	664.62	667.94	25	35	30	637.94	8.45	659.49			9.38	658.56			9.88	658.06				
GAMW42	663.12	665.8	5	15	10	655.80	6.65	659.15	5.20E-03	Up	7.20	658.60	4.73E-04	Up	7.68	658.12	0.00E+00	Up	6.88E-04	Up
GAMW42B	663.15	665.66	26	36	31	634.66	6.40	659.26			7.05	658.61			7.54	658.12				
GAMW43	663.14	665.59	5	15	10	655.59	6.25	659.34	3.62E-03	Up	7.30	658.29	1.81E-03	Up	7.80	657.79	9.04E-04	Up	5.27E-04	Up
GAMW43B	663.12	665.53	16	26	21	644.53	6.15	659.38			7.22	658.31			7.73	657.80				
GAMW44	664.11	666.31	5	15	10	656.31	6.90	659.41	-2.85E-03	Down	8.10	658.21	-4.75E-04	Down	8.62	657.69	-9.50E-04	Down	-5.48E-04	Down
GAMW44B	664.11	666.25	26	36	31	635.25	6.90	659.35			8.05	658.20			8.58	657.67				
GAMW51	666.15	668.77	5	15	10	658.77	9.25	659.52	7.73E-03	Up	10.20	658.57	7.73E-03	Up	10.85	657.92	7.28E-03	Up	7.51E-03	Up
GAMW51B	666.03	668.79	27	37	32	636.79	9.10	659.69			10.05	658.74			10.71	658.08				
GAMW57	670.46	672.985	5	15	10	662.99	13.52	659.47	3.32E-04	Up	14.88	658.11	3.32E-04	Up	15.43	657.56	3.32E-04	Up	9.50E-05	Up
GAMW57B	670.45	672.895	35	45	40	632.90	13.42	659.48			14.78	658.12			15.33	657.57				
GAMW58	664.99	667.555	5	15	10	657.56	8.75	658.81	2.51E-03	Up	9.60	657.96	5.70E-15	Up	10.12	657.44	1.00E-03	Up	1.22E-03	Up
GAMW58B	664.88	667.605	25	35	30	637.61	8.75	658.86			9.65	657.96			10.15	657.46				
GAMW59	665.93	668.505	5	15	10	658.51	8.85	659.66	4.01E-04	Up	NM	NM	NA	NA	10.59	657.92	4.01E-04	Up	2.00E-04	Up
GAMW59B	665.95	668.565	30	40	35	633.57	8.90	659.67			NM	NM			10.64	657.93				
GAMW60	665.08	667.515	5	15	10	657.52	7.85	659.67	0.00E+00	Up	NM	NM	NA	NA	9.61	657.91	8.00E-04	Up	6.67E-04	Up
GAMW60B	665.06	667.515	30	40	35	632.52	7.85	659.67			NM	NM			9.59	657.93				

Notes:
ft-bgs = Feet below ground surface
ft-msl = Feet above mean sea level
ft-btoc = Feet below top of casing
ft/ft = Feet/Feet
NA- not applicable, well was not yet installed

Prepared by: DFSC
Checked by: KNG
Reviewed by: MAH

Table 2 Monitoring Well Construction Details
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

CCR Unit	Monitoring Well ID	Ground Surface Elevation (ft-msl)	Total Borehole Depth (ft)	Top of Casing Elevation (ft-msl)	Sounded Well Depth (ft-btoc)	Well Material	Screen Length (ft)	Screen Depth		Screen Elevation		
								Top (ft-bgs)	Bottom (ft-bgs)	Top (ft-msl)	Middle (ft-msl)	Bottom (ft-msl)
WDA	GAMW01	664.90	15.00	668.19	18.86	2" Sch 40 PVC	10.00	5.00	15.00	659.90	654.90	649.90
	GAMW01B	665.20	36.00	667.87	37.80	2" Sch 40 PVC	10.00	26.00	36.00	639.20	634.20	629.20
	GAMW02	666.08	15.00	669.57	19.00	2" Sch 40 PVC	10.00	5.00	15.00	661.08	656.08	651.08
	GAMW03	665.14	15.00	668.77	18.30	2" Sch 40 PVC	10.00	5.00	15.00	660.14	655.14	650.14
	GAMW03B	665.29	35.00	668.16	37.79	2" Sch 40 PVC	10.00	25.00	35.00	640.29	635.29	630.29
	GAMW05	666.69	17.00	669.75	20.01	2" Sch 40 PVC	10.00	7.00	17.00	659.69	654.69	649.69
	GAMW12	664.35	15.00	667.29	18.17	2" Sch 40 PVC	10.00	5.00	15.00	659.35	654.35	649.35
	GAMW12B	664.23	35.00	666.81	37.82	2" Sch 40 PVC	10.00	25.00	35.00	639.23	634.23	629.23
	GAMW13	664.31	15.00	667.24	18.45	2" Sch 40 PVC	10.00	5.00	15.00	659.31	654.31	649.31
	GAMW13B	664.23	35.00	667.12	38.86	2" Sch 40 PVC	10.00	25.00	35.00	639.23	634.23	629.23
	GAMW14	664.76	15.00	667.96	18.43	2" Sch 40 PVC	10.00	5.00	15.00	659.76	654.76	649.76
	GAMW14B	664.62	35.00	667.94	39.19	2" Sch 40 PVC	10.00	25.00	35.00	639.62	634.62	629.62
	GAMW42	663.12	15.00	665.80	17.97	2" Sch 40 PVC	10.00	5.00	15.00	658.12	653.12	648.12
	GAMW42B	663.15	36.00	665.66	36.70	2" Sch 40 PVC	10.00	26.00	36.00	637.15	632.15	627.15
	GAMW42C	663.20	50.00	666.28	52.91	2" Sch 40 PVC	10.00	40.00	50.00	623.20	618.20	613.20
	GAMW43	663.14	15.00	665.59	16.29	2" Sch 40 PVC	10.00	5.00	15.00	658.14	653.14	648.14
	GAMW43B	663.12	26.00	665.53	32.28	2" Sch 40 PVC	10.00	16.00	26.00	647.12	642.12	637.12
	GAMW44	664.11	15.00	666.31	16.02	2" Sch 40 PVC	10.00	5.00	15.00	659.11	654.11	649.11
	GAMW44B	664.11	36.00	666.25	38.82	2" Sch 40 PVC	10.00	26.00	36.00	638.11	633.11	628.11
	GAMW51	666.15	15.00	668.77	18.58	2" Sch 40 PVC	10.00	5.00	15.00	661.15	656.15	651.15
	GAMW51B	666.03	37.00	668.79	39.99	2" Sch 40 PVC	10.00	27.00	37.00	639.03	634.03	629.03
	GAMW57	670.46	15.00	672.97	25.55	2" Sch 40 PVC	10.00	5.00	15.00	665.46	660.46	655.46
	GAMW57B	670.45	45.00	672.88	47.45	2" Sch 40 PVC	10.00	35.00	45.00	635.45	630.45	625.45
	GAMW58	664.99	15.00	667.54	17.58	2" Sch 40 PVC	10.00	5.00	15.00	659.99	654.99	649.99
	GAMW58B	664.88	35.00	667.59	37.81	2" Sch 40 PVC	10.00	25.00	35.00	639.88	634.88	629.88
	GAMW59	665.93	15.00	668.49	17.22	2" Sch 40 PVC	10.00	5.00	15.00	660.93	655.93	650.93
	GAMW59B	665.95	40.00	668.55	42.38	2" Sch 40 PVC	10.00	30.00	40.00	635.95	630.95	625.95
	GAMW60	665.08	15.00	667.50	17.39	2" Sch 40 PVC	10.00	5.00	15.00	660.08	655.08	650.08
	GAMW60B	665.06	40.00	667.50	42.59	2" Sch 40 PVC	10.00	30.00	40.00	635.06	630.06	625.06
MSRB, MCWB, and DRYING AREA	GAMW04	665.81	15.00	669.21	17.86	2" Sch 40 PVC	10.00	5.00	15.00	660.81	655.81	650.81
	GAMW06	667.50	15.00	670.81	18.82	2" Sch 40 PVC	10.00	5.00	15.00	662.50	657.50	652.50
	GAMW07	666.55	15.00	669.89	18.89	2" Sch 40 PVC	10.00	5.00	15.00	661.55	656.55	651.55
	GAMW07B	666.83	40.00	669.39	42.40	2" Sch 40 PVC	10.00	30.00	40.00	636.83	631.83	626.83
	GAMW08	665.95	15.00	669.66	18.78	2" Sch 40 PVC	10.00	5.00	15.00	660.95	655.95	650.95
	GAMW08B	665.92	36.00	668.47	38.79	2" Sch 40 PVC	10.00	26.00	36.00	639.92	634.92	629.92
	GAMW09	665.10	15.00	668.99	18.48	2" Sch 40 PVC	10.00	5.00	15.00	660.10	655.10	650.10
	GAMW09B	665.35	35.00	668.29	37.42	2" Sch 40 PVC	10.00	25.00	35.00	640.35	635.35	630.35
	GAMW15	665.01	15.00	668.25	18.71	2" Sch 40 PVC	10.00	5.00	15.00	660.01	655.01	650.01
	GAMW15B	665.14	35.00	668.05	38.86	2" Sch 40 PVC	10.00	25.00	35.00	640.14	635.14	630.14
	GAMW16	665.20	15.00	668.37	18.20	2" Sch 40 PVC	10.00	5.00	15.00	660.20	655.20	650.20
	GAMW16B	665.16	35.00	667.76	40.13	2" Sch 40 PVC	10.00	25.00	35.00	640.16	635.16	630.16
	GAMW17	668.81	15.00	671.93	18.00	2" Sch 40 PVC	10.00	5.00	15.00	663.81	658.81	653.81
	GAMW17B	668.86	35.00	670.60	40.34	2" Sch 40 PVC	10.00	25.00	35.00	643.86	638.86	633.86
	GAMW18	666.04	15.00	669.07	18.51	2" Sch 40 PVC	10.00	5.00	15.00	661.04	656.04	651.04
	GAMW18B	665.94	35.00	668.47	35.89	2" Sch 40 PVC	10.00	25.00	35.00	640.94	635.94	630.94
	GAMW46	661.99	15.00	664.80	17.50	2" Sch 40 PVC	10.00	5.00	15.00	656.99	651.99	646.99
	GAMW46B	661.98	32.00	664.79	33.00	2" Sch 40 PVC	10.00	22.00	32.00	639.98	634.98	629.98
	GAMW52	664.07	15.00	666.79	18.50	2" Sch 40 PVC	10.00	5.00	15.00	659.07	654.07	649.07
	GAMW52B	664.50	37.00	666.90	39.34	2" Sch 40 PVC	10.00	27.00	37.00	637.50	632.50	627.50
	GAMW53	664.68	15.00	667.24	17.49	2" Sch 40 PVC	10.00	5.00	15.00	659.68	654.68	649.68
	GAMW53B	664.62	36.00	667.29	40.10	2" Sch 40 PVC	10.00	26.00	36.00	638.62	633.62	628.62
	GAMW54	663.87	15.00	666.37	15.46	2" Sch 40 PVC	10.00	5.00	15.00	658.87	653.87	648.87
	GAMW54B	663.98	32.00	666.47	36.41	2" Sch 40 PVC	10.00	22.00	32.00	641.98	636.98	631.98
	GAMW55*	665.06	15.00	667.64	18.68	2" Sch 40 PVC	10.00	5.00	15.00	660.06	655.06	650.06
	GAMW55R	665.36	15.00	667.71	16.31	2" Sch 40 PVC	10.00	5.00	15.00	660.36	655.36	650.36
	GAMW55B	665.18	35.00	667.53	37.60	2" Sch 40 PVC	10.00	25.00	35.00	640.18	635.18	630.18
	GAMW56	665.43	15.00	667.91	15.56	2" Sch 40 PVC	10.00	5.00	15.00	660.43	655.43	650.43
	GAMW56B	665.33	35.00	667.82	36.84	2" Sch 40 PVC	10.00	25.00	35.00	640.33	635.33	630.33
	GAMW63B	666.31	33.00	668.74	35.43	2" Sch 40 PVC	10.00	23.00	33.00	643.31	638.31	633.31
	GAMW64B	664.42	31.00	666.83	33.26	2" Sch 40 PVC	10.00	21.00	31.00	643.42	638.42	633.42

Table 2 Monitoring Well Construction Details
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

CCR Unit	Monitoring Well ID	Ground Surface Elevation (ft-msl)	Total Borehole Depth (ft)	Top of Casing Elevation (ft-msl)	Sounded Well Depth (ft-btoc)	Well Material	Screen Length (ft)	Screen Depth		Screen Elevation		
								Top (ft-bgs)	Bottom (ft-bgs)	Top (ft-msl)	Middle (ft-msl)	Bottom (ft-msl)
LANDFILL Phase V, Phase VI and Phase VII	GAMW20	664.61	16.00	667.21	18.95	2" Sch 40 PVC	10.00	6.00	16.00	658.61	653.61	648.61
	GAMW20B	664.48	35.00	667.40	18.22	2" Sch 40 PVC	10.00	25.00	35.00	639.48	634.48	629.48
	GAMW21*	666.60	18.00	668.38	20.36	2" Sch 40 PVC	10.00	8.00	18.00	658.60	653.60	648.60
	GAMW21B*	666.66	37.00	669.37	36.34	2" Sch 40 PVC	10.00	27.00	37.00	639.66	634.66	629.66
	GAMW22*	666.33	18.00	668.64	20.38	2" Sch 40 PVC	13.00	5.00	18.00	661.33	654.83	648.33
	GAMW22B*	666.39	37.00	669.38	37.13	2" Sch 40 PVC	10.00	27.00	37.00	639.39	634.39	629.39
	GAMW23*	667.02	19.00	668.34	20.30	2" Sch 40 PVC	14.00	5.00	19.00	662.02	655.02	648.02
	GAMW23B*	667.03	38.00	670.02	37.92	2" Sch 40 PVC	10.00	28.00	38.00	639.03	634.03	629.03
	GAMW24	662.09	16.00	665.46	20.31	2" Sch 40 PVC	10.00	6.00	16.00	656.09	651.09	646.09
	GAMW24B	662.13	31.00	665.43	35.38	2" Sch 40 PVC	10.00	21.00	31.00	641.13	636.13	631.13
	GAMW25	665.26	16.00	668.07	19.43	2" Sch 40 PVC	10.00	6.00	16.00	659.26	654.26	649.26
	GAMW25B	665.26	35.00	667.97	37.00	2" Sch 40 PVC	10.00	25.00	35.00	640.26	635.26	630.26
	GAMW26	664.89	16.00	667.83	20.00	2" Sch 40 PVC	10.00	6.00	16.00	658.89	653.89	648.89
	GAMW26B	664.91	33.00	667.76	37.08	2" Sch 40 PVC	10.00	23.00	33.00	641.91	636.91	631.91
	GAMW27	662.68	16.00	665.57	20.00	2" Sch 40 PVC	10.00	6.00	16.00	656.68	651.68	646.68
	GAMW27B	662.65	31.00	665.52	34.73	2" Sch 40 PVC	10.00	21.00	31.00	641.65	636.65	631.65
	GAMW28*	662.24	16.00	665.56	20.15	2" Sch 40 PVC	10.00	6.00	16.00	656.24	651.24	646.24
	GAMW28B*	662.32	29.00	665.62	32.92	2" Sch 40 PVC	10.00	19.00	29.00	643.32	638.32	633.32
	GAMW29	666.58	16.00	669.48	20.39	2" Sch 40 PVC	10.00	6.00	16.00	660.58	655.58	650.58
	GAMW29B	666.64	36.00	669.43	40.52	2" Sch 40 PVC	10.00	26.00	36.00	640.64	635.64	630.64
	GAMW30	664.27	16.00	666.92	20.40	2" Sch 40 PVC	10.00	6.00	16.00	658.27	653.27	648.27
	GAMW30B	664.27	32.00	666.96	35.49	2" Sch 40 PVC	10.00	22.00	32.00	642.27	637.27	632.27
	GAMW31	662.68	16.00	665.39	19.26	2" Sch 40 PVC	10.00	6.00	16.00	656.68	651.68	646.68
	GAMW31B	662.69	30.00	665.40	32.10	2" Sch 40 PVC	10.00	20.00	30.00	642.69	637.69	632.69
	GAMW32	665.44	18.00	668.09	21.07	2" Sch 40 PVC	10.00	8.00	18.00	657.44	652.44	647.44
	GAMW32B	665.53	34.00	668.25	36.93	2" Sch 40 PVC	10.00	24.00	34.00	641.53	636.53	631.53
	GAMW33	662.63	16.00	665.24	20.33	2" Sch 40 PVC	10.00	6.00	16.00	656.63	651.63	646.63
	GAMW33B	662.43	31.00	665.25	35.35	2" Sch 40 PVC	10.00	21.00	31.00	641.43	636.43	631.43
	GAMW34	661.78	16.00	664.83	20.28	2" Sch 40 PVC	10.00	6.00	16.00	655.78	650.78	645.78
	GAMW34B	661.65	29.00	664.84	30.48	2" Sch 40 PVC	10.00	19.00	29.00	642.65	637.65	632.65
	GAMW35B	661.78	24.00	664.61	26.66	2" Sch 40 PVC	10.00	14.00	24.00	647.78	642.78	637.78
	GAMW36	662.24	16.00	664.97	20.28	2" Sch 40 PVC	10.00	6.00	16.00	656.24	651.24	646.24
	GAMW36B	662.35	25.50	665.04	35.33	2" Sch 40 PVC	1.00	24.50	25.50	637.85	637.35	636.85
	GAMW37B	662.68	25.00	665.36	27.78	2" Sch 40 PVC	10.00	15.00	25.00	647.68	642.68	637.68
	GAMW38	660.93	15.00	663.29	17.97	2" Sch 40 PVC	10.00	5.00	15.00	655.93	650.93	645.93
	GAMW38B	660.81	29.50	663.31	32.00	2" Sch 40 PVC	10.00	19.50	29.50	641.31	636.31	631.31
	GAMW39	661.04	15.00	663.53	17.95	2" Sch 40 PVC	10.00	5.00	15.00	656.04	651.04	646.04
	GAMW39B	660.96	29.50	663.49	31.15	2" Sch 40 PVC	10.00	19.50	29.50	641.46	636.46	631.46
	GAMW40	664.11	15.00	666.56	19.94	2" Sch 40 PVC	10.00	5.00	15.00	659.11	654.11	649.11
	GAMW40B	664.05	31.50	666.40	35.16	2" Sch 40 PVC	10.00	21.50	31.50	642.55	637.55	632.55
	GAMW41	660.09	15.00	662.43	16.40	2" Sch 40 PVC	10.00	5.00	15.00	655.09	650.09	645.09
	GAMW41B	660.08	27.00	662.17	30.04	2" Sch 40 PVC	10.00	17.00	27.00	643.08	638.08	633.08
	GAMW48	660.81	15.00	663.38	17.00	2" Sch 40 PVC	10.00	5.00	15.00	655.81	650.81	645.81
	GAMW48B	660.44	30.00	663.33	32.30	2" Sch 40 PVC	10.00	20.00	30.00	640.44	635.44	630.44
	GAMW49	662.00	15.00	664.64	14.18	2" Sch 40 PVC	10.00	5.00	15.00	657.00	652.00	647.00
	GAMW49B	662.12	33.00	664.52	34.82	2" Sch 40 PVC	10.00	23.00	33.00	639.12	634.12	629.12
	GAMW50	662.52	15.00	665.17	19.60	2" Sch 40 PVC	10.00	5.00	15.00	657.52	652.52	647.52
	GAMW50B	662.28	31.00	664.90	31.79	2" Sch 40 PVC	10.00	21.00	31.00	641.28	636.28	631.28
	GAMW10	663.99	15.00	667.83	18.75	2" Sch 40 PVC	10.00	5.00	15.00	658.99	653.99	648.99
	GAMW11	663.60	15.00	667.17	19.18	2" Sch 40 PVC	10.00	5.00	15.00	658.60	653.60	648.60
	MW-1D	666.36	NA	668.86	33.68	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-1S	666.43	NA	668.81	19.52	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA

Table 2 Monitoring Well Construction Details
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

CCR Unit	Monitoring Well ID	Ground Surface Elevation (ft-msl)	Total Borehole Depth (ft)	Top of Casing Elevation (ft-msl)	Sounded Well Depth (ft-btoc)	Well Material	Screen Length (ft)	Screen Depth		Screen Elevation		
								Top (ft-bgs)	Bottom (ft-bgs)	Top (ft-msl)	Middle (ft-msl)	Bottom (ft-msl)
LANDFILL Phase V, Phase VI and Phase VII	MW-2S	662.10	NA	664.10	11.96	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-3D	664.84	NA	667.58	29.75	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-3S	664.82	NA	667.58	18.41	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-4D	664.13	NA	666.56	33.24	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-4S	664.26	NA	666.90	17.51	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-5D	662.75	NA	664.37	31.00	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-5S	662.72	NA	664.29	16.19	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-6D	661.79	NA	664.64	33.29	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-6S	662.01	NA	664.61	19.06	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-7D	662.01	NA	664.72	32.91	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-7S	661.99	NA	664.80	16.33	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-8D	661.34	NA	663.52	35.42	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-8S	661.42	NA	663.75	18.04	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-9D	661.84	NA	662.68	39.20	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-9S	661.83	NA	662.42	19.53	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-10D	662.20	NA	663.18	31.22	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-10S	661.95	NA	662.53	14.68	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-11D	661.51	NA	663.57	32.86	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-11S	661.46	NA	663.25	17.18	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-12D	661.58	NA	663.60	32.75	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-12S	661.54	NA	663.48	16.83	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-13D	662.03	NA	664.80	32.52	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-13S	662.22	NA	664.67	17.90	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-14D	662.64	NA	665.41	33.20	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	MW-14S	662.57	NA	665.24	17.72	2" Sch 40 PVC	NA	NA	NA	NA	NA	NA
	GAPIEZ07	665.15	15.00	668.77	18.91	2" Sch 40 PVC	10.00	5.00	15.00	660.15	655.15	650.15

Notes:

ft-bgs = Feet below ground surface

ft-msl = Feet above mean sea level

ft-btoc = Feet below top of casing

WDA = Waste Disposal Area

MSRB = Material Storage Runoff Basin

MCWB = Metal Cleaning Waste Basin

No highlight indicates well is not sampled as part of the CCR monitoring program, however, water levels are used in groundwater level contour maps.

Yellow highlight indicates a background well

Green highlight indicates a downgradient well

2" Sch 40 PVC = Two-inch diameter well, constructed of schedule 40 polyvinyl chloride materials

Survey elevations for new wells obtained from Marbach, Brady, and Weaver survey, June 2016, August 2018, and June 2019.

*Monitoring well was decommissioned.

Prepared by: KNG
Checked by: DFSC
Reviewed by: MAH

Table 3: Monitoring Well Network
CCR Unit Schahfer Waste Disposal Area
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

CCR Unit	Well Purpose	Monitoring Well ID	Installation Date	Decommission Date (If Applicable)	Basis For Action
Waste Disposal Area	Background Monitoring Well	GAMW-03	6/27/2015	-	Installed for groundwater quality monitoring[1]
		GAMW-03B	5/24/2016	-	
	Downgradient Monitoring Well	GAMW-01	6/26/2015	-	Installed for groundwater quality monitoring[1]
		GAMW-12	5/23/2016	-	
		GAMW-13	5/24/2016	-	
		GAMW-13B	5/23/2016	-	
		GAMW-14	5/23/2016	-	
		GAMW-14B	5/23/2016	-	
		GAMW-01B	7/31/2018	-	Installed to characterize the nature and extent of a potential release[2]
		GAMW-12B	7/31/2018	-	
		GAMW-51	7/25/2018	-	
		GAMW-51B	7/25/2018	-	
		GAMW-42	7/24/2018	-	Installed to monitor groundwater quality at the property boundary[3]
		GAMW-42B	7/24/2018	-	
		GAMW-42C	6/8/2019	-	
		GAMW-43	5/16/2018	-	
		GAMW-43B	5/16/2018	-	
		GAMW-44	5/16/2018	-	
		GAMW-44B	5/16/2018	-	
		GAMW-57	6/7/2019	-	
		GAMW-57B	6/7/2019	-	
		GAMW-58	6/6/2019	-	
		GAMW-58B	6/6/2019	-	
		GAMW-59	6/8/2019	-	Installed to characterize the nature and extent of a potential release[2]
		GAMW-59B	6/6/2019	-	
		GAMW-60	6/8/2019	-	
		GAMW-60B	6/4/2019	-	

1) Per 40 CFR §257.93, Golder collected eight rounds of background data prior to October 17, 2017.
2) Per 40 CFR §257.95(g)(1)(i) Rule requirements, Golder collected additional data to further characterize the nature and extent of potential groundwater impacts.
3) Per 40 CFR §257.95(g)(1)(iii), Golder collected data to monitor groundwater quality in the direction of flow at the property boundary.

Prepared by: KNG
Checked by: KMC
Reviewed by: MAH

Table 4 Groundwater Protection Standards
CCR Unit Schahfer Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	MCL (mg/L)	2018 GWPS (mg/L)	2019 GWPS (mg/L)
Antimony	0.006	0.006	0.006
Arsenic	0.01	0.015	0.015
Barium	2	2	2
Beryllium	0.004	0.004	0.004
Cadmium	0.005	0.005	0.005
Chromium	0.1	0.1	0.1
Cobalt(1)	0.006(2)	0.015	0.015
Fluoride	4	4	4
Lead(1)	0.015(2)	0.0005	0.015
Lithium(1)	0.04(2)	0.0088	0.04
Mercury	0.002	0.002	0.002
Molybdenum(1)	0.1(2)	0.009	0.1
Radium 226+228	5	5	5
Selenium	0.05	0.05	0.05
Thallium	0.002	0.002	0.002

Notes:
MCL= Environmental Protection Agency Maximum Contaminant Concentration
2018 GWPS= Groundwater Protection Standard calculated August 23, 2018.
2019 GWPS= Groundwater Protection Standard calculated in February 2019
mg/L= milligrams per liter
1) These four constituents do not have an established MCL. Prior to the Phase 1 Part 1 ammendment becoming effective on August 29, 2018, the GWPS was calculated based on background concentrations according to the CCR Final Rule.
2) The Phase 1 Part 1 amended health-based standard, effective August 29, 2018.

Prepared by: KNG
Checked by: DFSC
Reviewed by: MAH

Table 5: Summary of Sampling Events
CCR Unit Schahfer Waste Disposal Area
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Well Purpose	Monitoring Well ID	Sample Event #1	Sample Event #2	Sample Event #3	Sample Event #4	Sample Event #5	Sample Event #6	Sample Event #7	Sample Event #8	Sample Event #9	Sample Event #10		Supplemental Sampling
Purpose of Sample		Background								Detection Monitoring	Annual Assessment Montitoring	Semi-Annual Assessment Monitoring	Nature and Extent Characterization Sampling
Sample Parameters		Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III	Appendix IV	Appendix III and detected Appendix IV	Appendix III and Appendix IV
Background Monitoring Well	GAMW03	7/13/2016	9/8/2016	11/8/2016	1/9/2017	3/1/2017	4/26/2017	6/28/2017	8/23/2017	10/4/2017	3/13/2018	4/20/2018	NS
	GAMW03B	7/13/2016	9/8/2016	11/8/2016	1/10/2017	3/1/2017	4/26/2017	6/28/2017	8/23/2017	10/4/2017	3/13/2018	4/20/2018	9/6/2018
Downgradient Monitoring Well	GAMW01	7/12/2016	9/8/2016	11/9/2016	1/9/2017	2/28/2017	4/25/2017	6/28/2017	8/22/2017	10/3/2017	3/12/2018	4/19/2018	NS
	GAMW01B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/6/2018
	GAMW12	7/12/2016	9/7/2016	11/8/2016	1/9/2017	2/28/2017	4/25/2017	6/28/2017	8/23/2017	10/4/2017	3/13/2018	4/20/2018	NS
	GAMW12B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/7/2018
	GAMW13	7/12/2016	9/7/2016	11/8/2016	1/9/2017	2/28/2017	4/25/2017	7/12/2017(1)	8/23/2017	10/3/2017	3/13/2018	4/20/2018	NS
	GAMW13B	7/12/2016	9/7/2016	11/8/2016	1/9/2017	2/28/2017	4/25/2017	7/12/2017(1)	8/23/2017	10/3/2017	3/13/2018	4/20/2018	9/6/2018
	GAMW14	7/12/2016	9/7/2016	11/8/2016	1/9/2017	2/28/2017	4/25/2017	6/28/2017	8/22/2017	10/3/2017	3/12/2018	4/19/2018	NS
	GAMW14B	7/12/2016	9/7/2016	11/8/2016	1/9/2017	2/28/2017	4/25/2017	7/12/2017(1)	8/22/2017	10/3/2017	3/12/2018	4/19/2018	9/6/2018
	GAMW42	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/13/2018
	GAMW42B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/13/2018
	GAMW42C	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW43	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	6/13/2018
	GAMW43B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	6/13/2018
	GAMW44	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	6/13/2018
	GAMW44B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	6/13/2018
	GAMW51	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/10/2018
	GAMW51B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	9/10/2018
	GAMW57	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW57B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW58	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW58B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW59	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW59B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW60	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	GAMW60B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Total Number of Samples		8	8	8	8	8	8	9	8	8	8	8	13

Notes:
(1) Original sample was lost in transit, well was resampled on the provided date.
(2) Semi-annual assessment monitoring parameters did not include radium
Sample counts do not include QC/QA samples.
NI= not installed
NS= not sampled

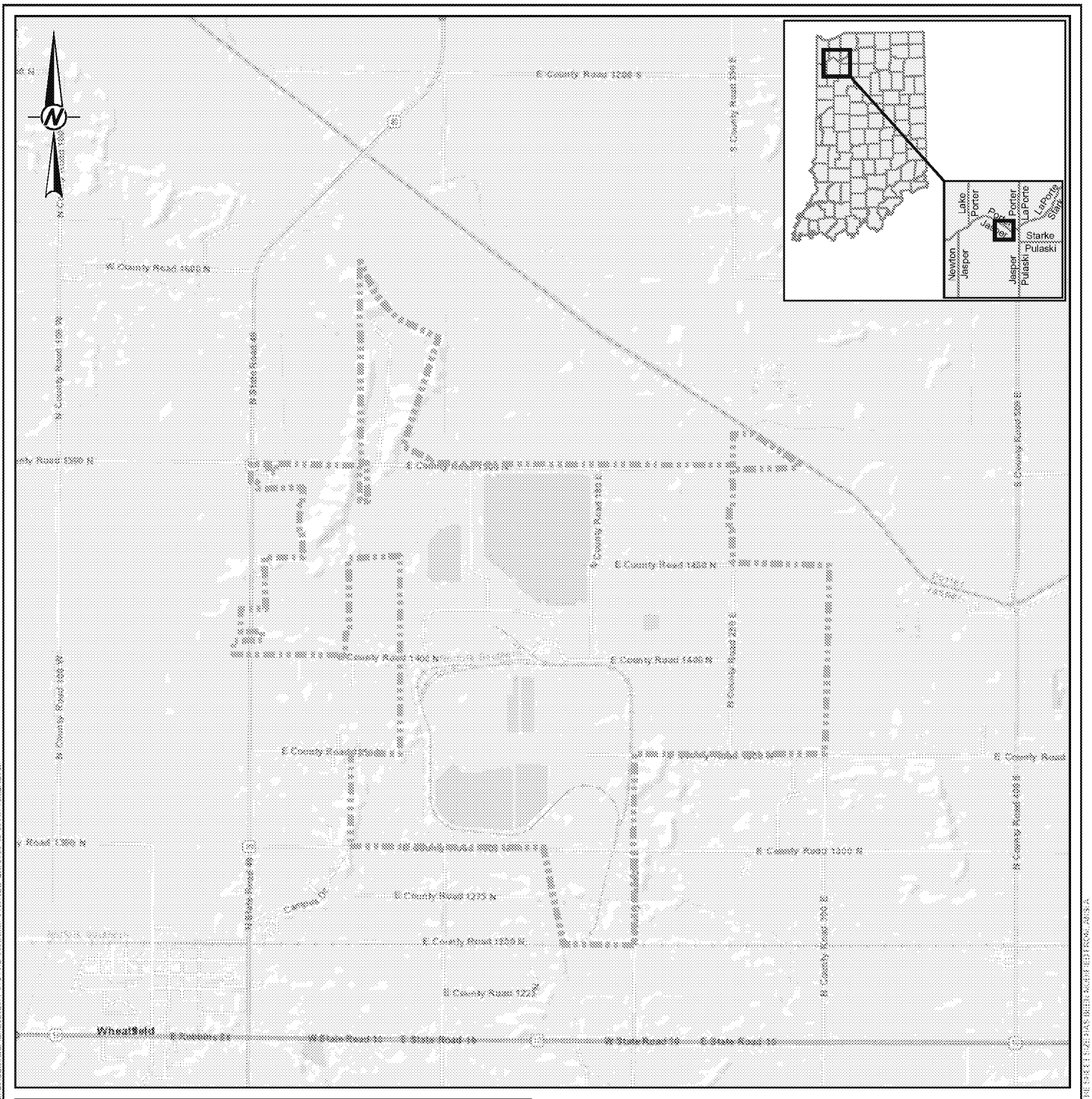
Table 5: Summary of Sampling
CCR Unit Schahfer W
NIPSCO LLC Rollin M
Wheatfield, Indiana

Well Purpose	Monitoring Well ID	Sample Event #11	Resample Event	Supplemental Sampling Event	Sample Event #12	Supplemental Sampling Event	Supplemental Sampling Event	Supplemental Sampling Event	Supplemental Sampling Event	Sample Event #13	Sample Event #14	Total Number of Samples
Purpose of Sample		Semi-Annual Assessment Monitoring	Confirmation of previous sample results	Nature and Extent Characterization Sampling	Annual Assessment Monitoring	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Semi-Annual Assessment Monitoring	Annual Assessment Monitoring	
Sample Parameters		Appendix III and Appendix IV	Appendix III and detected Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Metals Only	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	
Background Monitoring Well	GAMW03	10/24/2018	NS	NS	4/25/2019	NS	NS	NS	NS	11/6/2019	5/8/2020	15
	GAMW03B	10/24/2018	NS	NS	4/26/2019	NS	NS	NS	NS	11/6/2019	5/12/2020	16
Downgradient Monitoring Well	GAMW01	10/23/2018	NS	NS	4/23/2019	NS	NS	NS	NS	11/6/2019	5/6/2020	15
	GAMW01B	10/23/2018	NS	NS	4/23/2019	NS	NS	NS	NS	11/6/2019	5/6/2020	5
	GAMW12	10/23/2018	NS	NS	4/24/2019	NS	NS	NS	NS	11/7/2019	5/11/2020	15
	GAMW12B	10/23/2018	NS	NS	4/25/2019	NS	NS	NS	NS	11/7/2019	5/7/2020	5
	GAMW13	10/24/2018	NS	NS	4/24/2019	NS	NS	NS	NS	11/6/2019	5/7/2020	14
	GAMW13B	10/24/2018	NS	NS	4/24/2019	NS	NS	NS	NS	11/6/2019	5/7/2020	15
	GAMW14	10/25/2018	3/1/2019	NS	4/22/2019	NS	NS	NS	NS	11/6/2019	5/6/2020	16
	GAMW14B	10/25/2018	NS	NS	4/22/2019	NS	NS	NS	NS	11/6/2019	5/6/2020	15
	GAMW42	10/31/2018	NS	3/4/2019	4/18/2019	6/5/2019	7/17/2019	8/26/2019	10/2/2019	11/5/2019	4/22/2020	10
	GAMW42B	NS	NS	3/4/2019	4/18/2019	6/5/2019	7/17/2019	8/27/2019	10/2/2019	11/5/2019	4/22/2020	9
	GAMW42C	NI	NI	NI	NI	NI	7/18/2019	8/28/2019	10/3/2019	11/5/2019	4/21/2020	5
	GAMW43	NS	NS	3/5/2019	4/19/2019	6/5/2019	7/17/2019	8/27/2019	10/2/2019	11/19/2019	4/22/2020	9
	GAMW43B	NS	NS	3/5/2019	4/19/2019	6/6/2019	7/17/2019	8/27/2019	10/2/2019	11/19/2019	4/30/2020	9
	GAMW44	NS	NS	3/5/2019	4/22/2019	6/6/2019	7/24/2019	8/27/2019	10/1/2019	11/20/2019	4/29/2020	9
	GAMW44B	NS	NS	3/5/2019	4/22/2019	6/6/2019	7/24/2019	8/27/2019	10/2/2019	11/20/2019	4/29/2020	9
	GAMW51	10/25/2018	NS	NS	4/26/2019	NS	NS	NS	NS	11/12/2019	5/13/2020	5
	GAMW51B	10/25/2018	NS	NS	4/26/2019	NS	NS	NS	NS	11/12/2019	5/13/2020	5
	GAMW57	NI	NI	NI	NI	NI	7/23/2019	8/29/2019	10/1/2019	11/19/2019	4/28/2020	5
	GAMW57B	NI	NI	NI	NI	NI	7/23/2019	8/29/2019	10/1/2019	11/19/2019	4/28/2020	5
	GAMW58	NI	NI	NI	NI	NI	7/22/2019	8/29/2019	10/1/2019	11/20/2019	4/30/2020	5
	GAMW58B	NI	NI	NI	NI	NI	7/22/2019	8/29/2019	10/1/2019	11/20/2019	4/30/2020	5
	GAMW59	NI	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	5/12/2020	3
	GAMW59B	NI	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	5/12/2020	3
	GAMW60	NI	NI	NI	NI	NI	7/22/2019	NS	NS	11/11/2019	5/11/2020	3
	GAMW60B	NI	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	5/11/2020	3
Total Number of Samples		13	1	6	18	6	15	11	11	27	27	233

Notes:
(1) Original sample was lost in transit, '
(2) Semi-annual assessment monitorir
Sample counts do not include QC/QA
NI= not installed
NS= not sampled

Prepared by: KNG
Checked by: DFSC
Reviewed by: MAH

Figures



LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	9/30/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	1

LEGEND

- Slurry Wall
- CCR Units
- Approximate Extent of Inactive Retired Waste Disposal Basin
- Phase VII
- Approximate Property Line

0 1,050 2,100

1 " = 1,050 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

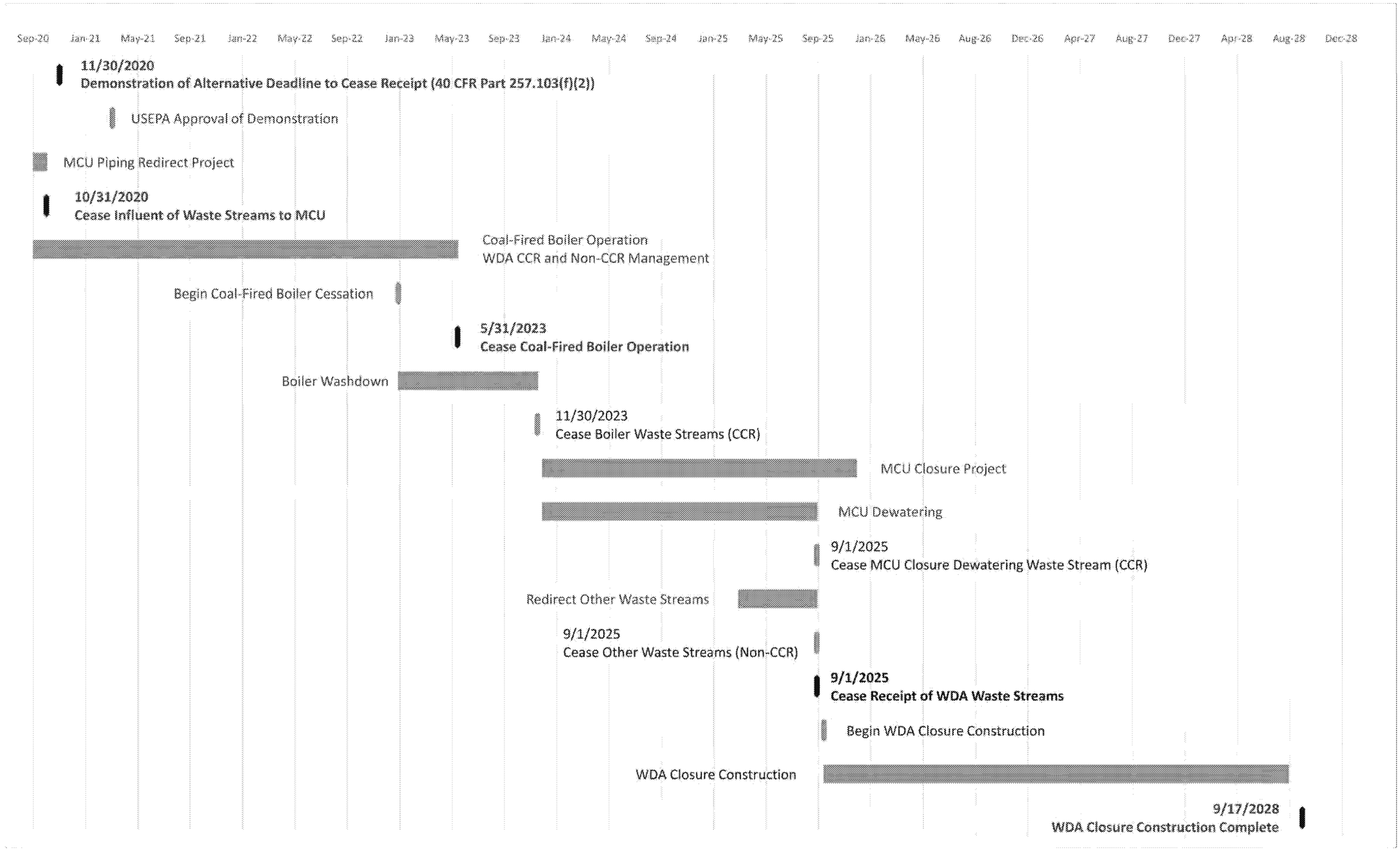
FACILITY SITE PLAN

CONSULTANT

GOLDER

YYYY-MM-DD	10/7/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	MAH
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	2



CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

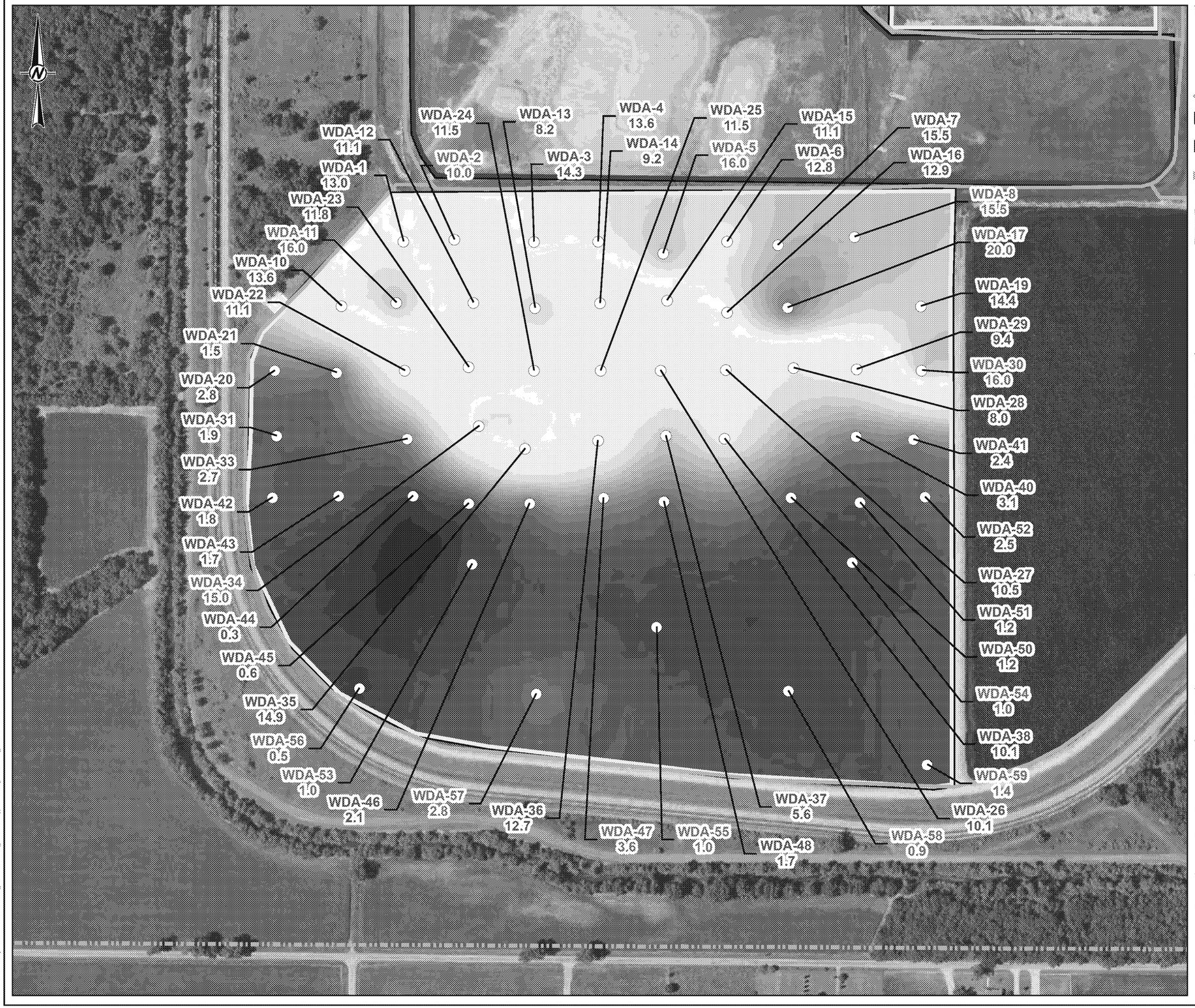
PROJECT
WDA ALTERNATIVE CLOSURE DEMONSTRATION
R.M. SCHAHFER GENERATING STATION
WHEATFEILD, INDIANA

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	RAW
PREPARED	AAZ
REVIEWED	
APPROVED	

TITLE
CESSATION OF OPERATION AND CLOSURE SCHEDULE

PROJECT NO.	CONTROL	REV.	FIGURE
20360525	201	0	3



LEGEND

- DA-6 CPT Sample Location
- DA-3 SPT Sample Location
- CPT/SPT Sample Location
- Slurry Wall
- CCR Units
- Approximate Extent of Inactive Retired Waste Disposal Area
- Approximate Property Line
- WDA Approximate CCR Thickness
  - High : 20
  - Middle: 10
  - Low : 0.5

FIGURE NARRATIVE

This figure illustrates an interpretation of the depth of coal combustion residuals (CCR) within the Waste Disposal Area (WDA). The actual elevation of the CCR surface may be more heterogeneous than shown and elevations between boring locations are inferred. Actual conditions will vary from those illustrated. Other interpretations are possible.

0 300 600

1 " = 300 feet Feet

NOTE(S)

1. GOLDER DEVELOPED THIS COLOR FLOOD MAP USING ARCGIS SOFTWARE DEVELOPED BY ESRI (VERSION 10.7). WHERE NECESSARY, GOLDER ADJUSTED EVS OUTPUT USING PROFESSIONAL JUDGMENT.
2. GEOLOGIC CONTACTS ILLUSTRATED BETWEEN AND BELOW BORINGS ARE INFERRED AND SHOULD NOT BE INTERPRETED AS EXACT INDICATORS OF GEOLOGIC CONDITIONS AT, BETWEEN OR BELOW BORINGS.

REFERENCE(S)

1. SERVICE LAYER CREDITS: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP), FARM SERVICES AGENCY (FSA), U. S. DEPARTMENT OF AGRICULTURE (USDA), UITS, INDIANA SPATIAL DATA PORTAL

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

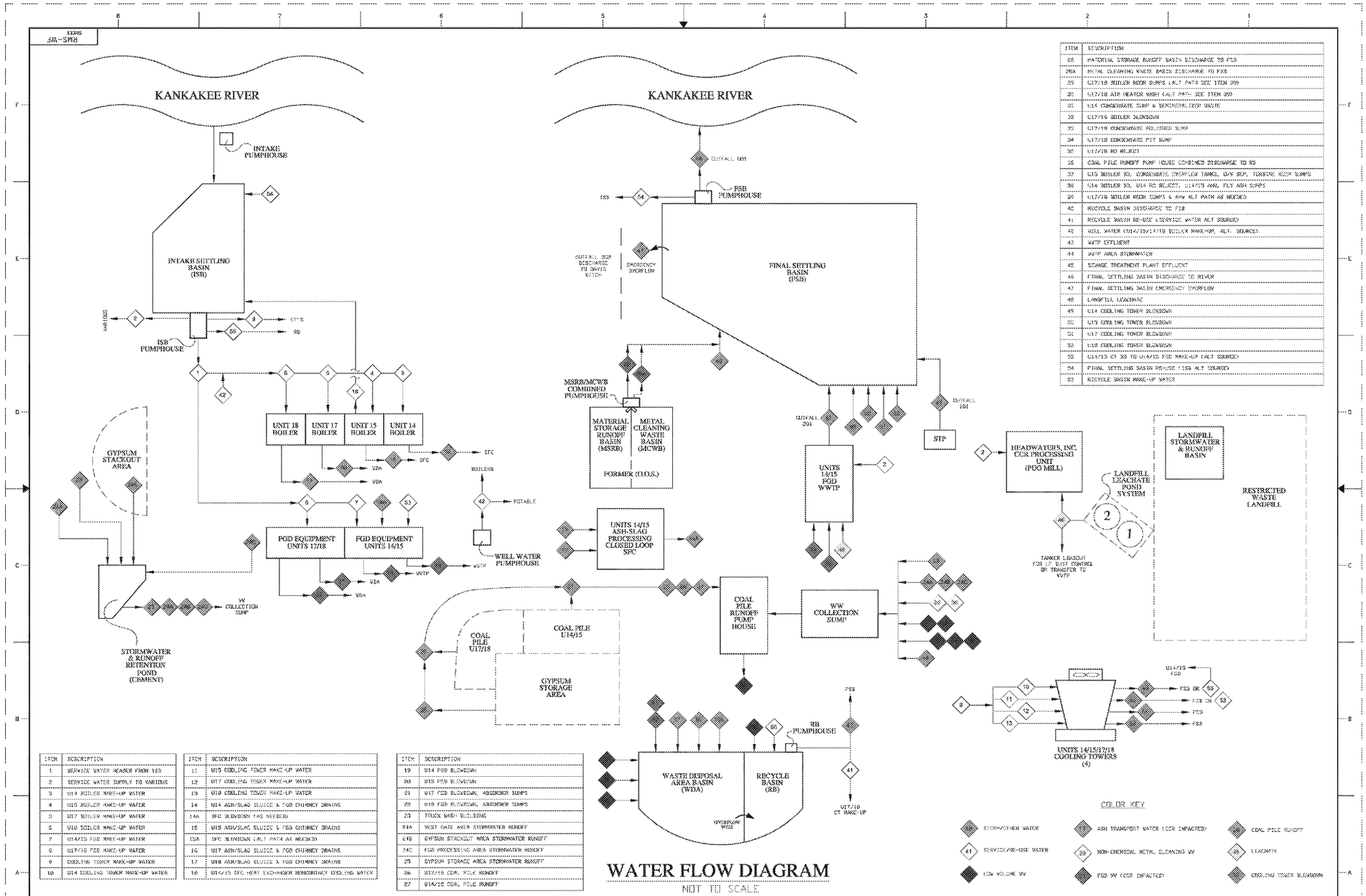
WASTE DISPOSAL AREA - APPROXIMATE ASH THICKNESS

CONSULTANT

GOLDER

YYYY-MM-DD	9/30/2020
DESIGNED	DFS
PREPARED	TBH
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV	FIGURE
20368079	A	0	4



ITEM	DESCRIPTION
28	MATERIAL STORAGE RUNOFF BASIN DISCHARGE TO FSB
28A	METAL CLEANING WASTE BASIN DISCHARGE TO FSB
29	U17/18 BOILER ROOM SUMPS ALT PATH SEE ITEM 29A
30	U17/18 AIR HEATER WASH (ALT PATH SEE ITEM 29A)
31	U14 CONDENSATE SUMP & DEMINERALIZER WASTE
32	U17/18 BOILER BLOWDOWN
33	U17/18 CONDENSATE POLISHER SUMP
34	U17/18 CONDENSATE PIT SUMP
35	U17/18 RO REJECT
36	COAL PILE RUNOFF PUMP HOUSE COMBINED DISCHARGE TO RB
37	U15 BOILER RO, CONDENSATE OVERFLOW TANKS, LAW SUP, TURBINE ROOM SUMPS
38	U14 BOILER RO, U14 RO REJECT, U14/15 ANG, FLY ASH SUMPS
39	U17/18 BOILER ROOM SUMPS & AHW ALT PATH AS NEEDED
40	RECYCLE BASIN DISCHARGE TO FSB
41	RECYCLE BASIN RE-USE (SERVICE WATER ALT SOURCE)
42	WELL WATER (U14/15/17/18 BOILER MAKE-UP, ALT. SOURCE)
43	WWTP EFFLUENT
44	WWTP AREA STORMWATER
45	SEWAGE TREATMENT PLANT EFFLUENT
46	FINAL SETTLING BASIN DISCHARGE TO RIVER
47	FINAL SETTLING BASIN EMERGENCY OVERFLOW
48	LANDFILL LEACHATE
49	U14 COOLING TOWER BLOWDOWN
50	U15 COOLING TOWER BLOWDOWN
51	U17 COOLING TOWER BLOWDOWN
52	U18 COOLING TOWER BLOWDOWN
53	U14/15 CT RO TO U14/15 FGD MAKE-UP (ALT SOURCE)
54	FINAL SETTLING BASIN RE-USE (ISB ALT SOURCE)
55	RECYCLE BASIN MAKE-UP WATER

ITEM	DESCRIPTION
1	SERVICE WATER HEADER FROM ISB
2	SERVICE WATER SUPPLY TO VARIOUS
3	U14 BOILER MAKE-UP WATER
4	U15 BOILER MAKE-UP WATER
5	U17 BOILER MAKE-UP WATER
6	U18 BOILER MAKE-UP WATER
7	U14/15 FGD MAKE-UP WATER
8	U17/18 FGD MAKE-UP WATER
9	COOLING TOWER MAKE-UP WATER
10	U14 COOLING TOWER MAKE-UP WATER

ITEM	DESCRIPTION
11	U15 COOLING TOWER MAKE-UP WATER
12	U17 COOLING TOWER MAKE-UP WATER
13	U18 COOLING TOWER MAKE-UP WATER
14	U14 ASH/SLAG SLUICE & FGD CHIMNEY DRAINS
14A	SFC BLOWDOWN (AS NEEDED)
15	U15 ASH/SLAG SLUICE & FGD CHIMNEY DRAINS
15A	SFC BLOWDOWN (ALT PATH AS NEEDED)
16	U17 ASH/SLAG SLUICE & FGD CHIMNEY DRAINS
17	U18 ASH/SLAG SLUICE & FGD CHIMNEY DRAINS
18	U14/15 SFC HEAT EXCHANGER NONCONTACT COOLING WATER

ITEM	DESCRIPTION
19	U14 FGD BLOWDOWN
20	U15 FGD BLOWDOWN
21	U17 FGD BLOWDOWN, ABSORBER SUMPS
22	U18 FGD BLOWDOWN, ABSORBER SUMPS
23	TRUCK WASH BUILDING
24A	WEST GATE AREA STORMWATER RUNOFF
24B	GYPSUM STACKOUT AREA STORMWATER RUNOFF
24C	FGD PROCESSING AREA STORMWATER RUNOFF
25	GYPSUM STORAGE AREA STORMWATER RUNOFF
26	U17/18 COAL PILE RUNOFF
27	U14/15 COAL PILE RUNOFF

WATER FLOW DIAGRAM

NOT TO SCALE

REV.	W.O.	DESCRIPTION	DATE	APPR. DRAFT	APPR. CHECK	FROM
1						
0		UPDATE WATER FLOW	10-5-2020	DA		
A		UPDATE WATER FLOW	7-12-2018	DA		

Northern Indiana Public Service Company
A NiSource Company

DRAWN: DA/AL
ENGINEER:
APPROVED:
DATE: 7-12-2018
SCALE: NONE

TITLE ROLLIN M. SCHAHFER GEN. STA.
LOCATION WHEATFIELD, INDIANA
DETAIL WATER FLOW DIAGRAM

NIPSCO DRAWING NO. RMS-WF
REV. B
SHEET

CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

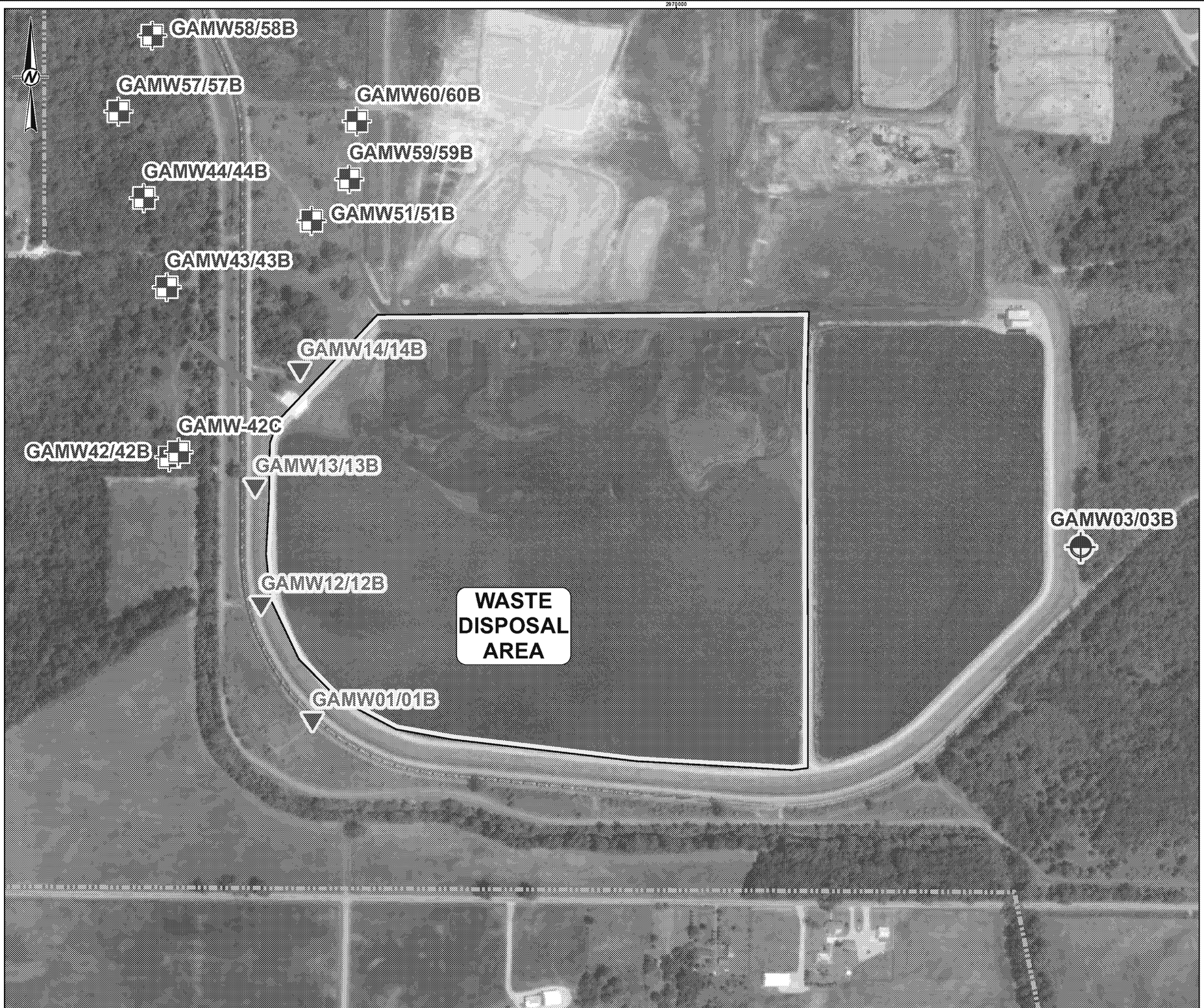
CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-07
DESIGNED	RAW
PREPARED	AAZ
REVIEWED	
APPROVED	

PROJECT
WDA ALTERNATIVE CLOSURE DEMONSTRATION
R.M. SCHAHFER GENERATING STATION
WHEATFEILD, INDIANA

TITLE
NIPSCO LLC WATER FLOW DIAGRAM

PROJECT NO.	CONTROL	REV.	FIGURE
20360525	201	0	5



LEGEND

- Assessment Monitoring Well
- Background Monitoring Well
- Downgradient Monitoring Well
- Generalized Groundwater Flow Direction
- Approximate Property Line
- CCR Unit

0 400 800

1 " = 400 feet Feet

NOTE(S)

1. THIS FIGURE DEPICTS THE GENERALIZED GROUNDWATER FLOW DIRECTION WITHIN THE UPPER PORTION OF SURFICIAL AQUIFER.

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

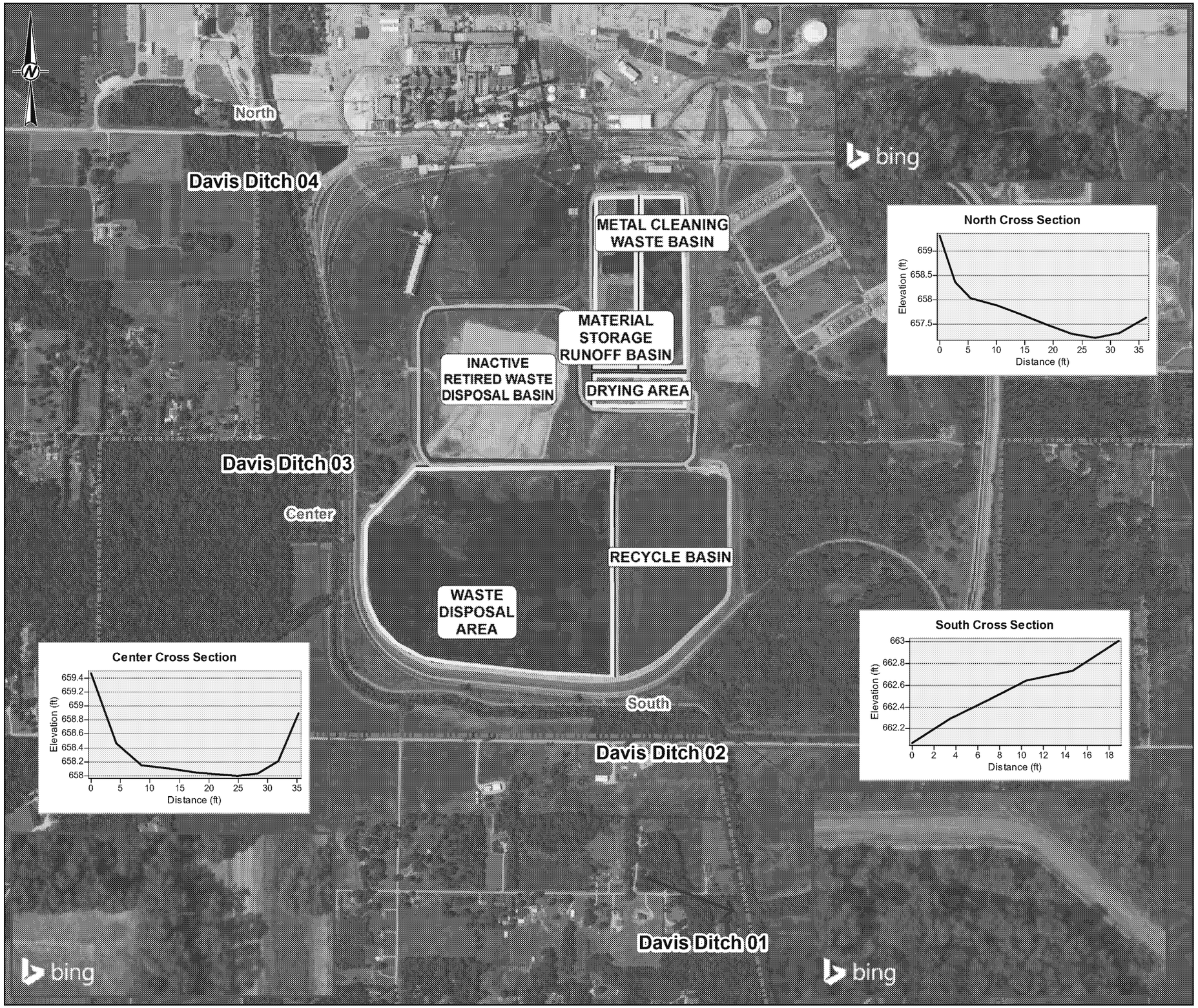
MONITORING WELL LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	9/30/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	6



LEGEND

- Stream Crossing Cross Section Location
- Slurry Wall
- Approximate Property Line
- CCR Units
- Inactive Retired Waste Disposal Basin

0 1,700

1 " = 850 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: © 2020 MICROSOFT CORPORATION © 2020 MAXAR ©CNES (2020) DISTRIBUTION AIRBUS DS
2. 2013 ELEVATION DATA DOWNLOADED FROM INDIANA UNIVERSITY'S INDIANA SPATIAL DATA PORTAL ON 6/16/2020.

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

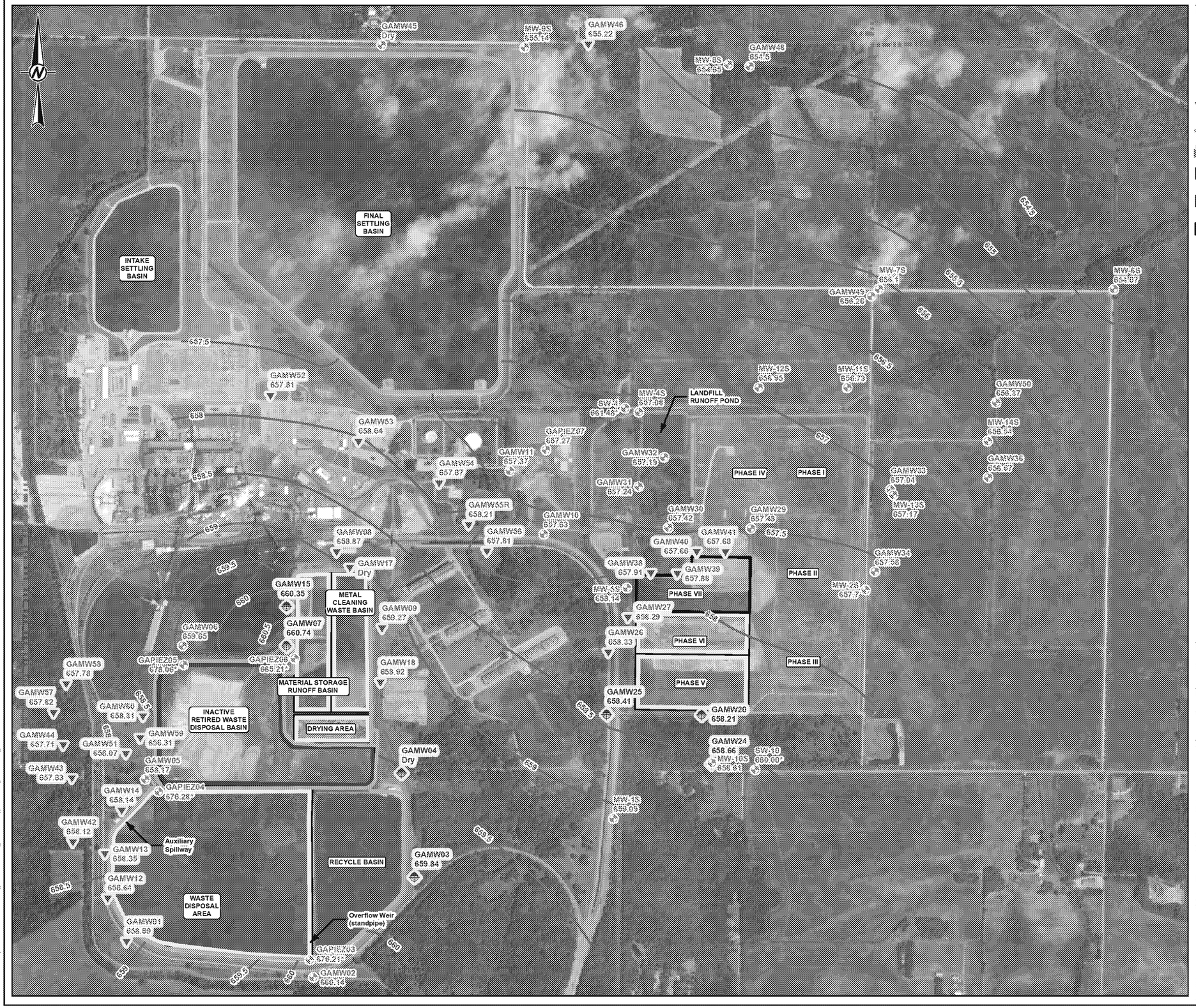
SURFACE WASTE SAMPLING LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	2020-09-30
DESIGNED	JSP
PREPARED	TBH
REVIEWED	-
APPROVED	-

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	7



LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Non-CCR Well
- September 2019 Groundwater Elevation Contour (0.5 ft interval)
- Slurry Wall
- Approximate Property Line
- CCR Units
- Approximate Extent of Inactive Retired Waste Disposal Basin
- Phase VII

NOTE(S)

1. WATER LEVEL MEASUREMENTS COLLECTED ON SEPTEMBER 25TH, 2019.
2. * INDICATES WELL NOT USED FOR CONTOURING.

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SEPTEMBER 2019 GROUNDWATER ELEVATION CONTOURS

CONSULTANT

GOLDER

YYYY-MM-DD	2020-09-30
DESIGNED	JSP
PREPARED	SHL
REVIEWED	-
APPROVED	-

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	8

LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Non-CCR Well
- March 2020 Groundwater Elevation Contour (0.5 ft interval)
- Slurry Wall
- Approximate Property Line
- CCR Units
- Inactive Retired Waste Disposal Basin
- Phase VII

0 2,100

1 " = 1,050 feet Feet

NOTE(S)

1. WATER LEVEL MEASUREMENTS COLLECTED ON MARCH 13TH 2020.
2. * INDICATES WELL NOT USED FOR CONTOURING.

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

WDA ALTERNATIVE CLOSURE DEMONSTRATION
R. M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

APRIL 2020 GROUNDWATER ELEVATION CONTOURS

CONSULTANT

GOLDER

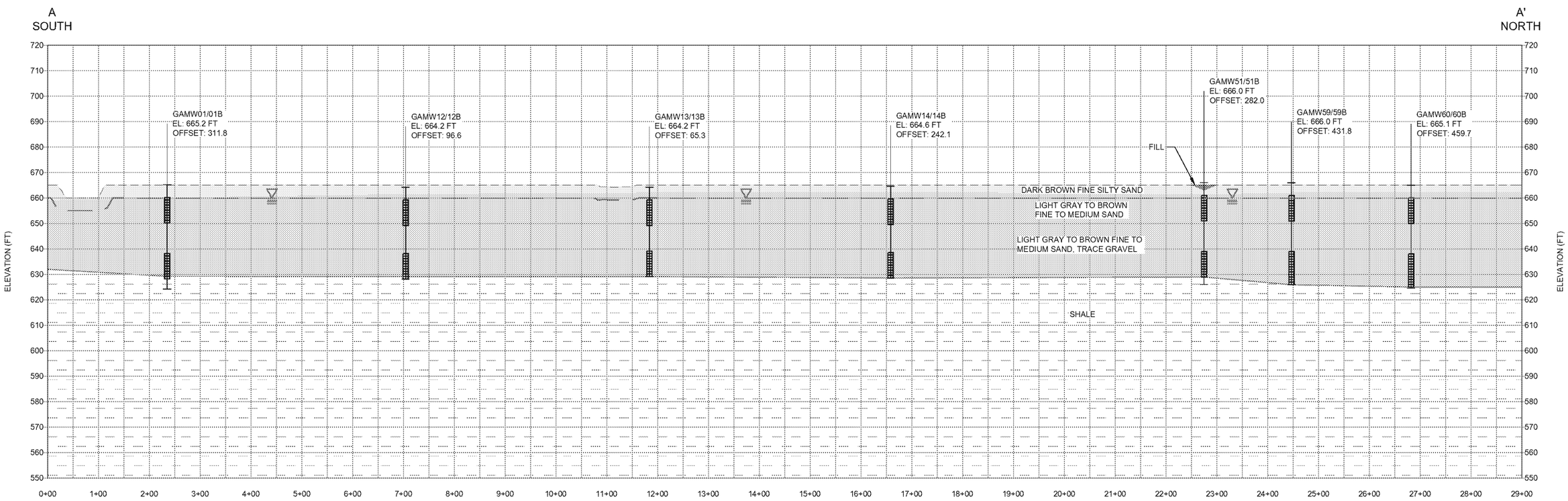
YYYY-MM-DD	2020-09-30
DESIGNED	JSP
PREPARED	TBH
REVIEWED	-
APPROVED	-

PROJECT NO.	CONTROL	REV.	FIGURE
20368079	A	0	9

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

1 in

0



SCALE 1" = 200' (A / 10) CROSS SECTION A-A'

LEGEND

GAMW-01/01B = WELL I.D.
EL: 665.2 FT = GROUND SURFACE ELEVATION
OFFSET: 311.8 = OFFSET DISTANCE

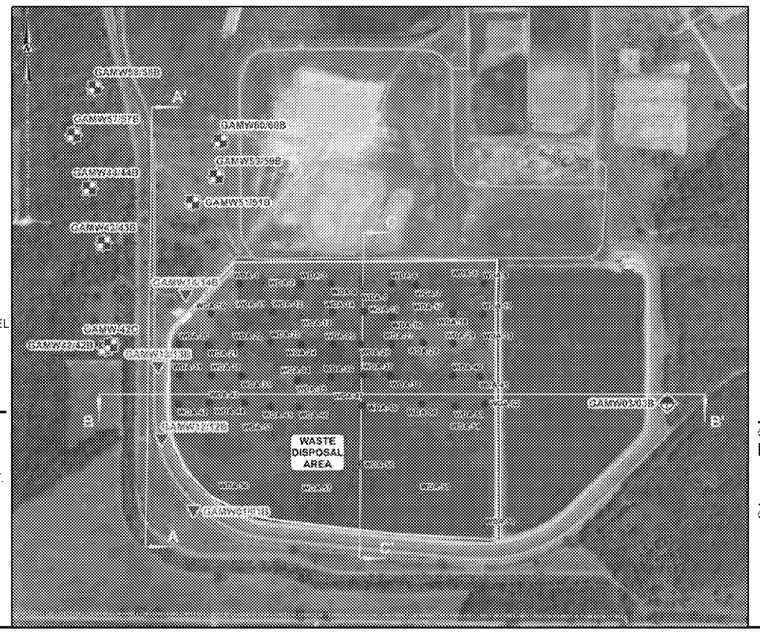
= APPROXIMATE GROUNDWATER ELEVATION
= WELL SCREEN
= END OF BORING LOCATION

FILL
DARK BROWN FINE SILTY SAND
LIGHT GRAY TO BROWN FINE TO MEDIUM SAND
LIGHT GRAY TO BROWN FINE TO COARSE SAND, TRACE GRAVEL
SHALE

NOTE(S)

1. GOLDER DEVELOPED THE GEOLOGIC CROSS SECTION USING BORING LOGS COMPLETED BY GOLDER BETWEEN JULY 2016 AND NOVEMBER 2019. WHERE NECESSARY, GOLDER ADJUSTED CONTACTS USING PROFESSIONAL JUDGEMENT.
2. GEOLOGIC CONTACTS ILLUSTRATED BETWEEN AND BELOW BORINGS ARE INFERRED AND SHOULD NOT BE INTERPRETED AS EXACT INDICATORS OF GEOLOGIC CONDITIONS AT, BETWEEN, OR BELOW BORINGS.

KEY MAP



VERTICAL SCALE: 0 20 40 — 1" = 40' FEET
HORIZONTAL SCALE: 0 100 200 — 1" = 200' FEET
KEY MAP: 0 500 1000 — 1" = 1000' FEET

CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

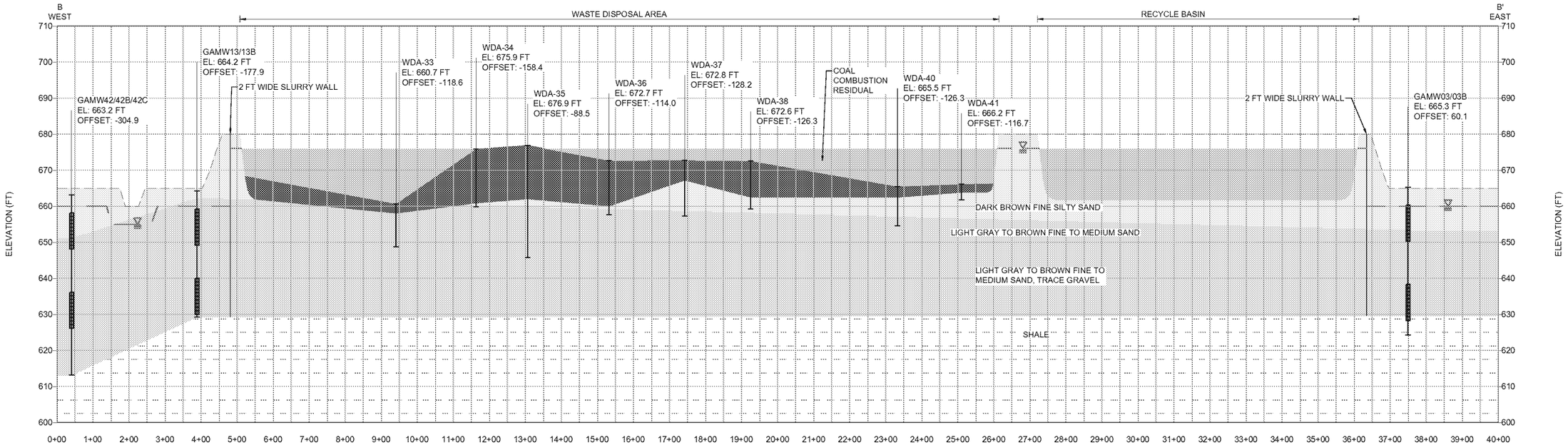
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-03
DESIGNED	DS
PREPARED	AAZ
REVIEWED	JP
APPROVED	

PROJECT
WDA ALTERNATIVE CLOSURE DEMONSTRATION
R.M. SCHAHFER GENERATING STATION
WHEATFEILD, INDIANA

TITLE
HYDROGEOLOGICAL CROSS SECTION A-A'

PROJECT NO.	CONTROL	REV.	FIGURE
20360525	201	0	10



SCALE 1" = 300' B/11 CROSS SECTION B-B'

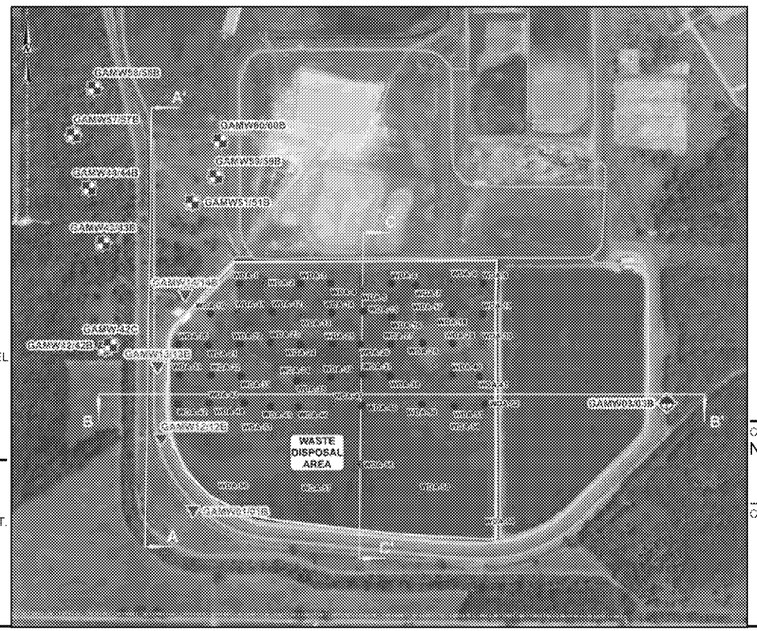
LEGEND

GAMW-03/03B = WELL I.D.
EL: 665.3 FT = GROUND SURFACE ELEVATION
OFFSET: 60.1 = OFFSET DISTANCE

= APPROXIMATE GROUNDWATER ELEVATION
= WELL SCREEN
= END OF BORING LOCATION

WATER
COAL COMBUSTION RESIDUAL
DARK BROWN FINE SILTY SAND
LIGHT GRAY TO BROWN FINE TO MEDIUM SAND
LIGHT GRAY TO BROWN FINE TO COARSE SAND, TRACE GRAVEL
SHALE

KEY MAP



VERTICAL SCALE: 0 15 30 — 1" = 30' FEET
HORIZONTAL SCALE: 0 150 300 — 1" = 300' FEET
KEY MAP: 0 500 1000 — 1" = 1000' FEET

NOTE(S)

1. GOLDER DEVELOPED THE GEOLOGIC CROSS SECTION USING BORING LOGS COMPLETED BY GOLDER BETWEEN JULY 2016 AND NOVEMBER 2019. WHERE NECESSARY, GOLDER ADJUSTED CONTACTS USING PROFESSIONAL JUDGEMENT.
2. GEOLOGIC CONTACTS ILLUSTRATED BETWEEN AND BELOW BORINGS ARE INFERRED AND SHOULD NOT BE INTERPRETED AS EXACT INDICATORS OF GEOLOGIC CONDITIONS AT, BETWEEN, OR BELOW BORINGS.

CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

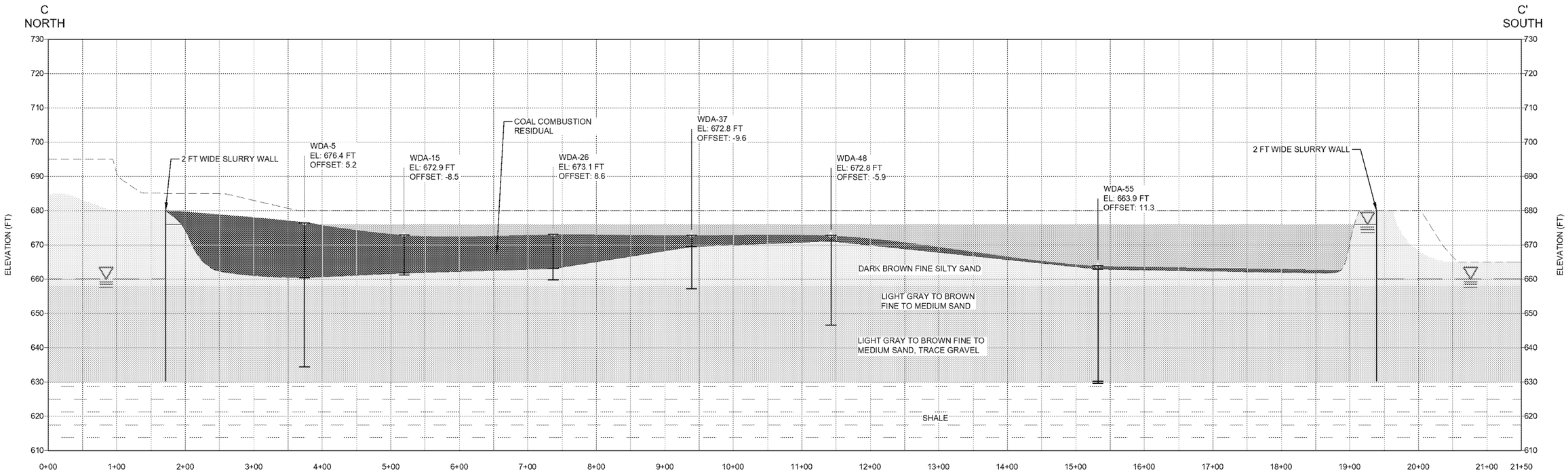
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-03
DESIGNED	DS
PREPARED	AAZ
REVIEWED	JP
APPROVED	

PROJECT
WDA ALTERNATIVE CLOSURE DEMONSTRATION
R.M. SCHAHFER GENERATING STATION
WHEATFEILD, INDIANA

TITLE
HYDROGEOLOGICAL CROSS SECTION B-B'

PROJECT NO.	CONTROL	REV.	FIGURE
20360525	201	0	11



SCALE 1" = 150' C/12 CROSS SECTION C-C'

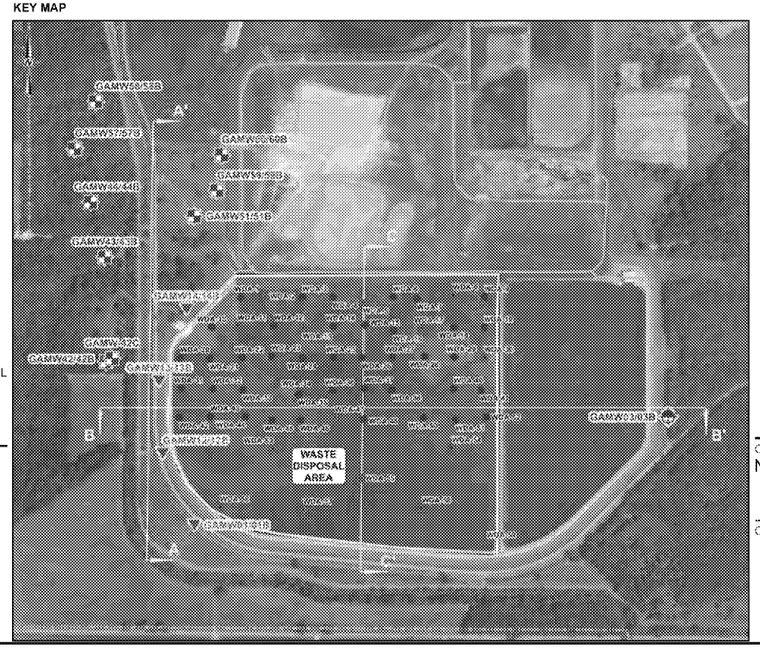
LEGEND

WDA-5	=	WELL I.D.
EL: 676.4 FT	=	GROUND SURFACE ELEVATION
OFFSET: 5.2	=	OFFSET DISTANCE
	=	APPROXIMATE GROUNDWATER ELEVATION
	=	WELL SCREEN
	=	END OF BORING LOCATION
		WATER
		COAL COMBUSTION RESIDUAL
		DARK BROWN FINE SILTY SAND
		LIGHT GRAY TO BROWN FINE TO MEDIUM SAND
		LIGHT GRAY TO BROWN FINE TO COARSE SAND, TRACE GRAVEL
		SHALE

NOTE(S)

1. GOLDER DEVELOPED THE GEOLOGIC CROSS SECTION USING BORING LOGS COMPLETED BY GOLDER BETWEEN JULY 2016 AND NOVEMBER 2019. WHERE NECESSARY, GOLDER ADJUSTED CONTACTS USING PROFESSIONAL JUDGEMENT.
2. GEOLOGIC CONTACTS ILLUSTRATED BETWEEN AND BELOW BORINGS ARE INFERRED AND SHOULD NOT BE INTERPRETED AS EXACT INDICATORS OF GEOLOGIC CONDITIONS AT, BETWEEN, OR BELOW BORINGS.

KEY MAP



VERTICAL SCALE: 0 15 30 — 1" = 30' FEET

HORIZONTAL SCALE: 0 75 150 — 1" = 150' FEET

KEY MAP: 0 500 1000 — 1" = 1000' FEET

CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-03
DESIGNED	DS
PREPARED	AAZ
REVIEWED	JP
APPROVED	

PROJECT
WDA ALTERNATIVE CLOSURE DEMONSTRATION
R.M. SCHAHFER GENERATING STATION
WHEATFEILD, INDIANA

TITLE
HYDROGEOLOGICAL CROSS SECTION C-C'

PROJECT NO.	CONTROL	REV.	FIGURE
20360525	201	0	12

Appendices

GOLDER

APPENDICES

Appendix A:	Location Restriction Certification Report, NIPSCO R.M. Schahfer Generating Station Impoundments 40 CFR Part §257.60-64, dated October 17, 2018
Appendix B:	Risk Assessment for the Waste Disposal Area- Haley & Aldrich, Inc - October 2020
Appendix C:	Waste Disposal Area Analytical Data 40 CFR Part §257.103(f)(2)(v)(C)(3)
Appendix D:	Certification of Facility Compliance 40 CFR Part §257. 103(f)(2)(v)(C)(1)
Appendix E:	Soil Borings and Monitoring Well Logs 40 CFR Part §257.103(f)(2)(v)(C)(2)(ii)
Appendix F:	Slug Test Results
Appendix G:	2019 Annual Groundwater Monitoring and Corrective Action Report- Waste Disposal Area - January 2020
Appendix H:	Waste Disposal Area Alternative Source Demonstration - November 2018
Appendix I:	Waste Disposal Area Alternative Source Demonstration - May 2019
Appendix J:	Waste Disposal Area Alternative Source Demonstration Recertification - November 2019
Appendix K:	Waste Disposal Area Alternative Source Demonstration - June 2020
Appendix L:	Structural Stability and Safety Factor Assessment Waste Disposal Area 40 CFR Part §257.73(d) and (e), dated October 5, 2016
Appendix M:	Fifth Annual RCRA CCR Unit Inspection Report Waste Disposal Area- Surface Impoundment 40 CFR Part §257.73(d), dated January 2, 2020
Appendix N:	WDA Closure Plan- Version # 5- Golder Associates, Inc. - October 2020

APPENDIX A

Location Restriction Certification Report, NIPSCO R.M. Schahfer Generating Station Impoundments 40 CFR Part §257.60-64, dated October 17, 2018

GOLDER

Location Restrictions Certification Report

NIPSCO R. M. Schahfer Generating Station Impoundments

Pursuant to:

40 CFR §257.60
40 CFR §257.61
40 CFR §257.62
40 CFR §257.63
40 CFR §257.64

Submitted to:

Northern Indiana Public Service Company
R. M. Schahfer Generating Station
Wheatfield, Indiana

Submitted by:

Golder Associates Inc.
15851 South US 27, Suite 50
Lansing, Michigan, USA 48906
+1 517 482-2262

Project No. 164817101

October 17, 2018

CERTIFICATION

Professional Engineer Certification Statement [40 CFR §257.60-64(b)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations, Sections 257.60 through 64 (40 CFR §257.60-64), I attest that this NIPSCO R. M. Schahfer Generating Station Impoundments Location Restrictions Certification Report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR §257.60-64.

Golder Associates Inc.

Signature

TIFFANY D. JOHNSON
REGISTERED
No. PE11500730
STATE OF
INDIANA
PROFESSIONAL ENGINEER

10/17/18

Date of Report Certification

Tiffany D. Johnson, P.E.

Name

PE11500730

Indiana Professional Engineer Certification Number

Table of Contents

CERTIFICATION **C-1**

1.0 INTRODUCTION **1**

1.1 Background 1

1.2 Purpose 1

2.0 LOCATION RESTRICTIONS **1**

2.1 Placement Above the Uppermost Aquifer [40 CFR §257.60] 1

2.2 Wetlands [40 CFR §257.61] 2

2.3 Fault Areas [40 CFR §257.62] 2

2.4 Seismic Impact Zones [40 CFR §257.63] 2

2.5 Unstable Areas [40 CFR §257.64] 2

2.5.1 Petroleum Fields/Wells 2

2.5.2 Sand and Gravel Pit 2

2.5.3 Active Mineral 2

2.5.4 Karst 3

2.5.5 Liquefaction Potential 3

2.5.6 Surface Mine 3

2.5.7 Underground Mine 3

2.5.8 Steep Slope 3

2.5.9 Abandoned Quarries 3

2.5.10 Differential Settlement 3

3.0 CONCLUSION AND SUMMARY **3**

4.0 REFERENCES **3**

Figures

Figure 1 Site Location Map

Figure 2 CCR Unit Location Map

1.0 INTRODUCTION

1.1 Background

40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Soil Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule" (CCR Final Rule), as amended, and corresponding regulations under 329 Indiana Administrative Code (IAC) 10-9-1 place requirements on the location of CCR management units. Golder Associates Inc. (Golder) on behalf of Northern Indiana Public Service Company (NIPSCO) evaluated the location criteria and prepared this Location Restrictions Certification Report for the R. M. Schahfer (RMSGS) Waste Disposal Area (WDA), Material Storage Runoff Basin (MSRB), Metal Cleaning Waste Basin (MCWB), and the Drying Area (together, the CCR Units). RMSGS occupies an area of approximately four-square miles located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (Latitude 41° 12' 36" and Longitude 87° 01' 48", see Figure 1). WDA is an approximately 80-acre impoundment that is surrounded by a slurry wall and located in the southwest region of RMSGS. The Drying Area is an approximately 5.5-acre impoundment that is surrounded by a slurry wall and located north-northeast of the WDA. The Drying Area has been completely filled with CCR. The MSRB and MCWB consist of two rectangular, approximately 15-acre impoundments located adjacent to one another. The ponds are separated by a narrow berm. While there is a perimeter slurry wall around the basins, there is no slurry wall within the narrow berm between the basins. These ponds are located north of the Drying Area. The location of all of the CCR Units is shown on Figure 2.

1.2 Purpose

The purpose of this Location Restrictions Certification Report is to provide demonstrations for the certification required by 40 CFR §257.60-64. Location Restrictions criteria include:

- §257.60 Placement above the uppermost aquifer
- §257.61 Wetlands
- §257.62 Fault areas
- §257.63 Seismic impact zones
- §257.64 Unstable areas

2.0 LOCATION RESTRICTIONS

The following sections outline NIPSCO's ("owner'") requirements as presented in 40 CFR §257 Subpart D, Location Restrictions regulations.

2.1 Placement Above the Uppermost Aquifer [40 CFR §257.60]

NIPSCO has collected groundwater elevation data from monitoring wells surrounding the CCR Units. The data collected indicate the maximum upper limit of the upper most aquifer was approximately 660 feet mean sea level (ft msl). Golder reviewed construction drawings, advanced 10 soil borings within the CCR Units, and completed 28 geophysical lines to better understand the presence and thickness of CCR and thus, the bottom elevation (base) of the CCR Units. Results of these activities indicate the elevation of the bottom of CCR (and, thus, the base) of the WDA to be between 635 ft msl and 665 ft msl, the MSRB and Drying Area to be between 657 ft msl and 660 ft msl, and the MCWB to be between 661 ft msl and 664 ft msl. This separation distance does not satisfy the requirements set forth in 40 CFR 257.60(a).

2.2 Wetlands [40 CFR §257.61]

To evaluate the location of the RMSGS CCR Units relative to wetlands, Golder reviewed readily available information:

- US Geological Survey (USGS) topographic map
- National Wetland Inventory (NWI) map
- US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey map
- Aerial imagery
- Federal Emergency Management Agency (FEMA) floodplain map

In addition to the desktop data review, Golder staff completed a field reconnaissance to evaluate the presence or absence of wetlands at the Site. Wetlands are mapped in areas adjacent to the Site (NWI Map). Visual observation during the Site visit indicated that there were no wetlands within the footprint of the WDA, MSRB, MCWB and the Drying Area. Based on Site reconnaissance and information compiled by Golder, the RMSGS CCR Units are not located within wetlands and meet the requirements of 40 CFR §257.61.

2.3 Fault Areas [40 CFR §257.62]

Based on Indiana Geological Survey Miscellaneous Map 85 (Gray and Steinmetz, 2012), the closest fault that has displaced during Holocene time is the 'Royal Center Fault' which is located approximately 35 miles southeast of the RMSGS. Therefore, the CCR units at the Site are not located within 200 feet of the outermost damage zone of a Holocene fault.

2.4 Seismic Impact Zones [40 CFR §257.63]

The United Stated Geological Survey (USGS) reports peak horizontal ground acceleration (PGA) at RMSGS to be approximately 0.06 g with a 2% probability of exceedance in 50 years using the values from the 2015 National Earthquake Hazards Reduction Program Recommended Seismic Provisions for New Buildings and Other Structures (USGS, 2018). Therefore, the CCR units at the Site are not located within a seismic impact zone as defined by 40 CFR §257.63, thereby meeting this requirement.

2.5 Unstable Areas [40 CFR §257.64]

Based on research conducted through the Indiana Geological Survey information website (http://igs.indiana.edu/), the USGS, and historical reports prepared by Golder and others for the RMSGS site, the following unstable areas information was identified.

2.5.1 Petroleum Fields/Wells

There is a 400 feet deep petroleum well identified 0.5 miles north and west of the Site.

2.5.2 Sand and Gravel Pit

The closest identified pit is located approximately two miles east of the Site.

2.5.3 Active Mineral

There are no active industrial minerals sites identified within three miles of the Site.

2.5.4 Karst

There are no karst terrain locations mapped near the Site.

2.5.5 Liquefaction Potential

Based on the historical information prepared for the site (Golder, 2016), the embankments and foundation soils for the RMSGS CCR Units are not susceptible to seismically induced liquefaction.

2.5.6 Surface Mine

There are no surface coal mines identified near the Site.

2.5.7 Underground Mine

There are no underground coal mines identified near the Site.

2.5.8 Steep Slope

There are embankments with notable steep slopes for the CCR Units. Golder performed a slope stability analysis and the results of the slope stability analysis indicate that the CCR Unit slopes have an acceptable factor of safety (Golder, 2011, 2016).

2.5.9 Abandoned Quarries

There are no abandoned quarries identified near the Site.

2.5.10 Differential Settlement

Differential settlement is not expected in the foundation soils for the CCR Units at RMSGS (Golder, 2011).

Based on Golder's evaluation of the data resources available, the CCR Units at the RMSGS meet the stability requirements under 40 CFR §257.64.

3.0 CONCLUSION AND SUMMARY

This report has been prepared in general accordance with normally accepted civil engineering practices to fulfill the reporting requirements of 40 CFR §257.60-257.64. Based on the review of the available information provided by NIPSCO, the CCR Units the WDA, Drying Area, MSRB, and the MCWB do not meet the requirements for the minimum separation between the CCR Unit base and the upper limit of the uppermost aquifer and therefore is subject to 40 CFR §257.101(b)(1).

This report will be placed in the facility's operating record in accordance with 40 CFR 257.105(e) and will be made available on the facility's publicly accessible internet site in accordance with 40 CFR 257.107(e).

4.0 REFERENCES

Advanced Geosciences, Inc. (2008). Instruction Manual for EarthImager 2D Version 2.3.0 Resistivity and IP Inversion Software.

Gray, W. E., Steinmetz, J. C. 2012, Map showing known faults and historic earthquake epicenters having magnitude 3.0 and larger in Indiana: Indiana Geological Survey Miscellaneous Map 85.

Golder Associates Inc., "2011 Geotechnical Investigation and Embankment Stability Analyses", October 2011.

Golder Associates Inc., "NIPSCO R.M. Schahfer Generating Facility Waste Disposal Area (WDA) Structural Stability and Safety Factor Assessment, Wheatfield, Indiana, Pursuant to 40 CFR 257.73(d) & 257.73(e)", October 2016.

Indiana Geological website, http://maps.indiana.edu/LayerGallery.html, September 2018.

Rubin, Yoram and S. Hubbard (2006). Hydrogeophysics. Dordrecht, Netherlands: Springer.

Sheriff, Robert E. (2002). Encyclopedic Dictionary of Applied Geophysics. Tulsa, Oklahoma: Society of Exploration Geophysicists, 2002.

United Stated Geological Survey website, http://earthquake.usgs.gov, September 2018.

United Stated Geological Survey, U.S. Seismic Design Maps. Retrieved September 2018, from https://earthquake.usgs.gov/designmaps/beta/us/.

GOLDER

golder.com

Golder and the G logo are trademarks of
Golder Associates Corporation

APPENDIX B

Risk Assessment for the Waste Disposal Area- Haley & Aldrich, Inc- October 2020

HALEY ALDRICH

www.haleyaldrich.com

REPORT ON

RISK ASSESSMENT FOR THE WASTE DISPOSAL AREA SCHAHFER GENERATING STATION WHEATFIELD, INDIANA

by
Haley & Aldrich, Inc.
Chicago, Illinois

for
Northern Indiana Public Service Company LLC (NIPSCO)
Wheatfield, Indiana

File No. 135077-002
October 2020

Table of Contents

		Page
List of Tables		**iii**
List of Figures		**iii**
List of Acronyms		**iv**
1.	**Introduction**	**1**
2.	**Objective**	**1**
3.	**Approach**	**2**
4.	**Conceptual Site Model**	**3**
5.	**Samples Used for Evaluation**	**5**
5.1	GROUNDWATER	5
5.2	GROUNDWATER SAMPLE ANALYSIS	6
5.3	DAVIS DITCH	7
6.	**Risk-Based Screening Levels**	**8**
6.1	DRINKING WATER SCREENING LEVELS	8
6.2	SCREENING LEVELS FOR THE PROTECTION OF SURFACE WATER	8
6.2.1	Calculated Recreational Risk-Based Screening Levels	9
6.3	ECOLOGICAL SCREENING LEVELS	9
6.3.1	Selected Screening Levels	10
7.	**Risk-Based Evaluation**	**10**
7.1	EVALUATION OF CCR MONITORING WELL GROUNDWATER	10
7.2	EVALUATION OF POTABLE GROUNDWATER	11
7.3	EVALUATION OF DAVIS DITCH SURFACE WATER SAMPLES	11
7.4	DEVELOPMENT AND APPLICATION OF A GROUNDWATER TO SURFACE WATER DILUTION ATTENUATION FACTOR	11
7.5	SURFACE WATER DILUTION ATTENUATION FACTOR	12
7.6	APPLICATION OF THE SW-DAF	12
7.7	UNCERTAINTY ANALYSIS	13
8.	**Conclusion**	**14**
9.	**References**	**14**

Tables

Figures
Appendix A – Calculated Recreational Risk-Based Screening Levels
Appendix B – Surface Water Dilution Attenuation Factor

List of Tables

Table No.	Title
1	COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
2	HUMAN HEALTH DRINKING WATER SCREENING LEVELS FOR GROUNDWATER
3	HUMAN HEALTH CALCULATED RISK BASED SCREENING LEVELS FOR SURFACE WATER
4	ECOLOGICAL SCREENING LEVELS FOR SURFACE WATER
5	SELECTED SURFACE WATER SCREENING LEVELS
6	COMPARISON OF POTABLE WATER SUPPLY SAMPLING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
7	COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
8	COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO HUMAN HEALTH CALCULATED RISK BASED SCREENING LEVELS FOR SURFACE WATER
9	COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO ECOLOGICAL SCREENING LEVELS FOR SURFACE WATER
10	DERIVATION OF RISK-BASED TARGET SCREENING LEVELS FOR GROUNDWATER

List of Figures

Figure No.	Title
1	FACILITY LOCATION
2	FACILITY FEATURES
3	WELL LOCATION MAP
4	POTABLE WATER SUPPLY WELLS
5	ON-LINE WELL SURVEY; 1 MILE RADIUS AROUND PROPERTY BOUNDARY
6	CONCEPTUAL SITE MODEL
7	SURFACE WATER SAMPLING LOCATIONS AND STREAM CROSSING CROSS SECTION LOCATION (2013 ELEVATION)
8	MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATION CONTOURS (AUGUST 2020)

List of Acronyms

AAC	Acute Aquatic Criterion
ASD	Alternative Source Demonstration
AWQC	Ambient Water Quality Criteria
CAC	Chronic Aquatic Criterion
CCR	Coal Combustion Residual
CSM	Conceptual Site Model
GWPS	Groundwater Protection Standards
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
NIPSCO	Northern Indiana Public Service Company
NTNC	Non-Transient Non-Community
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act
RBSL	Risk-Based Screening Level
RSL	Regional Screening Level
SMCL	Secondary Maximum Contaminant Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SW-DAF	Surface Water Dilution Attenuation Factor
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
WDA	Waste Disposal Area

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) prepared this Risk Assessment for the Waste Disposal Area (WDA) at the Schahfer Generating Station in Wheatfield, Indiana ("Site") for Northern Indiana Public Service Company LLC (NIPSCO).

The Schahfer Generating Station is a coal-fueled, steam turbine electric generating plant in Wheatfield, Jasper County, Indiana **(Figure 1)**. The WDA is an approximately 80-acre impoundment on the southwest corner of the Schahfer facility. The WDA is surrounded by a slurry wall. A facility road is present on the east, south, and west sides of the WDA. On the south and west sides of the WDA just beyond the road and the WDA berm is Davis Ditch. Site features are illustrated on **Figure 2**. Undeveloped, agricultural, and residential property are located beyond the facility property line.

The U.S. Environmental Protection Agency (USEPA) issued a final rule for "Disposal of Coal Combustion Residuals from Electric Utilities" in 2015 (the CCR Rule) (USEPA, 2015). One of the requirements in the CCR Rule is that utilities monitor groundwater at coal ash management facilities, and that the data be reported publicly. The WDA is subject to the CCR Rule. NIPSCO is complying with the CCR Rule and has posted the required information on their publicly-available website: *https://www.nipsco.com/our-company/about-us/our-environment/ccr-rule-compliance.*

The CCR Rule requires that the downgradient monitoring wells be located at the edge of the ash management area. Moreover, the CCR Rule limits the evaluation of groundwater monitoring data from ash management areas to groundwater protection standards (GWPS), whether or not that groundwater is used as a source of drinking water. GWPS are Federal primary drinking water standards, also known as Maximum Contaminant Levels or MCLs (USEPA, 2018) that are enforceable for municipal drinking water supplies (or drinking water screening levels where MCLs are not available), or site-specific background, whichever is higher.

The wells used to evaluate the CCR Rule requirements for the WDA are shown on **Figure 3**; all are on NIPSCO property. Groundwater on the property is used as a source of drinking water; potable water wells on facility property that are used to supply drinking water to the Site are located in a well field on the NIPSCO property approximately 1.6 miles northwest of the WDA, as shown on **Figure 4**.

In addition to an evaluation of groundwater used as a source of drinking water, NIPSCO has requested that Haley & Aldrich take an additional step to evaluate potential use of off-site groundwater as drinking water, and groundwater-to-surface water transport and exposure pathways through the development of risk-based groundwater screening levels that are protective of surface water in the Davis Ditch. This report provides that evaluation.

2. Objective

The purpose of this risk assessment is to determine whether the WDA in its current configuration may pose a risk to human health or the environment. The data to be evaluated are from the groundwater monitoring collected under the CCR Rule, potable water collected from the facility, and surface water collected from Davis Ditch. In this report, Haley & Aldrich examines groundwater monitoring data collected for the well network associated with the WDA at Schahfer Generating Station and collected by

Golder Associates Inc. (Golder), which used the methods and procedures outlined in the USEPA CCR Rule.

The risk assessment follows current USEPA guidance for risk assessment (USEPA, 1989) and includes consideration of Indiana water quality regulations as appropriate.

3. Approach

The analysis presented in this report was conducted by evaluating the environmental setting of the Site, including its location and where CCR management has occurred at the facility. Information on where groundwater is located at the facility, the rate(s) of groundwater flow, the direction(s) of groundwater flow, and where waterbodies may intercept groundwater flow are reviewed and summarized here.

A conceptual model was developed based on this physical setting information, and the model was used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify where ecological populations could come into contact with surface water. Groundwater data are evaluated on a human health risk basis and an ecological risk basis.

Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people. Generally, there are four components to the process (USEPA, 1989):

(1) Hazard Identification/Data Evaluation,
(2) Toxicity Assessment,
(3) Exposure Assessment, and
(4) Risk Characterization.

The USEPA and other regulatory agencies, including the Indiana Department of Environmental Management (IDEM), develop "screening levels" of constituent concentrations in groundwater (and other media) that are considered to be protective of specific human exposures. In developing the screening levels, USEPA uses a specific target risk level (component 4) combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water). Similarly, ecological screening levels for surface water are developed by USEPA and IDEM to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects. Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists but indicate that further evaluation may be warranted.

The data in this report were evaluated using human health risk-based and ecological risk-based screening levels drawn from USEPA and IDEM sources. The screening levels are used to determine if the concentration levels of constituents could pose a risk to human health or the environment and warrant further evaluation.

4. Conceptual Site Model

A conceptual site model (CSM) is used to evaluate the potential for human or ecological exposure to constituents that may have been released to the environment. Some of the questions posed during the CSM evaluation include:

- What is the source? This evaluation focuses on the WDA as the potential source.
- How can constituents be released from the source? Constituents present in the WDA can be dissolved into standing and infiltrating water (from precipitation) and those constituents may move through the subsurface in shallow groundwater.
- How and where do constituents travel within a medium? Constituents could move into shallow groundwater. Constituents could move with groundwater as it flows, usually in a downgradient/downhill direction. The general direction of groundwater flow in the vicinity of the WDA is to the northwest.
- What environmental media may be affected by constituent release? Is there a point where a receptor (human or ecological) could contact the constituents in the medium? Receptors could be exposed to constituents in shallow groundwater or in surface water.

Groundwater moves slowly through the rock and soils beneath the ground (in comparison to open water flow above grade). But like surface water, it also moves from areas of high elevation to areas of low elevation and can move into adjacent surface water.

Water impounded in the WDA is contained by a slurry wall that extends from near the ground surface to impermeable shale bedrock at a depth of 35 feet. The slurry wall is constructed of a mixture of sand and bentonite (Golder, 2020a).

The conceptual site model for this evaluation assumes that the slurry wall is reasonably intact (Golder, 2020a), but that some amount of groundwater may escape underneath the slurry wall and impact adjacent groundwater (Golder, 2020b). That groundwater may flow to Davis Ditch. Davis Ditch is part of a regulated drainage network and appears to have an engineered channel for at least three miles upstream of the WDA.

Adjacent to the western edge of the WDA, groundwater flows to the northwest (**Figure 8**). This means potential release of constituents to groundwater from the WDA will generally be limited in extent by the direction of groundwater flow (northwest). CCR-derived constituents present in groundwater may move to adjacent surface water; here, that could be the Davis Ditch that surrounds the west and south sides of the WDA. Due to impounded conditions in the WDA, there is potential for some groundwater flow towards the south adjacent to the southern edge of the WDA. Such flow would likely be captured as discharge to Davis Ditch and not progress any further southward. Thus, the environmental media of interest for this evaluation are:

- Groundwater at the facility; and
- Davis Ditch surface water.

The facility is secured by a maintained chain-link fence around the entire perimeter of the property. Thus, the general public does not have direct access to the WDA. Potable water at the facility is obtained from the well field approximately 1.6 miles northwest of the WDA. Golder conducted a desk-top search for private wells within a one-mile radius of the facility. The results are reported in a memorandum dated April 19, 2018, and states that the report relied upon Indiana Department of Natural Resources (IDNR) data that was current as of 2016. **Figure 5** shows the locations of the private wells identified within a one-mile radius of the facility. The closest private well is located approximately 600 feet to the south of the WDA. Therefore, for this evaluation it is assumed that off-site groundwater is used as drinking water, and is conservatively assumed that the groundwater may be impacted by CCR-derived constituents from the WDA.

Facility workers are assumed to be covered by the Occupational Safety and Health Administration (OSHA) regulations, however facility worker exposure to groundwater during use of the water as potable water for the Site was evaluated as a potentially complete pathway. There are eight on-site water wells (40-56 feet deep) located approximately 1.6 miles northwest of the WDA that are used to supply water to the Site (**Figure 4**). Water from these wells is used by on-site workers for potable purposes. The results of the sampling of two of the potable wells and several drinking water point-of-consumption locations at the facility are discussed further in Section 7 of this report.

Georgia Pacific Gypsum LLC, located to the west of the Schahfer Generating Station facility, is listed in the IDNR significant withdrawal wells database as having three wells all located approximately 1-mile northwest of the WDA, as shown in **Figure 4**. The wells are listed as having process, fire, and potable uses (IDNR, 2020). The Georgia Pacific Gypsum LLC facility is also registered under the IDEM Drinking Water Branch as an active Non-Transient Non-Community (NTNC) (serves at least the same 25 non-residential individuals during 6 months of the year), water system served by a groundwater well #1 (IDEM Water System No: IN2370870) (IDEM, 2020). It is currently unknown if workers at the Georgia Pacific Gypsum facility use water from the facility for drinking water.

Groundwater samples from the NIPSCO facility water supply wells do not show evidence of CCR impacts (see discussion in Section 7).

Davis Ditch is part of a regulated drainage network and appears to have an engineered channel for at least three miles upstream of the WDA. Davis Ditch enters the facility property near the southeast corner of the WDA and exits the facility at the northern border. The length of Davis Ditch within the facility is approximately 3 miles. Public access to Davis Ditch within the facility is prevented by the security fence.

Davis Ditch is not a supply source for drinking water. Although Davis Ditch is not accessible by the public within the facility boundary, it is evaluated here as if such access could occur. Davis Ditch could be used for human recreation, though its small size would limit it mostly to wading. It was assumed that Davis Ditch is not large enough to support a consumptive fishery. Aquatic life and mammalian life are also potential receptors for Davis Ditch.

A depiction of the conceptual site model is shown in **Figure 6**. The potentially complete exposure pathways identified in the figure are those evaluated here:

- On-Site Worker (Direct contact with groundwater during use of the water as potable water for the Site);
- Recreational User (Current or future recreational use of Davis Ditch for swimming and wading activities);
- Ecological Receptors (Davis Ditch); and
- Off-Site Resident (Direct contact with groundwater used as drinking water).

Based on this CSM and the facility setting, samples collected from groundwater monitoring wells, potable groundwater wells, point-of-consumption drinking water locations inside facility buildings, and Davis Ditch surface water have been included in the evaluation. The samples have been analyzed for constituents that are commonly associated with CCR, as discussed below. However, it is recognized by the USEPA that all of these constituents can also be naturally occurring and can be found in rocks, soils, water and sediments; thus, it is necessary to understand what the naturally occurring background levels are for these constituents. The CCR Rule requires sampling and analysis of upgradient and/or background groundwater just for this reason. The same reasoning applies to the surface water, thus, when sampling surface water for this evaluation, samples were collected upstream to assess background conditions, and downstream to assess whether the facility may be having impact on surface water quality. The sampling is detailed in the next section.

To answer the question, "Are the constituent concentrations high enough to potentially exert a toxic effect?" health risk-based screening levels from USEPA and IDEM sources are used for comparison to the data, as described in Sections 6 and 7 below.

5. Samples Used for Evaluation

5.1 GROUNDWATER

The CCR Rule requires that groundwater monitoring occur at one (1) upgradient location and three (3) downgradient locations.

For the WDA, the CCR groundwater monitoring network includes one pair of background wells, four pairs of downgradient monitoring wells, and eight assessment monitoring well pairs located around the perimeter of the WDA. In September 2020, an additional well pair, GAMW65/GAMW65B was installed to the south of the WDA to address the potential for some groundwater flow towards the south adjacent to the southern edge of the WDA due to impounded conditions in the WDA. Such flow would likely be captured as discharge to Davis Ditch and not progress any further southward. These CCR groundwater monitoring network wells are listed in the table below:

Background Wells	Downgradient Monitoring Wells	Assessment Monitoring Wells
GAMW-03/ GAMW-03B	GAMW-01/GAMW-01B	GAMW42/GAMW42B/GAMW42C
	GAMW-12/GAMW-12B	GAMW43/GAMW43B
	GAMW-13/GAMW-13B	GAMW44/GAMW44B
	GAMW-14/GAMW-14B	GAMW51/GAMW51B
		GAMW57/GAMW57B
		GAMW58/GAMW58B
		GAMW59/GAMW59B
		GAMW60/GAMW60B
		GAMW65/GAMW65B

Monitoring well locations for the WDA are shown on **Figure 3.** In general, the monitoring wells are screened in the shallow sandy alluvial aquifer zone.

To support the evaluation of groundwater used as a source of drinking water, two samples were collected in August 2020 from two of the groundwater wells used for potable water at the facility (Well #5 and Well #7B, see **Figure 4**). Three samples were also collected from the domestic water house, first floor sink in the first aid room, and 3rd floor kitchen sink; the samples were collected by NIPSCO/Golder personnel. The results are presented in Section 7.

5.2 GROUNDWATER SAMPLE ANALYSIS

The CCR Rule identifies the constituents that are included for groundwater testing; these are:

Appendix III	Appendix IV	
Boron	Antimony	Lead
Calcium	Arsenic	Lithium
Chloride	Barium	Mercury
pH	Beryllium	Molybdenum
Sulfate	Cadmium	Selenium
TDS*	Chromium	Thallium
Fluoride**	Cobalt	Radium 226/228
	Fluoride	

*Total Dissolved Solids

**Fluoride is on both Appendix III and Appendix IV.

The CCR Rule requires eight (8) rounds of groundwater sampling and analysis be conducted for all wells to provide a baseline for current conditions. At the WDA, eight rounds of groundwater samples were collected from background and downgradient wells between July 2016 and August 2017. Detection monitoring occurred in October 2017. The CCR Rule requires statistical methods be used to determine whether a statistically significant increase (SSI) above background exists for the Appendix III constituents

(first column in the table above), a condition that triggers conducting Assessment Monitoring. Based on the SSI results, four assessment monitoring events have been performed between March 2018 and November 2019.

Based on the CCR Rule assessment monitoring results, concentrations of three (3) constituents, molybdenum, arsenic, and cobalt of the 15 Appendix IV constituents analyzed in the downgradient wells are statistically above the GWPS, as defined in the CCR Rule. These measured concentrations are then referred to as Statistically Significant Levels (SSLs). Alternative source demonstrations (ASD) conducted by Golder determined that arsenic and cobalt concentrations are due to natural variation, and molybdenum concentrations are due to a natural source, and not a release from the WDA.

The Golder report "2019 Annual Groundwater Monitoring and Corrective Action Report - Waste Disposal Area" report provides more detail on the objectives of the rounds of groundwater sampling. Appendix III and IV analytical results for the baseline and assessment monitoring events are summarized in **Table 1** for the WDA.

5.3 DAVIS DITCH

Surface water samples (not required by the CCR Rule for compliance) were collected by Golder from 4 locations in Davis Ditch in August 2020. These locations are shown on **Figure 7**. To assess water conditions unaffected by facility operations, Golder sampled Davis Ditch River at two (2) locations upstream of the WDA (Davis Ditch 02 and Davis Ditch 01).

Golder also sampled one location approximately adjacent to the WDA (Davis Ditch 03) and one location downstream of the WDA (Davis Ditch 04). The data from these locations are used to assess whether there is potential impact by the WDA to surface water quality.

To create an appropriate dataset for comparison, the above parameters were also used for the surface water sample analysis except for radium 226/228. As discussed in Section 7, radium-226/228 was not detected above risk-based screening levels in the CCR Rule monitoring wells. Two sets of analyses were conducted on the surface water samples. The samples were analyzed for the list above (referred to as the "total (unfiltered)" results), and then an aliquot of each sample was filtered to remove sediments/particulates and then analyzed (referred to as the "dissolved (filtered)" results). This is an important step for the analysis of surface water samples for two reasons:

- Surface water can carry a large sediment load – the total (unfiltered) results include constituent concentrations that are associated with the sediment from upstream locations and not the water; and
- Some of the ecological screening levels used to evaluate the results apply only to dissolved (filtered) data.

6. Risk-Based Screening Levels

A comprehensive set of risk-based screening levels has been compiled for this evaluation for the types of potential exposures identified in the conceptual site model discussion above:

- Human health drinking water consumption;
- Human health recreational use of surface water; and
- Aquatic ecological receptors for freshwater surface water.

6.1 DRINKING WATER SCREENING LEVELS

The human health screening levels for drinking water are from IDEM and USEPA sources and address the drinking water exposure pathway. The IDEM criteria for drinking water class groundwater are the same as the Federal primary drinking water standards, also known as MCLs. The IDEM criteria for ground water in a drinking water supply well also include criteria for indicator levels that are the same as the Federal secondary drinking water standards, also known as SMCLs. USEPA Risk-based Screening Levels (RSLs) (USEPA, 2020a) for tapwater (drinking water, or untreated groundwater used as potable water) have also been included for constituents which do not have promulgated IDEM/MCL criteria. The tapwater RSLs are based on USEPA default assumptions for residential exposure to tapwater. These sources, in the order in which they are to be used, are:

- Indiana Administrative Code Title 327 - Water Pollution Control Division. 327 IAC 2-11-6(a)(1). Health protective goals for select inorganic contaminants in untreated groundwater used as drinking water. (IWPCD, 2020a)
- USEPA Office of Water, Health Advisory Program. 2018 Edition of the Drinking Water Standards and Health Advisories. Maximum Contaminant Levels. (USEPA, 2018)
- USEPA. Regional Screening Levels (RSLs), May 2020. Values for tapwater. (USEPA, 2020a)

Screening levels for human health drinking water are provided in **Table 2**.

It is important to note that the use of a more comprehensive set of screening levels in this evaluation provides a broader risk-based evaluation of the groundwater data than would be provided by the CCR Rule requirements.

6.2 SCREENING LEVELS FOR THE PROTECTION OF SURFACE WATER

The human health screening levels for drinking water are specific to the evaluation of groundwater used as a source of drinking water. Based on the CSM presented in Section 4 and **Figure 6**, this section outlines the risk-based human health and ecological surface water screening levels that are protective of surface water in Davis Ditch.

Human health screening levels for surface water are identified for recreational uses of surface water. It was assumed that Davis Ditch is not a source of drinking water, nor is it large enough to support a consumptive fishery, therefore, published human health screening levels for surface water that are generally derived to be protective of the use of surface water as a drinking water source and the

consumption of fish from a surface water body were not used in the evaluation. For this analysis, screening levels specific for swimming and wading have been developed, as discussed in Section 6.2.1.

6.2.1 Calculated Recreational Risk-Based Screening Levels

Site-specific risk-based screening levels (RBSLs) are essentially refined screening levels to account for receptor population characteristics and exposure pathways. Although surface water that is used as a recreational water body for swimming could be evaluated using drinking water standards which assume that people are drinking and bathing in the water daily, site-specific RBSLs for surface water reflect incidental ingestion and dermal contact at an exposure rate and magnitude commensurate with swimming activities.

Potential exposures to constituents in surface water could, in general, occur through incidental ingestion and dermal contact. However, the specific nature of the potential exposures is dependent on the type of water body. Specifically:

- Incidental ingestion and dermal contact with shallow surface water (e.g., less than two feet in depth) can only occur via wading because the water is not deep enough to permit swimming.
- Incidental ingestion and dermal contact with deeper surface water (e.g., more than three feet in depth) could occur via swimming. Exposures during swimming could be potentially complete in Davis Ditch.

RBSLs derived for recreational exposures to surface water for a recreational swimmer and wader are presented in **Table 3**. The RBSLs were calculated using USEPA-derived exposure factors and equations, as well as site-specific inputs where appropriate using the USEPA RSL calculator (USEPA, 2020b). The RBSL presented is the lower of the noncancer RBSL at a target noncancer hazard index of 1 and the RBSL calculated for a target cancer-based risk of 10^{-5} (IDEM uses a target cancer-based risk of 10^{-5} in its risk evaluation program, thus, it is used in this evaluation as well). The RSL calculator output, including the exposure parameters used, is provided in **Appendix A**.

6.3 ECOLOGICAL SCREENING LEVELS

Ecological screening levels for surface water are published to provide a conservative estimate of the concentration to which an ecological receptor can be exposed without experiencing adverse effects. Due to the conservative methods used to derive published reference screening levels, it can be assumed with reasonable certainty that concentrations at or below screening levels will not result in any adverse effects to survival, growth, and/or reproduction. Concentrations above published ecological screening levels for surface water, however, do not necessarily indicate that a potential ecological risk exists, but rather that further evaluation may be warranted.

Table 4 presents the published ecological risk-based screening levels for surface water. Some of the screening levels are based on the hardness of the water, a default hardness value of 100 milligrams per liter (mg/L) has been used, in accordance with USEPA and IDEM guidance. Some screening levels apply only to total surface water concentrations, and some screening levels apply to only dissolved surface water concentrations. Values for both scenarios are provided. The table also identifies the selected ecological risk-based screening levels for further evaluation.

These screening level sources, in the order in which they are used, are:

- Current (promulgated) IDEM Aquatic Life Criterion Applicable to All State Waters Except Waters of the State Within the Great Lakes System; acute aquatic criterion (AAC) and chronic aquatic criterion (CAC). Indiana Administrative Code Title 327 Water Pollution Control Division. (IWPCD, 2020b)
- Planned Revisions to Metals Criteria for the Protection of Aquatic Life and Human Health. IDEM Aquatic Life Criterion Applicable to All State Waters Except Waters of the State Within the Great Lakes System; AAC and CAC. (IN.gov, 2020; 2017).
- USEPA Region 5 Resource Conservation and Recovery Act (RCRA) Ecological Screening Levels, Archive Document. (USEPA, 2003)
- USEPA Ambient Water Quality Criteria (AWQC) Freshwater Chronic and Acute. (USEPA, 2020c)

6.3.1 Selected Screening Levels

Table 5 presents the lowest selected screening level for surface water for the human health recreational and each of the ecological potential exposure scenarios (from **Tables 2 through 4**).

7. Risk-Based Evaluation

This section describes the risk-based approach for evaluation of the data from the WDA.

7.1 EVALUATION OF CCR MONITORING WELL GROUNDWATER

Groundwater data from fourteen rounds of sampling of the shallow alluvial aquifer groundwater were compared to the human health risk-based drinking water screening levels as discussed in Section 6.1. **Figure 3** shows that the monitoring wells are all located at or near the edge of the WDA and, therefore, provide worst-case groundwater results.

Table 1 compares the results of all WDA CCR monitoring well sampling rounds to the human health drinking water screening levels. The vast majority of the results indicate concentration levels below the human health drinking water screening levels. Groundwater results from the newly installed wells GAMW65/GAMW65B to the south of the WDA are all below human health drinking water screening levels. A limited number of parameters are above a screening level for some, but not all, sampling events. Out of the 3,452 groundwater analyses conducted through November 2019, only 149 results are above a human health drinking water screening level (see **Table 1**). Put another way, approximately 96% of the groundwater results for the CCR Rule monitoring wells located at the edge of the WDA (downgradient wells) are below the human health drinking water screening levels.

The striking aspect of the analysis shown in **Table 1** is how few CCR monitoring well results are above a conservative risk-based drinking water screening level for human health, given that the wells are located immediately adjacent to the base of the WDA, and the facility has been in operation since 1976, thus, for over 40 years. Even for the very few results that may be above screening values for some of the sampling events, ASDs determined that the arsenic, cobalt, and molybdenum SSLs identified under the CCR Rule are not due to a release from the WDA, and there is no complete drinking water exposure pathway to groundwater at these locations. In addition, the pH, sulfate, and TDS screening levels are

based on Federal secondary MCLs, or SMCLs, that are generally based on aesthetics (taste, color) and are not risk-based.

The SSI and SSL values reflect a statistical evaluation that mathematically compares the results of the various rounds of samples to background water quality and GWPS as required under the CCR Rule. However, such values without further evaluation do not establish that there is an actual adverse impact to human health or the environment. The CSM process and screening analysis described in this report provide the relevant context for such groundwater monitoring results and whether the WDA poses a true risk to human health and the environment.

7.2 EVALUATION OF POTABLE GROUNDWATER

Table 6 provides the analytical results from groundwater samples collected in August 2020 from two of the groundwater wells used for potable water at the facility (Well #5 and Well #7B, see **Figure 4**), and three samples collected from the domestic water house, first floor sink in the first aid room, and 3rd floor kitchen sink, and compares the results to the human health drinking water screening levels. As shown on **Table 6**, all concentrations are below the human health drinking water screening levels, demonstrating that these wells are not affected by facility coal ash management operations.

7.3 EVALUATION OF DAVIS DITCH SURFACE WATER SAMPLES

Tables 7 through 9 provide the analytical results from surface water samples collected from 4 locations in Davis Ditch in August 2020 and comparison to risk-based screening levels. As shown in **Tables 7 through 9**, there are no analytical results for Davis Ditch above human health drinking water screening levels (this screening comparison was included to be conservative; Davis Ditch is not used as a source of drinking water), human health recreational, or ecological screening levels. In addition, constituent concentrations are similar in upstream and downstream samples.

Thus, even this small water body immediately adjacent to the WDA does not show evidence of risk to human health or the environment from ash management operations at the WDA. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

7.4 DEVELOPMENT AND APPLICATION OF A GROUNDWATER TO SURFACE WATER DILUTION ATTENUATION FACTOR

If a groundwater concentration is above a surface water screening level, that does not mean that surface water will be adversely impacted by the groundwater. For Davis Ditch, where a theoretical pathway of exposure exists, there is no evidence of impact and all samples are below screening levels. However, this evaluation is included here to be used to evaluate future groundwater results for the WDA with respect to Davis Ditch.

Dilution and attenuation mechanisms can occur as groundwater moves to surface water. This section describes the approach to evaluating the magnitude of dilution effects resulting from the mixing of groundwater that may flow from beneath the WDA to the nearby surface water body, Davis Ditch (**Figure 2**), through the development of a Surface Water Dilution Attenuation Factor (SW-DAF). This factor is then applied to the target risk-based surface water concentrations to identify target

groundwater concentrations that are protective of surface water. These risk-based target groundwater concentrations (protective of Davis Ditch) are used to evaluate the current groundwater data and can be used to evaluate future groundwater data. Such an exercise in assumptions can help put in context whether a theoretical risk to public water supplies exists, particularly where, as here, actual surface water samples have been collected and evaluated.

The primary driving force responsible for migration of constituents from the WDA is seepage of impounded water through and/or under the containing slurry wall and groundwater capture by Davis Ditch. To make a conservative estimate of the potential impacts of groundwater to the Davis Ditch, a SW-DAF has been calculated. The SW-DAF describes the effect of mixing on constituent concentrations expected for the surface water body potentially receiving the groundwater. Currently available on-site groundwater information, groundwater elevation data and other hydrogeological data, and Davis Ditch data were used for this evaluation.

The details of the SW-DAF development and results are provided in **Appendix B**. The evaluation took into account the potential for seepage through and/or under the slurry wall and discharge to Davis Ditch.

7.5 SURFACE WATER DILUTION ATTENUATION FACTOR

The SW-DAF was calculated to quantify the dilution of groundwater that may flow from beneath the WDA towards Davis Ditch (see **Appendix B**). The most conservative assumptions were used wherever possible. For groundwater that may flow to Davis Ditch, the conservatively calculated SW-DAF is **38** (a unitless value).

7.6 APPLICATION OF THE SW-DAF

Table 10 presents the selected human health recreational and ecological surface water screening levels (from **Tables 3 through 4**) and identifies the lowest screening level for surface water for the potential exposure scenarios. **Table 10** also shows the application of the SW-DAF to calculate risk-based groundwater screening levels for each of the Appendix III and Appendix IV groundwater constituents. For each constituent, the human health recreational and ecological screening levels are presented. The lowest of the screening levels is then identified for surface water. The SW-DAF is then applied to this lowest screening level for surface water to result in the target groundwater concentrations developed based on the SW-DAF of 38 for Davis Ditch.

Table 10 identifies the maximum groundwater concentration of each constituent detected in the downgradient and assessment WDA monitoring wells. The comparison between the target levels and the maximum concentrations in **Table 10** indicates that there is a wide margin of safety between the two values. This margin is shown in the last column of the tables. To illustrate, concentration levels of arsenic, cobalt, and molybdenum would need to be more than 16, 17, and 270 times higher, respectively, than currently measured levels before an adverse impact in Davis Ditch could occur.

This means that not only do the present concentrations of constituents in groundwater at the WDA not pose a risk to human health or the environment, but even much higher concentrations would not be harmful. This comprehensive evaluation demonstrates that there are no adverse impacts on human health from Davis Ditch resulting from coal ash management practices at the WDA.

7.7 UNCERTAINTY ANALYSIS

This section identifies and discusses uncertainties in the risk assessment in order to place the conclusions in context or perspective. This risk assessment is subject to a number of uncertainties. The following presents a consideration of the site-specific uncertainties.

Samples Used for Evaluation

While the data used in the risk assessment are assumed to be representative of general area conditions and a result of random sampling, the CCR Rule requires that the downgradient monitoring wells be located at the edge of the ash management area. These sample locations are biased towards areas that are more likely to contain higher concentrations of CCR-derived constituents, compared to what may be present at other areas of the Site. Thus, it is expected that concentrations measured in the CCR monitoring wells are a conservative estimate of exposure point concentrations.

In this risk assessment, all detected sample results are conservatively compared to applicable risk-based human health and ecological screening levels. The assumption that constituents detected in groundwater or Davis Ditch surface water, even if detected only once, are characteristic of conditions across the Site contributes to the uncertainty (possible overestimation) of this risk assessment.

Risk-Based Screening Levels

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects. Risk-based screening levels are derived by regulatory agencies using conservative assumptions about the potential toxicity of constituents and the potential for exposure to those constituents in environmental media. The goal is to over-estimate rather than under-estimate toxicity and exposure, and this is done by employing default parameters defined by IDEM and USEPA in the screening level derivation.

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

Ecological risk-based screening levels are not available for boron, fluoride, lithium, and molybdenum. However, as can be seen in **Table 9**, concentrations for lithium are all non-detect, and concentrations for boron, fluoride and molybdenum are similar in upstream and downstream samples, indicating that ash management operations at the WDA do not show evidence of risk to human health or the environment in Davis Ditch. In addition, concentrations of boron, fluoride, lithium, and molybdenum are all below the conservative human health drinking water and human health recreational screening levels, as shown on **Tables 7 and 8**.

Exposure Scenarios

Exposure scenarios in a risk assessment are selected to be representative of potential exposures to constituents in environmental media that may be experienced by human receptors based on current and reasonably foreseeable land use. These exposure scenarios are developed for a hypothetical

receptor, but one that would represent an upper-bound exposure scenario. Therefore, exposure levels are assumed for these receptors that are much greater than expected to typically occur in an actual population. For example, the evaluation of on-site worker exposure to groundwater as drinking water for the Site using conservative human health residential drinking water screening levels is likely to overestimate, rather than underestimate the potential on-site worker exposure.

8. Conclusion

This comprehensive evaluation demonstrates that there are no adverse impacts on human health or ecological receptors from constituents present in groundwater resulting from coal ash management practices at the Waste Disposal Area at the Schahfer Generating Station.

9. References

1. Golder Associates. 2020a. NIPSCO LLC R.M. Schahfer Generating Station Slurry Wall Assessment Report. Report no. 191-27906, February.

2. Golder Associates. 2020b. 2019 Annual Groundwater Monitoring and Corrective Action Report – Waste Disposal Area, NIPSCO LLC R.M. Schahfer Generating Station. Report no. 191-21567, January.

3. IDEM. 2020. Indiana Department of Environmental Management. Drinking Water Branch. Public Water Supply Systems. Available at: https://myweb.in.gov/IDEM/DWW/

4. IDNR. 2020. Indiana Department of Natural Resources. Significant Water Withdrawal Facility Data. Available at: https://www.in.gov/dnr/water/4841.htm

5. IN.gov. 2017. Planned Revisions to Metals Criteria for the Protection of Aquatic Life and Human Health. Second Notice of Tables Rulemaking [pdf]. IDEM proposed revisions to Aquatic Life Criteria for metals are presented in Tables 1-4. Available at: https://www.in.gov/idem/cleanwater/files/wqs_rulemaking_tables_second_notice.pdf

6. IN.gov. 2020. IDEM. Water Quality in Indiana. Water Quality Standards. Active Projects. Available at: http://www.in.gov/idem/cleanwater/2329.htm

7. IWPCD. 2020a. 327 IAC 2-11-6. Indiana Register Database: Indiana Administrative Code. Update September 9, 2020. Title 327 Water Pollution Control Division. Article 2. Water Quality Standards. Rule 11. Groundwater Quality Standards. Section 6. Criteria for Drinking Water Class Ground Water. Sec. 6. (a) (1). Maximum Permissible Level for Inorganic Contaminants in Untreated Groundwater Used as Drinking Water. Available at: http://www.in.gov/legislative/iac/title327.html

8. IWPCD. 2020b. 327 IAC 2-1-6. Indiana Register Database: Indiana Administrative Code. Update September 9, 2020. Title 327 Water Pollution Control Division. Article 2. Water Quality Standards. Rule 1. Water Quality Standards Applicable to All State Waters Except Waters of the State Within the Great Lakes System. Section 6. Minimum Surface Water Quality Standards.

Sec. 6. (a) (3). Surface Water Quality Criteria for Specific Substances. Available at: http://www.in.gov/legislative/iac/title327.html

9. USEPA. 1989. Risk Assessment Guidance for Superfund, Volume 1. Human Health Evaluation Manual (Part A), interim final. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. Available at: https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part

10. USEPA. 2003. Resource Conservation and Recovery Act (RCRA) Ecological Screening Values. Archive Document. August 22, 2003. Available at: https://archive.epa.gov/region5/waste/cars/web/pdf/ecological-screening-levels-200308.pdf

11. USEPA. 2015. Final Rule: Disposal of Coal Combustion Residuals (CCRs) for Electric Utilities. 80 FR 21301-21501. U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/coalash/coal-ash-rule

12. USEPA. 2018. 2018 Edition of the Drinking Water Standards and Health Advisories. Office of Water. U.S. Environmental Protection Agency, Washington, DC. EPA 822-F-18-001. Available at: https://www.epa.gov/dwstandardsregulations/2018-drinking-water-standards-and-advisory-tables

13. USEPA. 2020a. Risk-Based Screening Levels. May 2020. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

14. USEPA. 2020b. Risk-Based Screening Levels Calculator. May 2020. Available at: https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

15. USEPA. 2020c. National Recommended Water Quality Criteria - Aquatic Life Criteria Table. Available at: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

TABLES

TABLE 1
COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS – JULY 2016 THROUGH NOVEMBER 2019 SAMPLING EVENTS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Monitoring Well ID		Date Sampled	Boron	Calcium	Chloride	Fluoride	pH (lab)	Sulfate	Total Dissolved Solids (TDS)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium, Total
			mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
		HH DW SL (a):	4	NA	250	4	6.5-8.5	250	500	0.006	0.01	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Background (Upgradient)	GAMW03	07/13/2016	0.23	83	7.7	0.15 J+	6.85	100 J-	400	0.00023 J	0.012	0.087	0.00055 J	0.000088 J	0.002 U	0.0014	0.001 U	0.0064 J	0.0002 U	0.0087 J	0.005 U	0.001 U	5 U
		09/08/2016	0.24	87	8.6	0.19 J	6.62	100	390	0.00091 J	0.011	0.096	0.00053 J	0.001 U	0.002 U	0.0043	0.001 U	0.008 U	0.0002 U	0.009 J	0.005 U	0.00028 J	0.696
		11/8/2016	0.25	100	10	5 U	6.53	110	500	0.002 U	0.011	0.11	0.001 U	0.001 U	0.002 U	0.01	0.00016 J	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	0.873 J+
		01/09/2017	0.22	94	9.1	0.12 J	6.69	110	430	0.002 U	0.01	0.081 J	0.001 U	0.001 U	0.002 U	0.011	0.001 U	0.0044 J	0.0002 U	0.01 U	0.00085 J	0.001 U	0.765
		03/01/2017	0.22	100	8.1	0.14 J	6.66	120	450	0.002 U	0.0076	0.087	0.001 U	0.001 U	0.002 U	0.013	0.001 U	0.0025 J	0.0002 U	0.01 U	0.005 U	0.001 U	0.385 U
		04/26/2017	0.23	110	6.8	0.13 J	6.64	130	510	0.002 U	0.0076	0.091	0.001 U	0.001 U	0.002 U	0.013	0.001 U	0.0045 J	0.0002 U	0.0082 J	0.005 U	0.001 U	0.399
		06/28/2017	0.21	87	10	0.2 J	6.76	83	420	0.002 U	0.015	0.071	0.001 U	0.001 U	0.002 U	0.0037	0.00052 J	0.0063 J	0.0002 U	0.0084 J	0.005 U	0.001 U	0.302 U
		08/23/2017	0.2	77	8.3	0.18 J	7.1	77	370	0.002 U	0.013	0.079	0.001 U	0.001 U	0.002 U	0.0019	0.001 U	0.0069 J	0.0002 UJ	0.0076 J	0.005 U	0.001 U	0.427 U
		10/04/2017	0.22	87	9	0.12 J	6.9	93	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/13/2018	-	-	-	0.16 J	6.61	-	-	0.002 U	0.018	0.074	0.001 U	0.001 U	0.002 U	0.0038	0.001 U	0.006 J	0.0002 U	0.0063 J	0.005 U	0.001 U	0.49 J+
		04/20/2018	0.2	93	4.9	0.2 J	7.13	110	380	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		10/24/2018	0.26	94	7.7	0.15	7.37	100	440	0.002 U	0.013	0.1	0.001 U	0.001 U	0.002 U	0.0037	0.001 U	0.0074 J	0.0002 U	0.0082 J	0.005 U	0.001 U	1.38 J+
		04/25/2019	0.16	84	2.4	0.2	6.94	86	350	0.002 U	0.0035 J	0.071	0.001 U	0.001 U	0.002 U	0.0099	0.001 U	0.0038 J	0.0002 U	0.0071 J	0.005 U	0.001 U	0.373 U
		11/06/2019	0.35	110 J-	6.5	0.17	6.74	150	490	0.002 U	0.016	0.11	0.001 U	0.001 U	0.002 U	0.0048	0.001 U	0.0058 J	0.0002 U	0.0063 J	0.005 U	0.001 U	-
	GAMW03B	07/13/2016	0.18	98	14	0.25 J+	7.01	58 J-	420	0.00019 J	0.0015 J	0.11	0.00044 J	0.001 U	0.002 U	0.001 U	0.001 U	0.0014 J	0.0002 U	0.0044 J	0.005 U	0.001 U	0.943
		09/08/2016	0.18	100	13	0.23 J	6.74	59	410	0.00033 J	0.0012 J	0.1	0.001 U	0.001 U	0.002 U	0.00031 J	0.001 U	0.008 U	0.0002 U	0.0043 J	0.005 U	0.001 U	1.15
		11/08/2016	0.2 U	110	15	5 U	6.53	58	420	0.002 U	0.0009 J	0.11	0.001 U	0.001 U	0.002 U	0.001 U	0.00035 J	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	1.36 J+
		01/10/2017	0.2 U	98	16	0.24 J	7.08	77	440	0.002 U	0.0013 J	0.096	0.001 U	0.001 U	0.00033 J	0.00017 J	0.001 U	0.0011 J	0.0002 U	0.01 U	0.00066 J	0.001 U	1.03
		03/01/2017	0.21	110	20	0.23 J	7.04	67	450	0.002 U	0.005 U	0.11	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0011 J	0.0002 U	0.01 U	0.005 U	0.001 U	0.62
		04/26/2017	0.23	110	20	0.2 J	6.97	67	480	0.002 U	0.00085 J	0.11	0.001 U	0.001 U	0.002 U	0.00038 J	0.001 U	0.008 U	0.0002 U	0.0045 J	0.005 U	0.001 U	0.449
		06/28/2017	0.25	110	22	0.24 J	6.81	66	510	0.002 U	0.00087 J	0.11	0.001 U	0.001 U	0.002 U	0.00021 J	0.001 U	0.008 U	0.0002 U	0.0052 J	0.005 U	0.001 U	1
		08/23/2017	0.27	99	21	0.24 J	7.29	68	450	0.002 U	0.005 U	0.12	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 UJ	0.0055 J	0.005 U	0.001 U	0.643
		10/04/2017	0.28	95	25	0.21 J	7.07	84	460	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/13/2018	-	-	-	0.2 J	6.83	-	-	0.002 U	0.005 U	0.13	0.001 U	0.001 U	0.002 U	0.00024 J	0.001 U	0.008 U	0.0002 U	0.0066 J	0.005 U	0.001 U	1.99 J+
		04/20/2018	0.3	110	23	0.22 J	7.12	66	420	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		09/06/2018	0.28	99	25	0.23 J	7.1	64	450	0.002 U	0.005 U	0.12	0.001 U	0.001 U	0.002 U	0.00036 J	0.001 U	0.008 U	0.0002 U	0.0067 J	0.0014 J	0.001 U	1.06
		10/24/2018	0.29	98	22	0.21	7.77	67	450	0.002 U	0.005 U	0.12	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0066 J	0.005 U	0.001 U	1.26 J+
		04/26/2019	0.25	90	24	0.22	7.15	74	460	0.002 U	0.005 U	0.1	0.001 U	0.001 U	0.002 U	0.0005 J	0.001 U	0.008 U	0.0002 U	0.0068 J	0.005 U	0.001 U	0.596
		11/06/2019	0.31	89 J-	24	0.26	7.08	80	410	0.002 U	0.005 U	0.11	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0074 J	0.005 U	0.001 U	-
Downgradient	GAMW01	07/12/2016	0.11	65	4.3	0.34 J+	7.18	54 J-	280	0.00048 J	0.019	0.059	0.00099 J	0.001 U	0.002 U	0.001 U	0.001 U	0.0031 J	0.0002 U	0.011	0.005 U	0.00018 J	5 U
		09/08/2016	0.36 J	83 J	12 J	0.38 J	6.5	100 J	380 J	0.00068 J	0.039 J	0.057 J	0.001 U	0.001 U	0.002 U	0.0011	0.001 U	0.008 U	0.0002 U	0.022	0.005 U	0.001 U	0.771
		11/09/2016	0.15 J	74	5.3	0.34 J	6.93	62	320	0.001 J	0.024	0.064	0.001 U	0.001 U	0.00038 J	0.00087 J	0.00023 J	0.008 U	0.0002 U	0.011	0.00075 J	0.001 U	0.403
		01/09/2017	0.2 U	71	5.6	0.34 J	7.33	52	280	0.0016 J	0.013	0.053	0.001 U	0.001 U	0.002 U	0.00068 J	0.001 U	0.0031 J	0.0002 U	0.01 U	0.0018 J	0.001 U	0.501 U
		02/28/2017	0.2 U	83	8.3	0.3 J	7.26	54	340	0.002 U	0.01	0.07	0.001 U	0.001 U	0.00037 J	0.00074 J	0.001 U	0.0015 J	0.0002 U	0.01 U	0.001 J	0.001 U	0.446 U
		04/25/2017	0.5	110	18	0.26 J	7.16	100	480	0.002 U	0.012	0.065	0.001 U	0.001 U	0.002 U	0.0016	0.001 U	0.003 J	0.0002 U	0.017	0.0016 J	0.001 U	0.551
		06/28/2017	1.2	110	18	0.35 J	6.5	200	580	0.002 U	0.023	0.093	0.001 U	0.001 U	0.002 U	0.0016	0.001 U	0.0042 J	0.0002 U	0.033	0.0031 J	0.001 U	0.692
		08/22/2017	1	81	12	0.41 J	7.24	130	420	0.002 U	0.03	0.077	0.001 U	0.00038 J	0.002 U	0.001	0.00065 J	0.0037 J	0.0002 UJ	0.045	0.0017 J	0.00032 J	0.835
		10/03/2017	0.74	81	16	0.38 J	7.18	110	420	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/12/2018	-	-	-	0.28 J	7.24	-	-	0.002 U	0.02	0.057	0.001 U	0.001 U	0.002 U	0.0011	0.001 U	0.0019 J	0.0002 U	0.014	0.0016 J	0.001 U	0.741 J+
		04/19/2018	0.3	87	10	0.32 J	7	50	360	-	0.03	0.052	-	-	-	0.001	-	-	-	0.016	-	-	0.475
		10/23/2018	0.29	77	8.1	0.3	6.78	68	350	0.002 U	0.035	0.052	0.001 U	0.001 U	0.002 U	0.00075 J	0.001 U	0.0028 J	0.0002 U	0.015	0.001 J	0.001 U	1.45 J+
		04/23/2019	1.1	110	20	0.31 J+	6.89	230	630	0.002 U	0.014	0.087	0.0014	0.001 U	0.002 U	0.0017	0.001 U	0.0023 J	0.0002 U	0.033	0.0077	0.00021 J	0.781
		11/06/2019	1.6	94 J-	13	0.41	7.2	180	520	0.002 U	0.013	0.069	0.001 U	0.001 U	0.002 U	0.001	0.001 U	0.0025 J	0.0002 U	0.031	0.0057	0.00046 J	-
	GAMW01B	09/06/2018	0.4	110	21	0.17 J	7.01	72	450	0.002 U	0.00077 J	0.19	0.00036 J	0.001 U	0.002 U	0.00056 J	0.001 U	0.0039 J	0.0002 U	0.0015 J	0.001 J	0.001 U	2.16
		10/23/2018	0.44	100	19	0.14	6.74	69	430	0.002 U	0.005 U	0.17	0.001 U	0.001 U	0.002 U	0.00027 J	0.001 U	0.0046 J	0.0002 U	0.01 U	0.005 U	0.001 U	2.62 J+
		04/23/2019	0.35	110	21	0.14 J+	6.98	73	490	0.002 U	0.005 U	0.19	0.00086 J	0.001 U	0.002 U	0.00033 J	0.001 U	0.0047 J	0.0002 U	0.0011 J	0.005 U	0.001 U	2.11
		11/06/2019	0.38	94 J-	19	0.15	6.94	67	440	0.002 U	0.005 U	0.15	0.001 U	0.001 U	0.002 U	0.00019 J	0.001 U	0.0042 J	0.0002 U	0.01 U	0.005 U	0.001 U	-

TABLE 1
COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS – JULY 2016 THROUGH NOVEMBER 2019 SAMPLING EVENTS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Monitoring Well ID		Date Sampled	Boron	Calcium	Chloride	Fluoride	pH (lab)	Sulfate	Total Dissolved Solids (TDS)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium, Total
			mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
		HH DW SL (a):	4	NA	250	4	6.5-8.5	250	500	0.006	0.01	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Downgradient	GAMW12	07/12/2016	0.073	93	3.8	0.24 J+	6.75	7.5 J-	390	0.002 U	0.0097	0.14	0.00021 J	0.001 U	0.002 U	0.0029	0.001 U	0.003 J	0.0002 U	0.002 J	0.005 U	0.001 U	0.735
		09/07/2016	0.075	91	6.1	0.23 J	6.85	15	390	0.002 U	0.0079	0.15	0.001 U	0.001 U	0.002 U	0.0041	0.001 U	0.008 U	0.0002 U	0.0037 J	0.005 U	0.001 U	0.823
		11/08/2016	0.2 U	97	9.6	5 UO	6.81	6.8	430	0.002 U	0.011	0.14	0.001 U	0.001 U	0.002 U	0.0025	0.001 U	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	2.14 J+
		01/09/2017	0.2 U	90	11	0.23 J	6.87	17	400	0.002 U	0.0058	0.11	0.001 U	0.001 U	0.002 U	0.0032	0.001 U	0.0029 J	0.0002 U	0.01 U	0.00054 J	0.001 U	0.721
		02/28/2017	0.2 U	97	10	0.19 J	6.89	12	410	0.002 U	0.0058	0.14	0.001 U	0.001 U	0.0007 J	0.003	0.001 U	0.0026 J	0.0002 U	0.01 U	0.0007 J	0.001 U	0.79
		04/25/2017	0.092 J	97	10	0.17 J	6.87	14	390	0.002 U	0.0059	0.12	0.001 U	0.001 U	0.002 U	0.0028	0.001 U	0.0032 J	0.0002 U	0.004 J	0.005 U	0.001 U	0.441
		06/28/2017	0.2 U	100	7.6	0.21 J	6.67	11	400	0.002 U	0.016	0.14	0.001 U	0.001 U	0.002 U	0.0031	0.001 U	0.0034 J	0.0002 U	0.003 J	0.005 U	0.001 U	0.6
		08/23/2017	0.2 U	89	5.2	0.23 J	6.69	11	400	0.002 U	0.017	0.13	0.001 U	0.001 U	0.002 U	0.0027	0.001 U	0.003 J	0.0002 UJ	0.0029 J	0.005 U	0.001 U	1.42
		10/04/2017	0.079 J	87	3.2	0.21 J	6.91	11	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/13/2018	-	-	-	0.19 J	6.62	-	-	0.00086 J	0.011	0.11	0.00032 J	0.001 U	0.002 U	0.0023	0.001 U	0.0023 J	0.0002 U	0.0035 J	0.00091 J	0.001 U	0.962 J+
		04/20/2018	0.095 J	87	3.3	0.24 J	7.17	11	350	-	0.0085	0.1	-	-	-	0.0016	-	-	-	-	-	-	0.67
		10/23/2018	0.081 J	94	2.5	0.19	7.79	12	360	0.002 U	0.018	0.12	0.00044 J	0.00024 J	0.002 U	0.0018	0.001 U	0.0032 J	0.0002 U	0.0033 J	0.005 U	0.001 U	1.3 J+
		04/24/2019	0.073 J	88	2.9	0.21	7.06	22	390	0.002 U	0.014	0.087	0.001 U	0.001 U	0.002 U	0.0031	0.001 U	0.0027 J	0.0002 U	0.0034 J	0.005 U	0.001 U	0.474 U
		11/07/2019	0.069 J	76	2.8	0.24	7.32	16	330	0.002 U	0.008	0.079	0.001 U	0.001 U	0.002 U	0.0028	0.001 U	0.003 J	0.0002 U	0.0036 J	0.005 U	0.00039 J	-
	GAMW12B	09/07/2018	0.28	100	22	0.12 J	7.15	63	670 J+	0.002 U	0.0013 J	0.11	0.001 U	0.001 U	0.002 U	0.00039 J	0.001 U	0.0042 J	0.0002 U	0.01 U	0.0024 J	0.001 U	1.66 J+
		10/23/2018	0.26	110	19	0.096	8.83	49	450	0.002 U	0.00079 J	0.12	0.001 U	0.001 U	0.00099 J	0.00038 J	0.001 U	0.0042 J	0.0002 U	0.01 U	0.005 U	0.001 U	1.61 J+
		04/25/2019	0.3	100	23	0.11	7	120	500	0.002 U	0.005 U	0.11	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0043 J	0.0002 U	0.0013 J	0.005 U	0.001 U	0.544 J
		11/07/2019	0.33	88	24	0.11	7.63	130	470	0.002 U	0.005 U	0.1	0.001 U	0.001 U	0.002 U	0.00044 J	0.00048 J	0.004 J	0.0002 U	0.0015 J	0.005 U	0.001 U	-
	GAMW13	07/12/2016	0.2	85	13	0.32 J+	6.71	14 J-	340	0.00016 J	0.01	0.13	0.00018 J	0.001 U	0.00097 J	0.001 U	0.001 U	0.0012 J	0.0002 U	0.0021 J	0.005 U	0.001 U	1.45
		09/07/2016	0.27	86	15	0.35 J	6.76	47	400	0.00028 J	0.014	0.14	0.001 U	0.001 U	0.002 U	0.0016	0.001 U	0.008 U	0.0002 U	0.0074 J	0.005 U	0.001 U	1.02
		11/08/2016	0.4	86	18	5 UO	6.78	62	430	0.002 U	0.013	0.14	0.001 U	0.001 U	0.002 U	0.0014	0.001 U	0.008 U	0.0002 U	0.013	0.005 U	0.001 U	1.54 J+
		01/09/2017	0.2 U	80	4.6	0.19 J	6.72	40	320	0.002 U	0.0076	0.092	0.001 U	0.001 U	0.002 U	0.0015	0.001 U	0.00047 J	0.0002 U	0.01 U	0.005 U	0.001 U	0.382 U
		02/28/2017	0.2 U	94	7.4	0.19 J	6.76	43	360	0.002 U	0.0052	0.11	0.001 U	0.001 U	0.00068 J	0.00077 J	0.001 U	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	0.644
		04/25/2017	0.18 J	100	8.2	0.22 J	6.74	52	380	0.002 U	0.006	0.13	0.001 U	0.001 U	0.002 U	0.00074 J	0.001 U	0.008 U	0.0002 U	0.004 J	0.005 U	0.001 U	0.807
		07/12/2017	0.21	87	10	0.27 J	6.81	25	340	0.002 U	0.0082	0.16	0.001 U	0.001 U	0.002 U	0.0005 J	0.001 U	0.0019 J	0.0002 U	0.0033 J	0.005 U	0.001 U	0.502
		08/23/2017	0.24	88	10	0.31 J	6.45	15	370	0.002 U	0.0087	0.14	0.001 U	0.001 U	0.002 U	0.00042 J	0.001 U	0.008 U	0.0002 UJ	0.0022 J	0.005 U	0.001 U	0.713
		10/03/2017	0.18 J	86	11	0.28 J	6.8	25	360	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/13/2018	-	-	-	5 U	6.4	-	-	0.002 U	0.0039 J	0.11	0.001 U	0.001 U	0.0012 J	0.0029	0.001 U	0.008 U	0.0002 U	0.0053 J	0.0011 J	0.001 U	0.667 J+
		04/20/2018	0.21	110	9.7	0.27 J	6.94	52	400 J	-	-	0.12	-	-	-	0.00096 J	-	-	-	-	-	-	0.401
		10/24/2018	0.38	74	14	0.28	6.88	59	350	0.002 U	0.01	0.14	0.001 U	0.001 U	0.002 U	0.00032 J	0.001 U	0.008 U	0.0002 U	0.0054 J	0.005 U	0.001 U	1.84 J+
		04/24/2019	0.18	75	7.9	0.24	6.79	52	360	0.002 U	0.005	0.081	0.00089 J	0.001 U	0.002 U	0.0012	0.001 U	0.008 U	0.0002 U	0.012	0.005 U	0.001 U	0.473 U
		11/06/2019	0.13	71 J-	3.9	0.31	7.15	40	330	0.002 U	0.006	0.063	0.001 U	0.001 U	0.002 U	0.00057 J	0.001 U	0.008 U	0.0002 U	0.0068 J	0.005 U	0.001 U	-
	GAMW13B	07/12/2016	0.71	80	24	0.28 J+	7.31	150 J-	440	0.00033 J	0.0021 J	0.093	0.00063 J	0.001 U	0.002 U	0.001 U	0.001 U	0.0023 J	0.0002 U	0.023	0.005 U	0.00015 J	5 U
		09/07/2016	0.76	70	25	0.29 J	7.48	150	410	0.002 U	0.0011 J	0.08	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.021	0.005 U	0.001 U	0.66 U
		11/08/2016	0.73	78	25	5 UO	7.17	150	410	0.002 U	0.0011 J	0.084	0.001 U	0.001 U	0.002 U	0.001 U	0.00042 J	0.008 U	0.0002 U	0.022	0.005 U	0.001 U	1.16 J+
		01/09/2017	0.78	76	25	0.3 J	7.45	150	390	0.002 U	0.0015 J	0.084	0.001 U	0.001 U	0.002 U	0.00018 J	0.001 U	0.0019 J	0.0002 U	0.019 J+	0.005 U	0.001 U	0.946
		02/28/2017	0.78	79	25	0.29 J	7.47	150	420	0.002 U	0.0013 J	0.097	0.001 U	0.001 U	0.00036 J	0.001 U	0.001 U	0.0016 J	0.0002 U	0.02	0.005 U	0.001 U	0.902
		04/25/2017	0.76	77	26	0.28 J	7.42	150	390	0.002 U	0.0014 J	0.093	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0017 J	0.0002 U	0.021	0.005 U	0.001 U	0.515 J
		07/12/2017	0.73	75	26	0.23 J	7.31	150	390	0.002 U	0.0013 J	0.089	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0034 J	0.0002 U	0.022	0.005 U	0.001 U	0.595
		08/23/2017	0.73	72	27	0.27 J	7.06	160	430	0.002 U	0.00092 J	0.086	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0021 J	0.0002 UJ	0.021	0.005 U	0.001 U	1.06
		10/03/2017	0.79	78	28	0.26 J	7.5	170	440	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/13/2018	-	-	-	0.27 J	7.27	-	-	0.002 U	0.0012 J	0.1	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.021	0.005 U	0.001 U	0.783 J+
		04/20/2018	0.76	76	27	0.31 J	7.64	150	370 J	-	-	0.094	-	-	-	-	-	-	-	0.021	-	-	0.863
		09/06/2018	0.72	72	27	0.28 J	7.37	150	410	0.002 U	0.005 U	0.087	0.001 U	0.001 U	0.002 U	0.00019 J	0.001 U	0.008 U	0.0002 U	0.018	0.001 J	0.001 U	0.885
		10/24/2018	0.71	71	24	0.25	7.45	150	420	0.002 U	0.005 U	0.082	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0018 J	0.0002 U	0.018	0.005 U	0.001 U	1.76 J+
		04/24/2019	0.71	72	27	0.35	7.3	150	430	0.002 U	0.0014 J	0.093	0.0013	0.001 U	0.002 U	0.001 U	0.001 U	0.0019 J	0.0002 U	0.021	0.005 U	0.00021 J	0.529
		11/06/2019	0.7	66 J-	27	0.34	7.81	150	400	0.002 U	0.00091 J	0.078	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0017 J	0.0002 U	0.017	0.005 U	0.001 U	-

TABLE 1
COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS – JULY 2016 THROUGH NOVEMBER 2019 SAMPLING EVENTS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Monitoring Well ID		Date Sampled	Boron	Calcium	Chloride	Fluoride	pH (lab)	Sulfate	Total Dissolved Solids (TDS)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium, Total
			mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
		HH DW SL (a):	4	NA	250	4	6.5-8.5	250	500	0.006	0.01	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Downgradient	GAMW14	07/12/2016	0.27	69	15	0.27 J+	6.32 O	100 J-	360	0.00036 J	0.0033 J	0.065	0.00013 J	0.001 U	0.002 U	0.012	0.001 U	0.00046 J	0.0002 U	0.0088 J	0.005 U	0.001 U	5 U
		09/07/2016	0.36	69	11	0.24 J	6.88	88	310	0.00032 J	0.0029 J	0.068	0.001 U	0.001 U	0.002 U	0.01	0.001 U	0.008 U	0.0002 U	0.011	0.005 U	0.001 U	0.553
		11/8/2016	0.25	72	8.7	2 UO	6.59	52	310	0.002 U	0.0055	0.065	0.001 U	0.001 U	0.002 U	0.015	0.001 U	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	1.03 J+
		01/09/2017	0.3	55	7.6	0.23 J	5.99 O	74	250 J+	0.00039 J	0.0023 J	0.059	0.001 U	0.001 U	0.002 U	0.0052	0.001 U	0.00038 J	0.0002 U	0.013 J+	0.00058 J	0.001 U	0.375 U
		02/28/2017	0.26	65	8.4	0.19 J	6.77	79	310	0.002 U	0.0024 J	0.07	0.001 U	0.001 U	0.00046 J	0.015	0.001 U	0.008 U	0.0002 U	0.011	0.0011 J	0.001 U	0.413 U
		04/25/2017	0.28	57	5.1	0.2 J	6.85	77	260	0.00091 J	0.0018 J	0.071	0.001 U	0.001 U	0.002 U	0.023	0.001 U	0.008 U	0.0002 U	0.0098 J	0.00095 J	0.001 U	0.447 U
		06/28/2017	0.24	58	2.1	0.22 J	6.93	48	260	0.002 U	0.0018 J	0.066	0.001 U	0.001 U	0.002 U	0.023	0.001 U	0.008 U	0.0002 U	0.0082 J	0.005 U	0.001 U	0.287 U
		08/22/2017	0.24	68	1.7 J	0.21 J	6.77	54	300	0.002 U	0.003 J	0.069	0.001 U	0.001 U	0.002 U	0.026	0.001 U	0.008 U	0.0002 UJ	0.0078 J	0.005 U	0.001 U	0.4 U
		10/03/2017	0.23	73	1.8	0.21 J	6.77	54	340	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/12/2018	-	-	-	0.25 J	6.75	-	-	0.0016 J	0.0021 J	0.061	0.001 U	0.001 U	0.0011 J	0.035	0.001 U	0.008 U	0.0002 U	0.011	0.005 U	0.001 U	0.366 U
		04/19/2018	0.25	37	1.4	0.29 J	6.99	35	220	-	-	0.049	-	-	-	0.052	-	-	-	0.0096 J	-	-	0.399
		10/25/2018	0.3	58	13	0.2	7.26	51	290	0.002 U	0.014	0.058	0.001 U	0.001 U	0.002 U	0.031	0.001 U	0.008 U	0.0002 U	0.011	0.005 U	0.001 U	0.671
		03/01/2019	0.2	38	2.8	0.21	7.01	35	210	0.002 U	0.012	0.041	0.001 U	0.001 U	0.002 U	0.0083	0.001 U	0.008 U	0.0002 U	0.0074 J	0.005 U	0.001 U	-
		04/22/2019	0.22	38	2.7	0.18	7.27	37	360	0.002 U	0.0028 J	0.049	0.001 U	0.001 U	0.002 U	0.0026	0.001 U	0.008 U	0.0002 U	0.011	0.005 U	0.001 U	0.345
		11/06/2019	0.16	59 J-	2.1	0.23	7.14	27	260	0.002 U	0.026	0.055	0.001 U	0.001 U	0.002 U	0.014	0.001 U	0.008 U	0.0002 U	0.0084 J	0.005 U	0.001 U	-
	GAMW14B	07/12/2016	2.8	150	100	0.29 J+	7.26	1200 J-	1900	0.00016 J	0.0029 J	0.13	0.00015 J	0.001 U	0.00094 J	0.001 U	0.0012	0.005 J	0.0002 U	0.035	0.005 U	0.001 U	3.26
		09/07/2016	2.4	130	100	0.27 J	7.38	950	2000	0.002 U	0.00095 J	0.12	0.001 U	0.001 U	0.002 U	0.00023 J	0.001 U	0.008 U	0.0002 U	0.035	0.005 U	0.001 U	2.47
		11/08/2016	3.4	140	120	20 U	7.11	1100	2000	0.00071 J	0.001 J	0.12	0.001 U	0.001 U	0.002 U	0.001 U	0.0004 J	0.008 U	0.0002 U	0.023	0.00087 J	0.001 U	3.11 J+
		01/09/2017	2.9	84	94	0.39 J	7.48	790	1700	0.0013 J	0.0015 J	0.081	0.001 U	0.001 U	0.002 U	0.00045 J	0.001 U	0.0053 J	0.0002 U	0.031 J+	0.00083 J	0.001 U	1.45
		02/28/2017	2.9	95	100	10 U	7.41	860	1700	0.002 U	0.00092 J	0.089	0.001 U	0.001 U	0.0007 J	0.0002 J	0.001 U	0.0046 J	0.0002 U	0.03	0.00061 J	0.001 U	2.17
		04/25/2017	2.9	110	100	0.3 J	7.39	900	1700	0.002 U	0.0015 J	0.096	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0054 J	0.0002 U	0.028	0.005 U	0.001 U	1.65
		07/12/2017	2.8	120	83	10 U	6.96	780	1500	0.002 U	0.0011 J	0.11	0.001 U	0.001 U	0.002 U	0.00019 J	0.001 U	0.0065 J	0.0002 U	0.014	0.005 U	0.001 U	1.17
		08/22/2017	3	120	100	0.35 J	7.44	960	1800	0.002 U	0.0009 J	0.1	0.001 U	0.001 U	0.002 U	0.00028 J	0.001 U	0.0051 J	0.0002 UJ	0.015	0.00099 J	0.00025 J	1.73
		10/03/2017	2.9	120	110	0.25 J	7.47	880	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		03/12/2018	-	-	-	10 U	7.59	-	-	0.002 U	0.0012 J	0.11	0.001 U	0.001 U	0.002 U	0.00019 J	0.001 U	0.0043 J	0.0002 U	0.022	0.005 U	0.001 U	1.87 J+
		04/19/2018	3	150	110	0.43 J-	7.55	990	2000	-	-	0.11	-	-	-	-	-	-	-	0.026	-	-	1.68
		09/06/2018	2.9	150	110	0.33 J	7.29	1100	2000	0.002 U	0.005 U	0.12	0.001 U	0.001 U	0.002 U	0.00039 J	0.001 U	0.0056 J	0.0002 U	0.033	0.0021 J	0.001 U	2.55
		10/25/2018	2.8	150	97	0.31	7.67	1100	1900	0.002 U	0.005 U	0.12	0.001 U	0.001 U	0.002 U	0.00022 J	0.001 U	0.0057 J	0.0002 U	0.035	0.001 J	0.001 U	2.73
		04/22/2019	2.9	140	99	0.31	7.75	1200	1900	0.002 U	0.005 U	0.11	0.00083 J	0.001 U	0.0044	0.00058 J	0.001 U	0.0058 J	0.0002 U	0.028	0.00093 J	0.00022 J	2.05
		11/06/2019	3.3	130 J-	120	0.39	7.93	1300	2200	0.002 U	0.005 U	0.11	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0059 J	0.0002 U	0.017	0.005 U	0.001 U	-
	GAMW42	09/13/2018	0.04 J	44	3.1	0.25 J	7.54	21	190	0.002 U	0.01	0.034	0.001 U	0.001 U	0.002 U	0.00027 J	0.001 U	0.008 U	0.0002 U	0.0035 J	0.005 U	0.001 U	0.476
		10/31/2018	0.041 J	38	2.8	0.2	7.15	23	170	0.002 U	0.0037 J	0.046	0.001 U	0.001 U	0.0014 J	0.00053 J	0.001 U	0.008 U	0.0002 U	0.0022 J	0.005 U	0.001 U	-
		03/04/2019	0.031 J	43	2.8	0.2	6.93	25	200	0.002 U	0.0025 J	0.022	0.001 U	0.001 U	0.0012 J	0.001 U	0.001 U	0.008 U	0.0002 U	0.0022 J	0.005 U	0.001 U	0.437 U
		04/18/2019	0.044 J	36	2.8	0.19	7.1	30	640	0.002 U	0.0023 J	0.024	0.001 U	0.001 U	0.002 U	0.00044 J	0.00064 J	0.008 U	0.0002 U	0.003 J	0.005 U	0.001 U	0.346 U
		06/05/2019	0.033 J	39	-	-	6.85	-	-	0.002 U	0.0019 J	0.018	0.00056 J	0.001 U	0.002 U	0.0002 J	0.001 U	0.008 U	0.0002 U	0.0023 J	0.005 U	0.00022 J	-
		07/17/2019	0.037 J	40	2.5	0.22	7.58	23	180	0.002 U	0.0016 J	0.019	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0019 J	0.005 U	0.001 U	0.393 U
		08/26/2019	0.043 J	47	3.1	0.2	7.54	27	210	0.002 U	0.0018 J	0.021	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.002 J	0.005 U	0.001 U	0.48 U
		10/02/2019	0.1 U	41	3.3	0.22	7.41	26	190	0.002 U	0.0022 J	0.02	0.00057 J	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0029 J	0.005 U	0.00062 J	0.539
		11/05/2019	0.033 J	43	3.2	0.21	7.83	25	190	0.002 U	0.0021 J	0.022	0.00072 J	0.001 U	0.0013 J	0.00023 J	0.001 U	0.008 U	0.0002 U	0.003 J	0.005 U	0.0007 J	-
	GAMW42B	09/13/2018	0.061 J	46	4	0.25 J	8.08	21	190	0.002 U	0.005 U	0.016	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0018 J	0.0002 U	0.0048 J	0.005 U	0.001 U	0.661
		03/04/2019	0.039 J	52	5	0.18	7.23	30	220	0.002 U	0.005 U	0.011	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0031 J	0.005 U	0.001 U	0.396 U
		04/18/2019	0.033 J	47	4.3	0.18	7.7	26	84	0.002 U	0.005 U	0.0093	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0026 J	0.005 U	0.001 U	0.384 U
		06/05/2019	0.035 J	50	-	-	7.12	-	-	0.002 U	0.005 U	0.012	0.0014	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0031 J	0.005 U	0.00062 J	-
		07/17/2019	0.038 J	48	4	0.19	8.25	26	220	0.002 U	0.005 U	0.012	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0025 J	0.005 U	0.001 U	0.46
		08/27/2019	0.026 J	52	4.3	0.18	7.57	27	230	0.002 U	0.005 U	0.014	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0035 J	0.005 U	0.0005 J	0.73
		10/02/2019	0.22	52	5.6	0.18	7.67	31	230	0.00059 J	0.005 U	0.013	0.00074 J	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0039 J	0.0011 J	0.0008 J	0.972
		11/05/2019	0.031 J	53	6.4	0.18	8.25	35	250	0.002 U	0.005 U	0.013	0.001 U	0.001 U	0.0024	0.001 U	0.001 U	0.008 U	0.0002 U	0.0033 J	0.005 U	0.00023 J	-
	GAMW42C	07/18/2019	1	45	6.4	0.3	7.81	13	220	0.002 U	0.005 U	0.015	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.037	0.0002 U	0.0053 J	0.005 U	0.00039 J	0.723
		08/28/2019	1	50	6.5	0.25	7.28	4.3	290	0.002 U	0.005 U	0.015	0.00048 J	0.001 U	0.002 U	0.0004 J	0.001 U	0.038	0.0002 U	0.0049 J	0.005 U	0.00061 J	1.14
		10/03/2019	0.79	45	5.8	0.25	7.48	5.6	270	0.002 U	0.005 U	0.01	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.025	0.0002 U	0.0027 J	0.005 U	0.001 U	0.972
		11/05/2019	0.75	45	5.8	0.26	7.64	4.5	280	0.002 U	0.005 U	0.01	0.001 U	0.001 U	0.001 J	0.0003 J	0.001 U	0.023	0.0002 U	0.0031 J	0.005 U	0.001 U	-

TABLE 1
COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS – JULY 2016 THROUGH NOVEMBER 2019 SAMPLING EVENTS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Monitoring Well ID		Date Sampled	Boron	Calcium	Chloride	Fluoride	pH (lab)	Sulfate	Total Dissolved Solids (TDS)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium, Total
			mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
		HH DW SL (a):	4	NA	250	4	6.5-8.5	250	500	0.006	0.01	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Downgradient	GAMW43	06/13/2018	0.025 J	26	6	0.15 J	6.63	25	160	0.002 U	0.0073	0.028	0.001 U	0.001 U	0.002 U	0.0023	0.001 U	0.008 U	0.0002 U	0.004 J	0.001 J	0.001 U	0.323 U
		03/05/2019	0.1 U	24	1.4	0.11	6.8	29	150	0.002 U	0.0036 J	0.021	0.00097 J	0.001 U	0.002 U	0.02	0.00048 J	0.008 U	0.0002 U	0.0016 J	0.005 U	0.001 U	0.371 U
		04/19/2019	0.1 U	22	0.92 J	0.1	7.07	31	140	0.00077 J	0.0024 J	0.016	0.00075 J	0.001 U	0.002 U	0.014	0.001 U	0.008 U	0.0002 U	0.0017 J	0.005 U	0.001 U	0.369 U
		06/05/2019	0.1 U	22	-	-	6.62	-	-	0.00063 J	0.0027 J	0.015	0.0019	0.001 U	0.002 U	0.0067	0.001 U	0.0023 J	0.0002 U	0.0017 J	0.001 J	0.00073 J	-
		07/17/2019	0.1 U	25	0.78 J	0.14	7.35	22	140	0.002 U	0.0025 J	0.019	0.001 U	0.001 U	0.002 U	0.0034	0.001 U	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	0.362 U
		08/27/2019	0.1 U	28	0.89 J	0.13	7.1	22	140	0.002 U	0.0037 J	0.018	0.001 U	0.001 U	0.002 U	0.0036	0.001 U	0.008 U	0.0002 U	0.0015 J	0.005 U	0.001 U	-
		10/02/2019	0.19	28	1.2	0.14	6.98	30	180	0.002 U	0.0033 J	0.026	0.001 U	0.001 U	0.002 U	0.0045	0.001 U	0.0022 J	0.0002 U	0.0035 J	0.005 U	0.00024 J	0.411 U
		11/19/2019	0.024 J	34	1.1	0.14	6.94	30	180	0.00077 J	0.0035 J	0.06	0.0014	0.001 U	0.002 U	0.0037	0.001 U	0.0026 J	0.0002 U	0.0048 J	0.0012 J	0.00091 J	-
	GAMW43B	06/13/2018	0.037 J	38	1.5	0.16 J	7.11	26	180	0.002 U	0.0018 J	0.015	0.001 U	0.001 U	0.0011 J	0.00033 J	0.00092 J	0.008 U	0.0002 U	0.0022 J	0.00089 J	0.001 U	0.408
		03/05/2019	0.029 J	42	1.5	0.17	7.62	31	140	0.002 U	0.005 U	0.012	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0018 J	0.005 U	0.001 U	0.373 U
		04/19/2019	0.036 J	43	1.6	0.17	7.76	35	170	0.002 U	0.005 U	0.014	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0018 J	0.005 U	0.001 U	0.375 U
		06/06/2019	0.1 U	39 J-	-	-	7.47	-	-	0.002 U	0.005 U	0.012	0.0011	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0025 J	0.005 U	0.00058 J	-
		07/17/2019	0.035 J	37	1.5	0.18	8.09	28	160	0.002 U	0.005 U	0.011	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0019 J	0.005 U	0.001 U	0.393 U
		08/27/2019	0.024 J	38	1.5	0.18	7.49	24	160	0.002 U	0.005 U	0.011	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.002 J	0.005 U	0.001 U	0.442 U
		10/02/2019	0.16	36	1.6	0.19	7.41	22	160	0.002 U	0.005 U	0.011	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0022 J	0.005 U	0.001 U	0.479 U
		11/19/2019	0.035 J	38	1.5	0.18	7.5	29	170	0.002 U	0.005 U	0.011	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0021 J	0.005 U	0.00028 J	-
	GAMW44	06/13/2018	0.05 J	25	10	0.096 J	6.77	50	200	0.0008 J	0.0054	0.024	0.001 U	0.001 U	0.0023	0.0025	0.001 U	0.008 U	0.0002 U	0.013	0.0014 J	0.001 U	0.649
		03/05/2019	0.025 J	24	2.4	0.13	6.23	57	170	0.002 U	0.0019 J	0.024	0.00073 J	0.001 U	0.0028	0.0017	0.0006 J	0.0038 J	0.0002 U	0.01 U	0.00096 J	0.001 U	0.362 U
		04/22/2019	0.032 J	24	3.1	0.16	6.41	68	200	0.002 U	0.0019 J	0.028	0.00083 J	0.001 U	0.0029	0.0019	0.00045 J	0.0043 J	0.0002 U	0.01 U	0.00092 J	0.001 U	0.543
		06/06/2019	0.1 U	20 J-	-	-	5.39	-	-	0.002 U	0.0045 J	0.032	0.00099 J	0.001 U	0.0031	0.0025	0.001 U	0.0042 J	0.0002 U	0.0013 J	0.00093 J	0.001 U	-
		07/24/2019	0.036 J	20	1.8	0.1	6.6	42	170	0.002 U	0.0087	0.025	0.001 U	0.001 U	0.0028	0.0025	0.001 U	0.005 J	0.0002 U	0.0012 J	0.005 U	0.001 U	0.435 U
		08/27/2019	0.032 J	23	1.6	0.11	6.31	42	160	0.002 U	0.01	0.024	0.001 U	0.001 U	0.0017 J	0.0028	0.001 U	0.0047 J	0.0002 U	0.002 J	0.005 U	0.001 U	0.973
		10/01/2019	0.03 J	34	1.9 J+	0.11 J+	6.91	51 J+	200	0.001 J	0.0091	0.032	0.0008 J	0.001 U	0.0016 J	0.0039	0.0006 J	0.0052 J	0.0002 U	0.0049 J	0.0011 J	0.00094 J	0.445 U
		11/20/2019	0.034 J	27	1.7	0.096	6.22	44	170	0.00072 J	0.054	0.034	0.00041 J	0.001 U	0.0023	0.0079	0.001 U	0.0042 J	0.0002 U	0.0058 J	0.005 U	0.00046 J	-
	GAMW44B	06/13/2018	0.034 J	40	7.9	0.11 J	7.29	25	170	0.002 U	0.005 U	0.013	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0021 J	0.005 U	0.001 U	0.368 U
		03/05/2019	0.024 J	32	1.6	0.13	7.79	14	120	0.002 U	0.005 U	0.0098	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0025 J	0.005 U	0.001 U	0.35 U
		04/22/2019	0.03 J	31	1.5	0.13	7.62	16	160	0.002 U	0.005 U	0.0091	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0026 J	0.005 U	0.001 U	0.312 U
		06/06/2019	0.1 U	30	-	-	7.52	-	-	0.002 U	0.005 U	0.0084	0.00031 J	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0026 J	0.005 U	0.001 U	-
		07/24/2019	0.024 J	31	1.3	0.14	8.28	11	150	0.002 U	0.005 U	0.0087	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0021 J	0.005 U	0.001 U	0.438 U
		08/27/2019	0.1 U	32	1.3	0.13	7.64	7.8	130	0.002 U	0.005 U	0.0087	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0019 J	0.005 U	0.001 U	0.465 U
		10/02/2019	0.12	31	1.5	0.15	7.16	7.6	120	0.002 U	0.005 U	0.0093	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.002 J	0.005 U	0.001 U	0.446 U
		11/20/2019	0.1 U	30	1.3	0.15	7.44	10	130	0.002 U	0.005 U	0.0081	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0022 J	0.005 U	0.001 U	-
	GAMW51	09/10/2018	0.68	130	6.3	0.44 J	8.08	130	550	0.002 U	0.0032 J	0.16	0.001 U	0.001 U	0.002 U	0.001	0.001 U	0.0073 J	0.0002 U	0.028	0.005 U	0.001 U	1.43
		10/25/2018	0.58	130	3.6	0.41	7.69	110	530	0.002 U	0.0031 J	0.17	0.001 U	0.001 U	0.002 U	0.0011	0.001 U	0.0052 J	0.0002 U	0.022	0.005 U	0.001 U	0.961
		04/26/2019	0.5	140	3.6	0.39	7.14	190	620	0.002 U	0.0016 J	0.096	0.001 U	0.001 U	0.002 U	0.0031	0.001 U	0.0049 J	0.0002 U	0.016	0.005 U	0.001 U	0.536
		11/12/2019	0.61	150	5.4	0.4	6.78	240	680	0.002 U	0.0015 J	0.1	0.001 U	0.001 U	0.002 U	0.003	0.001 U	0.006 J	0.0002 U	0.018	0.005 U	0.001 U	-
	GAMW51B	09/10/2018	6.9	250	62	0.79 J	8.72	1300	2200	0.002 U	0.0017 J	0.07	0.001 U	0.001 U	0.002 U	0.00028 J	0.001 U	0.05	0.0002 U	0.13	0.005 U	0.001 U	2.01
		10/25/2018	7.4	240	54	0.8	8.86	1600	2200	0.002 U	0.0013 J	0.063	0.001 U	0.001 U	0.002 U	0.00022 J	0.001 U	0.048	0.0002 U	0.13	0.0011 J	0.001 U	2.75
		04/26/2019	7.6	290	57	0.81	7.48	1400	2400	0.002 U	0.0034 J	0.085	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.064	0.0002 U	0.18	0.005 U	0.001 U	2.74
		11/12/2019	0.028 J	1 U	57	0.83	7.15	1500	2300	0.002 U	0.005 U	0.005 U	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.01 U	0.005 U	0.001 U	-
	GAMW57	07/23/2019	0.037 J	22	1.5	0.031 J	7.42	33	150	0.002 U	0.005 U	0.012	0.001 U	0.001 U	0.0014 J	0.00074 J	0.001 U	0.008 U	0.0002 UJ	0.016	0.005 U	0.001 U	0.419 U
		08/29/2019	0.042 J	25	1.2	0.034 J	7.7	35	120	0.002 U	0.005 U	0.008	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.022	0.005 U	0.001 U	0.453 U
		10/01/2019	0.023 J	23	1 J+	0.033 J+	7.58	31 J+	120	0.002 U	0.005 U	0.006	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0055 J	0.005 U	0.0003 J	0.548 U
		11/19/2019	0.038 J	24	1.3	0.031 J	7.61	34	130	0.002 U	0.005 U	0.0088	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.024	0.005 U	0.001 U	-
	GAMW57B	07/23/2019	0.095 J	46	9.4	0.14	8.21	23	210	0.002 U	0.00075 J	0.024	0.001 U	0.001 U	0.0021	0.001 U	0.001 U	0.0029 J	0.0002 UJ	0.0061 J	0.005 U	0.001 U	0.502
		08/29/2019	0.19	48	12	0.13	7.4	18	220	0.002 U	0.00076 J	0.029	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0058 J	0.0002 U	0.011	0.005 U	0.001 U	0.435 U
		10/01/2019	0.031 J	39	8.9 J+	0.14 J+	7.67	17 J+	190	0.002 U	0.005 U	0.018	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.008 U	0.0002 U	0.0028 J	0.005 U	0.001 U	0.543 U
		11/19/2019	0.16	46	11	0.14	7.53	14	190	0.002 U	0.005 U	0.025	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0044 J	0.0002 U	0.0073 J	0.005 U	0.001 U	-

TABLE 1
COMPARISON OF WDA GROUNDWATER MONITORING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS – JULY 2016 THROUGH NOVEMBER 2019 SAMPLING EVENTS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Monitoring Well ID		Date Sampled	Boron	Calcium	Chloride	Fluoride	pH (lab)	Sulfate	Total Dissolved Solids (TDS)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium, Total
			mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
		HH DW SL (a):	4	NA	250	4	6.5-8.5	250	500	0.006	0.01	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Downgradient	GAMW58	07/22/2019	0.046 J	10	1.3	0.31	5.42	43	100 J+	0.002 U	0.005 U	0.055	0.0013	0.00035 J	0.002 U	0.011	0.001	0.002 J	0.0002 UJ	0.01 U	0.005 U	0.00038 J	0.599 U
		08/29/2019	0.047 J	13	1.1	0.31	5.82	41	110	0.002 U	0.00098 J	0.047	0.00097 J	0.001 U	0.002 U	0.01	0.0011	0.0017 J	0.0002 U	0.0016 J	0.005 U	0.001 U	0.457 U
		10/01/2019	0.028 J	38	3.9 J+	0.16 J+	6.18	25 J+	190	0.002 U	0.005 U	0.017	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0028 J	0.0002 U	0.0059 J	0.005 U	0.001 U	1.2
		11/20/2019	0.037 J	8.8	1.5	0.29	5.02	40	100	0.002 U	0.005 U	0.058	0.0015	0.0004 J	0.002 U	0.0096	0.0012	0.0021 J	0.0002 U	0.0017 J	0.005 U	0.00064 J	-
	GAMW58B	07/22/2019	0.047 J	38	4	0.17	8.74	24	180	0.002 U	0.005 U	0.018	0.00035 J	0.001 U	0.002 U	0.00021 J	0.001 U	0.0031 J	0.0002 UJ	0.023	0.005 U	0.0005 J	0.504 U
		08/29/2019	0.043 J	39	3.8	0.17	8.33	21	200	0.002 U	0.005 U	0.02	0.001 U	0.001 U	0.002 U	0.00019 J	0.001 U	0.0025 J	0.0002 U	0.02	0.005 U	0.001 U	0.506 U
		10/01/2019	0.029 J	39	3.9 J+	0.17 J+	7.57	26 J+	180	0.00063 J	0.005 U	0.017	0.00055 J	0.001 U	0.002 U	0.001 U	0.001 U	0.0032 J	0.0002 U	0.0069 J	0.005 U	0.00067 J	0.603 U
		11/20/2019	0.026 J	36	3.7	0.16	7.49	25	160	0.002 U	0.005 U	0.017	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U	0.0019 J	0.0002 U	0.011	0.005 U	0.001 U	-
	GAMW59	07/19/2019	1.2	250	6.5	0.65	7.51	580	1100	0.002 U	0.0033 J	0.1	0.001 U	0.001 U	0.002 U	0.0005 J	0.001 U	0.015	0.0002 U	0.03	0.005 U	0.001 U	1.11
		11/11/2019	1.4	280	9.8	0.63	7.29	770 J-	1200	0.002 U	0.0024 J	0.088	0.00044 J	0.001 U	0.002 U	0.00081 J	0.001 U	0.016	0.0002 UJ	0.046	0.005 U	0.00049 J	-
	GAMW59B	07/19/2019	4.8	310	38	0.46	7.83	1400	2100	0.002 U	0.0015 J	0.065	0.001 U	0.001 U	0.002 U	0.0003 J	0.001 U	0.019	0.0002 U	0.06	0.005 U	0.001 U	2.3
		11/11/2019	5.4	330	44	0.46	7.47	1600 J-	2100	0.002 U	0.00081 J	0.058	0.001 U	0.001 U	0.002 U	0.00023 J	0.001 U	0.019	0.0002 UJ	0.092	0.005 U	0.00034 J	-
	GAMW60	07/22/2019	2.1	330	7.8	0.65	7.34	890	1400	0.002 U	0.005 U	0.044	0.001 U	0.001 U	0.002 U	0.0011	0.001 U	0.0068 J	0.0002 UJ	0.042	0.005 U	0.001 U	0.504 U
		11/11/2019	1.5	350	11	0.66	7.15	890 J-	780 J	0.002 U	0.00086 J	0.036	0.001 U	0.001 U	0.002 U	0.002	0.001 U	0.008 U	0.0002 UJ	0.035	0.005 U	0.001 U	-
	GAMW60B	07/19/2019	8.1	280	19	0.37	8.41	1200	1700	0.002 U	0.00088 J	0.06	0.001 U	0.001 U	0.002 U	0.00021 J	0.001 U	0.0067 J	0.0002 U	0.37	0.005 U	0.001 U	2.25
		11/11/2019	7.2	300	18	0.39	7.78	1200 J-	1600	0.002 U	0.005 U	0.063	0.001 U	0.001 U	0.002 U	0.00024 J	0.001 U	0.008 U	0.0002 UJ	0.39	0.005 U	0.001 U	-
	GAMW68	9/9/2020	0.10 U	61.9	20.7	0.2	8	68.4	296	0.0010 U	0.0010 U	0.072	0.00020 U	0.00020 U	0.0020 U	0.0010 U	0.0010 U	0.0091	0.00020 U	0.0041	0.0010 U	0.0010 U	-
	GAMW68B	9/9/2020	0.10 U	42.6	19.7	0.15	8	75.5	237	0.0010 U	0.0015	0.11	0.00020 U	0.00020 U	0.0020 U	0.0010 U	0.0010 U	0.0080 U	0.00020 U	0.0021	0.0010 U	0.0010 U	-

Notes:

- : Constituent not included in this analysis.
DW - Drinking Water.
HH - Human Health.
mg/L - milligrams per liter.
NA - Not Available.
pCi/L - picoCurie per liter.
SL - Screening Level.
WDA - Waste Disposal Area.

Qualifiers:
J - Value is estimated.
U - Constituent was not detected, value is the reporting limit.
J+ - Value is estimated with a potential high bias
J- - Value is estimated with a potential low bias
O - Result was identified as an outlier and removed from the background data set.

(a) - Drinking Water Screening Levels selected in Table 2 using the following hierarchy:
1) IDEM Criteria for Drinking Water Class Groundwater
2) USEPA MCL
3) USEPA RSL - Tap Water

Detected Concentration > HH DW SL.

TABLE 2
HUMAN HEALTH DRINKING WATER SCREENING LEVELS FOR GROUNDWATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

		Human Health Published Screening Level - Drinking			
Constituent	CAS RN	IDEM Criteria for Drinking Water Class Groundwater (a) (mg/L)	USEPA MCL (b) (mg/L)	USEPA RSL Tap Water (c) (mg/L)	Selected Screening Level - Drinking Water (d) (mg/L)
Detection Monitoring - USEPA Appendix III Constituents					
Boron	7440-42-8	NA	NA	4	4
Calcium	7440-70-2	NA	NA	NA	NA
Chloride	16887-00-6	250	NA	NA	250
Fluoride	16984-48-8	4	4	0.8	4
pH	pH	NA	6.5-8.5 (e)	NA	6.5-8.5
Sulfate	14808-79-8	250	NA	NA	250
Total Dissolved Solids	TDS	500	NA	NA	500
Assessment Monitoring - USEPA Appendix IV Constituents					
Antimony	7440-36-0	0.006	0.006	0.0078	0.006
Arsenic	7440-38-2	0.01	0.01	0.000052	0.01
Barium	7440-39-3	2	2	3.8	2
Beryllium	7440-41-7	0.004	0.004	0.025	0.004
Cadmium	7440-43-9	0.005	0.005	0.0092	0.005
Chromium (Total)	7440-47-3	0.1	0.1	22 (f)	0.1
Cobalt	7440-48-4	NA	NA	0.006	0.006
Lead	7439-92-1	0.015 (g)	0.015 (g)	0.015 (g)	0.015
Lithium	7439-93-2	NA	NA	0.04	0.04
Mercury	7439-97-6	0.002 (h)	0.002 (h)	0.0057 (i)	0.002
Molybdenum	7439-98-7	NA	NA	0.1	0.1
Selenium	7782-49-2	0.05	0.05	0.1	0.05
Thallium	7440-28-0	0.002	0.002	0.0002	0.002
Radiological (pCi/L)					
Radium-226 & 228	7440-14-4	5	5	NA	5

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
IDEM - Indiana Department of Environmental Management.
MCL - Maximum Contaminant Level.
mg/L - milligrams/liter.
NA - Not Available.
pCi/L - picoCuries/liter.
RSL - Regional Screening Level.
USEPA - United States Environmental Protection Agency.

(a) - IDEM Water Quality Standards. Title 327 of the Indiana Administrative Code (IAC). Article 2. Water Quality Standards. Rule 11. Ground Water Quality Standards. Part 327 IAC 2-11-6. Criteria for Drinking Water Class Ground Water. http://www.in.gov/legislative/iac/T03270/A00020.PDF?
(b) - USEPA, 2018. 2018 Edition of the Drinking Water Standards and Health Advisories. March. https://www.epa.gov/dwstandardsregulations/2018-drinking-water-standards-and-advisory-tables
(c) - USEPA, 2020. Regional Screening Levels (May 2020). Values for Tap Water, Hazard Index = 1.0. TR = 1E-06. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables
(d) - The hierarchy for selection among the Human Health Published Screening Levels for Drinking Water is:
1) IDEM Criteria for Drinking Water Class Groundwater
2) USEPA MCL
3) USEPA RSL - Tap Water
(e) - USEPA Secondary MCL value.
(f) - Value for chromium (III).
(g) - Treatment Technology Action Level. This is a drinking water treatment action level applicable to regulated Community and Non-Transient Non-Community public water systems.
http://www.in.gov/idem/files/factsheet_owq_pws_lead_copper.pdf
https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=60001N8P.txt
(h) - Value for inorganic mercury.
(i) - Value for mercuric chloride.

TABLE 3
HUMAN HEALTH CALCULATED RISK BASED SCREENING LEVELS FOR SURFACE WATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	Human Health Calculated RBSL - Recreational Use of Surface Water (c)				Selected Human Health Calculated RBSL - Recreational Use of Surface Water (b) (mg/L)
		Current/Future Off-Site Recreational Swimmer Age-Adjusted (Ages 1 - 26) (a) (mg/L)		Current/Future Off-Site Recreational Wader Age-Adjusted (Ages 1 - 26) (a) (mg/L)		
Detection Monitoring - USEPA Appendix III Constituents (j)						
Boron	7440-42-8	114		120		114
Chloride	16887-00-6	NA		NA		NA
Fluoride	16984-48-8	22.9		23.9		22.9
Assessment Monitoring - USEPA Appendix IV Constituents						
Antimony	7440-36-0	0.171		0.218		0.171
Arsenic	7440-38-2	0.0236	(e, f)	0.0389	(e, g)	0.0236
Barium	7440-39-3	63.7		97.1		63.7
Beryllium	7440-41-7	0.121		0.345		0.121
Cadmium	7440-43-9	0.134		0.225		0.134
Chromium (Total)	7440-47-3	155	(i)	386	(i)	155
Cobalt	7440-48-4	0.178		0.181		0.178
Lead	7439-92-1	0.015	(d)	0.015	(d)	0.015
Lithium	7439-93-2	1.14		1.2		1.14
Mercury	7439-97-6	0.0956	(h)	0.146	(h)	0.0956
Molybdenum	7439-98-7	2.86		2.99		2.86
Selenium	7782-49-2	2.86		2.99		2.86
Thallium	7440-28-0	0.00572		0.00598		0.00572
Radiological (pCi/L)						
Radium-226 & 228	7440-14-4	NA		NA		NA

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
NA - Not Available.
pCi/L - picoCuries/liter.
mg/L - micrograms/liter.
RBSL - Risk-Based Screening Level.
USEPA - United States Environmental Protection Agency.

(a) - Documentation for the receptor-specific Human Health Calculated Screening Level for Recreational Use of Surface Water is provided in Attachment A. Site-specific risk based screening levels (RBSLs) calculated using USEPA exposure factors and the USEPA screening levels calculator. https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
(b) - The selected human health RBSL for recreational use of surface water is the minimum value from the Current/Future Off-Site Recreational Swimmer and Current/Future Off-Site Recreational Wader RBSLs.
(c) - Some calculated values may be above solubility limits.
(d) - USEPA lead action level of 0.015 mg/L for lead in drinking water (USEPA, 2018) is used as the RBSL.
(e) - Arsenic RBSLs are based on the lower of the values based on a hazard index of 1 and an excess lifetime cancer risk of 1E-05. Note that of the constituents evaluated, arsenic is the only constituent with an RSL based on potential carcinogenic effects.
(f) - RBSL based on cancer endpoint at 1E-5 (noncancer-based RBSL is 0.172 mg/L).
(g) - RBSL based on cancer endpoint at 1E-5 (noncancer-based RBSL is 0.179 mg/L).
(h) - Value for mercuric chloride used.
(i) - Value for chromium (III) used.
(j) - Detection Monitoring - EPA Appendix III Constituents without health risk-based screening levels are not included.

TABLE 4
ECOLOGICAL SCREENING LEVELS FOR SURFACE WATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

		Ecological Published Screening Levels - Surface Water														Selected Ecological Screening Level (acute) (f) (mg/L)		Selected Ecological Screening Level (chronic) (f) (mg/L)	
		IDEM AAC Aquatic Life Criterion (acute) (current) (a) (mg/L)		IDEM CAC Aquatic Life Criterion (chronic) (current) (a) (mg/L)		IDEM AAC Aquatic Life Criterion (acute) (proposed) (b)(c) (mg/L)		IDEM CAC Aquatic Life Criterion (chronic) (proposed) (b)(c) (mg/L)		USEPA Region 5 Ecological Screening Values (freshwater - chronic) (d) (mg/L)		USEPA NRWQC Aquatic Life Criteria CMC - Freshwater (acute) (e) (mg/L)		USEPA NRWQC Aquatic Life Criteria CCC - Freshwater (chronic) (e) (mg/L)					
Constituent	**CAS RN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Detection Monitoring - USEPA Appendix III Constituents (n)																			
Boron	7440-42-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	860	860	230	230	860	860	230	230
Fluoride	16984-48-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assessment Monitoring - USEPA Appendix IV Constituents																			
Antimony	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA	0.08	NA	NA	NA	NA	NA	NA	NA	0.08	NA
Arsenic	7440-38-2	0.36	0.36 (j)	0.19	0.19 (j)	0.34	0.34 (j)	0.15	0.15 (j)	0.148	NA	0.34 (i)	0.34 (i)	0.15 (i)	0.15 (i)	0.36	0.36	0.19	0.19
Barium	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA	0.22 (h)	NA	NA	NA	NA	NA	NA	NA	0.22	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	NA	NA	0.0036	NA	NA	NA	NA	NA	NA	NA	0.0036	NA
Cadmium	7440-43-9	0.0039 (k)	0.0037 (k)	0.0011 (k)	0.0010 (k)	0.0019 (k)	0.0018 (k)	0.00079 (k)	0.00072 (k)	0.00015 (h)	NA	0.0019 (k)	0.0018 (k)	0.00079 (k)	0.00072 (k)	0.0039	0.0037	0.0011	0.0010
Chromium (Total)	7440-47-3	1.7 (m)	0.55 (m)	0.21 (m)	0.18 (m)	1.8 (m)	0.57 (m)	0.086 (m)	0.074 (m)	0.042 (h, m)	NA	1.8 (m)	0.57 (m)	0.086 (m)	0.074 (m)	1.7	0.55	0.21	0.18
Cobalt	7440-48-4	NA	NA	NA	NA	NA	NA	NA	NA	0.024	NA	NA	NA	NA	NA	NA	NA	0.024	NA
Lead	7439-92-1	0.082 (k)	0.065 (k)	0.0032 (k)	0.0025 (k)	0.12 (k)	0.10 (k)	0.010 (k)	0.0079 (k)	0.00117 (h)	NA	0.082 (k)	0.065 (k)	0.0032 (k)	0.0025 (k)	0.082	0.065	0.0032	0.0025
Lithium	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0024	NA	0.000012	NA	0.0024	NA	0.000012	NA	0.0000013	NA	0.0016 (l)	0.0014 (l)	0.00091 (l)	0.00077 (l)	0.0024	0.0014	0.000012	0.00077
Molybdenum	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	0.13	NA	0.035	NA	NA	NA	NA	0.0031 (g)	0.005	NA	NA	NA	NA	0.0031 (g)	0.13	NA	0.035	0.0031
Thallium	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA	NA	NA	NA	NA	NA	NA	0.01	NA
Radiological (pCi/L)																			
Radium-226 & 228	7440-14-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
AAC - Acute Aquatic Criterion
CAC - Chronic Aquatic Criterion
CAS RN - Chemical Abstracts Service Registry Number.
CCC - Continuous Criterion Concentration
CMC - Criterion Maximum Concentration
IDEM - Indiana Department of Environmental Management
mg/L - micrograms/liter.
NA - Not Available
NRWQC - National Recommended Water Quality Criteria
pCi/L - picoCuries/liter.
USEPA - United States Environmental Protection Agency

TABLE 4
ECOLOGICAL SCREENING LEVELS FOR SURFACE WATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Notes:

(a) - IDEM Water Quality Standards. Title 327 of the IAC. Article 2. Water Quality Standards. Rule 1. Water Quality Standards Applicable to All State Waters Except Waters of the State Within the Great Lakes System.
Part 327 IAC 2-1-6 Minimum Surface Water Quality Standards. Tables 6-1, 6-2, and 6-3. Surface Water Quality Standards for metals apply to total recoverable concentrations.
The screening levels for hardness-based metals are calculated for a default hardness value of 100 mg/L $CaCC_3$.
http://www.in.gov/legislative/iac/T03270/A00020.PDF?

(b) - IDEM (IN.gov). Water Quality in Indiana. Water Quality Standards. Active Projects - Planned Revisions to Metals Criteria for the Protection of Aquatic Life and Human Health.
Second Notice of Tables of Rulemaking. IDEM is providing notice of its intent to revise Indiana's Aquatic Life and Human Health Ambient Water Quality Criteria (WQC) for metals (total recoverable).
Aquatic Life Criteria Tables 1, 2, and 4. The screening levels for hardness-dependent metals are calculated for a default hardness value of 100 mg/L CaCO3.
Proposed revisions reflect updates to USEPA NRWQC at Section 304(a) of the Clean Water Act.
https://www.in.gov/idem/cleanwater/files/wqs_rulemaking_tables_second_notice.pdf

(c) - IDEM (IN.gov). Water Quality in Indiana. Water Quality Standards.
http://www.in.gov/idem/cleanwater/2329.htm

(d) - USEPA Archive Document. USEPA Region 5 Resource Conservation and Recovery Act (RCRA) - Ecological Screening Values. August 22, 2003.
https://archive.epa.gov/region5/waste/cars/web/pdf/ecological-screening-levels-200308.pdf

(e) - USEPA Water Quality Criteria. Current Water Quality Criteria Tables. National Recommended Water Quality Criteria - Aquatic Life Criteria Table.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm

(f) - The hierarchy for the selection of ecological screening levels is:
1) IDEM Aquatic Life Criterion (current).
2) IDEM Aquatic Life Criterion (proposed).
3) USEPA Region 5. Freshwater Screening Values.
4) USEPA NRWQC. Aquatic Life Criteria - Freshwater.

(g) - USEPA Office of Water. Final Criterion: Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater. 30 June 2016.
Freshwater value for chronic (30 day) water column concentration (mg/L) of dissolved selenium in lotic (flowing) surface water. The criterion is based on fish ovary concentrations, and in lieu of that, the water column values are used.
https://www.epa.gov/sites/production/files/2016-07/documents/aquatic_life_awqc_for_selenium_-_freshwater_2016.pdf

(h) - USEPA Region 5, RCRA Ecological Screening Levels (archive 2003-08-22) for hardness-dependent metal, freshwater - chronic criteria. Value displayed corresponds to a soft water total hardness of 50 mg/L as CaCO3.

(i) - Value for inorganic arsenic only.

(j) - Value for inorganic arsenic as arsenite, As(III).

(k) - Criterion expressed as a function of total hardness (mg/L). Value displayed corresponds to a default total hardness of 100 mg/L.

(l) - Aquatic Life Criterion for metallic mercury (CAS RN 7439-97-6) and/or methylmercury (CAS RN 22967-92-6).

(m) - Value for chromium (III).

(n) - Detection Monitoring - EPA Appendix III Constituents without health risk-based screening levels are not included.

TABLE 5
SELECTED SURFACE WATER SCREENING LEVELS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	HH Calculated Recreational RBSL (a) (mg/L)	ECO SL - Total (acute) (b) (mg/L)	ECO SL - Dissolved (acute) (b) (mg/L)	ECO SL - Total (chronic) (b) (mg/L)	ECO SL - Dissolved (chronic) (b) (mg/L)
Detection Monitoring - USEPA Appendix III Constituents (c)						
Boron	7440-42-8	114	NA	NA	NA	NA
Chloride	16887-00-6	NA	860	860	230	230
Fluoride	16984-48-8	22.9	NA	NA	NA	NA
Assessment Monitoring - USEPA Appendix IV Constituents						
Antimony	7440-36-0	0.171	NA	NA	0.08	NA
Arsenic	7440-38-2	0.0236	0.36	0.36	0.19	0.19
Barium	7440-39-3	63.7	NA	NA	0.22	NA
Beryllium	7440-41-7	0.121	NA	NA	0.0036	NA
Cadmium	7440-43-9	0.134	0.0039	0.0037	0.0011	0.0010
Chromium (Total)	7440-47-3	155	1.7	0.55	0.21	0.18
Cobalt	7440-48-4	0.178	NA	NA	0.024	NA
Lead	7439-92-1	0.015	0.082	0.065	0.0032	0.0025
Lithium	7439-93-2	1.14	NA	NA	NA	NA
Mercury	7439-97-6	0.0956	0.0024	0.0014	0.000012	0.00077
Molybdenum	7439-98-7	2.86	NA	NA	NA	NA
Selenium	7782-49-2	2.86	0.13	NA	0.035	0.0031
Thallium	7440-28-0	0.00572	NA	NA	0.01	NA
Radiological (pCi/L)						
Radium-226 & 228	7440-14-4	NA	NA	NA	NA	NA

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
ECO SL - Ecological Screening Level.
HH - Human Health.
IDEM - Indiana Department of Environmental Management.
mg/L - milligrams/liter.
NA - Not Available.
NRWQC - National Recommended Water Quality Criteria.
pCi/L - picoCuries/liter.
RBSL - Risk-Based Screening Level.
USEPA - United States Environmental Protection Agency.

(a) - The Human Health Calculated Screening Levels are presented in Table 3.
The minimum calculated value for the Off-Site Recreational Wader and Swimmer was selected.

(b) - Ecological Screening Levels selected in Table 4 using the following hierarchy:
1) IDEM Aquatic Life Criterion (current).
2) IDEM Aquatic Life Criterion (proposed).
3) USEPA Region 5. Freshwater Screening Values.
4) USEPA NRWQC. Aquatic Life Criteria - Freshwater.

(c) - Detection Monitoring - EPA Appendix III Constituents without health risk-based screening levels are not included.

TABLE 6
COMPARISON OF POTABLE WATER SUPPLY SAMPLING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	Fraction	Unit	Selected Human Health Drinking Water Screening Level (a)	PWS-01 Deep Well #7B 8/31/2020	PWS-02 Deep Well #5 8/31/2020	PWS-03 Domestic Water House 8/31/2020	PWS-04 First Floor Sink, First Aid Room 8/31/2020	PWS-05 3rd Floor, Kitchen Sink 8/31/2020	Detected Concentration Above Selected Human Health Drinking Water Screening Level?
Metals										
Antimony	7440-36-0	T	mg/L	0.006	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	T	mg/L	0.01	0.0013	0.0012	0.0011	0.0011	0.001	No
Barium	7440-39-3	T	mg/L	2	0.029	0.027	0.027	0.027	0.027	No
Beryllium	7440-41-7	T	mg/L	0.004	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	T	mg/L	4	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	No
Cadmium	7440-43-9	T	mg/L	0.005	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	T	mg/L	NA	37	54.6	43.3	43.8	43.2	No
Chromium	7440-47-3	T	mg/L	0.1	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	T	mg/L	0.006	0.0023	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	T	mg/L	0.015	0.0053	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	T	mg/L	0.04	< 0.0080 U	< 0.0080 U	< 0.0080 U	< 0.0080 U	< 0.0080 U	No
Mercury	7439-97-6	T	mg/L	0.002	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Molybdenum	7439-98-7	T	mg/L	0.1	0.0016	0.0023	0.0017	0.0016	0.0017	No
Selenium	7782-49-2	T	mg/L	0.05	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	T	mg/L	0.002	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Wet Chem										
Chloride	16887-00-6	T	mg/L	250	8.3	8.8	8.6	10.1	9.9	No
Fluoride	16984-48-8	T	mg/L	4	0.094	0.058	0.081	0.082	0.08	No
pH	pH	T	SU	6.5-8.5	8	7.6	7.8	7.8	7.8	No
Sulfate	14808-79-8	T	mg/L	250	35.6	44.3	38.2	39.6	46.4	No
Total Dissolved Solids	TDS	D	mg/L	500	144	207	164	159	165	No

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
D - dissolved.
IDEM - Indiana Department of Environmental Management.
MCL - Maximum Contaminant Level.
RSL - Regional Screening Level.
mg/L - milligrams/liter.
SU - standard unit.
T - total.
USEPA - United States Environmental Protection Agency.

(a) - Human Health Drinking Water Screening Levels selected in Table 2 using the following hierarchy:

1) IDEM Criteria for Drinking Water Class Groundwater
2) USEPA MCL
3) USEPA RSL - Tap Water

TABLE 7
COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	Fraction	Unit	Selected Human Health Drinking Water Screening Level (a)	DAVIS DITCH 01 8/31/2020	DAVIS DITCH 02 8/31/2020	DAVIS DITCH 03 8/31/2020	DAVIS DITCH 04 8/31/2020	Detected Concentration Above Selected Human Health Drinking Water Screening Level?
Metals, Dissolved									
Antimony	7440-36-0	D	mg/L	0.006	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	D	mg/L	0.01	0.0015	0.0014	0.0015	0.0012	No
Barium	7440-39-3	D	mg/L	2	0.059	0.064	0.055	0.051	No
Beryllium	7440-41-7	D	mg/L	0.004	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	D	mg/L	4	< 0.10 U	< 0.10 U	< 0.10 U	0.12	No
Cadmium	7440-43-9	D	mg/L	0.005	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	D	mg/L	NA	53.6	56	56	62.8	No
Chromium	7440-47-3	D	mg/L	0.1	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	D	mg/L	0.006	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	D	mg/L	0.015	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	D	mg/L	0.04	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	No
Mercury	7439-97-6	D	mg/L	0.002	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Molybdenum	7439-98-7	D	mg/L	0.1	0.0053	0.0045	0.0045	0.0056	No
Selenium	7782-49-2	D	mg/L	0.05	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	D	mg/L	0.002	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Metals, Total									
Antimony	7440-36-0	T	mg/L	0.006	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	T	mg/L	0.01	0.0017	0.0016	0.0016	0.0015	No
Barium	7440-39-3	T	mg/L	2	0.063	0.065	0.057	0.053	No
Beryllium	7440-41-7	T	mg/L	0.004	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	T	mg/L	4	< 0.10 U	< 0.10 U	< 0.10 U	0.11	No
Cadmium	7440-43-9	T	mg/L	0.005	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	T	mg/L	NA	52.9	55.3	56.2	60.3	No
Chromium	7440-47-3	T	mg/L	0.1	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	T	mg/L	0.006	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	T	mg/L	0.015	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	T	mg/L	0.04	< 0.0080 U	< 0.0080 U	< 0.0080 U	< 0.0080 U	No
Mercury	7439-97-6	T	mg/L	0.002	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Molybdenum	7439-98-7	T	mg/L	0.1	0.0049	0.0042	0.0042	0.0055	No
Selenium	7782-49-2	T	mg/L	0.05	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	T	mg/L	0.002	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Wet Chem									
Chloride	16887-00-6	T	mg/L	250	11.4	11.2	11.9	13.7	No
Fluoride	16984-48-8	T	mg/L	4	0.11	0.11	0.11	0.12	No
pH	pH	T	SU	6.5-8.5	8.1	8	8.1	8.2	No
Sulfate	14808-79-8	T	mg/L	250	38.8	38.2	37	59.7	No
Total Dissolved Solids	TDS	D	mg/L	500	231	232	229	274	No

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
D - dissolved.
IDEM - Indiana Department of Environmental Management.
MCL - Maximum Contaminant Level.
RSL - Regional Screening Level.
mg/L - milligrams/liter.
SU - standard unit.
T - total.
USEPA - United States Environmental Protection Agency.

(a) - Human Health Drinking Water Screening Levels selected in Table 2 using the following hierarchy:

1) IDEM Criteria for Drinking Water Class Groundwater
2) USEPA MCL
3) USEPA RSL - Tap Water

TABLE 8
COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO HUMAN HEALTH CALCULATED RISK BASED SCREENING LEVELS FOR SURFACE WATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	Fraction	Unit	Selected Human Health Calculated RBSL - Recreational Use of Surface Water (a)	DAVIS DITCH 01 8/31/2020	DAVIS DITCH 02 8/31/2020	DAVIS DITCH 03 8/31/2020	DAVIS DITCH 04 8/31/2020	Detected Concentration Above Selected Human Health Calculated RBSL-Recreational Use of Surface Water?
Metals, Dissolved									
Antimony	7440-36-0	D	mg/L	0.171	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	D	mg/L	0.0236	0.0015	0.0014	0.0015	0.0012	No
Barium	7440-39-3	D	mg/L	63.7	0.059	0.064	0.055	0.051	No
Beryllium	7440-41-7	D	mg/L	0.121	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	D	mg/L	114	< 0.10 U	< 0.10 U	< 0.10 U	0.12	No
Cadmium	7440-43-9	D	mg/L	0.134	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	D	mg/L	NA	53.6	56	56	62.8	No
Chromium	7440-47-3	D	mg/L	155	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	D	mg/L	0.178	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	D	mg/L	0.015	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	D	mg/L	1.14	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	No
Mercury	7439-97-6	D	mg/L	0.0956	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Molybdenum	7439-98-7	D	mg/L	2.86	0.0053	0.0045	0.0045	0.0056	No
Selenium	7782-49-2	D	mg/L	2.86	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	D	mg/L	0.00572	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Metals, Total									
Antimony	7440-36-0	T	mg/L	0.171	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	T	mg/L	0.0236	0.0017	0.0016	0.0016	0.0015	No
Barium	7440-39-3	T	mg/L	63.7	0.063	0.065	0.057	0.053	No
Beryllium	7440-41-7	T	mg/L	0.121	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	T	mg/L	114	< 0.10 U	< 0.10 U	< 0.10 U	0.11	No
Cadmium	7440-43-9	T	mg/L	0.134	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	T	mg/L	NA	52.9	55.3	56.2	60.3	No
Chromium	7440-47-3	T	mg/L	155	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	T	mg/L	0.178	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	T	mg/L	0.015	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	T	mg/L	1.14	< 0.0080 U	< 0.0080 U	< 0.0080 U	< 0.0080 U	No
Mercury	7439-97-6	T	mg/L	0.0956	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Molybdenum	7439-98-7	T	mg/L	2.86	0.0049	0.0042	0.0042	0.0055	No
Selenium	7782-49-2	T	mg/L	2.86	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	T	mg/L	0.00572	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Wet Chem									
Chloride	16887-00-6	T	mg/L	NA	11.4	11.2	11.9	13.7	No
Fluoride	16984-48-8	T	mg/L	22.9	0.11	0.11	0.11	0.12	No
pH	pH	T	SU	NA	8.1	8	8.1	8.2	No
Sulfate	14808-79-8	T	mg/L	NA	38.8	38.2	37	59.7	No
Total Dissolved Solids	TDS	D	mg/L	NA	231	232	229	274	No

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
D - dissolved.
mg/L - milligrams/liter.
NA - Not Available.
RBSL - Risk-Based Screening Level.
SU - standard unit.
T - total.
USEPA - United States Environmental Protection Agency.

(b) - The selected human health RBSL for recreational use of surface water is the minimum value from the Current/Future Off-Site Recreational Swimmer and Current/Future Off-Site Recreational Wader RBSLs as selected in Table 3.

TABLE 9
COMPARISON OF DAVIS DITCH SAMPLING RESULTS TO ECOLOGICAL SCREENING LEVELS FOR SURFACE WATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

Constituent	CAS RN	Fraction	Unit	Selected Ecological Screening Level (acute) (a)	Selected Ecological Screening Level (chronic) (a)	DAVIS DITCH 01 8/31/2020	DAVIS DITCH 02 8/31/2020	DAVIS DITCH 03 8/31/2020	DAVIS DITCH 04 8/31/2020	Detected Concentration Above Selected Ecological Screening Levels?
Metals, Dissolved										
Antimony	7440-36-0	D	mg/L	NA	NA	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	D	mg/L	0.36	0.19	0.0015	0.0014	0.0015	0.0012	No
Barium	7440-39-3	D	mg/L	NA	NA	0.059	0.064	0.055	0.051	No
Beryllium	7440-41-7	D	mg/L	NA	NA	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	D	mg/L	NA	NA	< 0.10 U	< 0.10 U	< 0.10 U	0.12	No
Cadmium	7440-43-9	D	mg/L	0.0037	0.0010	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	D	mg/L	NA	NA	53.6	56	56	62.8	No
Chromium	7440-47-3	D	mg/L	0.55	0.18	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	D	mg/L	NA	NA	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	D	mg/L	0.065	0.0025	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	D	mg/L	NA	NA	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	No
Mercury	7439-97-6	D	mg/L	0.0014	0.00077	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Molybdenum	7439-98-7	D	mg/L	NA	NA	0.0053	0.0045	0.0045	0.0056	No
Selenium	7782-49-2	D	mg/L	NA	0.0031	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	D	mg/L	NA	NA	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Metals, Total										
Antimony	7440-36-0	T	mg/L	NA	0.08	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Arsenic	7440-38-2	T	mg/L	0.36	0.19	0.0017	0.0016	0.0016	0.0015	No
Barium	7440-39-3	T	mg/L	NA	0.22	0.063	0.065	0.057	0.053	No
Beryllium	7440-41-7	T	mg/L	NA	0.0036	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Boron	7440-42-8	T	mg/L	NA	NA	< 0.10 U	< 0.10 U	< 0.10 U	0.11	No
Cadmium	7440-43-9	T	mg/L	0.0039	0.0011	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Calcium	7440-70-2	T	mg/L	NA	NA	52.9	55.3	56.2	60.3	No
Chromium	7440-47-3	T	mg/L	1.7	0.21	< 0.0020 U	< 0.0020 U	< 0.0020 U	< 0.0020 U	No
Cobalt	7440-48-4	T	mg/L	NA	0.024	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lead	7439-92-1	T	mg/L	0.082	0.0032	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Lithium	7439-93-2	T	mg/L	NA	NA	< 0.0080 U	< 0.0080 U	< 0.0080 U	< 0.0080 U	No
Mercury	7439-97-6	T	mg/L	0.0024	0.000012	< 0.00020 U	< 0.00020 U	< 0.00020 U	< 0.00020 U	No
Molybdenum	7439-98-7	T	mg/L	NA	NA	0.0049	0.0042	0.0042	0.0055	No
Selenium	7782-49-2	T	mg/L	0.13	0.035	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Thallium	7440-28-0	T	mg/L	NA	0.01	< 0.0010 U	< 0.0010 U	< 0.0010 U	< 0.0010 U	No
Wet Chem										
Chloride	16887-00-6	T	mg/L	860	230	11.4	11.2	11.9	13.7	No
Fluoride	16984-48-8	T	mg/L	NA	NA	0.11	0.11	0.11	0.12	No
pH	pH	T	SU	NA	6.5 – 9	8.1	8	8.1	8.2	No
Sulfate	14808-79-8	T	mg/L	NA	NA	38.8	38.2	37	59.7	No
Total Dissolved Solids	TDS	D	mg/L	NA	NA	231	232	229	274	No

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
D - dissolved.
IDEM - Indiana Department of Environmental Management
mg/L - micrograms/liter.
NA - Not Available
NRWQC - National Recommended Water Quality Criteria
SU - standard unit.
T - total.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 4 using the following hierarchy:

1) IDEM Aquatic Life Criterion (current).
2) IDEM Aquatic Life Criterion (proposed).
3) USEPA Region 5. Freshwater Screening Values.
4) USEPA NRWQC. Aquatic Life Criteria - Freshwater.

TABLE 10
DERIVATION OF RISK-BASED TARGET SCREENING LEVELS FOR GROUNDWATER
NORTHERN INDIANA PUBLIC SERVICE COMPANY (NIPSCO), LLC
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

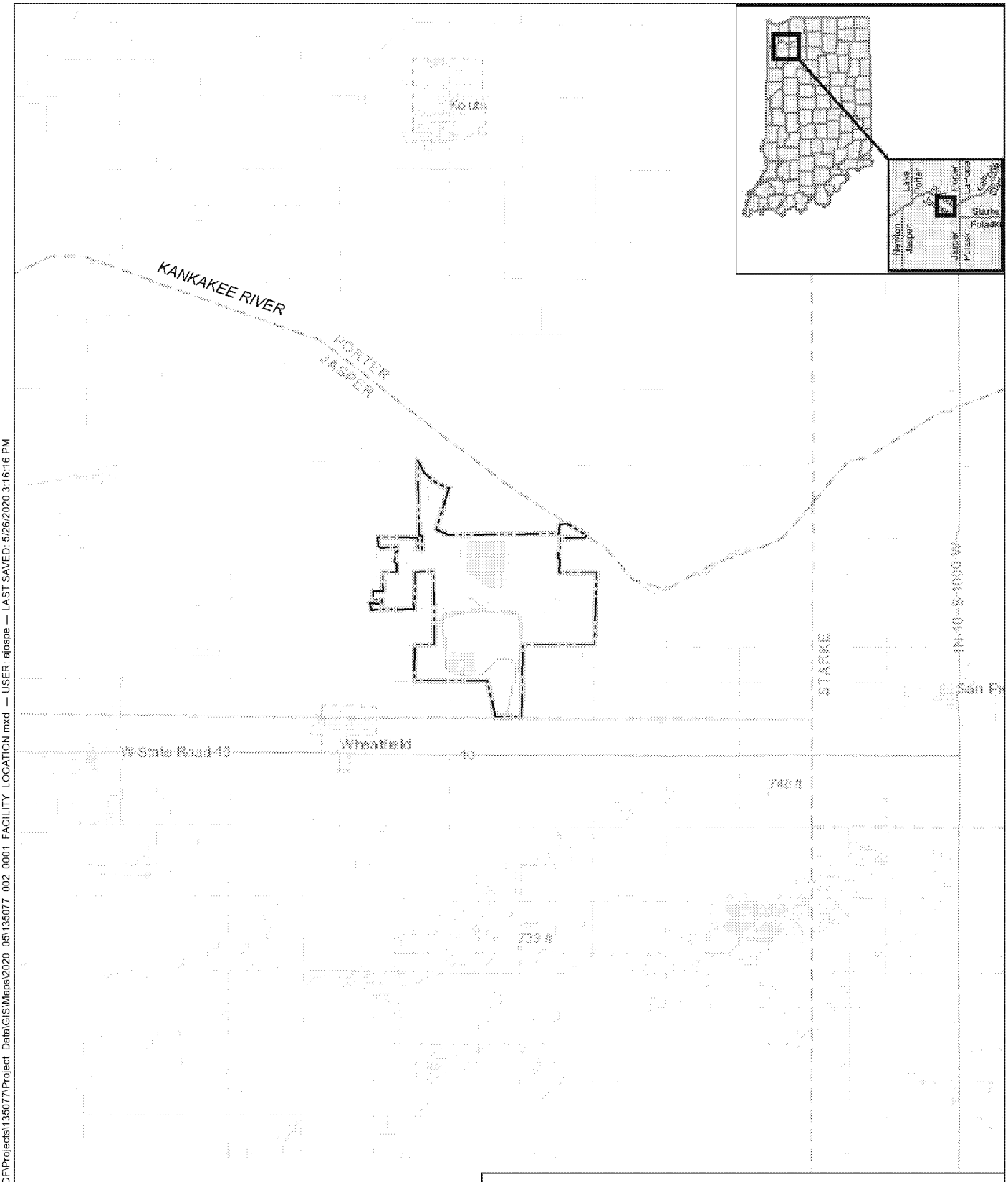
								Dilution Attenuation Factor - Davis Ditch (c)	38	Waste Disposal Area		
Constituent	CAS RN	HH Calculated Recreational RBSL (a) (mg/L)	ECO SL - Total (acute) (b) (mg/L)	ECO SL - Dissolved (acute) (b) (mg/L)	ECO SL - Total (chronic) (b) (mg/L)	ECO SL - Dissolved (chronic) (b) (mg/L)	Lowest of the Human Health and Ecological Screening Levels for Surface Water (mg/L)	Target Groundwater Screening Level - Davis Ditch (d) (mg/L)	Maximum Groundwater Concentration - Waste Disposal Area (e) (mg/L)		Ratio Between Target Groundwater Screening Level and the Maximum Groundwater Concentration (f)
Detection Monitoring - USEPA Appendix III Constituents (g)											
Boron	7440-42-8	114	NA	NA	NA	NA	114	4,332	8.1	GAMW60B	>530
Chloride	16887-00-6	NA	860	860	230	230	230	8,740	120	GAMW14B	>72
Fluoride	16984-48-8	22.9	NA	NA	NA	NA	22.9	870	0.83	GAMW51B	>1,000
Assessment Monitoring - USEPA Appendix IV Constituents											
Antimony	7440-36-0	0.171	NA	NA	0.08	NA	0.08	3.0	0.0016	GAMW01/GAMW14	>1,800
Arsenic	7440-38-2	0.0236	0.36	0.36	0.19	0.19	0.0236	0.90	0.054	GAMW44	>16
Barium	7440-39-3	63.7	NA	NA	0.22	NA	0.22	8.4	0.19	GAMW01B	>43
Beryllium	7440-41-7	0.121	NA	NA	0.0036	NA	0.0036	0.14	0.0019	GAMW43	>71
Cadmium	7440-43-9	0.134	0.0039	0.0037	0.0011	0.0010	0.0010	0.04	0.0004	GAMW58	>97
Chromium (Total)	7440-47-3	155	1.7	0.55	0.21	0.18	0.18	7	0.0044	GAMW14B	>1,500
Cobalt	7440-48-4	0.178	NA	NA	0.024	NA	0.024	0.91	0.052	GAMW14	>17
Lead	7439-92-1	0.015	0.082	0.065	0.0032	0.0025	0.0025	0.10	0.0012	GAMW14B/GAMW58	>79
Lithium	7439-93-2	1.14	NA	NA	NA	NA	1.14	43	0.064	GAMW51B	>670
Mercury	7439-97-6	0.0956	0.0024	0.0014	0.000012	0.00077	0.000012	0.00046	ND	NA	NA
Molybdenum	7439-98-7	2.86	NA	NA	NA	NA	2.86	109	0.39	GAMW60B	>270
Selenium	7782-49-2	2.86	0.13	NA	0.035	0.0031	0.0031	0.12	0.0077	GAMW01	>15
Thallium	7440-28-0	0.00572	NA	NA	0.01	NA	0.00572	0.22	0.00094	GAMW44	>230
Radiological (pCi/L)											
Radium-226 & 228	7440-14-4	NA	NA	NA	NA	NA	NA	NA	3.26	GAMW14B	NA

Notes:

CAS RN - Chemical Abstracts Service Registry Number.
ECO SL - Ecological Screening Level.
HH - Human Health.
IDEM - Indiana Department of Environmental Management.
mg/L - milligram per liter.
NA - Not Available.
ND- Not Detected.
NRWQC - National Recommended Water Quality Criteria.
RBSL - Risk-Based Screening Level.
pCi/L - picoCuries/liter.
USEPA - United States Environmental Protection Agency.

(a) - The Human Health Calculated Screening Levels are presented in Table 3.
The minimum calculated value for the Off-Site Recreational Wader and Swimmer was selected.
(b) - Ecological Screening Levels selected in Table 4 using the following hierarchy:
1) IDEM Aquatic Life Criterion (current).
2) IDEM Aquatic Life Criterion (proposed).
3) USEPA Region 5. Freshwater Screening Values.
4) USEPA NRWQC. Aquatic Life Criteria - Freshwater.
(c) - Estimated value, see Appendix B for derivation.
(d) - The Target Groundwater Screening Level = Minimum SL x Dilution Factor.
(e) - Maximum concentration from downgradient wells.
(f) - Ratio = Target Groundwater Screening Level / Maximum Groundwater Concentration.
(g) - Detection Monitoring - EPA Appendix III Constituents without health risk-based screening levels are not included.

FIGURES



GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\135077\Project_Data\GIS\Maps\2020_05\135077_002_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 5/26/2020 3:16:16 PM

LEGEND

APPROXIMATE SITE BOUNDARY

NOTES

1. SITE BOUNDARY APPROXIMATED FROM GOLDER ASSOCIATES REPORT.
2. BASE MAP SOURCE: ESRI

N

0 5,000 10,000

SCALE IN FEET

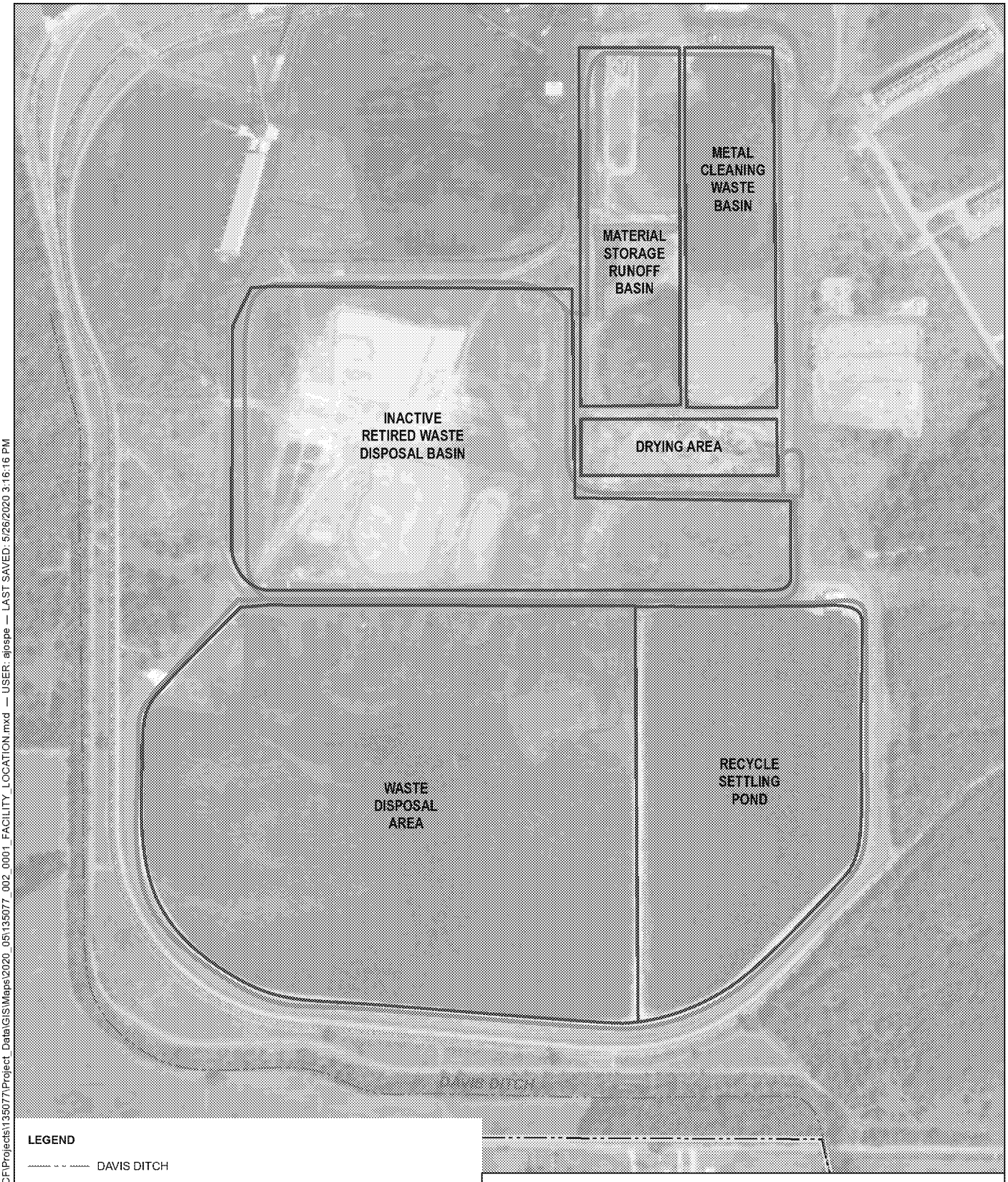
HALEY ALDRICH

SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

FACILITY LOCATION

MAY 2020

FIGURE 1



LEGEND

- DAVIS DITCH
- SLURRY WALL
- FACILITY FEATURE
- SITE BOUNDARY

NOTES

1. SITE BOUNDARY APPROXIMATED FROM GOLDER ASSOCIATES REPORT.
2. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
3. BASE MAP SOURCE: ESRI

N

0 300 600

SCALE IN FEET

HALEY ALDRICH

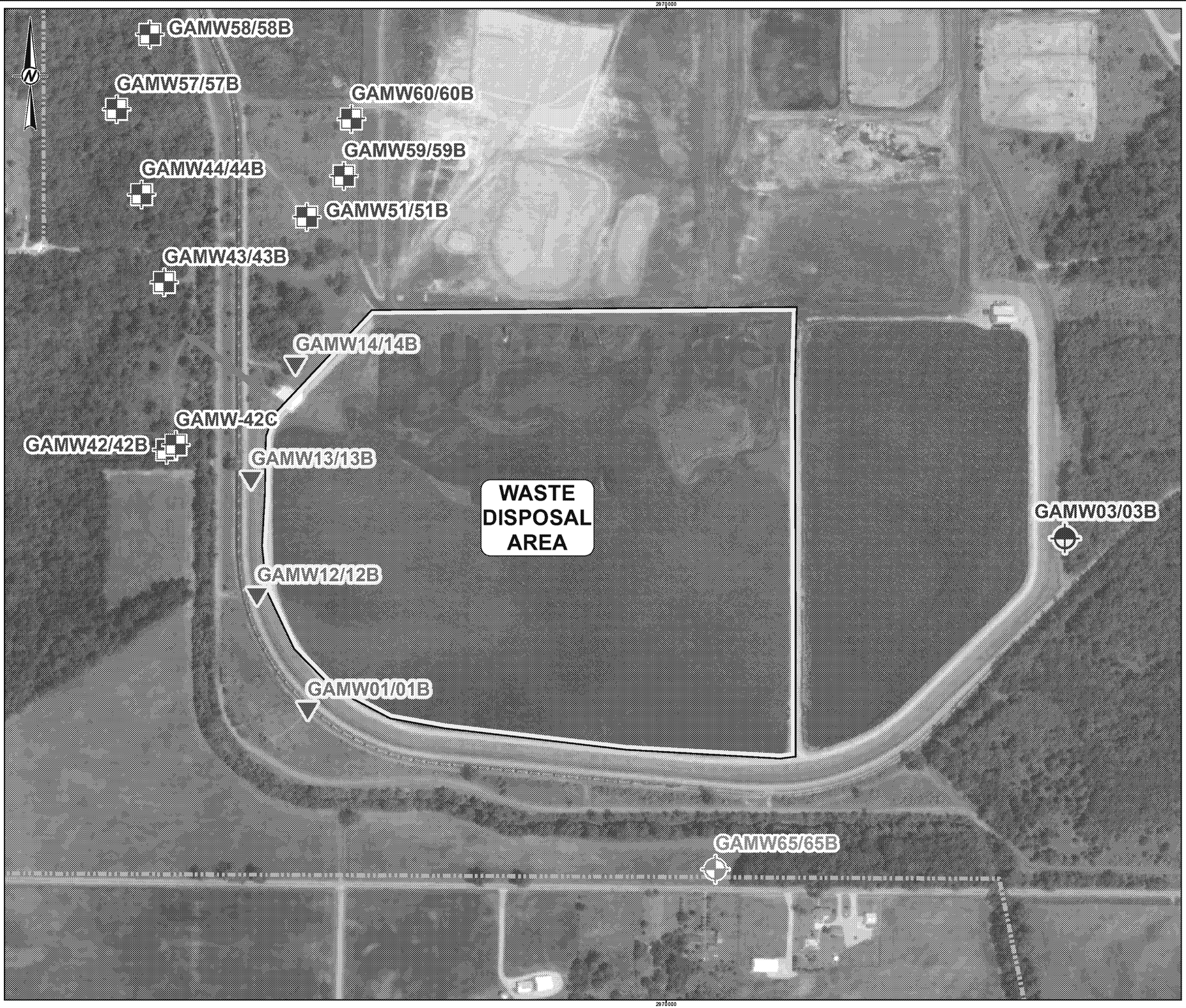
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

FACILITY FEATURES

MAY 2020

FIGURE 2

GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\135077\Project_Data\GIS\Maps\2020_05\135077_002_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 5/26/2020 3:16:16 PM



LEGEND

- Assessment Monitoring Well
- Background Monitoring Well
- Downgradient Monitoring Well
- Proposed Monitoring Well
- Generalized Groundwater Flow Direction
- Approximate Property Line
- CCR Unit

0 800
1 " = 400 feet Feet

NOTE(S)

REFERENCE(S)
1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT
NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE
WELL LOCATION MAP
WASTE DISPOSAL AREA

CONSULTANT
GOLDER

YYYY-MM-DD	8/19/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
19121567	A	0	3

FIGURE 4
POTABLE WATER SUPPLY WELLS
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

9/21/2020, 9:53:12 AM

* Not used for potable water supply.

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Groundwater Wells

- Energy Production
- Public Supply

Surface Water Intakes

- Irrigation

Facilities

- Energy Production
- Irrigation
- Public Supply

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

InDNRMaps
IN Dept. Natural Resources 2018

LEGEND

Non-NIPSCO Owned Water Wells (IDNR)

- Field Located (29 Well Locations)
- Location Estimated (46 Well Locations)

NIPSCO Water Well Location and Frequency

- Single Well Location (40)
- 2 Overlapping Well Locations (1)
- 3 Overlapping Well Locations (2)
- 6 Overlapping Well Locations (1)

Non-NIPSCO Owned Water Well Location and Frequency

- Single Well Location (68)
- 2 Overlapping Well Locations (4)
- 1 Mile Buffer
- Approximate Property Line

FIGURE NARRATIVE

This figure shows groundwater well locations near the R.M. Schahfer Generating Station based on a search of the Indiana Department of Natural Resources (IDNR), Division of Water database. Color flooding represents multiple well records at one location. NIPSCO owned wells are not included in the 1 mile radius count. The plotted well locations include both IDNR-field verified and estimated locations based on the Indiana Public Land Survey System. Golder did not field verify any of the well locations, which should only be used for qualitative purposes. Data are current as of June 16, 2016. Additional wells may be present

REFERENCES

IMAGERY: USDA Farm Sevice Agency 2016 NAIP.
WATERWELLS_IDNR_IN: Water-Well Locations in Indiana (Indiana Department of Natural Resources, Point Shapefile), 20160616.

0 1,500 3,000 6,000 Feet

1 inch = 3,000 feet

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW

PROJECT
NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE
ON-LINE WELL SURVEY

1 MILE RADIUS AROUND PROPERTY BOUNDARY

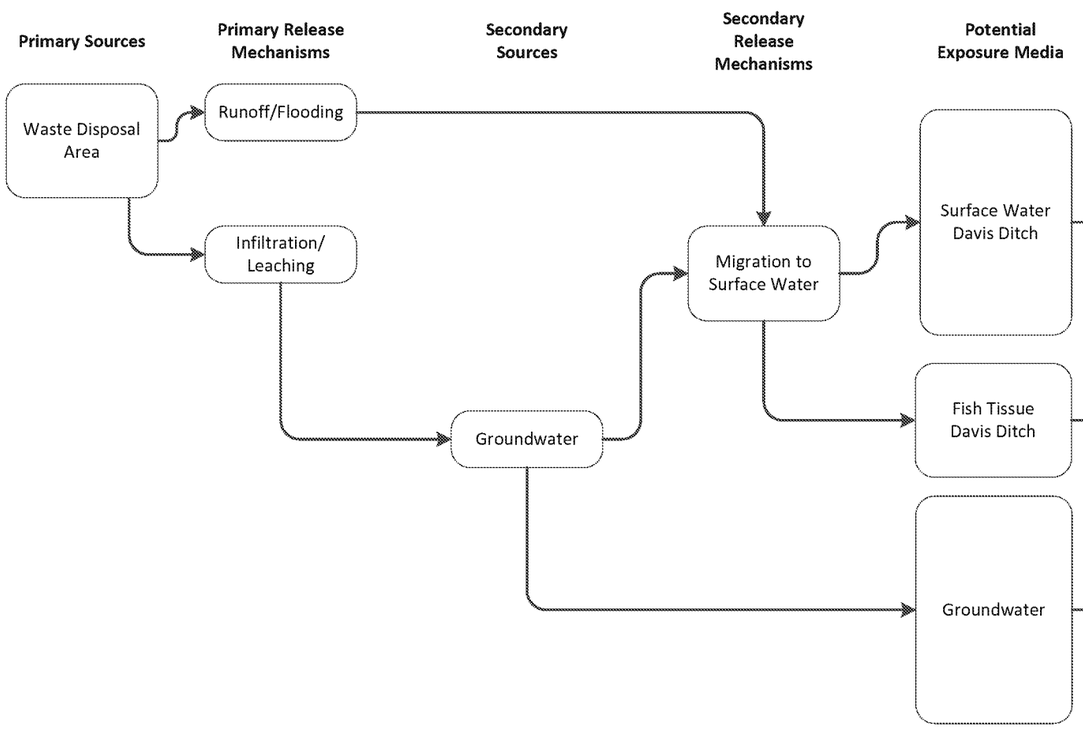
GOLDER
Manchester, New Hampshire

PROJECT No.		164-8174	FILE No.	P1648171A032_1milebuffer
DESIGN	DFS	2018-04-18	SCALE: AS SHOWN	REV. 1
GIS	SHL/JB	2018-04-18		
CHECK				
REVIEW				

FIGURE 5

Path: V:\001 GIS Projects\2016\P1648171_NIPSCO\MDX\ST_AIREV1\P1648171A032_1milebuffer.mxd

FIGURE 6
CONCEPTUAL SITE MODEL
RISK ASSESSMENT
WASTE DISPOSAL AREA
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA



Potential Exposure Route	Potential Human Health Receptors: Current/Future Off-Site Resident Adult/Child	Current/Future Off-Site Recreational User (Swimmer/ Wader)	Current/Future Off-Site Recreational Fisher (c)	Current/Future Facility Worker (d)	Potential Ecological Receptors: Aquatic Receptors
Surface Water Davis Ditch					
Drinking Water Use	○ (a)	○	○	○	NA
Incidental Ingestion	○	⊙	○	○	NA
Dermal Contact	○	⊙	○	○	NA
Aquatic Exposure	NA	NA	NA	NA	⊙
Fish Tissue Davis Ditch					
Ingestion	○	○	○	○	NA
Aquatic Exposure	NA	NA	NA	NA	⊙
Groundwater					
Drinking Water Use	⊙ (b)	○	○	⊙ (d)	NA
Incidental Ingestion	○	○	○	○	NA
Dermal Contact	○	○	○	○	NA
Aquatic Exposure	NA	NA	NA	NA	○ (e)

Notes:

● Pathway potentially complete

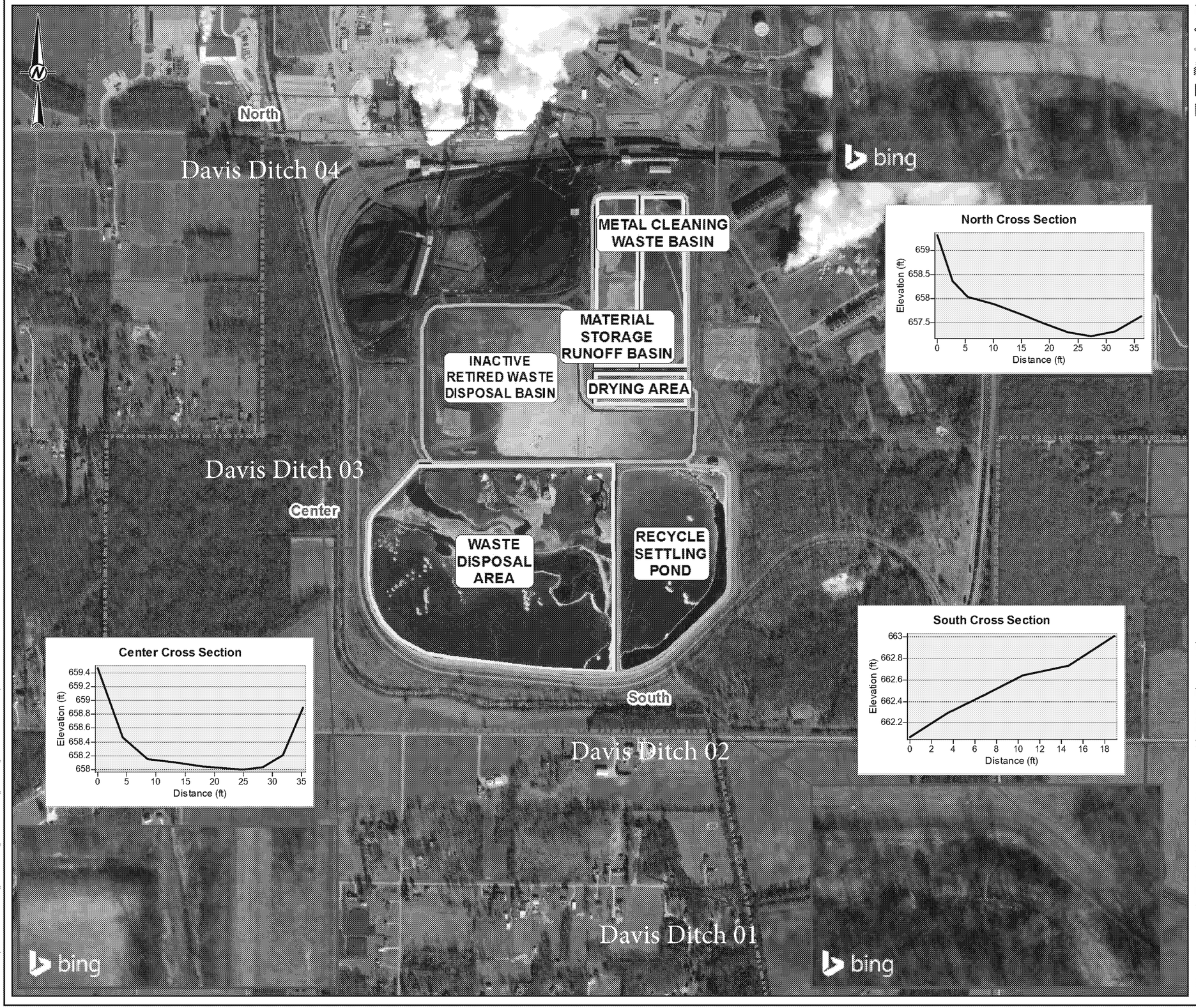
⊙ Pathway potentially complete – pathway evaluated in this risk assessment; results indicate no risk to human health or the environment.

○ Pathway evaluated and found incomplete; results indicate no risk to human health or the environment.

(a) Davis Ditch is not used as a source of drinking water.
(b) It was assumed that the shallow alluvial aquifer within a mile radius of the WDA is used for drinking water purposes.
(c) It was assumed that Davis Ditch is not large enough to support a consumptive fishery.
(d) Facility workers are assumed to be covered by OSHA regulations, however facility worker exposure to groundwater as potable water for the Site was evaluated as a potentially complete pathway.
(e) Ecological Receptors are not exposed to groundwater.

NA – Not Applicable.

HALEY ALDRICH



LEGEND

- Stream Crossing Cross Section Location
- Slurry Wall
- Approximate Property Line
- CCR Units
- Inactive Retired Waste Disposal Basin

0 850 1,700

1 " = 850 feet Feet

NOTE(S)

1. WATER LEVEL MEASUREMENTS COLLECTED ON MARCH 13TH 2020.

REFERENCE(S)

1. SERVICE LAYER CREDITS: © 2020 MICROSOFT CORPORATION © 2020 MAXAR ©CNES (2020) DISTRIBUTION AIRBUS DS
2. 2013 ELEVATION DATA DOWNLOADED FROM INDIANA UNIVERSITY'S INDIANA SPATIAL DATA PORTAL ON 6/16/2020.

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

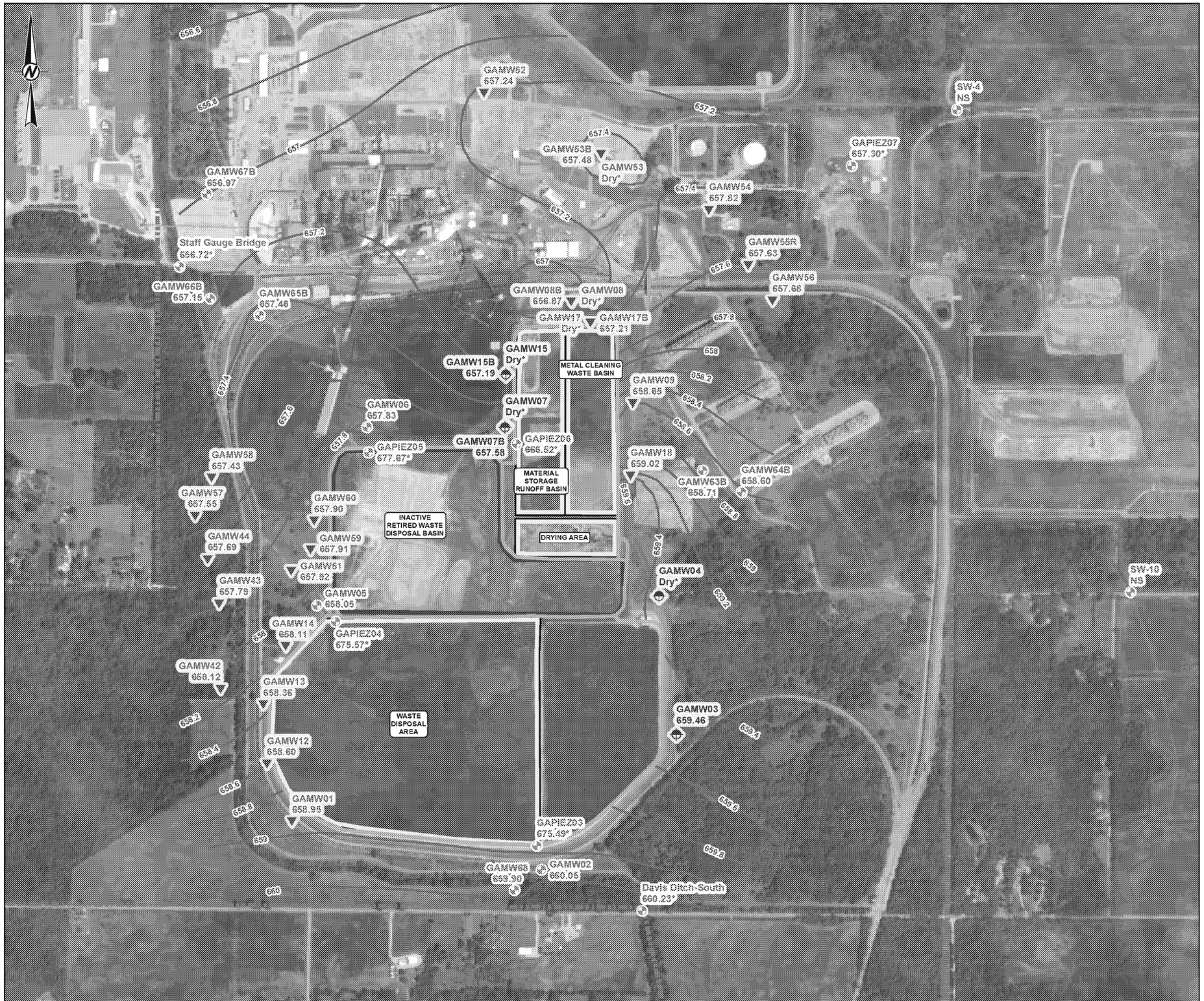
SURFACE WATER SAMPLING LOCATIONS AND STREAM CROSSING CROSS SECTION LOCATION (2013 ELEVATION)

CONSULTANT

GOLDER

YYYY-MM-DD	2020-06-23
DESIGNED	JSP
PREPARED	TBH
REVIEWED	-
APPROVED	-

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	7



LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Non-CCR Well
- Slurry Wall
- Approximate Property Line
- CCR Units
- Inactive Retired Waste Disposal Basin

0 800 1,600

1 " = 800 feet Feet

FIGURE NARRATIVE

THIS FIGURE DEPICTS THE GROUNDWATER ELEVATION, AS MEASURED IN 50 MONITORING WELLS SCREENED WITHIN THE UPPER PORTION OF THE SURFICIAL AQUIFER, AND IS INTENDED TO REPRESENT THE APPROXIMATE ELEVATION OF THE GROUNDWATER POTENTIOMETRIC SURFACE. THE POSTED DATA WERE CALCULATED FROM DEPTH TO WATER MEASUREMENTS MADE BY GOLDER ON AUGUST 28, 2020.

THE DIRECTION OF HORIZONTALGROUNDWATER FLOW AT AND NEAR THE POTENTIOMETRIC SURFACE CAN BE GENERALLY INTERPRETED AS BEING PERPENDICULAR TO THE GROUNDWATER ELEVATION CONTOURS. GOLDER INFERRED THE ELEVATION CONTOURS BASED ON THE DATA ILLUSTRATED.

THE ACTUAL ELEVATION OF THE POTENTIOMETRIC SURFACE IS LIKELY MORE HETEROGENEOUS THAN SHOWN AND ACTUAL CONDITIONS WILL VARY. OTHER INTERPRETATIONS ARE POSSIBLE. THE DEPTH TO GROUNDWATER IS KNOWN TO VARY WITH TIME.

NOTE(S)

1. NS INDICATES LOCATION WAS NOT SAMPLED.
2. * INDICATES NOT USED IN CONTOURING

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATION CONTOURS (AUGUST 2020)

CONSULTANT

GOLDER

YYYY-MM-DD	2020-09-21
DESIGNED	JSP
PREPARED	TBH
REVIEWED	-
APPROVED	-

PROJECT NO.	CONTROL	REV.	FIGURE
19121567	A	0	8

APPENDIX A

Calculated Recreational Risk-Based Screening Levels

TABLE A-1
HUMAN HEALTH EXPOSURE PARAMETERS FOR DERIVATION OF RISK BASED SCREENING LEVELS (RBSLs) - RECREATIONAL SURFACE WATEF

			Current/Future Off-Site Recreational Swimmer								Current/Future Off-Site Recreational Wader							
Exposure Parameter		Units	Child (Age <6)		Adolescent (6-<16 years)		Adult		Child, Adolescent and Adult (Ages 1 - 26)		Child (Age <6)		Adolescent (6-<16 years)		Adult		Child, Adolescent and Adult (Ages 1 - 26)	
Standard Parameters																		
Body Weight	BW	kg	15	USEPA, 2011 [1]	44	USEPA, 2011 [1]	80	USEPA, 2014a	NA		15	USEPA, 2011 [1]	44	USEPA, 2011 [1]	80	USEPA, 2014a	NA	
Exposure Duration	ED	years	6	Ages <6	10	Ages 6 - <16	10	Balance of 26-yr exposure	26		6	Ages <6	10	Ages 6 - <16	10	Balance of 26-yr exposure	26	
Non-carcinogenic Averaging Time	Atnc	days	2190	ED expressed in days	3650	ED expressed in days	3650	ED expressed in days	9490	ED expressed in days	2190	ED expressed in days	3650	ED expressed in days	3650	ED expressed in days	9490	ED expressed in days
Carcinogenic Averaging Time	Atc	days	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime
Incidental Ingestion of Surface Water																		
Exposure Frequency	EF	days/year	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b
Water Ingestion Rate	IR	L/day	0.10	USEPA, 2014b [2]	0.10	USEPA, 2014b [2]	0.10	USEPA, 2014b [2]	NA		0.10	USEPA, 2014b [2]	0.02	USEPA, 2014b [2]	0.02	USEPA, 2014b [2]	NA	
Fraction Ingested	FI	unitless	1.0	Assumption	1.0	Assumption	1.0	Assumption	1.0	Assumption	1.0	Assumption	1.0	Assumption	1.0	Assumption	1.0	Assumption
Age-Adjusted Water Ingestion Factor	IFWadj	L/kg	NA		NA		NA		3.39		NA		NA		NA		2.12	
Age-Adjusted Water Ingestion Factor-Mutagenic	IFWM	L/kg	NA		NA		NA		13.23		NA		NA		NA		10.33	
Dermal Exposure with Surface Water																		
Exposure Frequency	EF	days/year	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b	45	USEPA, 2014b
Exposed Skin Surface Area	SA	cm^2	6365	USEPA, 2014a	13350	USEPA, 2011 [3]	19652	USEPA, 2014a	NA		1770	USEPA, 2011 [4]	3820	USEPA, 2011 [4]	5790	USEPA, 2011 [4]	NA	
Exposure Time	t-event	hr/event	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific [5]	2	Site-specific
Events per Day	EV	event/day	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific [5]	1.0	Site-specific
Age-Adjusted Dermal Contact Factor	DFWadj	events-cm^2/kg	NA		NA		NA		361647		NA		NA		NA		103497	
Age-Adjusted Dermal Contact Factor-Mutagenic	DFWM	events-cm^2/kg	NA		NA		NA		1131185		NA		NA		NA		319693	

NOTES AND ABBREVIATIONS

USEPA, 2002 - Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OWSWER 9355.4-24
USEPA, 2011 - Exposure Factors Handbook. USEPA/600/R-10/030. October, 2011.
USEPA, 2014a - Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER 9200.1-120. February 6, 2014.
USEPA, 2014b - Region 4 Human Health Risk Assessment Supplemental Guidance. January 2014. Draft Final.
[1] - Table 8-1 of USEPA (2011).
[2] - Ingestion rate of 50 ml/hour of surface water is used for exposures to water during swimming. Intake rates for exposure to surface water during wading are 50 ml/hour for children 1-6, and 10 ml/hour for adolescents and adults.
The water ingestion rate in liters/day is calculated as follows: ingestion (ml/hr) x exposure time (hr/event)/1000 (ml/L).
[3] - Based on weighted average of mean values for 6-<16 years.
[4] - Based on surface area of hands, forearms, lower legs, and feet.
[5] - Assumes 2 hours per event and that on days when recreation in water occurs, all daily exposure to water is derived from locations at the Site.

Values based on a time-weighted average of child, adolescent, and adult exposure values are calculated as follows:
Water
IFWadj = (child ED [0-2] x child EF [0-2] x child IR [0-2] / child BW [0-2]) + (child ED [2-6] x child EF [2-6] x child IR [2-6] / child BW [2-6]) + (older child ED [6-16] x older child EF [6-16] x older child IR [6-16] / older child BW [6-16]) + (adult ED x adult EF x adult IR / adult BW)
DFWadj = (child EF [0-2] x child ED [0-2] x child SA [0-2] x child EV [0-2] / child BW [0-2]) + (child EF [2-6] x child ED [2-6] x child SA [2-6] x child EV [2-6] / child BW [2-6]) + (older child EF [6-16] x older child ED [6-16] x older child SA [6-16] x older child EV [6-16] / older child BW [6-16]) + (adult EF x adult ED x adult SA x adult EV / adult BW)
Water - mutagenic
IFWM = (child ED [0-2] x child EF [0-2] x child IR [0-2] x ADAF [0-2] / child BW [0-2]) + (child ED [2-6] x child EF [2-6] x child IR [2-6] x ADAF [2-6] / child BW [2-6]) + (older child ED [6-16] x child EF [6-16] x older child IR [6-16] x ADAF [6-16] / older child BW [6-16]) + (adult ED x adult EF x adult IR x adult ADAF / adult BW)
DFWM = (child EF [0-2] x child ED [0-2] x child SA [0-2] x child EV [0-2] x ADAF [0-2] / child BW [0-2]) + (child EF [2-6] x child ED [2-6] x child SA [2-6] x child EV [2-6] x ADAF [2-6] / child BW [2-6]) + (older child EF [6-16] x older child ED [6-16] x older child SA [6-16] x older child EV [6-16] x ADAF [6-16] / older child BW [6-16]) +
(adult EF x adult ED x adult SA x adult EV x adult ADAF / adult BW)

USEPA guidance for early life exposure to carcinogens (USEPA, 2005) requires that risks for potentially carcinogenic constituents that are presumed to act by a mutagenic mode of action be calculated differently than for constituents that do not act via a mutagenic mode of action.
Therefore, the age-dependent adjustment factors (ADAF) will be applied for calculations involving children under the age of 16. The ADAFs are as follows:

Age 0 to 2 years (2 year interval from birth until 2nd birthday) – ADAF = 10

Ages 2 to 16 years (14 year interval from 2nd birthday to 16th birthday) – ADAF = 3

Ages 16 and up (after 16th birthday) – no adjustment - ADAF = 1

The exposure parameters for children ages <6 are applied to children 0 - 2 and 2- 6.

Current/Future Off-Site Recreational Swimmer

Site-specific

Recreator Equation Inputs for Surface Water

*** Inputted values different from Recreator defaults are highlighted.**

Variable	Recreator Surface Water Default Value	Form-input Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	44
BW_{16-30} (body weight) kg	80	80
BW_{a} (body weight - adult) kg	80	62
BW_{rec-a} (body weight - adult) kg	80	62
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	0	354100.645
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	0	1131184.77
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) years	2	2
ED_{2-6} (exposure duration) years	4	4
ED_{6-16} (exposure duration) years	10	10
ED_{16-30} (exposure duration) years	10	10
ED_{rec-a} (exposure duration - adult) years	20	20
EF_{rec-w} (exposure frequency) days/yea	0	45
EF_{2-6} (exposure frequency) days/yea	0	45
EF_{6-16} (exposure frequency) days/yea	0	45
EF_{16-30} (exposure frequency) days/yea	0	45
EF_{rec-a} (adult exposure frequency) days/yea	0	45
ET_{0-2} (exposure time) hours/event	0	2
ET_{2-6} (exposure time) hours/event	0	2
ET_{6-16} (exposure time) hours/event	0	2
ET_{16-30} (exposure time) hours/event	0	2
ET_{rec-a} (adult exposure time) hours/event	0	2
EV_{0-2} (events) events/day	0	1
EV_{2-6} (events) events/day	0	1
EV_{6-16} (events) events/day	0	1
EV_{16-30} (events) events/day	0	1
EV_{rec-a} (adult) events/day	0	1
THQ (target hazard quotient) unitless	0.1	1
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	0	6.503
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate) L/kg	0	26.461
IRW_{0-2} (water intake rate) L/hour	0.12	0.1
IRW_{2-6} (water intake rate) L/hour	0.12	0.1
IRW_{6-16} (water intake rate) L/hour	0.124	0.1
IRW_{16-30} (water intake rate) L/hour	0.0985	0.1
IRW_{rec} (water intake rate - adult) L/day	0.11	0.1
IRW_{rec-a} (water intake rate - adult) L/hr	0.11	0.1
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2	6365	6365
SA_{2-6} (skin surface area) cm^2	6365	6365
SA_{6-16} (skin surface area) cm^2	19652	13350
SA_{16-30} (skin surface area) cm^2	19652	19652
SA_{rec} (skin surface area - adult) cm^2	19652	16501
SA_{rec-a} (skin surface area - adult) cm^2	19652	16501
Apparent thickness of stratum corneum (cm)	0.001	0.001
TR (target risk) unitless	0.000001	0.00001

Output generated 28MAY2020:14:53:40

Site-specific

Recreator Regional Screening Levels (RSL) for Surface Water

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; O = OWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	RAGSe GIABS (unitless)	K_p (cm/hr)	MW	FA (unitless)	In EPD?	$DA_{event(ca)}$	$DA_{event(nc\ child)}$	$DA_{event(nc\ adult)}$	Ingestion SL TR=1E-05 (ug/L)	Dermal SL TR=1E-05 (ug/L)	Carcinogenic SL TR=1E-05 (ug/L)	Ingestion SL (Child) THQ=1 (ug/L)	Dermal SL (Child) THQ=1 (ug/L)	Noncarcinogenic SL (Child) THQ=1 (ug/L)	Ingestion SL (Adult) THQ=1 (ug/L)	Dermal SL (Adult) THQ=1 (ug/L)	Noncarcinogenic SL (Adult) THQ=1 (ug/L)	Screening Level (ug/L)
Antimony (metallic)	7440-36-0	No	No	Inorganics	-		0.0004	I	0.0003	A	0.1500	0.0010	121.7600	1.0000	Yes	-	0.0011	0.0018	-	-	-	243.0000	573.0000	171.0000	1010.0000	914.0000	479.0000	
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.5000	I	0.0003	I	0.0000	C	1.0000	0.0010	74.9220	1.0000	Yes	0.0005	0.0057	0.0091	26.2000	241.0000	23.6000	183.0000	2870.0000	172.0000	754.0000	4570.0000	647.0000	
Barium	7440-39-3	No	No	Inorganics	-		0.2000	I	0.0005	H	0.0700	0.0010	137.3300	1.0000	Yes	-	0.2676	0.4267	-	-	-	122000.0000	134000.0000	63700.0000	503000.0000	213000.0000	150000.0000	
Beryllium and compounds	7440-41-7	No	No	Inorganics	-		0.0020	I	0.0000	I	0.0070	0.0010	9.0100	1.0000	Yes	-	0.0003	0.0004	-	-	-	1220.0000	134.0000	121.0000	5030.0000	213.0000	205.0000	
Boron And Borates Only	7440-42-8	No	No	Inorganics	-		0.2000	I	0.0200	H	1.0000	0.0010	13.8400	1.0000	Yes	-	3.8230	6.0953	-	-	-	122000.0000	1910000.0000	114000.0000	503000.0000	3050000.0000	432000.0000	
Cadmium (Water)	7440-43-9	No	No	Inorganics	-		0.0005	I	0.0000	A	0.0500	0.0010	112.4000	1.0000	Yes	-	0.0005	0.0008	-	-	-	304.0000	239.0000	134.0000	1260.0000	381.0000	292.0000	
Chromium(III), Insoluble Salts	16065-83-1	No	No	Inorganics	-		1.5000	I	-		0.0130	0.0010	52.0000	1.0000	Yes	-	0.3727	0.5943	-	-	-	913000.0000	186000.0000	155000.0000	3770000.0000	297000.0000	275000.0000	
Cobalt	7440-48-4	No	No	Inorganics	-		0.0003	P	0.0000	P	1.0000	0.0004	58.9300	1.0000	Yes	-	0.0057	0.0091	-	-	-	183.0000	7170.0000	178.0000	754.0000	11400.0000	708.0000	
Fluoride	16984-48-8	No	No	Inorganics	-		0.0400	C	0.0130	C	1.0000	0.0010	38.0000	1.0000	Yes	-	0.7646	1.2191	-	-	-	24300.0000	382000.0000	22900.0000	101000.0000	610000.0000	86300.0000	
Lithium	7439-93-2	No	No	Inorganics	-		0.0020	P	-		1.0000	0.0010	6.9400	1.0000	Yes	-	0.0382	0.0610	-	-	-	1220.0000	19100.0000	1140.0000	5030.0000	30500.0000	4320.0000	
Mercuric Chloride	7487-94-7	No	No	Inorganics	-		0.0003	I	0.0003	G	0.0700	0.0010	271.5000	1.0000	Yes	-	0.0004	0.0006	-	-	-	183.0000	201.0000	95.6000	754.0000	320.0000	225.0000	
Molybdenum	7439-98-7	No	No	Inorganics	-		0.0050	I	-		1.0000	0.0010	95.9400	1.0000	Yes	-	0.0956	0.1524	-	-	-	3040.0000	47800.0000	2860.0000	12600.0000	76200.0000	10800.0000	
Selenium	7782-49-2	No	No	Inorganics	-		0.0050	I	0.0200	C	1.0000	0.0010	78.9600	1.0000	Yes	-	0.0956	0.1524	-	-	-	3040.0000	47800.0000	2860.0000	12600.0000	76200.0000	10800.0000	
Thallium (Soluble Salts)	7440-28-0	No	No	Inorganics	-		0.0000	X	-		1.0000	0.0010	204.3800	1.0000	Yes	-	0.0002	0.0003	-	-	-	6.0800	95.6000	5.7200	25.1000	152.0000	21.6000	

Output generated 28MAY2020:14:53:40

Current/Future Off-Site Recreational Wader

Site-specific

Recreator Equation Inputs for Surface Water

*** Inputted values different from Recreator defaults are highlighted.**

Variable	Recreator Surface Water Default Value	Form-input Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	44
BW_{16-30} (body weight) kg	80	80
BW_{a} (body weight - adult) kg	80	62
BW_{rec-a} (body weight - adult) kg	80	62
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm²-event/kg	0	101610
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm²-event/kg	0	319693.295
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) years	2	2
ED_{2-6} (exposure duration) years	4	4
ED_{6-16} (exposure duration) years	10	10
ED_{16-30} (exposure duration) years	10	10
ED_{rec-a} (exposure duration - adult) years	20	20
EF_{rec-w} (exposure frequency) days/year	0	45
EF_{2-6} (exposure frequency) days/year	0	45
EF_{6-16} (exposure frequency) days/year	0	45
EF_{16-30} (exposure frequency) days/year	0	45
EF_{rec-a} (adult exposure frequency) days/year	0	45
ET_{0-2} (exposure time) hours/event	0	2
ET_{2-6} (exposure time) hours/event	0	2
ET_{6-16} (exposure time) hours/event	0	2
ET_{16-30} (exposure time) hours/event	0	2
ET_{rec-a} (adult exposure time) hours/event	0	2
EV_{0-2} (events) events/day	0	1
EV_{2-6} (events) events/day	0	1
EV_{6-16} (events) events/day	0	1
EV_{16-30} (events) events/day	0	1
EV_{rec-a} (adult) events/day	0	1
THQ (target hazard quotient) unitless	0.1	1
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	0	4.181
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate) L/kg	0	20.652
IRW_{0-2} (water intake rate) L/hour	0.12	0.1
IRW_{2-6} (water intake rate) L/hour	0.12	0.1
IRW_{6-16} (water intake rate) L/hour	0.124	0.02
IRW_{16-30} (water intake rate) L/hour	0.0985	0.02
IRW_{rec} (water intake rate - adult) L/day	0.11	0.02
IRW_{rec-a} (water intake rate - adult) L/hr	0.11	0.02
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm²	6365	1770
SA_{2-6} (skin surface area) cm²	6365	1770
SA_{6-16} (skin surface area) cm²	19652	3820
SA_{16-30} (skin surface area) cm²	19652	5790
SA_{rec} (skin surface area - adult) cm²	19652	4805
SA_{rec-a} (skin surface area - adult) cm²	19652	4805
Apparent thickness of stratum corneum (cm)	0.001	0.001
TR (target risk) unitless	0.000001	0.00001

Output generated 28MAY2020:15:12:47

Site-specific

Recreator Regional Screening Levels (RSL) for Surface Water

Key: I = IRIS, P = PPRTV; O = OPP; A = ATSDR, C = Cal EPA, X = PPRTV Screening Level; H = MEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	RAGSe GIABS (unitless)	K_p (cm/hr)	MW	FA (unitless)	In EPD?	$DA_{event(c)}$	$DA_{event(nc)}$	$DA_{event(nc,adult)}$	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL (Child) THQ=1 (ug/L)	Dermal SL (Child) THQ=1 (ug/L)	Noncarcinogenic SL (Child) THQ=1 (ug/L)	Ingestion SL (Adult) THQ=1 (ug/L)	Dermal SL (Adult) THQ=1 (ug/L)	Noncarcinogenic SL (Adult) THQ=1 (ug/L)	Screening Level (ug/L)
Antimony (metallic)	7440-36-0	No	No	Inorganics	-		0.0004	I	0.0003	A	0.1500	0.0010	121.7600	1.0000	Yes	-	0.0041	0.0063	-	-	-	243.0000	2060.0000	216.0000	5030.0000	3140.0000	1930.0000	
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.5000	I	0.0003	I	0.0000	C	1.0000	0.0010	74.9220	1.0000	Yes	0.0017	0.0206	0.0314	40.7000	838.0000	38.9000	183.0000	10300.0000	179.0000	3770.0000	15700.0000	3040.0000	
Barium	7440-39-3	No	No	Inorganics	-		0.2000	I	0.0005	H	0.0700	0.0010	137.3300	1.0000	Yes	-	0.9623	1.4652	-	-	-	122000.0000	481000.0000	97100.0000	2510000.0000	733000.0000	567000.0000	
Beryllium and compounds	7440-41-7	No	No	Inorganics	-		0.0020	I	0.0000	I	0.0070	0.0010	9.0100	1.0000	Yes	-	0.0010	0.0015	-	-	-	1220.0000	481.0000	345.0000	25100.0000	733.0000	712.0000	
Boron And Borates Only	7440-42-8	No	No	Inorganics	-		0.2000	I	0.0200	H	1.0000	0.0010	13.8400	1.0000	Yes	-	13.7476	20.9319	-	-	-	122000.0000	6870000.0000	120000.0000	2510000.0000	10500000.0000	2030000.0000	
Cadmium (Water)	7440-43-9	No	No	Inorganics	-		0.0005	I	0.0000	A	0.0500	0.0010	112.4000	1.0000	Yes	-	0.0017	0.0026	-	-	-	304.0000	959.0000	225.0000	6250.0000	1310.0000	1080.0000	
Chromium(III), Insoluble Salts	16065-83-1	No	No	Inorganics	-		1.5000	I	-		0.0130	0.0010	52.0000	1.0000	Yes	-	1.3404	2.0409	-	-	-	913000.0000	870000.0000	386000.0000	18900000.0000	1020000.0000	968000.0000	
Cobalt	7440-48-4	No	No	Inorganics	-		0.0003	P	0.0000	P	1.0000	0.0004	58.9300	1.0000	Yes	-	0.0206	0.0314	-	-	-	183.0000	25800.0000	181.0000	3770.0000	39200.0000	3440.0000	
Fluoride	16984-48-8	No	No	Inorganics	-		0.0400	C	0.0130	C	1.0000	0.0010	38.0000	1.0000	Yes	-	2.7495	4.1864	-	-	-	24300.0000	1370000.0000	23900.0000	503000.0000	2090000.0000	405000.0000	
Lithium	7439-93-2	No	No	Inorganics	-		0.0020	P	-		1.0000	0.0010	6.9400	1.0000	Yes	-	0.1375	0.2093	-	-	-	1220.0000	68700.0000	1200.0000	25100.0000	105000.0000	20300.0000	
Mercuric Chloride	7487-94-7	No	No	Inorganics	-		0.0003	I	0.0003	G	0.0700	0.0010	271.5000	1.0000	Yes	-	0.0014	0.0022	-	-	-	183.0000	722.0000	146.0000	3770.0000	1100.0000	851.0000	
Molybdenum	7439-98-7	No	No	Inorganics	-		0.0050	I	-		1.0000	0.0010	95.9400	1.0000	Yes	-	0.3437	0.5233	-	-	-	3040.0000	172000.0000	2990.0000	62900.0000	262000.0000	50700.0000	
Selenium	7782-49-2	No	No	Inorganics	-		0.0050	I	0.0200	C	1.0000	0.0010	78.9600	1.0000	Yes	-	0.3437	0.5233	-	-	-	3040.0000	172000.0000	2990.0000	62900.0000	262000.0000	50700.0000	
Thallium (Soluble Salts)	7440-28-0	No	No	Inorganics	-		0.0000	X	-		1.0000	0.0010	204.3800	1.0000	Yes	-	0.0007	0.0010	-	-	-	6.0800	344.0000	5.9800	126.0000	523.0000	101.0000	

Output generated 28MAY2020:15:12:47

APPENDIX B

Surface Water Dilution Attenuation Factor

ATTACHMENT B

SURFACE WATER DILUTION ATTENUATION FACTOR

This attachment describes the evaluation of the magnitude of dilution effects resulting from the mixing of groundwater that may flow from the Waste Disposal Area (WDA) to Davis Ditch (**Figure B-1**), and describes the development of a dilution attenuation factor (DAF) between groundwater and surface water.

Water impounded in the WDA is contained by a slurry wall that extends from near the ground surface to impermeable shale bedrock at a depth of 35 feet. The slurry wall is constructed of a mixture of sand and bentonite (Golder, 2020a).

The conceptual site model for this evaluation assumes that the slurry wall is reasonably intact (Golder, 2020a), but that some amount of groundwater may escape underneath the slurry wall and impact adjacent groundwater (Golder, 2020b). That groundwater may flow to Davis Ditch. Davis Ditch is part of a regulated drainage network and appears to have an engineered channel for at least three miles upstream of the WDA.

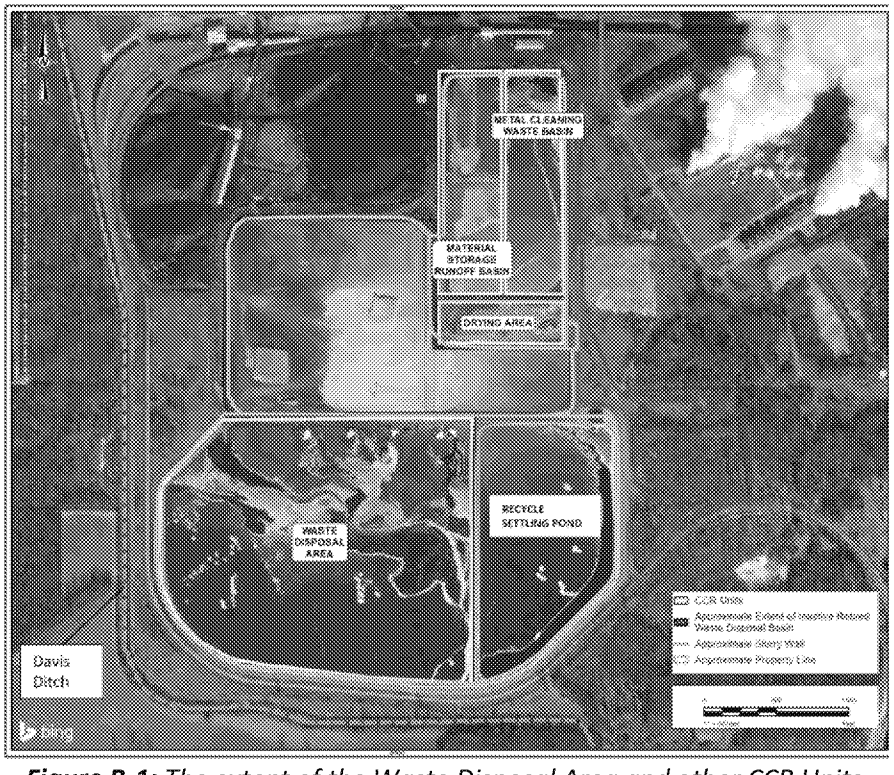


Figure B-1: *The extent of the Waste Disposal Area and other CCR Units.*

Estimation of Dilution and Attenuation Effects

The surface water dilution/attenuation factor (SW-DAF) is a factor that describes the mixing effects on constituent concentration anticipated in a surface water body that receives constituents from groundwater discharge. A site-specific SW-DAF can be estimated using the following formula:

$$\text{SW-DAF} = Q_R \div Q_{GW} \quad (1)$$

where Q_R is the estimated representative river flow rate under low flow conditions and Q_{GR} is the estimated flux of groundwater from the WDA to Davis Ditch.

1. Q_R – Flow of Davis Ditch at the WDA

Davis Ditch runs along the western edge of the site. It is part of a managed drainage network that ultimately discharges to the Kankakee River (**Figure B-2**).

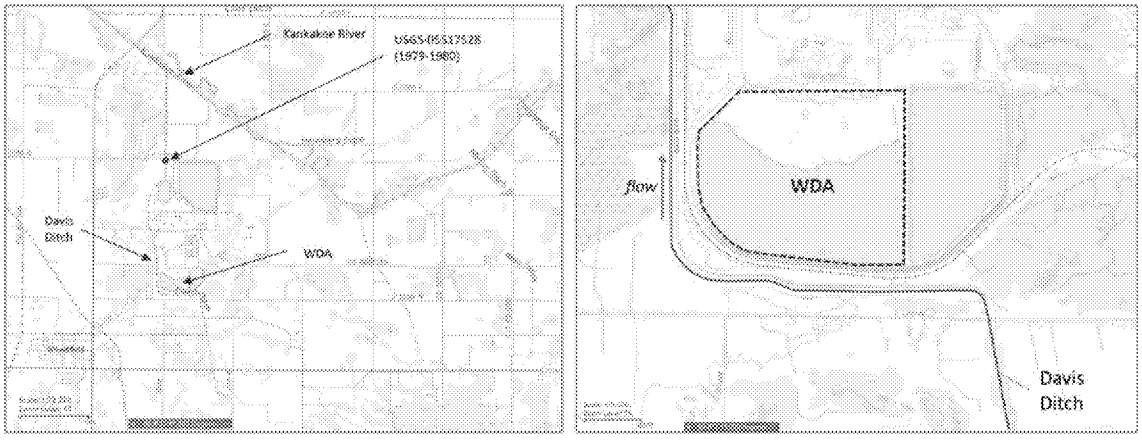


Figure B-2: *Configuration of Davis Ditch relative to the WDA and Kankakee River.*
https://www.usgs.gov/core-science-systems/national-geospatial-program/national-map

Flow characteristics for Davis Ditch can be approximated using the StreamStats tool developed by the United States Geological Survey (USGS) (Ries et al., 2017; https://streamstats.usgs.gov/ss/). The StreamStats results indicate that at the Schahfer Facility, Davis Ditch drains a watershed of approximately 8.4 square miles (**Figure B-3**).

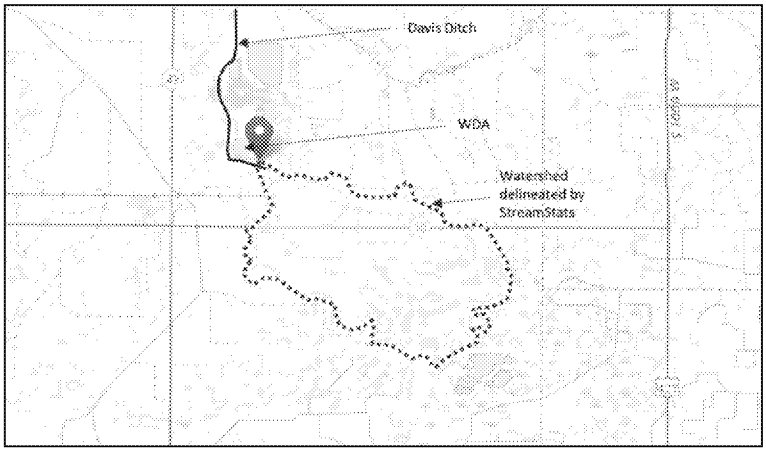


Figure B-3: *Watershed delineated by StreamStats.*

The StreamStats analysis indicates the following low flow conditions in cubic feet per second (cfs):

7 day, 10 year recurrence low flow (7Q10)..... **1.76 cfs**
30 day, 10 year recurrence low flow (30Q10)..... **1.63 cfs**

In 1979-1980, the USGS collected a small set of hydrological data immediately downstream of the Schahfer Facility, with measured discharge between 2 and 30 cfs (**Figure B-4**). It is not known if the ditch and related drainage network were in their present configuration at that time. Although the data are insufficient for statistical analysis, the minimum measured flow value of 2 cfs is consistent with the StreamStats results.

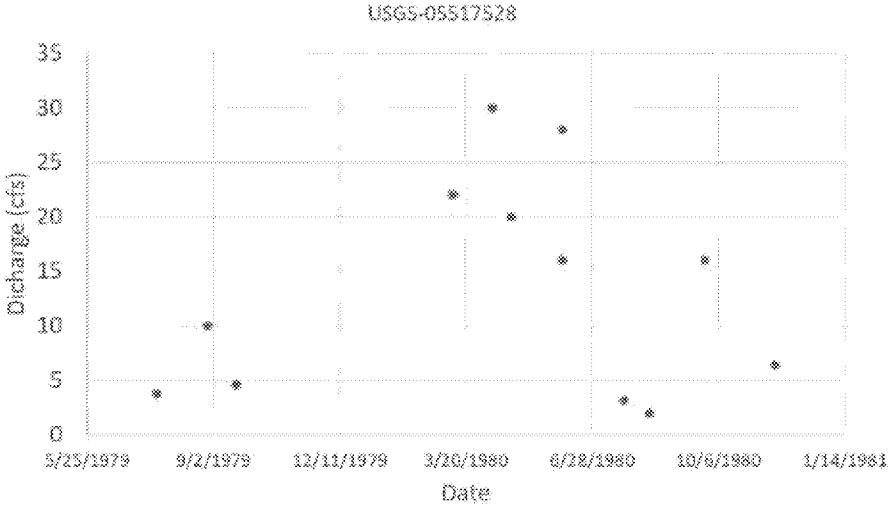


Figure B-4: *Historic flow of Davis Ditch at USGS Station 05517528 (from NDQMC 2020).*

2. Q_{GW} – Flow of groundwater from WDA to Davis Ditch

Water impounded in the WDA is contained by a slurry wall that extends from near the ground surface to impermeable shale bedrock at a depth of 35 feet. Investigations indicate that the WDA slurry wall is reasonably intact (Golder, 2020a). This is borne out by the fact that the slurry wall is able to consistently maintain more than 15 feet of hydraulic head in the WDA (**Figure B-5**).

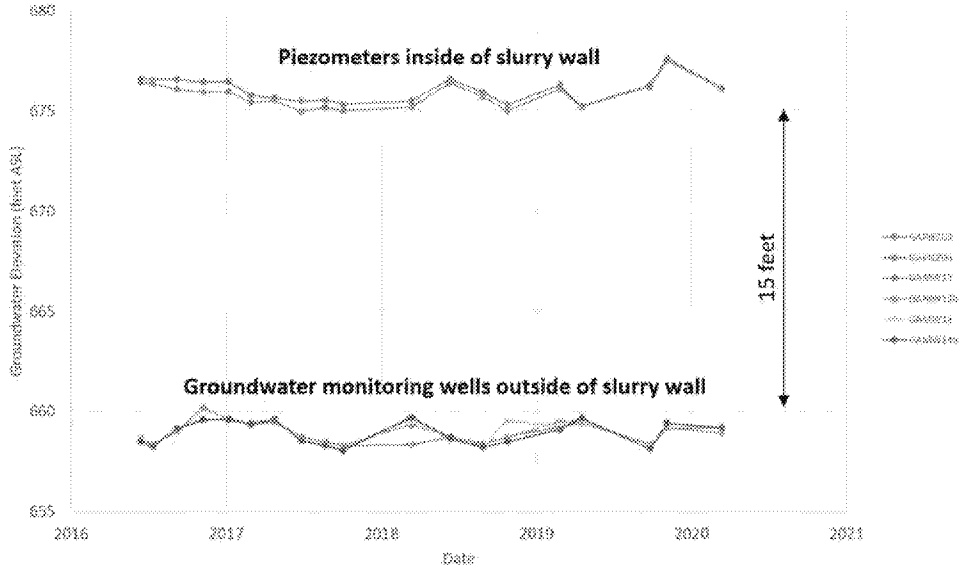


Figure B-5: *Groundwater elevation difference maintained by slurry wall (data provided by Golder).*

In the existing conceptual model, WDA leachate escaping through the slurry wall would travel laterally through the shallow, sandy aquifer and could potentially reach Davis Ditch by recharge through the hyporheic zone. The rate of this hypothetical flow is Q_{GW} in the SW-DAF calculation. To evaluate this rate, a flow model was constructed using site maps and descriptive details of the berms and slurry wall from Golder 2020a (**Figures B-6** and **B-7**). Since they are not separated by a slurry wall, the model includes both the WDA and adjacent Recycle Settling Pond. The model grid was constructed using Visual Modflow FLEX software from Waterloo Hydrogeologic, and flow equations solved using MODFLOW-NWT (Niswonger, 2011).

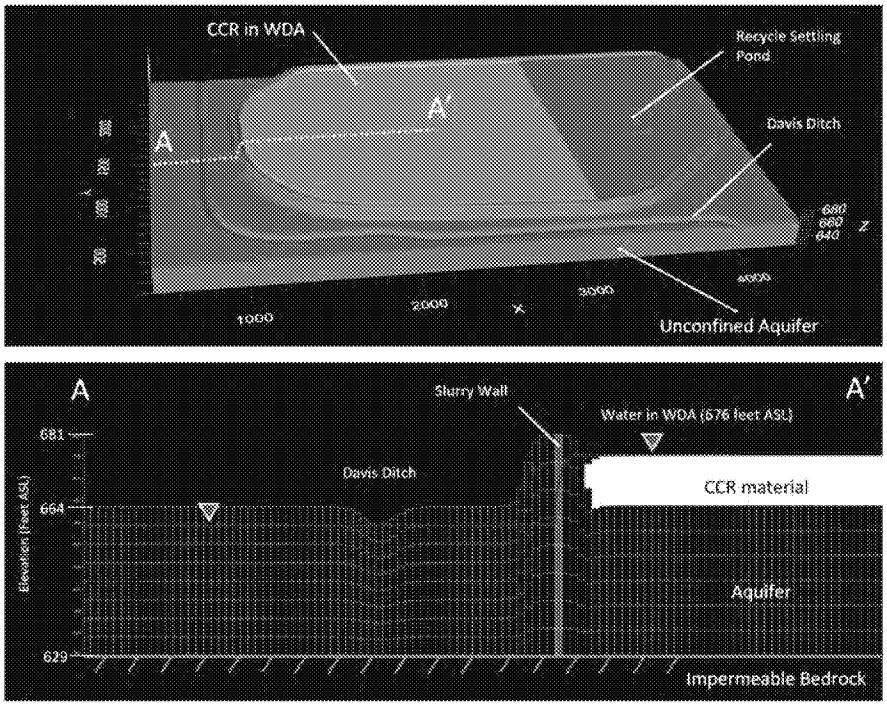


Figure B-6: *The groundwater flow model. Top: 3D model domain; Bottom: cross section through berm, slurry wall and Davis Ditch.*

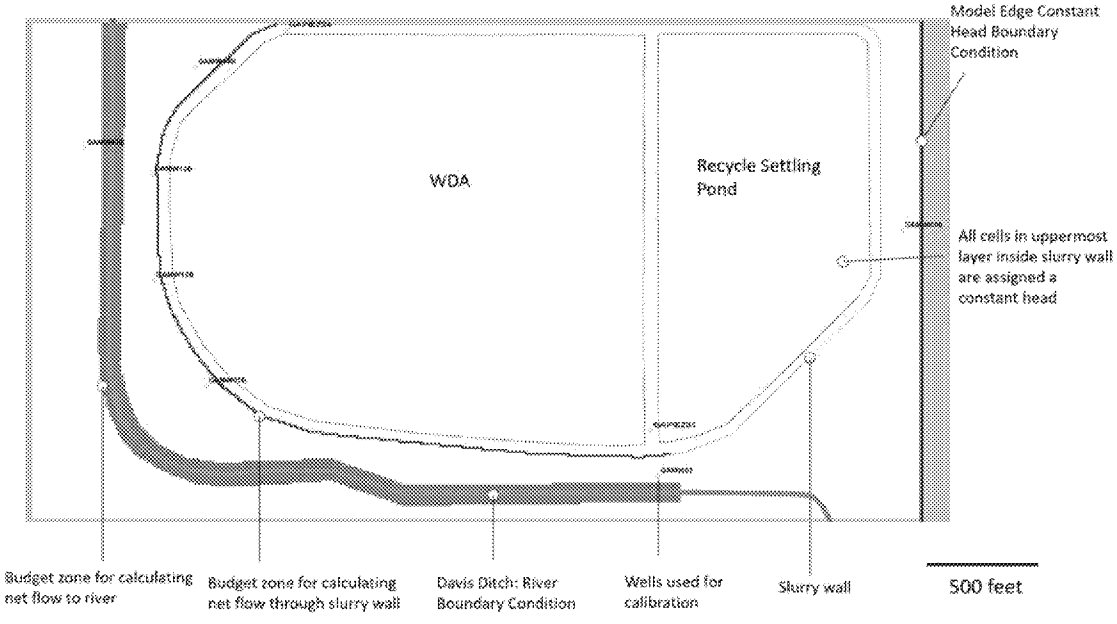


Figure B-7: *Groundwater flow model, Map View.*

Modeling assumptions:

- The unconfined aquifer beneath the WDA is approximately 35 feet thick;
- Hydraulic conductivity of the aquifer is 71 feet per day (ft/day), the value indicated for the uppermost 70 feet of unconsolidated deposits, the average value for the Davis Ditch watershed area indicated by StreamStats (derived from the IDNR well database);
- Hydraulic conductivity is isotropic;
- Ground surface near the WDA is relatively uniform and can be approximated as 664 feet above sea level (ASL);
- The base of the CCR material is near the original ground surface;
- The elevation of water impounded in the adjacent Recycle Settling Pond is approximately the same as the historical data from GAMPIEZ03 and GAMPIEZ04 - approximately 676 feet ASL; and
- The stage of Davis Ditch is approximately 659.5 feet ASL based on water levels in adjacent wells. This close relationship between stream stage and wells was confirmed with a new upstream staff gage installed in August of 2020.

Grid cells in the model domain have dimensions of 8.8 feet by 8.8 feet laterally, and 6.5 feet thick at the slurry wall. The slurry wall is represented as an effective property by assigning a weighted harmonic average of the aquifer and slurry wall:

$$k_{\text{eff}} = \frac{8.8}{\frac{(8.8 - b_s)}{k_{aq}} + \frac{b_s}{k_s}}$$

Where k_{aq} is hydraulic conductivity of the aquifer, k_s is the hydraulic conductivity of the slurry wall, b_s is the slurry wall thickness, and k_{eff} is the effective hydraulic conductivity assigned to the cell. For the aquifer properties used in this model, a slurry wall thickness of 2 feet, and slurry wall hydraulic conductivity of 0.003 ft/day (1×10^{-6} centimeters per second (cm/sec); a typical value for bentonite mixed with native soils), the effective permeability assigned to slurry wall grid cells by this formula is 0.013 ft/day.

Typical hydraulic conductivity for shale is in the range of 3×10^{-7} to 6×10^{-3} ft/day (Domenico, P.A. and Schwartz, F.W., 1990). As this is at least a factor of 10 less conductive than the effective property of the slurry wall grid cells, the shale bedrock is approximated as a no-flow boundary condition in the model.

The model was manually calibrated to groundwater levels measured in March of 2020 (**Figure B-8**). The calibration process revealed that the model is most sensitive to the hydraulic conductivity and integrity of the slurry wall, and to a lesser extent the stage of Davis Ditch. When the hydraulic conductivity of the slurry wall is increased by a modest amount to represent discontinuities, the large hydraulic gradient observed between the pond and adjacent wells is lost. It is noteworthy that a high-quality fit was realized without adjustments to any of the assumed parameters other than the stage of Davis Ditch and

constant head boundary condition on the eastern edge of the model, and that the results are relatively insensitive to the hydraulic conductivity of the aquifer.

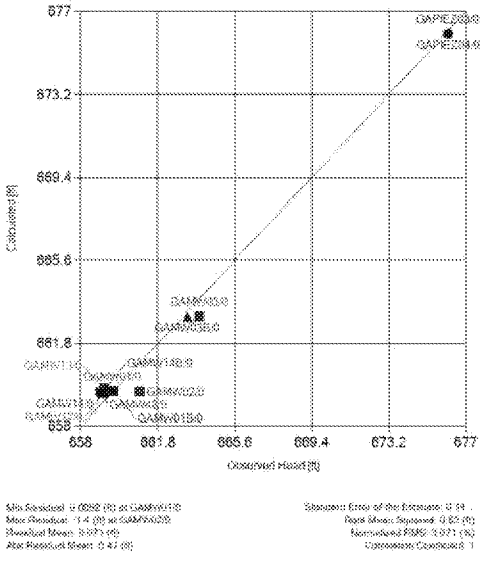


Figure B-8: *Groundwater flow model calibration (observed vs. calculated heads).*

The constant head edge boundary condition is representative of the higher water levels adjacent to the eastern edge of the Recycle Settling pond in (GAMW03 and GAMW03B) and does not have much influence on the WDA. As illustrated with a MODPATH calculation, groundwater flows radially from the WDA and is captured by Davis Ditch (**Figure B-10**).

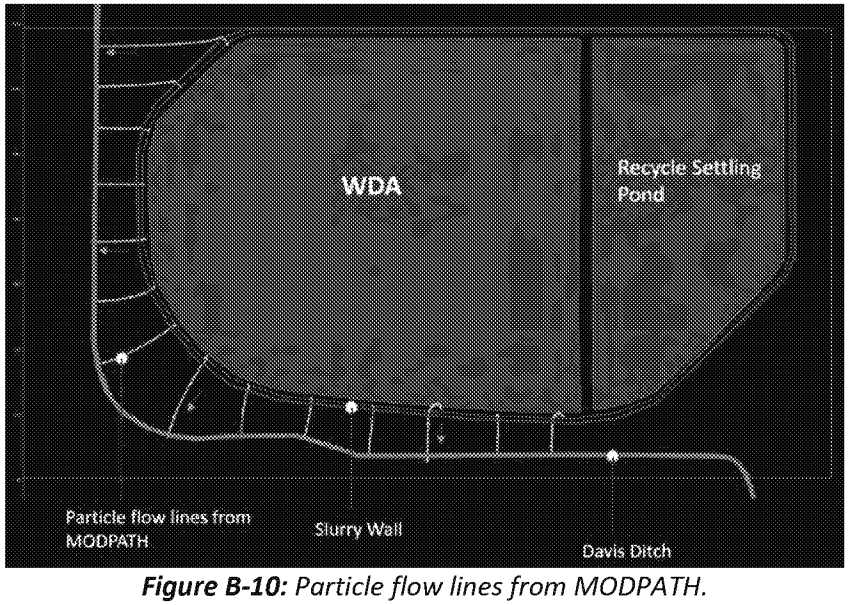


Figure B-10: *Particle flow lines from MODPATH.*

Overall Q_{GW}

From the model, the total discharge to Davis Ditch was 9,000 cubic feet per day (or 0.10 cfs). Groundwater flow through the section of slurry wall facing Davis Ditch was 3,700 cubic feet per day (or 0.043 cfs), which is approximately 43% of the total discharge.

3. SW-DAF for Davis Ditch

Based on the 3Q10 value of Q_R and Q_{GW} estimated from the groundwater flow model, the SW-DAF that is representative of low flow conditions in Davis Ditch is:

$$SW - DAF = \frac{Q_R}{Q_{GW}} = \frac{1.63\ cfs}{0.043\ cfs} = \mathbf{38}$$

This estimate assumes that low flow conditions are accurately represented by output from StreamStats, which is primarily designed for characterizing natural streams. Davis Ditch is part of a regulated drainage network and appears to have an engineered channel for at least three miles upstream of the WDA. The stage of the ditch in the groundwater flow model was consistent with staff gages surveyed in September 2020. The SW-DAF calculation will be reviewed should additional data become available and the calculation can be updated if necessary.

REFERENCES

Domenico, P.A. and Schwartz, F.W. 1990. Physical and chemical hydrogeology, John Wiley and Sons. Inc., New York, New York.

Golder Associates. 2020a. NIPSCO LLC R.M. Schahfer Generating Station Slurry Wall Assessment Report. Report no. 191-27906, February.

Golder Associates. 2020b. 2019 Annual Groundwater Monitoring and Corrective Action Report – Waste Disposal Area, NIPSCO LLC R.M. Schahfer Generating Station. Report no. 191-21567, January.

National Water Quality Monitoring Council (NDQMC). Water Quality Database. https://www.waterqualitydata.us/provider/NWIS/USGS-IN/USGS-05517528/ Original Data Source: United States Geological Survey. Accessed May 19, 2020.

Niswonger, R. 2011. MODFLOW-NWT, A Newton Formulation for MODFLOW-2005. United States Geological Survey Groundwater Resources Program, Techniques and Methods 6-A37.

Ries, K.G., III, Newson J.K., Smith, M.J., Guthrie, J.D., Steeves, P.A., Haluska, T.L., Kolb, K.R., Thompson, R.F., Santoro, R.D., and Vraga, H.W. 2017. StreamStats, version 4: U.S. Geological Survey Fact

2017–3046, 4 p., https://doi.org/10.3133/fs20173046. [Supersedes USGS Fact Sheet 2008–3067.]

APPENDIX C

Waste Disposal Area Analytical Data 40 CFR Part §257.103(f)(2)(v)(C)(3)

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW01																
	Sample Date	2016-07-12	2016-09-08		2016-11-09	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-23	2019-04-23		2019-11-06	2020-05-06
	Sample Type	N	FD	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.11	1.2 J	0.36 J	0.15 J	0.2 U	0.2 U	0.5	1.2	1	0.74		0.3	0.29	1.1	1.1	1.6	1.2
Calcium	mg/L	65	240 J	83 J	74	71	83	110	110	81	81		87	77	110	110	94 J-	91
Chloride	mg/L	4.3	28 J	12 J	5.3	5.6	8.3	18	18	12	16		10	8.1	20	20	13	9.5
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.31 J+	0.31 J+	0.41	0.36
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78		6.89	7.2	7.54
Sulfate	mg/L	54 J-	500 J	100 J	62	52	54	100	200	130	110		50	68	220	230	180	136
Total Dissolved Solids	mg/L	280	1100 J	380 J	320	280	340	480	580	420	420		360	350	600	630	520	395
CCR Appendix IV																		
Antimony	mg/L	0.00048 J	0.001 J	0.00068 J	0.001 J	0.0016 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.019	0.014 J	0.039 J	0.024	0.013	0.01	0.012	0.023	0.03		0.02	0.03	0.035	0.015	0.014	0.013	0.01
Barium	mg/L	0.059	0.078 J	0.057 J	0.064	0.053	0.07	0.065	0.093	0.077		0.057	0.052	0.052	0.088	0.087	0.069	0.065
Beryllium	mg/L	0.00099 J	0.00068 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.0014	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00038 J	0.002 U	0.00037 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00053 J	0.0011	0.00087 J	0.00068 J	0.00074 J	0.0016	0.0016	0.001		0.0011	0.001	0.00075 J	0.0016	0.0017	0.001	0.001
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.31 J+	0.31 J+	0.41	0.36
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00065 J		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0031 J	0.008 U	0.008 U	0.008 U	0.0031 J	0.0015 J	0.003 J	0.0042 J	0.0037 J		0.0019 J		0.0028 J	0.0021 J	0.0023 J	0.0025 J	0.008 U
Mercury	mg/L	0.0002 U	0.00035	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.011	0.025	0.022	0.011	0.01 U	0.01 U	0.017	0.033	0.045		0.014	0.016	0.015	0.033	0.033	0.031	0.018
Radium, Total	pci/l	5 U	0.399 U	0.771	0.403	0.501 U	0.446 U	0.551	0.692	0.835		0.741 J+	0.475	1.45 J+	1.21	0.781		1.6
Radium-226	pci/l	1 U	0.118	0.328	0.341 U	0.247	0.148	0.304	0.658 J+	0.46		0.284	0.292	0.614 J+	0.693	0.474		1.4
Radium-228	pci/l	1 U	0.399 U	0.512 U	0.359 U	0.501 U	0.446 U	0.314 U	0.341 U	0.435 U		0.457 J+	0.183	0.832 J+	0.517	0.388 U		0.199 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00075 J	0.0018 J	0.001 J	0.0016 J	0.0031 J	0.0017 J		0.0016 J		0.001 J	0.0075	0.0077	0.0057	0.0018
Thallium	mg/L	0.00018 J	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00032 J		0.001 U		0.001 U	0.001 U	0.00021 J	0.00046 J	0.001 U
Sample Parameters																		
DO	mg/L	0.14		0.9	0.18	0.25	0.17	0.07	0.61	0.32	0.19	0.28	0.14	0.22		1.97	0.31	0.31
ORP	millivolts	-92.6		-21.4	-120.7	-110.5	-127.2	-102.8	98.3	-43.1	-48.2	-85.1	284.1	-130.2		27.1	-217.5	-70.9
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78		6.89	7.2	7.54
SC	uS/cm	448		604	512	416	508	707	844	650	673	395	550	594		624	547	713
TEMP	deg c	13.9		17.8	16.2	11.2	9.73	10.8	13.8	17	17.2	9.2	9.4	16.9		2.4	15.9	10.3
TURB	ntu	1.25		2.12	3.92	4.79	3.86	3.69	4.22	2.22	2.8	4.61	4.05	4.81		4.48	3.8	4.79

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW01B					GAMW03																		
	Sample Date	2018-09-06	2018-10-23	2019-04-23	2019-11-06	2020-05-06	2016-07-13	2016-09-08	2016-11-08	2017-01-09		2017-03-01	2017-04-26	2017-06-28	2017-08-23		2017-10-04	2018-03-13	2018-04-20	2018-10-24		2019-04-25	2019-11-06	2020-05-08
	Sample Type	N	N	N	N	N	N	N	N	FD	N	N	N	N	FD	N	N	N	N	FD	N	N	N	N
Chemical Name	Unit																								
CCR Appendix III																									
Boron	mg/L	0.4	0.44	0.35	0.38	0.33	0.23	0.24	0.25	0.24	0.22	0.22	0.23	0.21	0.2	0.2	0.22		0.2	0.28	0.26	0.16	0.35	0.3
Calcium	mg/L	110	100	110	94 J-	99	83	87	100	110	94	100	110	87	75	77	87		93	97	94	84	110 J-	97.2
Chloride	mg/L	21	19	21	19	18.8	7.7	8.6	10	9.1	9.1	8.1	6.8	10	8.2	8.3	9		4.9	22	7.7	2.4	6.5	4.4
Fluoride	mg/L	0.17 J	0.14	0.14 J+	0.15	0.14	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15	0.2	0.17	0.18 J-
pH	SU	7.01	6.74	6.98	6.94	7.3	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37	6.94	6.74	7.17
Sulfate	mg/L	72	69	73	67	69.8	100 J-	100	110	110	110	120	130	83	77	77	93		110	67	100	86	150	101
Total Dissolved Solids	mg/L	450	430	490	440	392	400	390	500	440	430	450	510	420	370	370	430		380	440	440	350	490	388
CCR Appendix IV																									
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.00023 J	0.00091 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.00077 J	0.005 U	0.005 U	0.005 U	0.001 U	0.012	0.011	0.011	0.01	0.01	0.0076	0.0076	0.015	0.012	0.013		0.018		0.005 U	0.013	0.0035 J	0.016	0.0061
Barium	mg/L	0.19	0.17	0.19	0.15	0.17	0.087	0.096	0.11	0.11 J	0.081 J	0.087	0.091	0.071	0.079	0.079		0.074		0.11	0.1	0.071	0.11	0.081
Beryllium	mg/L	0.00036 J	0.001 U	0.00086 J	0.001 U	0.0002 U	0.00055 J	0.00053 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	8.8E-05 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00056 J	0.00027 J	0.00033 J	0.00019 J	0.001 U	0.0014	0.0043	0.01	0.011	0.011	0.013	0.015	0.0037	0.0018	0.0019		0.0038		0.001 U	0.0037	0.0099	0.0048	0.0076
Fluoride	mg/L	0.17 J	0.14	0.14 J+	0.15	0.14	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15	0.2	0.17	0.18 J-
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00016 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00052 J	0.00045 J	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0039 J	0.0046 J	0.0047 J	0.0042 J	0.008 U	0.0064 J	0.008 U	0.008 U	0.0042 J	0.0044 J	0.0025 J	0.0045 J	0.0063 J	0.0067 J	0.0069 J		0.006 J		0.008 U	0.0074 J	0.0038 J	0.0058 J	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0015 J	0.01 U	0.0011 J	0.01 U	0.001 U	0.0087 J	0.009 J	0.01 U	0.012 J+	0.01 U	0.01 U	0.0082 J	0.0084 J	0.0069 J	0.0076 J		0.0063 J		0.0065 J	0.0082 J	0.0071 J	0.0063 J	0.011
Radium, Total	pci/l	2.16	2.62 J+	2.11		1.27 U	5 U	0.696	0.873 J+	0.53 U	0.765	0.385 U	0.399	0.302 U	0.346 U	0.427 U		0.49 J+		1.11 J+	1.38 J+	0.373 U		1.88
Radium-226	pci/l	1.56	1.47 J+	1.13		0.405 U	1 U	0.276	0.408 U	0.287 U	0.277	0.115	0.157	0.114 J+	0.117	0.126		0.165		0.567 J+	0.342 J+	0.314 U		0.265 U
Radium-228	pci/l	0.6	1.15 J+	0.982		0.86	1 U	0.539 U	0.728 J+	0.53 U	0.513 U	0.385 U	0.338 U	0.302 U	0.346 U	0.427 U		0.42 U		0.547	1.04	0.373 U		1.61 J+
Selenium	mg/L	0.001 J	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00085 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																									
DO	mg/L	0.62	0.23	1.06	0.32	0.1	0.38	0.61	0.24		0.71	1.07	0.73	0.61		0.22	0.29	1.3	0.9		0.99	1.1	0.43	1.02
ORP	millivolts	-96.2	-111.7	-23.6	-196.7	-99.3	186.5	7.4	-30.2		-34	-28.5	-21.7	-24.1		-28.5	-83.1	-76.4	-98.2		-283.8	40.1	-182.6	14.8
pH	SU	7.01	6.74	6.98	6.94	7.3	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37	6.94	6.74	7.17
SC	uS/cm	684	687	563	468	734	599	630	711		586	588	760	550		583	655	369	572		675	352	510	675
TEMP	deg c	13.9	13.9	9.88	13.8	12.7	13.4	16.2	15.5		10.8	9.02	10.4	12.7		15.2	16.1	8.6	7.9		16.2	3.28	15	9.1
TURB	ntu	4.16	2.41	3.15	1.2	4.66	2.72	4.41	2.92		4.58	4.68	4.42	4.5		2.51	4.18	4.66	4.96		3.55	3.49	4.41	13.3

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW03B																
	Sample Date	2016-07-13	2016-09-08	2016-11-08	2017-01-10	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-09-06		2018-10-24	2019-04-26	2019-11-06	2020-05-12
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.18	0.18	0.2 U	0.2 U	0.21	0.23	0.25	0.27	0.28		0.3	0.32	0.28	0.29	0.25	0.31	0.31
Calcium	mg/L	98	100	110	98	110	110	110	99	95		110	100	99	98	90	89 J-	104
Chloride	mg/L	14	13	15	16	20	20	22	21	25		23	24	25	22	24	24	22.6
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21	0.22	0.26	0.23
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77	7.15	7.08	7.31
Sulfate	mg/L	58 J-	59	58	77	67	67	66	68	84		66	64	64	67	74	80	77.1
Total Dissolved Solids	mg/L	420	410	420	440	450	480	510	450	460		420	470	450	450	460	410	412
CCR Appendix IV																		
Antimony	mg/L	0.00019 J	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.0015 J	0.0012 J	0.0009 J	0.0013 J	0.005 U	0.00085 J	0.00087 J	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Barium	mg/L	0.11	0.1	0.11	0.096	0.11	0.11	0.11	0.12		0.13		0.12	0.12	0.12	0.1	0.11	0.12
Beryllium	mg/L	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00031 J	0.001 U	0.00017 J	0.001 U	0.00038 J	0.00021 J	0.001 U		0.00024 J		0.00034 J	0.00036 J	0.001 U	0.0005 J	0.001 U	0.001 U
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21	0.22	0.26	0.23
Lead	mg/L	0.001 U	0.001 U	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0014 J	0.008 U	0.008 U	0.0011 J	0.0011 J	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0044 J	0.0043 J	0.01 U	0.01 U	0.01 U	0.0045 J	0.0052 J	0.0055 J		0.0066 J		0.0067 J	0.0067 J	0.0066 J	0.0068 J	0.0074 J	0.0078
Radium, Total	pci/l	0.943	1.15	1.36 J+	1.03	0.62	0.449	1	0.643		1.99 J+		1.14	1.06	1.26 J+	0.596		1.33 U
Radium-226	pci/l	0.642 J+	0.52	0.537	0.513	0.29	0.456	0.447 J+	0.414		0.458		0.671	0.574	0.478 J+	0.38 U		0.514 U
Radium-228	pci/l	1 U	0.629	0.823 J+	0.513	0.39 U	0.338 U	0.556	0.354 U		1.53 J+		0.47	0.49	0.783	0.442		0.816 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00066 J	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.0014 J	0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																		
DO	mg/L	0.42	1.11	0.32	0.48	0.41	0.15	0.38	0.31	0.17	0.4	0.19		1.12	0.5	1.7	0.58	0.2
ORP	millivolts	196.3	-26.8	-61.4	-98.9	-86.2	-77.9	-49.1	-34.5	-94.7	-85.2	-95.1		-66.2	-294.4	7.6	-181.9	-86.4
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77	7.15	7.08	7.31
SC	uS/cm	676	680	6.84	678	631	737	656	730	728	515	778		669	719	527	443	732
TEMP	deg c	12.4	13.2	13.2	12.2	11.63	12.1	12.2	13	13.3	11.3	4.1		13	13.69	9.03	13.1	11.5
TURB	ntu	3.66	4.73	2.84	2.02	3.1	2.51	1.84	1.16	0.81	4.59	4.36		3.55	3.54	3.56	1.92	4.44

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW12																	GAMW12B					
	Sample Date	2016-07-12		2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-10-23	2019-04-24	2019-11-07		2020-05-11	2018-09-07	2018-10-23	2019-04-25		2019-11-07	2020-05-07
	Sample Type	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	FD	N	N	N
Chemical Name	Unit																							
CCR Appendix III																								
Boron	mg/L	0.07	0.073	0.075	0.2 U	0.2 U	0.2 U	0.092 J	0.2 U	0.2 U	0.079 J		0.095 J	0.081 J	0.073 J	0.071 J	0.069 J	0.1 U	0.28	0.26	0.31	0.3	0.33	0.38
Calcium	mg/L	88	93	91	97	90	97	97	100	89	87		87	94	88	76	76	85.2	100	110	100	100	88	96.6
Chloride	mg/L	2.3	3.8	6.1	9.6	11	10	10	7.6	5.2	3.2		3.3	2.5	2.9	2.8	2.8	3.4	22	19	23	23	24	23.4
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.21	0.23	0.24	0.17	0.12 J	0.096	0.11	0.11	0.11	0.1
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.06		7.32	7.2	7.15	8.83		7	7.63	7.55
Sulfate	mg/L	5.9 J-	7.5 J-	15	6.8	17	12	14	11	11	11		11	12	22	14	16	11.3	63	49	120	120	130	134
Total Dissolved Solids	mg/L	380	390	390	430	400	410	390	400	400	390		350	360	390	360	330	349	870 J+	450	480	500	470	461
CCR Appendix IV																								
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.00086 J		0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.0086	0.0097	0.0079	0.011	0.0058	0.0058	0.0059	0.016	0.017		0.011	0.0085	0.018	0.014	0.0077	0.008	0.012	0.0013 J	0.00079 J	0.005 U	0.005 U	0.005 U	0.001 U
Barium	mg/L	0.14	0.14	0.15	0.14	0.11	0.14	0.12	0.14	0.13		0.11	0.1	0.12	0.087	0.079	0.079	0.091	0.11	0.12	0.12	0.11	0.1	0.11
Beryllium	mg/L	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.00032 J		0.00044 J	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.00024 J	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00099 J	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.0026	0.0029	0.0041	0.0025	0.0032	0.003	0.0028	0.0031	0.0027		0.0023	0.0016	0.0018	0.0031	0.0027	0.0028	0.0029	0.00039 J	0.00038 J	0.001 U	0.001 U	0.00044 J	0.001 U
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.21	0.23	0.24	0.17	0.12 J	0.096	0.11	0.11	0.11	0.1
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J	0.001 U
Lithium	mg/L	0.0025 J	0.003 J	0.008 U	0.008 U	0.0029 J	0.0026 J	0.0032 J	0.0034 J	0.003 J		0.0023 J		0.0032 J	0.0027 J	0.0028 J	0.003 J	0.008 U	0.0042 J	0.0042 J	0.0043 J	0.0043 J	0.004 J	0.008 U
Mercury	mg/L	0.00019 J+	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.01 U	0.002 J	0.0037 J	0.01 U	0.01 U	0.01 U	0.004 J	0.003 J	0.0029 J		0.0035 J		0.0033 J	0.0034 J	0.0032 J	0.0036 J	0.0031	0.01 U	0.01 U	0.0014 J	0.0013 J	0.0015 J	0.0019
Radium, Total	pci/l	0.921	0.735	0.823	2.14 J+	0.721	0.79	0.441	0.6	1.42		0.962 J+	0.67	1.3 J+	0.474 U			1.01 U	1.66 J+	1.61 J+	1.03 J	0.544 J		1.76
Radium-226	pci/l	0.591 J+	0.476 J+	0.472	1.12	0.3	0.38	0.262	0.426 J+	0.529		0.322	0.321	0.57 J+	0.307 U			0.472 U	0.886 J+	0.916 J+	0.439	0.426 U		1.27
Radium-228	pci/l	1 U	1 U	0.423 U	1.02 J+	0.423 U	0.409	0.354 U	0.305 U	0.893		0.64 J+	0.35	0.734 J+	0.474 U			0.538 U	0.774	0.695 J+	0.592	0.373 U		0.493 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00054 J	0.0007 J	0.005 U	0.005 U	0.005 U		0.00091 J		0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.0024 J	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.00039 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																								
DO	mg/L		0.57	2.06	0.25	0.31	0.25	0.1	0.4	0.32	0.46	0.33	0.25	0.93	1.07		2.61	0.15	0.6	0.52		0.76	4.86	0.1
ORP	millivolts		-47.5	-44.9	-71.8	-50.3	-74	-66.7	-75.8	-30.1	-101.1	-87.5	-239.8	-377.3	-12.7		-4.1	-98.5	-98.9	-378.3		-10.2	-34.9	-117.6
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.06		7.32	7.2	7.15	8.83		7	7.63	7.55
SC	uS/cm		634	688	660	569	605	664	645	667	665	393	558	628	381		421	625	712	760		560	482	734
TEMP	deg c		14.7	19.5	16.2	10.6	9.38	10.8	14.3	17.2	17.5	8.2	8.7	16.99	0.8		12.97	9.5	14	14.11		11.5	1.39	12.2
TURB	ntu		2.97	3.11	4.9	4.44	4.61	4.46	3.78	3.33	3.41	3.55	4.12	2.91	12.6		3.1	7.99	3.33	1.39		3.56	4.02	4.86

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW13														
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20	2018-10-24	2019-04-24	2019-11-06	2020-05-07
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit															
CCR Appendix III																
Boron	mg/L	0.2	0.27	0.4	0.2 U	0.2 U	0.18 J	0.21	0.24	0.18 J		0.21	0.38	0.18	0.13	0.21
Calcium	mg/L	85	86	86	80	94	100	87	88	86		110	74	75	71 J-	69.1
Chloride	mg/L	13	15	18	4.6	7.4	8.2	10	10	11		9.7	14	7.9	3.9	9
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28	0.24	0.31	0.25
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88	6.79	7.15	7.02
Sulfate	mg/L	14 J-	47	62	40	43	52	25	15	25		52	59	52	40	42.3
Total Dissolved Solids	mg/L	340	400	430	320	360	380	340	370	360		400 J	350	360	330	323
CCR Appendix IV																
Antimony	mg/L	0.00016 J	0.00028 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.01	0.014	0.013	0.0076	0.0052	0.006	0.0082	0.0087		0.0039 J		0.01	0.005	0.006	0.0037
Barium	mg/L	0.13	0.14	0.14	0.092	0.11	0.13	0.16	0.14		0.11	0.12	0.14	0.081	0.063	0.078
Beryllium	mg/L	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.00089 J	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.00097 J	0.002 U	0.002 U	0.002 U	0.00068 J	0.002 U	0.002 U	0.002 U		0.0012 J		0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.0016	0.0014	0.0015	0.00077 J	0.00074 J	0.0005 J	0.00042 J		0.0029	0.00096 J	0.00032 J	0.0012	0.00057 J	0.0011
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28	0.24	0.31	0.25
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0012 J	0.008 U	0.008 U	0.00047 J	0.008 U	0.008 U	0.0019 J	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0021 J	0.0074 J	0.013	0.01 U	0.01 U	0.004 J	0.0033 J	0.0022 J		0.0053 J		0.0054 J	0.012	0.0068 J	0.0065
Radium, Total	pci/l	1.45	1.02	1.54 J+	0.382 U	0.644	0.807	0.502	0.713		0.667 J+	0.401	1.84 J+	0.473 U		1.09 U
Radium-226	pci/l	1.04 J+	0.588	0.455	0.302 U	0.208	0.23	0.461 J+	0.34		0.193	0.224	0.671 J+	0.241 U		0.19 U
Radium-228	pci/l	1 U	0.435	1.09 J+	0.382 U	0.436	0.577	0.375 U	0.373		0.474 J+	0.177	1.17	0.473 U		0.901
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.0011 J		0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																
DO	mg/L	0.23	0.95	6.77	0.43	0.6	0.28	0.91	0.28	0.41	0.81	0.32	1.12	1.35	2.26	1.21
ORP	millivolts	-92.2	-70.8	-95.5	-66.2	-84.8	-96	-4.1	16.8	-34.8	-101.1	-112.4	-268.7	94.8	42	-17.9
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88	6.79	7.15	7.02
SC	uS/cm	6.14	717	694	538	593	664	630	661	655	446	723	614	304	433	680
TEMP	deg c	16.3	20.5	16.6	10.4	9.14	11.2	16	17.6	17.8	8.2	8.7	17.02	1.7	9.2	10.1
TURB	ntu	4.75	2.41	3.92	1.59	1.51	2.11	3.16	1.28	2.05	4.77	2.88	1.12	4.63	1.38	3.82

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW13B																			
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28		2017-04-25		2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20		2018-09-06	2018-10-24	2019-04-24	2019-11-06	2020-05-07	
	Sample Type	N	N	N	N	FD	N	FD	N	N	N	N	N	FD	N	N	N	N	N	FD	N
Chemical Name	Unit																				
CCR Appendix III																					
Boron	mg/L	0.71	0.76	0.73	0.78	0.74	0.78	0.74	0.76	0.73	0.73	0.79			0.76	0.72	0.71	0.71	0.7	0.63	0.64
Calcium	mg/L	80	70	78	76	76	79	78	77	75	72	78			76	72	71	72	66 J-	71.8	72.1
Chloride	mg/L	24	25	25	25	25	25	25	26	26	27	28			27	27	24	27	27	29.9	30.1
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25	0.35	0.34	0.24	0.24
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45	7.3	7.81		7.81
Sulfate	mg/L	150 J-	150	150	150	150	150	150	150	150	160	170			150	150	150	150	150	141	142
Total Dissolved Solids	mg/L	440	410	410	390	420	420	400	390	390	430	440			370 J	410	420	430	400	355	380
CCR Appendix IV																					
Antimony	mg/L	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.001 U
Arsenic	mg/L	0.0021 J	0.0011 J	0.0011 J	0.0015 J	0.0013 J	0.0013 J	0.0016 J	0.0014 J	0.0013 J	0.00092 J		0.0012 J	0.00098 J		0.005 U	0.005 U	0.0014 J	0.00091 J	0.0012	0.0013
Barium	mg/L	0.093	0.08	0.084	0.084	0.093	0.097	0.091	0.093	0.089	0.086		0.1	0.091	0.094	0.087	0.082	0.093	0.078	0.08	0.079
Beryllium	mg/L	0.00063 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.0013	0.001 U	0.0002 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00036 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U		0.00019 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25	0.35	0.34	0.24	0.24
Lead	mg/L	0.001 U	0.001 U	0.00042 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0023 J	0.008 U	0.008 U	0.0019 J	0.0013 J	0.0016 J	0.0018 J	0.0017 J	0.0034 J	0.0021 J		0.008 U	0.008 U		0.008 U	0.0018 J	0.0019 J	0.0017 J	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U			0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.023	0.021	0.022	0.019 J+	0.02	0.02	0.021	0.021	0.022	0.021		0.021	0.022	0.021	0.018	0.018	0.021	0.017	0.019	0.019
Radium, Total	pci/l	5 U	0.66 U	1.16 J+	0.946	0.571 U	0.902	0.911 J	0.515 J	0.595	1.06		0.783 J+	0.571	0.863	0.885	1.76 J+	0.529		1.01 U	1.31
Radium-226	pci/l	0.438 J+	0.511	0.665	0.64	0.387	0.404	0.603 J	0.316 J	0.41 J+	0.573		0.423	0.293	0.311	0.567	0.646 J+	0.436		0.354 U	0.337 U
Radium-228	pci/l	1 U	0.66 U	0.495 J+	0.416 U	0.571 U	0.497	0.353 U	0.36 U	0.308 U	0.489		0.36 J+	0.278	0.552	0.386 U	1.11	0.435 U		0.659 U	0.977
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U		0.001 J	0.005 U	0.005 U	0.005 U	0.001 U	0.001 U
Thallium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U
Sample Parameters																					
DO	mg/L	0.65	1.05	0.44	0.226		0.69		0.22	0.56	0.63	0.34	0.53		0.14	0.38	1.24	1.16	2.1		0.22
ORP	millivolts	-86.5	-92.3	-110.1	-111.5		-114.4		-125.7	-72.6	1.1	-72.1	-98.1		-230.2	-118.7	-235.5	17.8	-45.2		-138.4
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45	7.3	7.81		7.81
SC	uS/cm	634	634	624	575		611		604	613	652	681	464		607	631	639	394	440		646
TEMP	deg c	14.7	16.8	14.5	12.7		12.6		13.2	13.9	14.4	14.4	12		12.3	14.14	14.1	3.39	11.67		12.4
TURB	ntu	4.94	1.94	1.57	2.86		4.56		4.5	3.86	1.8	0.42	4.22		4.19	2.25	1.08	4.07	2.03		4.98

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW14																
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28		2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-25	2019-03-01	2019-04-22	2019-11-06	2020-05-06
	Sample Type	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.27	0.36	0.25	0.3	0.26	0.28	0.26	0.24	0.24	0.23		0.25	0.3	0.2	0.22	0.16	0.16
Calcium	mg/L	69	69	72	55	65	57	58	58	68	73		37	58	38	38	59 J-	41.5
Chloride	mg/L	15	11	8.7	7.6	8.4	5.1	2	2.1	1.7 J	1.8		1.4	13	2.8	2.7	2.1	0.85
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21	0.18	0.23	0.18
pH	SU	6.32	6.88	6.59	5.99	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01	7.27	7.14	6.95
Sulfate	mg/L	100 J-	88	52	74	79	77	52	48	54	54		35	51	35	37	27	22.7
Total Dissolved Solids	mg/L	360	310	310	250 J+	310	260	270	260	300	340		220	290	210	360	260	163
CCR Appendix IV																		
Antimony	mg/L	0.00036 J	0.00032 J	0.002 U	0.00039 J	0.002 U	0.00091 J	0.002 U	0.002 U	0.002 U		0.0016 J		0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.0033 J	0.0029 J	0.0055	0.0023 J	0.0024 J	0.0018 J	0.0017 J	0.0018 J	0.003 J		0.0021 J		0.014	0.012	0.0028 J	0.026	0.0057
Barium	mg/L	0.065	0.068	0.065	0.059	0.07	0.071	0.065	0.066	0.069		0.061	0.049	0.058	0.041	0.049	0.055	0.042
Beryllium	mg/L	0.00013 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.00046 J	0.002 U	0.002 U	0.002 U	0.002 U		0.0011 J		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.012	0.01	0.015	0.0052	0.015	0.023	0.022	0.023	0.026		0.035	0.052	0.031	0.0083	0.0026	0.014	0.0072
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21	0.18	0.23	0.18
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.00046 J	0.008 U	0.008 U	0.00038 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0088 J	0.011	0.01 U	0.013 J+	0.011	0.0098 J	0.008 J	0.0082 J	0.0078 J		0.011	0.0096 J	0.011	0.0074 J	0.011	0.0084 J	0.0066
Radium, Total	pci/l	5 U	0.553	1.03 J+	0.375 U	0.413 U	0.447 U	0.72	0.287 U	0.4 U		0.366 U	0.399	0.671		0.345		0.624 U
Radium-226	pci/l	0.282 J+	0.16 U	0.486	0.24 U	0.114 U	0.12	0.13 J+	0.11 J+	0.151		0.0752 U	0.0656	0.239		0.318 U		0.28 U
Radium-228	pci/l	1 U	0.426	0.598 U	0.375 U	0.413 U	0.447 U	0.59	0.287 U	0.4 U		0.366 U	0.333	0.432		0.328 U		0.344 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00058 J	0.0011 J	0.00095 J	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																		
DO	mg/L	0.39	1.24	0.78	1.68	3.38	0.6		3.1	1.19	0.46	1.33	1.02	1.8	0.32	3.21	1.49	1.39
ORP	millivolts	179.6	163.9	75.6	230.3	225.8	82.1		268.3	110.1	89.5	-117	-243.1	-240.9	-11.5	61.3	38.2	45.4
pH	SU	6.32	6.88	6.59	5.99	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01	7.27	7.14	6.95
SC	uS/cm	501	512	505	360	430	400		404	466	578	241	283	464	226	223	325	330
TEMP	deg c	14.7	18.6	15.5	11.2	9.85	10.9		13.5	16.2	16.7	8.99	9.4	16.3	8.79	10.3	14.71	10.2
TURB	ntu	2.33	1.33	0.57	0.91	4.14	2.71		3.23	3.71	2.61	4.41	4.89	1.81	4.43	4.68	2.51	4.93

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW14B																
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-09-06	2018-10-25	2019-04-22	2019-11-06		2020-05-06
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	2.8	2.4	3.4	2.9	2.9	2.9	2.8	3	2.9		3	2.9	2.8	2.9	3.4	3.3	4.8
Calcium	mg/L	150	130	140	84	95	110	120	120	120		150	150	150	140	130 J-	130 J-	148
Chloride	mg/L	100	100	120	94	100	100	83	100	110		110	110	97	99	120	120	130
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31	0.31	0.4	0.39	0.38
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67	7.75		7.93	7.7
Sulfate	mg/L	1200 J-	950	1100	790	860	900	780	960	880		990	1100	1100	1200	1300	1300	1540
Total Dissolved Solids	mg/L	1900	2000	2000	1700	1700	1700	1500	1800	1800		2000	2000	1900	1900	1800	2200	2650
CCR Appendix IV																		
Antimony	mg/L	0.00016 J	0.002 U	0.00071 J	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.0029 J	0.00095 J	0.001 J	0.0015 J	0.00092 J	0.0015 J	0.0011 J	0.0009 J		0.0012 J		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001
Barium	mg/L	0.13	0.12	0.12	0.081	0.089	0.096	0.11	0.1		0.11	0.11	0.12	0.12	0.11	0.11	0.11	0.1
Beryllium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.00083 J	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.00094 J	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.0044	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00023 J	0.001 U	0.00045 J	0.0002 J	0.001 U	0.00019 J	0.00028 J		0.00019 J		0.00039 J	0.00022 J	0.00058 J	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31	0.31	0.4	0.39	0.38
Lead	mg/L	0.0012	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.005 J	0.008 U	0.008 U	0.0053 J	0.0046 J	0.0054 J	0.0065 J	0.0051 J		0.0043 J		0.0056 J	0.0057 J	0.0058 J	0.0057 J	0.0059 J	0.011
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.035	0.035	0.023	0.031 J+	0.03	0.028	0.014	0.015		0.022	0.026	0.033	0.035	0.028	0.017	0.017	0.043
Radium, Total	pci/l	3.26	2.47	3.11 J+	1.45	2.17	1.65	1.17	1.73		1.87 J+	1.68	2.55	2.73	2.05			2.22
Radium-226	pci/l	2.06 J+	1.32	1.69	1.04	0.861	0.795	0.715 J+	0.967		1.01	0.823	1.24	1.66	0.802			1.05
Radium-228	pci/l	1.2	1.15	1.42 J+	0.402	1.31	0.856	0.452	0.759		0.86 J+	0.861	1.31	1.07	1.25			1.17
Selenium	mg/L	0.005 U	0.005 U	0.00087 J	0.00083 J	0.00061 J	0.005 U	0.005 U	0.00099 J		0.005 U		0.0021 J	0.001 J	0.00093 J	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00025 J		0.001 U		0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U	0.001 U
Sample Parameters																		
DO	mg/L	0.3	1.28	0.44	0.35	0.27	0.11	1.02	0.76	0.31	0.37	0.17	0.44	1.3	1.07		2.16	0.11
ORP	millivolts	-60.6	29.7	-76.7	-79.8	-81.4	-112.8	31.4	58	-93.4	102.6	-286.8	-114.1	-211.9	28.8		-21.4	-110.4
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67	7.75		7.93	7.7
SC	uS/cm	2425	2515	2557	2019	1990	2211	2156	2177	2295	1844	2171	2642	2542	1887		2124	3957
TEMP	deg c	14.6	16.3	14	12.4	12.5	13.3	13.5	14	14.1	12.4	12.5	13.91	13.4	12.8		13.37	12.7
TURB	ntu	4.7	1.94	0.97	1.48	4.05	4.13	1.26	0.63	0.48	3.79	2.59	1.42	1.41	2.79		0.71	4.78

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW42													GAMW42B								
	Sample Date	2018-09-13	2018-10-31	2019-03-04		2019-04-18	2019-06-05	2019-07-17	2019-08-26	2019-10-02	2019-11-05		2020-04-22		2018-09-13	2019-03-04	2019-04-18	2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-05	2020-04-22
	Sample Type	N	N	FD	N	N	N	N	N	N	FD	N	FD	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																						
CCR Appendix III																							
Boron	mg/L	0.04 J	0.041 J	0.033 J	0.031 J	0.044 J	0.033 J	0.037 J	0.043 J	0.1 U	0.034 J	0.033 J	0.1 U	0.1 U	0.061 J	0.039 J	0.033 J	0.035 J	0.038 J	0.026 J	0.22	0.031 J	0.1 U
Calcium	mg/L	44	38	44	43	36	39	40	47	41	42	43	42.9	43.5	46	52	47	50	48	52	52	53	47.4
Chloride	mg/L	3.1	2.8	2.9	2.8	2.8		2.5	3.1	3.3	3.1	3.2	3.1	3.2	4	5	4.3		4	4.3	5.6	6.4	4.2
Fluoride	mg/L	0.25 J	0.2	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.21	0.2	0.25 J	0.18	0.18		0.19	0.18	0.18	0.18	0.19
pH	SU	7.54	7.15		6.93	7.1	6.85	7.58	7.54	7.41		7.83		7.9	8.08	7.23	7.7	7.12	8.25	7.57	7.67	8.25	8.08
Sulfate	mg/L	21	23	25	25	30		23	27	26	25	25	24.5	24.3	21	30	26		26	27	31	35	23.3
Total Dissolved Solids	mg/L	190	170	180	200	640		180	210	190	190	190	173	171	190	220	84		220	230	230	250	188
CCR Appendix IV																							
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00059 J	0.002 U	0.001 U
Arsenic	mg/L	0.01	0.0037 J	0.0026 J	0.0025 J	0.0023 J	0.0019 J	0.0016 J	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.0012	0.0012	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Barium	mg/L	0.034	0.046	0.023	0.022	0.024	0.018	0.019	0.021	0.02	0.021	0.022	0.018	0.019	0.016	0.011	0.0093	0.012	0.012	0.014	0.013	0.013	0.012
Beryllium	mg/L	0.001 U	0.001 U	0.0004 J	0.001 U	0.001 U	0.00056 J	0.001 U	0.001 U	0.00057 J	0.001 U	0.00072 J	0.0002 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.0014	0.001 U	0.001 U	0.00074 J	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.0014 J	0.0012 J	0.0012 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0024	0.002 U
Cobalt	mg/L	0.00027 J	0.00053 J	0.001 U	0.001 U	0.00044 J	0.0002 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.25 J	0.2	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.21	0.2	0.25 J	0.18	0.18		0.19	0.18	0.18	0.18	0.19
Lead	mg/L	0.001 U	0.001 U	0.00045 J	0.001 U	0.00064 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0018 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0035 J	0.0022 J	0.0024 J	0.0022 J	0.003 J	0.0023 J	0.0019 J	0.002 J	0.0029 J	0.0023 J	0.003 J	0.002	0.002	0.0048 J	0.0031 J	0.0026 J	0.0031 J	0.0025 J	0.0035 J	0.0039 J	0.0033 J	0.0023
Radium, Total	pci/l	0.476		0.536	0.437 U	0.346 U		0.393 U	0.48 U	0.539			0.173 U	0.769 U	0.661	0.396 U	0.384 U		0.46	0.73	0.972		0.768 U
Radium-226	pci/l	0.26		0.165	0.0922 U	0.0867 U		0.36 UJ	0.1 UJ	0.244 J+			-0.228 U	-0.0489 U	0.419	0.233	0.139		0.278 UJ	0.165	0.428 J+		0.154 U
Radium-228	pci/l	0.335 U		0.436 U	0.437 U	0.346 U		0.393 UJ	0.48 UJ	0.408 U			0.173 U	0.769	0.356 U	0.396 U	0.384 U		0.413 UJ	0.462 U	0.544		0.614 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U	0.00062 J	0.001 U	0.0007 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00062 J	0.001 U	0.0005 J	0.0008 J	0.00023 J	0.001 U
Sample Parameters																							
DO	mg/L	0.8	0.13		0.06	0.79	0.29	2.19	1.95	0.22		1.25		0.11	0.53	0.07	0.65	0.27	1.46	0.9	0.18	0.8	0.13
ORP	millivolts	-112.2	-147.1		113.7	-38.9	-82.3	13.9	-94.6	75.7		108		-90.7	-248.6	-157.6	-133.1	-139.2	-132	-137.7	44.8	-60.2	-119.8
pH	SU	7.54	7.15		6.93	7.1	6.85	7.58	7.54	7.41		7.83		7.9	8.08	7.23	7.7	7.12	8.25	7.57	7.67	8.25	8.08
SC	uS/cm	288	274		184	192	198	211	229	220		208		302	297	244	245	245	246	262	254	255	330
TEMP	deg c	14.8	13.9		8.2	8.8	11.5	13.7	14.8	14.9		13.06		8.9	12.8	10.9	10.8	12.2	12.7	12.8	13.4	11.81	10.8
TURB	ntu	3.92	4.11		3.16	8.18	2.47	2.4	1.4	1.6		2.81		4.2	4.9	3.15	4.05	0.6	1.09	0.58	0.96	0.36	4.88

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW42C					GAMW43									
	Sample Date	2019-07-18	2019-08-28	2019-10-03	2019-11-05	2020-04-21	2018-06-13	2019-03-05	2019-04-19		2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-19	2020-04-22
	Sample Type	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N
Chemical Name	Unit															
CCR Appendix III																
Boron	mg/L	1	1	0.79	0.75	0.8	0.025 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.19	0.024 J	0.1 U
Calcium	mg/L	45	50	45	45	45.6	26	24	21	22	22	25	28	28	34	24.2
Chloride	mg/L	6.4	6.5	5.8	5.8	6.3	6	1.4	1.1	0.92 J		0.78 J	0.89 J	1.2	1.1	0.82
Fluoride	mg/L	0.3	0.25	0.25	0.26	0.2	0.15 J	0.11	0.11	0.1		0.14	0.13	0.14	0.14	0.15
pH	SU	7.81	7.28	7.48	7.64	7.65	6.63	6.8		7.07	6.62	7.35	7.1	6.98	6.94	7.5
Sulfate	mg/L	13	4.3	5.6	4.5	4.5	25	29	31	31		22	22	30	30	25.6
Total Dissolved Solids	mg/L	220	290	270	280	239	160	150	130	140		140	140	180	180	113
CCR Appendix IV																
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.00061 J	0.00077 J	0.00063 J	0.002 U	0.002 U	0.002 U	0.00077 J	0.001 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.0073	0.0036 J	0.0024 J	0.0024 J	0.0027 J	0.0025 J	0.0037 J	0.0033 J	0.0035 J	0.0021
Barium	mg/L	0.015	0.015	0.01	0.01	0.013	0.028	0.021	0.016	0.016	0.015	0.019	0.018	0.026	0.06	0.015
Beryllium	mg/L	0.001 U	0.00048 J	0.001 U	0.001 U	0.0002 U	0.001 U	0.00097 J	0.001 U	0.00075 J	0.0019	0.001 U	0.001 U	0.001 U	0.0014	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.001 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.0004 J	0.001 U	0.0003 J	0.001 U	0.0023	0.02	0.013	0.014	0.0067	0.0034	0.0036	0.0045	0.0037	0.0068
Fluoride	mg/L	0.3	0.25	0.25	0.26	0.2	0.15 J	0.11	0.11	0.1		0.14	0.13	0.14	0.14	0.15
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.037	0.038	0.025	0.023	0.032	0.008 U	0.008 U	0.008 U	0.008 U	0.0023 J	0.008 U	0.008 U	0.0022 J	0.0026 J	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0053 J	0.0049 J	0.0027 J	0.0031 J	0.0038	0.004 J	0.0016 J	0.0015 J	0.0017 J	0.0017 J	0.01 U	0.0015 J	0.0035 J	0.0048 J	0.001 U
Radium, Total	pci/l	0.723	1.14	0.972		1.73 U	0.323 U	0.371 U	0.405 U	0.369 U		0.362 U		0.411 U		1.11 U
Radium-226	pci/l	0.668 J-	0.701	0.752		1.22	0.285 U	0.0944 U	0.125	0.0973 U		0.268 UJ		0.151 U		0.187 U
Radium-228	pci/l	0.42 U	0.437	0.433 U		0.512 U	0.323 U	0.371 U	0.405 U	0.369 U		0.362 UJ		0.411 U		0.927 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.001 J	0.005 U	0.005 U	0.005 U	0.001 J	0.005 U	0.005 U	0.005 U	0.0012 J	0.001 U
Thallium	mg/L	0.00039 J	0.00061 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00073 J	0.001 U	0.001 U	0.00024 J	0.00091 J	0.001 U
Sample Parameters																
DO	mg/L	0.83	0.29	0.04	0.22	0.09	0.19	0.1		0.99	0.17	0.88	0.63	0.31	0.32	0.12
ORP	millivolts	-127.9	-205.2	-64.7	293.9	-119	-12	42.7		119.6	47.7	18.7	-18.6	87.7	-220.2	-19.2
pH	SU	7.81	7.28	7.48	7.64	7.65	6.63	6.8		7.07	6.62	7.35	7.1	6.98	6.94	7.5
SC	uS/cm	360	350	292	259	451	269	148		141	150	171	203	235	197	219
TEMP	deg c	13.3	12.3	11.9	11.5	11.2	13.1	7.48		8.2	12	15.7	16.3	16.4	12.6	9.1
TURB	ntu	4.43	4.5	4.69	9.33	14.92	4.35	3.99		4.6	4.2	2.98	1.95	4.2	4.05	4.21

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW43B										GAMW44										
	Sample Date	2018-06-13	2019-03-05	2019-04-19	2019-06-06		2019-07-17	2019-08-27	2019-10-02	2019-11-19	2020-04-30	2018-06-13	2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-08-27		2019-10-01		2019-11-20	2020-04-29
	Sample Type	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	FD	N	FD	N	N	N
Chemical Name	Unit																					
CCR Appendix III																						
Boron	mg/L	0.037 J	0.029 J	0.036 J	0.1 U	0.1 U	0.035 J	0.024 J	0.16	0.035 J	0.1 U	0.05 J	0.025 J	0.032 J	0.1 U	0.036 J	0.1 U	0.032 J	0.026 J	0.03 J	0.034 J	0.1 U
Calcium	mg/L	38	42	43	38 J-	39 J-	37	38	36	38	40	25	24	24	20 J-	20	37	23	32	34	27	19.3
Chloride	mg/L	1.5	1.5	1.6			1.5	1.5	1.6	1.5	1.6	10	2.4	3.1		1.8	1.5	1.6	1.9 J+	1.9 J+	1.7	2.3
Fluoride	mg/L	0.16 J	0.17	0.17			0.18	0.18	0.19	0.18	0.19	0.096 J	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096	0.18
pH	SU	7.11	7.62	7.76		7.47	8.09	7.49	7.41	7.5	8.2	6.77	6.23	6.41	5.99	6.6		6.31		6.91	6.22	6.41
Sulfate	mg/L	26	31	35			28	24	22	29	30.4	50	57	68		42	24	42	51 J+	51 J+	44	64
Total Dissolved Solids	mg/L	180	140	170			160	160	160	170	153	200	170	200		170	170	160	190	200	170	179
CCR Appendix IV																						
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.0008 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 J	0.00072 J	0.001 U
Arsenic	mg/L	0.0018 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.0054	0.0019 J	0.0019 J	0.0045 J	0.0087	0.005 U	0.01	0.0095	0.0091	0.054	0.044
Barium	mg/L	0.015	0.012	0.014	0.012	0.012	0.011	0.011	0.011	0.011	0.012	0.024	0.024	0.028	0.032	0.025	0.011	0.024	0.031	0.032	0.034	0.024
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.00075 J	0.0011	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.00073 J	0.00083 J	0.00099 J	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 J	0.00041 J	0.00034
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0023	0.0028	0.0029	0.0031	0.0028	0.002 U	0.0017 J	0.0012 J	0.0016 J	0.0023	0.0042
Cobalt	mg/L	0.00033 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025	0.0017	0.0019	0.0025	0.0025	0.001 U	0.0028	0.0039	0.0039	0.0079	0.0029
Fluoride	mg/L	0.16 J	0.17	0.17			0.18	0.18	0.19	0.18	0.19	0.096 J	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096	0.18
Lead	mg/L	0.00092 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.00045 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0038 J	0.0043 J	0.0042 J	0.005 J	0.008 U	0.0047 J	0.0042 J	0.0052 J	0.0042 J	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0022 J	0.0018 J	0.0018 J	0.0022 J	0.0025 J	0.0019 J	0.002 J	0.0022 J	0.0021 J	0.0017	0.013	0.01 U	0.01 U	0.0013 J	0.0012 J	0.0019 J	0.002 J	0.0037 J	0.0049 J	0.0058 J	0.0033
Radium, Total	pci/l	0.408	0.373 U	0.375 U			0.393 U	0.442 U	0.479 U		0.403 U	0.649	0.362 U	0.543		0.435 U	0.496 U	0.973	0.622 U	0.445 U		1.16 U
Radium-226	pci/l	0.252 U	0.0977 U	0.105 U			0.317 UJ	0.124 U	0.144 U		0.0661 U	0.268	0.193	0.12		0.196 U	0.153 U	0.138 U	0.255	0.155 U		1.16
Radium-228	pci/l	0.303 U	0.373 U	0.375 U			0.393 UJ	0.442 U	0.479 U		0.337 U	0.381	0.362 U	0.423		0.435 U	0.496 U	0.518 U	0.622 U	0.445 U		-0.986 U
Selenium	mg/L	0.00089 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.0014 J	0.00096 J	0.00092 J	0.00093 J	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.00042 J	0.00058 J	0.001 U	0.001 U	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00094 J	0.00046 J	0.001 U
Sample Parameters																						
DO	mg/L	0.18	0.05	0.99		0.22	0.77	0.67	0.82	0.27	0.12	0.68	0.05	3.85	1.95	3.04		1.06		0.96	0.39	1.85
ORP	millivolts	-81.5	-85.9	-92.1		-114.5	-119.2	-87.8	78.7	-208.4	-151.2	51.6	101.4	134.8	166.1	75.1		28.7		83.1	-148.8	-1
pH	SU	7.11	7.62	7.76		7.47	8.09	7.49	7.41	7.5	8.2	6.77	6.23	6.41	5.99	6.6		6.31		6.91	6.22	6.41
SC	uS/cm	245	187	197		193	186	190	175	154	280	272	140	170	140	151		189		279	156	252
TEMP	deg c	12.1	10.3	10		11.9	13	13.3	13.3	12	10.2	12.8	6.02	9.1	12.1	14.3		15.7		16.1	11.7	8.8
TURB	ntu	2.01	1.56	2.44		3.16	0.9	0.66	0.87	1.43	2.74	4.38	3.09	4.96	5.75	4.69		4.78		3.65	4.4	12.28

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW44B										GAMW51					GAMW51B				
	Sample Date	2018-06-13		2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-08-27	2019-10-02	2019-11-20	2020-04-29	2018-09-10	2018-10-25	2019-04-26	2019-11-12	2020-05-13	2018-09-10	2018-10-25	2019-04-26	2019-11-12	2020-05-13
	Sample Type	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																				
CCR Appendix III																					
Boron	mg/L	0.036 J	0.034 J	0.024 J	0.03 J	0.1 U	0.024 J	0.1 U	0.12	0.1 U	0.1 U	0.68	0.58	0.5	0.61	0.87	6.9	7.4	7.6	0.028 J	8.5
Calcium	mg/L	39	40	32	31	30	31	32	31	30	29.8	130	130	140	150	174	250	240	290	1 U	306
Chloride	mg/L	7.8	7.9	1.6	1.5		1.3	1.3	1.5	1.3	1.7	6.3	3.6	3.6	5.4	5.1	62	54	57	57	59.2
Fluoride	mg/L	0.1 J	0.11 J	0.13	0.13		0.14	0.13	0.15	0.15	0.13	0.44 J	0.41	0.39	0.4	0.27	0.79 J	0.8	0.81	0.83	0.62
pH	SU		7.29	7.79	7.62	7.52	8.28	7.64	7.16	7.44	8.31	8.08	7.69	7.14	6.78	7.14	8.72	8.86	7.48	7.15	7.93
Sulfate	mg/L	24	25	14	16		11	7.8	7.6	10	7.6	130	110	190	240	310	1300	1600	1400	1500	1440
Total Dissolved Solids	mg/L	180	170	120	160		150	130	120	130	109	550	530	620	680	747	2200	2200	2400	2300	2320
CCR Appendix IV																					
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.0032 J	0.0031 J	0.0016 J	0.0015 J	0.0018	0.0017 J	0.0013 J	0.0034 J	0.005 U	0.0036
Barium	mg/L	0.013	0.013	0.0098	0.0091	0.0084	0.0087	0.0087	0.0093	0.0081	0.0081	0.16	0.17	0.096	0.1	0.1	0.07	0.063	0.085	0.005 U	0.078
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.00031 J	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001	0.0011	0.0031	0.003	0.0031	0.00028 J	0.00022 J	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.1 J	0.11 J	0.13	0.13		0.14	0.13	0.15	0.15	0.13	0.44 J	0.41	0.39	0.4	0.27	0.79 J	0.8	0.81	0.83	0.62
Lead	mg/L	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0073 J	0.0052 J	0.0049 J	0.006 J	0.012	0.05	0.048	0.064	0.008 U	0.076
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0021 J	0.0021 J	0.0025 J	0.0026 J	0.0026 J	0.0021 J	0.0019 J	0.002 J	0.0022 J	0.0019	0.028	0.022	0.016	0.018	0.023	0.13	0.13	0.18	0.01 U	0.18
Radium, Total	pci/l	0.306 U	0.368 U	0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		0.409 U	1.43	0.961	0.536		0.96 U	2.01	2.75	2.74		2.81
Radium-226	pci/l	0.221 U	0.256 U	0.0972 U	0.105 U		0.175 U	0.162 U	0.147 U		0.409 U	0.681 J+	0.635	0.323		-0.0643 U	1.27 J+	1.46	1.37		1.22
Radium-228	pci/l	0.306 U	0.368 U	0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		-0.738 U	0.745	0.354 U	0.381 U		0.96	0.741	1.29	1.38		1.59
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.0011 J	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																					
DO	mg/L		0.48	0.04	1.53	1.19	1.75	0.65	0.28	0.14	0.47	0.31	1.9	1.12	0.09	0.13	0.26	1.08	1.69	0.1	0.13
ORP	millivolts		-55.9	-124	9.7	-126.1	-33.3	-122.7	115.3	-171.5	-143	-124.4	-247.2	17.2	-191.3	-89.7	-169.2	-258.6	25.8	-222.3	-142.8
pH	SU		7.29	7.79	7.62	7.52	8.28	7.64	7.16	7.44	8.31	8.08	7.69	7.14	6.78	7.14	8.72	8.86	7.48	7.15	7.93
SC	uS/cm		248	148	150	144	143	154	153	122	202	1076	806	661	640	1121	3438	2720	2139	1796	3199
TEMP	deg c		11.6	10.49	11.5	11.7	11.7	12.8	12.6	11.4	10.7	15.79	15.08	9.1	14.1	11.7	14.43	13.63	10	12.9	13.6
TURB	ntu		3.22	1.99	1.11	0.54	0.78	0.37	0.24	1.14	2.44	0.94	1	2.91	4.58	4.9	2.98	1.49	1.89	3.16	2.78

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW57					GAMW57B					GAMW58						GAMW58B				
	Sample Date	2019-07-23	2019-08-29	2019-10-01	2019-11-19	2020-04-28	2019-07-23	2019-08-29	2019-10-01	2019-11-19	2020-04-28	2019-07-22		2019-08-29	2019-10-01	2019-11-20	2020-04-30	2019-07-22	2019-08-29	2019-10-01	2019-11-20	2020-04-30
	Sample Type	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																					
CCR Appendix III																						
Boron	mg/L	0.037 J	0.042 J	0.023 J	0.038 J	0.1 U	0.095 J	0.19	0.031 J	0.16	0.1 U	0.043 J	0.046 J	0.047 J	0.028 J	0.037 J	0.1 U	0.047 J	0.043 J	0.029 J	0.026 J	0.1 U
Calcium	mg/L	22	25	23	24	19.9	46	48	39	46	40.5	10	10	13	38	8.8	10.4	38	39	39	36	38.7
Chloride	mg/L	1.5	1.2	1 J+	1.3	2.4	9.4	12	8.9 J+	11	10.4	1.2	1.3	1.1	3.9 J+	1.5	1.2	4	3.8	3.9 J+	3.7	3.9
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.05 U	0.14	0.13	0.14 J+	0.14	0.13	0.32	0.31	0.31	0.16 J+	0.29	0.28	0.17	0.17	0.17 J+	0.16	0.17
pH	SU	7.42	7.7	7.58	7.61	6.94	8.21	7.4	7.67	7.53	8.05		5.42	5.82	6.18	5.02	5.64	8.74	8.33	7.57	7.49	8.26
Sulfate	mg/L	33	35	31 J+	34	39.4	23	18	17 J+	14	19.5	43	43	41	25 J+	40	53.8	24	21	26 J+	25	24.1
Total Dissolved Solids	mg/L	150	120	120	130	108	210	220	190	190	161	95 J+	100 J+	110	190	100	89	180	200	180	160	155
CCR Appendix IV																						
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.00063 J	0.002 U	0.001 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.00075 J	0.00076 J	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.00098 J	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Barium	mg/L	0.012	0.008	0.006	0.0088	0.012	0.024	0.029	0.018	0.025	0.019	0.055	0.055	0.047	0.017	0.058	0.041	0.018	0.02	0.017	0.017	0.016
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.0011	0.0013	0.00097 J	0.001 U	0.0015	0.00059	0.00035 J	0.001 U	0.00055 J	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.00031 J	0.00035 J	0.001 U	0.001 U	0.0004 J	0.00028	0.001 U	0.001 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.0014 J	0.002 U	0.002 U	0.002 U	0.002 U	0.0021	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00074 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.011	0.011	0.01	0.001 U	0.0096	0.011	0.00021 J	0.00019 J	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.05 U	0.14	0.13	0.14 J+	0.14	0.13	0.32	0.31	0.31	0.16 J+	0.29	0.28	0.17	0.17	0.17 J+	0.16	0.17
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0011	0.001	0.0011	0.001 U	0.0012	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0029 J	0.0058 J	0.008 U	0.0044 J	0.008 U	0.0018 J	0.002 J	0.0017 J	0.0028 J	0.0021 J	0.008 U	0.0031 J	0.0025 J	0.0032 J	0.0019 J	0.008 U
Mercury	mg/L	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.016	0.022	0.0055 J	0.024	0.008	0.0061 J	0.011	0.0028 J	0.0073 J	0.0033	0.01 U	0.01 U	0.0016 J	0.0059 J	0.0017 J	0.001 U	0.023	0.02	0.0069 J	0.011	0.0035
Radium, Total	pci/l	0.419 U	0.453 U	0.548 U		0.581 U	0.502	0.435 U	0.543 U		1.72	0.54 U	0.599 U	0.457 U	1.2		1.18	0.504 U	0.506 U	0.603 U		0.416 U
Radium-226	pci/l	0.161 U	0.118 U	0.193		0.177 U	0.213 U	0.233	0.295		0.491 U	0.286 U	0.282 U	0.243	0.307		0.262	0.232 U	0.118 U	0.174		0.267 U
Radium-228	pci/l	0.419 U	0.453 U	0.548 U		0.404 U	0.492 U	0.435 U	0.543 U		1.23	0.54 U	0.599 U	0.457 U	0.895		0.914 U	0.504 U	0.506 U	0.603 U		0.149 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.001 U	0.0003 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J	0.001 U	0.001 U	0.00064 J	0.001 U	0.0005 J	0.001 U	0.00067 J	0.001 U	0.001 U
Sample Parameters																						
DO	mg/L	5.56	3.89	3.94	2.67	7.44	1.12	0.78	0.35	0.22	0.09		4.29	1.88	0.63	3.38	2.72	1.21	8.56	0.43	0.19	0.11
ORP	millivolts	54.6	43.1	126.2	-127	168.6	-98.1	-109.6	94.6	-211.9	-148.6		114.8	95.4	102.8	-53.6	139.6	-165	-248.6	90	-179.2	-153.7
pH	SU	7.42	7.7	7.58	7.61	6.94	8.21	7.4	7.67	7.53	8.05		5.42	5.82	6.18	5.02	5.64	8.74	8.33	7.57	7.49	8.26
SC	uS/cm	127	152	133	124	186	237	277	213	190	319		8.6	99	105	67	159	204	214	204	168	292
TEMP	deg c	12.4	12.3	13.3	11.6	10.2	11.8	11.8	12.5	10.8	11.6		13.1	13.8	14.5	12	8.4	11	12.2	12.8	11.1	10.1
TURB	ntu	4.81	2.82	2.9	3.06	3.82	4.9	4.39	0.82	1.28	4.41		4.02	1.8	0.61	1.98	2.20	4.35	2.75	0.49	1.02	4.11

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Appendix C: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

	Location	GAMW59			GAMW59B			GAMW60				GAMW60B		
	Sample Date	2019-07-19	2019-11-11	2020-05-12	2019-07-19	2019-11-11	2020-05-12	2019-07-22	2019-11-11		2020-05-11	2019-07-19	2019-11-11	2020-05-11
	Sample Type	N	N	N	N	N	N	N	FD	N	N	N	N	N
Chemical Name	Unit													
CCR Appendix III														
Boron	mg/L	1.2	1.4	1.1	4.8	5.4	7.2	2.1	1.4	1.5	1.4	8.1	7.2	7.5
Calcium	mg/L	250	280	324	310	330	249	330	350	350	374	280	300	334
Chloride	mg/L	6.5	9.8	11.4	38	44	56.2	7.8	11	11	12	19	18	17.6
Fluoride	mg/L	0.65	0.63	0.44	0.46	0.46	0.55	0.65	0.64	0.66	0.44	0.37	0.39	0.36
pH	SU	7.51	7.29	7.25	7.83	7.47	7.73	7.34		7.15	7.22	8.41	7.78	8
Sulfate	mg/L	580	770 J-	686	1400	1600 J-	1310	890	880 J-	890 J-	809	1200	1200 J-	1080
Total Dissolved Solids	mg/L	1100	1200	2040	2100	2100	1310	1400	1500 J	780 J	1460	1700	1600	1640
CCR Appendix IV														
Antimony	mg/L	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.001 U
Arsenic	mg/L	0.0033 J	0.0024 J	0.0017	0.0015 J	0.00081 J	0.001 U	0.005 U	0.0009 J	0.00086 J	0.001 U	0.00088 J	0.005 U	0.001 U
Barium	mg/L	0.1	0.088	0.099	0.065	0.058	0.041	0.044	0.036	0.036	0.029	0.06	0.063	0.064
Beryllium	mg/L	0.001 U	0.00044 J	0.0002 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.0002 U
Cadmium	mg/L	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.001 U	0.0002 U	0.001 U	0.001 U	0.0002 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.0005 J	0.00081 J	0.001 U	0.0003 J	0.00023 J	0.001 U	0.0011	0.0019	0.002	0.0017	0.00021 J	0.00024 J	0.001 U
Fluoride	mg/L	0.65	0.63	0.44	0.46	0.46	0.55	0.65	0.64	0.66	0.44	0.37	0.39	0.36
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.015	0.016	0.025	0.019	0.019	0.023	0.0068 J	0.008 U	0.008 U	0.016	0.0067 J	0.008 U	0.015
Mercury	mg/L	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U
Molybdenum	mg/L	0.03	0.046	0.014	0.06	0.092	0.085	0.042	0.035	0.035	0.019	0.37	0.39	0.38
Radium, Total	pci/l	1.11		1.83	2.3		1.51	0.504 U			0.403 U	2.25		2.23
Radium-226	pci/l	0.607		0.924	0.981		0.427 U	0.298 U			0.154 U	1.63		1.43
Radium-228	pci/l	0.499		0.904	1.32		1.08	0.504 U			0.249 U	0.622		0.797
Selenium	mg/L	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.001 U	0.005 U	0.005 U	0.005 U	0.0012	0.005 U	0.005 U	0.001 U
Thallium	mg/L	0.001 U	0.00049 J	0.001 U	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters														
DO	mg/L	0.77	0.21	0.12	0.55	0.11	0.13	1.06		0.32	0.16	0.67	0.14	0.13
ORP	millivolts	-94.6	154.8	-86	-117.3	-214.4	-126.7	23.5		-152.8	8.6	-160.7	-202.1	-145.1
pH	SU	7.51	7.29	7.25	7.83	7.47	7.73	7.34		7.15	7.22	8.41	7.78	8
SC	uS/cm	1264	1132	1669	2082	1837	2891	1437		1182	1871	1643	1320	2131
TEMP	deg c	20.9	18	13.4	16	14.3	13.3	17.6		15.3	11	15.8	12.8	12.3
TURB	ntu	1.5	2.41	4.87	4.84	2.55	2.31	2.46		2.11	3.58	4.1	3.83	4.35

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Prepared by: DFSC
Checked by: KMC
Reviewed by: MAH

APPENDIX D

Certification of Facility Compliance
40 CFR Part §257.103(f)(2)(v)(C)(1)

ALTERNATIVE CLOSURE REQUIREMENTS CERTIFICATION OF COMPLIANCE
Pursuant to 40 C.F.R. 257.103(f)

R.M. Schahfer Generating Station

Northern Indiana Public Service Company requires additional time to close the Waste Disposal Area ("WDA") and must continue to use the CCR surface impoundment due to the absence of alternative disposal capacity both on and offsite of the facility. In support of this demonstration, and as required by 40 C.F.R. §257.103(f)(2)(C)(1), Northern Indiana Public Service Company submits the following certification:

> I hereby certify that to the best of my knowledge and inquiry of those persons who are immediately responsible for compliance with environmental regulations for the Waste Disposal Area at R.M. Schahfer Generating System, the facility is in compliance with all of the requirements of 40 C.F.R. Part 257, Subpart D.

Kurt W. Sangster, Vice President Electric Generation
Northern Indiana Public Service Company

APPENDIX E

Soil Borings and Monitoring Well Logs 40 CFR Part §257.103(f)(2)(v)(C)(2)(ii)

BOREHOLE LOG: GAMW-01

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169108.216 E: 2968518.988
GROUND SURFACE ELEV.: 664.98
TOP OF CASING ELEV.: 668.19
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/26/2015
END DATE/TIME: 6/26/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to black fine SILTY SAND, some gravel		1	SS		0.25 / 2	0-2': SILTY GRAVEL, fine to coarse, poorly-graded, black, non-cohesive, dry, loose. (GM) SPTs (1-5-5-1)		Bentonite chips 0-3 ft-bgs
			2	SS		2 / 2	2-4': SILTY SAND, fine, poorly-graded, dark brown, trace gravel, non-cohesive, dry, loose. (SM) SPTs (6-3-3-4)		Filter Pack #7 Sand 3-3.5 ft-bgs
660.0									Filter Pack #5 Sand 3.5-15 ft-bgs
	reddish-brown fine to medium SILTY SAND		3	SS		1.5 / 2	5-5.75': SILTY SAND, fine, poorly-graded, dark brown, trace gravel, non-cohesive, dry, loose. (SM) 5.75-7': SAND, fine, poorly-graded, reddish-brown, trace silt, wet, compact. (SP) SPTs (7-7-5-8)		2" PVC Screen slot 0.010" 5-15 ft-bgs
655.0									
	gray to brown medium to coarse SAND, trace silt		4	SS		2 / 2	10-11': SAND, fine, poorly-graded, reddish-brown, trace silt, wet, compact. (SP) 11-12': SAND, medium to coarse, well-graded, gray to brown, trace silt, wet, loose. (SP) SPTs (5-4-5-8)		
650.0									
645.0									
640.0									
635.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-01B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 41
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169107.374 E: 2968525.2
GROUND SURFACE ELEV.: 665.2
TOP OF CASING ELEV.: 667.85
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 11:00:00 AM
END DATE/TIME: 7/31/2018 11:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	light brown fine SAND and rounded GRAVEL, some silt			RS			0-1.3': SAND and rounded GRAVEL <2 inch, fine, poorly-graded, light brown, some silt, dry. (SP)		Bentonite Grout 0-22 ft bgs
	dark brown fine SILTY SAND			RS			1.3-2.5': SILTY SAND, fine, poorly-graded, dark brown, cohesive, wet. (SM)		
660.0	light gray fine to coarse SAND			RS			5-5.2': SAND, fine to medium, well-graded, light and dark gray, wet. (SW)		
				RS			5.2-7': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
655.0				RS			10-13.75': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
650.0	light gray fine to coarse SAND, trace to some gravel			RS			16-20': SAND, coarse, poorly-graded, light gray, some fine to medium sand, trace rounded gravel <1 cm, wet. (SP)		
645.0									Bentonite Chips 22-24 ft bgs #5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Gravelly Sand (SPG)
Shale
USCS Silty Sand (SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-01B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 41
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169107.374 E: 2968525.2
GROUND SURFACE ELEV.: 665.2
TOP OF CASING ELEV.: 667.85
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 11:00:00 AM
END DATE/TIME: 7/31/2018 11:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light gray fine to coarse SAND, trace to some gravel		SB-01B-25'-27'	RS			25-27': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 26-36 ft bgs
				RS			27-27.2': SAND, coarse, light gray. (SP) 27.2-28.7': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
635.0									
630.0	gray clayey SHALE		SB-01B-36'-37'	RS			36-37': CLAYEY SHALE, gray, wet.		#5 Sand 36-41 ft bgs
				RS			37-40': CLAYEY SHALE, gray, wet.		
625.0			SB-01B-40'-41'	RS			40-41': CLAYEY SHALE, gray, wet.		
620.0									

LITHOLOGY LEGEND

USCS Poorly-graded Gravelly Sand (SPG)
Shale
USCS Silty Sand (SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-02

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2168720.879 E: 2970548.504
GROUND SURFACE ELEV.: 666.08
TOP OF CASING ELEV.: 669.57
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/26/2015
END DATE/TIME: 6/26/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	light brown fine SAND, trace silt		1	SS		2 / 2	0-0.58': ORGANIC SILT, some sand, low-plasticity, dark brown, plant roots, non-cohesive, dry, loose. (OL) 0.58-2': SAND, fine, poorly-graded, light brown, trace gravel, trace silt, moist, loose. (SP) SPTs (2-4-3-5)		Cement and bentonite grout mix 0-1.5 ft-bgs Bentonite chips 1.5-3.5 ft-bgs Filter Pack #7 Sand 3.5-4 ft-bgs Filter Pack #5 Sand 4-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0	reddish-brown fine to medium SILTY SAND		2	SS		2 / 2	5-6': SAND, fine, poorly-graded, trace gravel, trace silt, light brown, moist, loose. (SP) 6-7': SILTY SAND, fine to medium, poorly-graded, reddish-brown, non-cohesive, wet, loose. (SM) SPTs (7-6-4-7)		
655.0	gray to brown fine SAND		3	SS		2 / 2	10-11': SILTY SAND, fine to medium, poorly-graded, reddish-brown, non-cohesive, wet, loose. (SM) 11-12': SAND, fine, poorly-graded, gray to brown, wet, compact. (SP) SPTs (4-5-7-9)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Silty Sand (SM)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-03

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169821.527 E: 2971646.342
GROUND SURFACE ELEV.: 665.11
TOP OF CASING ELEV.: 668.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/27/2015
END DATE/TIME: 6/27/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND		1	SS		1.83 / 2	0-2': SILTY SAND, fine, poorly-graded, dark brown, plant roots, trace gravel, trace silt, moist, loose. (SM) SPTs (2-2-2-3)		Cement and bentonite grout mix 0-1.5 ft-bgs
660.0	gray to brown fine SAND, trace silt		2	SS		2 / 2	5-5.83': SILTY SAND, fine, poorly-graded, trace gravel, dark brown, plant roots, non-cohesive, moist, loose. (SM) 5.83-7': SAND, fine, poorly-graded, light brown, orange stained ribbons, trace silt, wet, compact. (SP) SPTs (5-5-5-5)		Bentonite chips 1.5-3.5 ft-bgs; Filter Pack #7 Sand 3.5-4 ft-bgs; Filter Pack #5 Sand 4-15 ft-bgs; 2" PVC Screen slot 0.010" 5-15 ft-bgs
655.0			3	SS		2 / 2	10-12': SAND, fine, poorly-graded, gray to brown, trace silt, wet, loose. (SP) SPTs (3-3-4-3)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: John
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-03B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36.8

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169813.708 E: 2971647.06
GROUND SURFACE ELEV.: 665.29
TOP OF CASING ELEV.: 668.20
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/24/2016 8:05:00 AM
END DATE/TIME: 5/24/2016 10:42:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- light brown fine to medium SAND, occasional organics, fly ash/ boiler slag, trace silt		1	SS		1.6 / 2	0-1.7': SAND, organics, light brown medium sand lenses; dark brown; trace fly ash/ boiler slag, trace silt, loose. (FILL) 1.7-2': SAND, oxidized, fine, poorly-graded; trace silt, loose (FILL). SPTs (3-2-5-5)		Bentonite grout mix 0-23 ft-bgs
660.0			2	SS		1.7 / 2	5-5.75': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, loose. (FILL) 5.75-7': SAND, medium, poorly-graded; brown; trace silt, wet, loose. (FILL) SPTs (3-4-4-5)		
655.0			3	SS		2 / 2	10-12': SAND, fine, poorly-graded; brown; trace oxides, trace silt, wet, very loose. (FILL) SPTs (2-2-2-2)		
650.0	brown, fine to medium SAND, trace gravel and oxides, trace silt		4	SS		0.9 / 2	15-17': SAND, fine, well-graded; brown; trace gravel, trace silt, moist, very loose. (SW) SPTs (1-2-2-3)		
645.0			5	SS		1 / 2	21-22': SAND, medium, well-graded; brown; trace gravel, trace silt, moist, loose. (SP) SPTs (2-2-4-4)		Bentonite chips 23-25 ft-bgs Filter Pack #5 Sand 25-37 ft-bgs

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-03B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36.8

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169813.708 E: 2971647.06
GROUND SURFACE ELEV.: 665.29
TOP OF CASING ELEV.: 668.20
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/24/2016 8:05:00 AM
END DATE/TIME: 5/24/2016 10:42:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	brown, fine to medium SAND, trace gravel and oxides, trace silt		6	SS		1.5 / 2	25-27': SAND, medium, well-graded; brown; trace oxides, trace silt, moist, compact. (SW) SPTs (4-5-7-7)		2 PVC Screen slot 0.010 27-37 ft-bgs
635.0			7	SS		0.9 / 2	30-32': SAND, medium, well-graded; brown; trace gravel, trace silt, wet, loose.(SP) SPTs (3-5-4-5)		
630.0	dark grey to black SHALE		8	SS		2 / 2	35-35.7': SAND, fine, poorly-graded; trace silt, moist, loose.(SP) 35.7': auger refusal in SHALE; dark grey to black.		
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-04

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170737.635 E: 2968871.614
GROUND SURFACE ELEV.: 665.73
TOP OF CASING ELEV.: 669.21
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/27/2015
END DATE/TIME: 6/27/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	brown to black fine SILTY SAND, trace gravel		1	SS		2 / 2	0-0.92': SAND, fine, poorly-graded, some organic silt in top 4 inches, light reddish-brown, plant roots, non-cohesive, wet, loose. (SP) 0.92-2': SILTY SAND, fine, poorly-graded, brown to black, trace gravel, non-cohesive, moist, loose. (SM) SPTs (2-3-4-3)		Cement and bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #7 Sand 3-3.5 ft-bgs Filter Pack #5 Sand 3.5-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0	gray to reddish-brown fine to medium SILTY SAND		2	SS		1.83 / 2	5-5.67': SILTY SAND, fine, poorly-graded, trace gravel, brown to black, non-cohesive, moist, loose. (SM) 5.67-6.17': SAND, fine, poorly-graded, light reddish-brown, trace silt, wet, loose. (SP) 6.17-7': SILTY SAND, fine, poorly-graded, gray to brown, non-cohesive, moist, loose. (SM) SPTs (2-3-4-5)		
655.0	gray fine SAND, trace silt		3	SS		1.58 / 2	10-12': SAND, fine, poorly-graded, gray, trace silt, wet, loose. (SP) SPTs (3-3-4-3)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: John
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-05

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 17
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170870.001 E: 2968721.916
GROUND SURFACE ELEV.: 666.69
TOP OF CASING ELEV.: 669.75
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/27/2015
END DATE/TIME: 6/27/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- brown to black fine to medium SAND, BOILER SLAG		1	SS		0.83 / 2	0-2': SAND, BOILER SLAG, medium, poorly-graded, black, trace silt, dry, very loose. (FILL) SPTs (1-0-1-0)		Cement and bentonite grout mix 0-3 ft-bgs
660.0			2	SS		1.33 / 2	5-7': SAND, fine, poorly-graded, brown, trace silt, moist, loose. (FILL) SPTs (1-2-2-2)		Bentonite chips 3-5 ft-bgs Filter Pack #7 Sand 5-6 ft-bgs Filter Pack #5 Sand 6-17 ft-bgs 2" PVC Screen slot 0.010" 7-17 ft-bgs
655.0			3	SS		1.25 / 2	10-12': SAND, fine, poorly-graded, brown, lenses of black angular BOILER SLAG, trace silt, wet, loose. (FILL) SPTs (2-3-5-6)		
650.0	grayish brown fine SAND, trace silt		4	SS		1.67 / 2	15-17': SAND, fine, poorly-graded, gray-brown, trace silt, wet, loose. (SP) SPTs (3-2-3-5)		
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: John
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-06

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172320.062 E: 2969128.6
GROUND SURFACE ELEV.: 667.50
TOP OF CASING ELEV.: 670.81
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/29/2015
END DATE/TIME: 6/29/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- BOILER SLAG and FLY ASH, gray clayey SAND		1	SS		1.92 / 2	0-1.42': BOILER SLAG and ASH, black, loose, wet, non-cohesive. (FILL) 1.42-2': CLAYEY SAND, gray, cohesive, stiff, W>PL. (FILL) SPTs (3-5-5-6)		Cement and bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #7 Sand 3-4 ft-bgs Filter Pack #5 Sand 4-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
665.0			2	SS		2 / 2	5-5.83': BOILER SLAG and ASH, black, loose, moist, non-cohesive. (FILL) 5.83-6.67': CLAYEY SAND, gray, cohesive, stiff W>PL. (FILL) 6.67-7': SAND, medium, poorly-graded, dark brown to light brown, trace silt, moist, loose. (SP) SPTs (3-4-4-6)		
660.0	light brown medium SAND, trace silt		3	SS		2 / 2	10-11': CLAYEY SAND, dark gray, cohesive, wet, W>PL. (SC) 11-12': SAND, medium, poorly-graded, light brown, trace silt, wet, loose. (SP) SPTs (2-3-3-4)		
655.0									
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: HMV
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-07

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172327.533 E: 2970256.339
GROUND SURFACE ELEV.: 666.60
TOP OF CASING ELEV.: 669.89
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/29/2015
END DATE/TIME: 6/29/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- BOILER SLAG and black FLY ASH, brown medium SAND, trace gravel, trace silt		1	SS		2 / 2	0-0.83': SAND, medium, poorly-graded, dark brown, organics, trace gravel, trace silt, moist, loose. (FILL) 0.83-1.5': FLY ASH, black, non-cohesive, moist, loose. (FILL) 1.5-2': SAND, medium, poorly-graded, brown, trace silt, moist, loose. (FILL) SPTs (4-4-5-7)		Cement and bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #7 Sand 3-4 ft-bgs Filter Pack #5 Sand 4-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0	light brown to black fine to medium SAND, trace gravel, trace silt		2	SS		1.66 / 2	5-6.25': FLY ASH, black, trace gravel, trace silt, moist, loose. (FILL) 6.25-7': SAND, poorly-graded medium, brown, trace gravel, trace silt, loose, wet. (SP) SPTs (7-5-3-3)		
655.0			3	SS		1.42 / 2	10-11.08': SAND, fine to medium, poorly-graded, black, trace gravel, trace organics, trace silt, wet, very loose. (SP) 11.08-12': SAND, medium, poorly-graded, light brown, trace silt, wet, very loose. (SP) SPTs (5-2-2-7)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: HMV
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-07B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 41
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172318.589 E: 2970251.363
GROUND SURFACE ELEV.: 666.83
TOP OF CASING ELEV.: 669.37
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 11:40:00 AM
END DATE/TIME: 7/25/2018 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- black BOILER SLAG and light to dark brown SILTY SAND, trace gravel			RS			0-0.8': SILTY SAND, fine, poorly-graded, light to dark brown, trace rounded gravel <1 cm, trace organics, dry. (SM)		Bentonite Grout 0-26 ft bgs
				RS					
				RS			0.8-1.4': SILTY SAND, fine, poorly-graded, dark brown, moist. (SM)		
665.0	dark brown fine SILTY SAND			RS					
	light gray fine GRAVELLY SAND, trace clay			RS			1.4-1.8': BOILER SLAG, black, moist. (FILL)		
	light gray to orange-brown fine to medium SAND			RS			1.8-2.7': SILTY SAND, fine, poorly-graded, dark brown, moist. (SM)		
				RS			2.7-3.2': GRAVELLY SAND, fine, poorly-graded, light gray, rounded gravel up to 2 inch, some clay, cohesive, wet. (SP)		
							3.2-3.4': SAND, fine to medium, well-graded, orange-brown, wet. (SW)		
660.0				RS			5-5.5': SAND, fine to medium, well-graded, orange-brown, wet. (SW)		
							5.5-7.8': SAND, fine to medium, well-graded, light gray to light brown, wet. (SW)		
							7.8-7.9': SAND, fine to medium, well-graded, orange, wet. (SW)		
				RS			7.9-9': SAND, fine to medium, well-graded, light gray to light brown, wet. (SW)		
							10-11.3': SAND, fine to medium, well-graded, light brown to light gray, wet. (SW)		
655.0	light brown to light gray fine to coarse SAND, trace to some gravel			RS			11.3-13.3': SAND, fine to coarse, well-graded, light brown to light gray, trace rounded gravel <1 cm, wet. (SW)		
650.0				RS			16-18': SAND, fine to coarse, well-graded, light brown to light gray, trace rounded gravel <1 cm, wet. (SW)		
				RS			18-20': SAND, medium to coarse, well-graded, light brown, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
				RS			20-22': SAND, medium to coarse, well-graded, light brown, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
645.0				RS			22-25': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		

LITHOLOGY LEGEND

Fill (made ground)
USCS Well-graded Sand (SW)
USCS Silty Sand (SM)
Shale
USCS Poorly-graded Gravelly Sand (SPG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-07B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 41
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172318.589 E: 2970251.363
GROUND SURFACE ELEV.: 666.83
TOP OF CASING ELEV.: 669.37
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 11:40:00 AM
END DATE/TIME: 7/25/2018 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light brown to light gray fine to coarse SAND, trace to some gravel			RS			25-29.2': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		Bentonite Chips 26-28 ft bgs #5 Sand Filter Pack 28-40 ft bgs
				RS			30-32': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 30-40 ft bgs
635.0				RS			32-34': SAND, fine to coarse, well-graded, light gray, some rounded gravel 1 up to 3 inch, wet. (SW)		
			SB-07B-35'-37'	RS			35-36.3': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW) 36.3-37': SAND, fine to coarse, well-graded, light gray, little rounded gravel 1 cm to 3 inch and <1 cm, wet. (SW)		
630.0				RS			37-37.5': SAND, fine to coarse, well-graded, light gray, little rounded gravel 1 cm to 3 inch and <1 cm, wet. (SW)		
	gray clayey SHALE			RS		1 / 1	40-41': CLAYEY SHALE, gray, weathered, wet. Less weathered from 40.5-41'.		#5 Sand 40-41 ft bgs
625.0									
620.0									

LITHOLOGY LEGEND

- Fill (made ground)
- USCS Well-graded Sand (SW)
- USCS Silty Sand (SM)
- Shale
- USCS Poorly-graded Gravelly Sand (SPG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-08

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173335.204 E: 2970799.89
GROUND SURFACE ELEV.: 666.01
TOP OF CASING ELEV.: 669.66
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/28/2015
END DATE/TIME: 6/28/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- SANDY GRAVEL, BOILER SLAG, trace silt		1	SS		1.33 / 2	0-2': SANDY GRAVEL, poorly-graded, angular, gray-brown, lenses of black BOILER SLAG, trace silt, dry, compact. (FILL) SPTs (6-12-14-19)		Cement and bentonite grout mix 0-1 ft-bgs
									Bentonite chips 1-3 ft-bgs
									Filter Pack #7 Sand 3-4 ft-bgs
									Filter Pack #5 Sand 4-15 ft-bgs
	brown medium SAND, trace silt						5-7': SAND, medium, poorly-graded, brown, trace silt, wet, very loose. (SP) SPTs (1-1-1-1)		2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0			2	SS		1.5 / 2			
655.0			3	SS		2 / 2	10-12': SAND, medium, poorly-graded, brown to light brown, trace silt, wet, loose. (SP) SPTs (2-2-5-9)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: HMV
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-08B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173334.7 E: 2970790.588
GROUND SURFACE ELEV.: 665.92
TOP OF CASING ELEV.: 668.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 2:35:00 PM
END DATE/TIME: 7/25/2018 3:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown GRAVEL			RS			0-0.25': GRAVEL, rounded <2 inch, light brown, dry. (GW)		Bentonite Grout 0-22 ft bgs
	light gray fine to coarse GRAVELLY SAND			RS					
665.0	dark brown fine SILTY SAND, some gravel			RS			0.25-0.8': GRAVELLY SAND, fine to coarse, well-graded, light gray, rounded gravel up to <2 inch, dry. (SW)		
	brown fine to medium CLAYEY SAND, some gravel			RS			0.8-1.5': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel <1 inch, moist. (SM)		
	brown fine to medium SAND			RS			1.5-3': CLAYEY SAND, fine to medium, well-graded, brown, some rounded gravel <1 inch, cohesive, dry. (SC)		
							3-5': SAND, fine to medium, well-graded, brown, moist. (SW)		
	light gray fine to medium SAND, some silt			RS			5-7': SAND, fine to medium, well-graded, light gray, some silt, somewhat cohesive, wet. (SW)		
660.0									
	light gray to light brown fine to coarse SAND, trace to some gravel								
655.0									
650.0				RS			16-17.5': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
				RS			17.5-19': SAND, fine to coarse, well-graded, light gray to light brown, trace rounded gravel <1 cm, wet. (SW)		
645.0				RS			20-24': SAND, fine to coarse, well-graded, light gray, wet. (SW)		Bentonite Chips 22-24 ft bgs
				RS			24-28': SAND, fine to coarse, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

USCS Well-graded Gravel (GW)
USCS Clayey Sand (SC)
USCS Well-graded Gravelly Sand (SWG)
USCS Well-graded Sand (SW)
USCS Silty Sand (SM)
USCS Poorly-graded Gravelly Sand (SPG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-08B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173334.7 E: 2970790.588
GROUND SURFACE ELEV.: 665.92
TOP OF CASING ELEV.: 668.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 2:35:00 PM
END DATE/TIME: 7/25/2018 3:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light gray to light brown fine to coarse SAND, trace to some gravel			RS					2" PVC Screen slot 0.010 26-36 ft bgs
				RS			28-30': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
635.0			SB-08B-30-32	RS			30-31.25': SAND, fine to coarse, well-graded, light gray, wet. (SW) 31.25-32': SAND, medium to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
	light gray coarse SAND and GRAVEL			RS			32-34': SAND and rounded GRAVEL <1 cm, coarse, poorly-graded, light gray, wet. (SP)		
630.0	gray clayey SHALE			RS		2 / 1	36-37': CLAYEY SHALE, gray, wet.		#5 Sand 36-37 ft bgs
625.0									
620.0									

LITHOLOGY LEGEND

USCS Well-graded Gravel (GW)
USCS Clayey Sand (SC)
USCS Well-graded Gravelly Sand (SWG)
USCS Well-graded Sand (SW)
USCS Silty Sand (SM)
USCS Poorly-graded Gravelly Sand (SPG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-09

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172509.361 E: 2971291.294
GROUND SURFACE ELEV.: 665.18
TOP OF CASING ELEV.: 668.99
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/28/2015
END DATE/TIME: 6/28/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	light brown to black medium SAND, trace silt		1	SS		1.75 / 2	0-1': SAND, medium, poorly-graded, black, organics, trace silt, moist, very loose. (SP) 1-2': SAND, medium, poorly-graded, light brown, trace silt, moist, very loose. (SP) SPTs (2-1-1-2)		Cement and bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #7 Sand 3-4 ft-bgs Filter Pack #5 Sand 4-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0			2	SS		1.5 / 2	5-6': SAND, medium, poorly-graded, brown, trace silt, moist, compact. (SP) 6-7': SAND, medium, poorly-graded, light brown, trace silt, moist, compact. (SP) SPTs (4-5-5-6)		
655.0			3	SS		1.92 / 2	10-10.58': SAND, medium, poorly-graded, brown, trace silt, wet, compact. (SP) 10.58-12': SAND, fine, poorly-graded, light brown, trace silt, wet, compact. (SP) SPTs (1-2-2-5)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: John
DRILL RIG: CME 75

LOGGED BY: HMV
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-09B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34.5
DEPTH TO BEDROCK: 34.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172502.567 E: 2971291.67
GROUND SURFACE ELEV.: 665.35
TOP OF CASING ELEV.: 668.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/24/2016 1:10:00 PM
END DATE/TIME: 5/24/2016 3:09:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- fine sand, occasional organics, oxides, fine lenses and fly ash/ boiler slag, trace silt		1	SS		1.9 / 2	0-1': SAND, organics, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace silt, loose. (FILL) 1-2': SAND, fine, poorly-graded; light brown; trace silt, dry, loose. (FILL) SPTs (2-2-3-4)		Bentonite grout mix 0-20.5 ft-bgs
660.0			2	SS		1.3 / 2	5-7': SAND, fine, poorly-graded; light brown; trace iron oxides, trace organics, trace silt, dry, compact. (FILL) SPTs (5-6-7-7)		
655.0			3	SS		1.2 / 2	10-12': SAND, 2 thick clayey lens, trace fly ash/ boiler slag, trace iron oxides, fine, poorly-graded; light brown; trace silt, dry, compact. (FILL) SPTs (6-8-8-7)		
650.0			4	SS		1.9 / 2	15-17': SAND, fine, poorly-graded; light brown; trace fly ash/ boiler slag, trace silt, wet, loose. (FILL) SPTs (2-4-3-5)		
645.0	red brown tan GRAVEL, trace silt light brown fine SAND, trace gravel, trace silt		5	SS		1.5 / 2	20-20.9': GRAVEL, rounded, well-graded; red brown tan; trace silt, wet, loose. (GW) 20.9-22': SAND, fine, poorly-graded; light brown; trace silt, wet, loose. (SP) SPTs (3-5-4-6)		Bentonite chips 20.5-22.5 ft-bgs Filter Pack #5 Sand 22.5-34.5 ft-bgs 2 PVC Screen slot

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Gravel (GW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-09B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34.5
DEPTH TO BEDROCK: 34.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172502.567 E: 2971291.67
GROUND SURFACE ELEV.: 665.35
TOP OF CASING ELEV.: 668.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/24/2016 1:10:00 PM
END DATE/TIME: 5/24/2016 3:09:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light brown fine SAND, trace gravel, trace silt		6	SS		1.5 / 2	25-27': SAND, fine, poorly-graded; light brown; trace gravel, trace silt, wet, compact. (SP) SPTs (5-6-6-7)		0.010 24.5-34.5 ft-bgs
635.0			7	SS		1.1 / 2	30-32': SAND, fine, poorly-graded; light brown; trace gravel, trace silt, wet, loose. (SP) 34.5': auger refusal in SHALE; dark grey to black. SPTs (3-3-5-4)		
630.0	SHALE								
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Gravel (GW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-10

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173531.415 E: 2973046.249
GROUND SURFACE ELEV.: 663.99
TOP OF CASING ELEV.: 667.83
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/28/2015
END DATE/TIME: 6/28/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine to medium SAND, organics, trace silt		1	SS		0.67 / 2	0-2': SAND, fine to medium, poorly-graded, dark brown, organics, trace silt, moist, loose. (SP) SPTs (1-2-4-7)		Cement and bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #7 Sand 3-4 ft-bgs Filter Pack #5 Sand 4-15 ft-bgs 2" PVC Screen slot 0.010" 5-15 ft-bgs
660.0			2	SS		1.67 / 2	5-6': SAND, fine to medium, poorly-graded, dark brown, organics, trace silt, moist, loose. (SP) 6-6.5': CLAYEY SAND, gray, cohesive, hard. (SC) 6.5-7': SAND, medium, poorly-graded, light brown, trace silt, moist, loose. (SP) SPTs (2-3-4-6)		
	tan to dark gray fine to medium SAND, trace silt								
655.0			3	SS		1.75 / 2	10-11': SAND, fine to medium, poorly-graded, dark gray, trace silt, wet, very loose. (SP) 11-12': SAND, fine to medium, poorly-graded, tan to brown, trace silt, wet, very loose. (SP) SPTs (2-1-1-1)		
650.0									
645.0									
640.0									
635.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: John
DRILL RIG: CME 75

LOGGED BY: HMV
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-11

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174218.618 E: 2972678.783
GROUND SURFACE ELEV.: 663.60
TOP OF CASING ELEV.: 667.17
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 6/25/2015
END DATE/TIME: 6/25/2015

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown ORGANIC SILT and SAND		1	SS		1.58 / 2	0-1': ORGANIC SILT and SAND, well-graded, some gravel, dark brown, plant roots, non-cohesive, moist. (OL)		Cement and bentonite grout mix 0-1 ft-bgs
	dark brown fine SAND, trace silt						1-2': SAND, fine, poorly-graded, dark brown, trace silt, moist, loose. (SP) SPTs (3-5-5-8)		Bentonite chips 1-3 ft-bgs
660.0									Filter Pack #7 Sand 3-3.5 ft-bgs
	dark brown fine SILTY SAND		2	SS		2 / 2	5-6.25': SILTY SAND, fine, poorly-graded, dark brown, trace silt, moist, compact. (SM)		Filter Pack #5 Sand 3.5-15 ft-bgs
	reddish-brown fine SAND, trace gravel, trace silt						6.25-7': SAND, fine, poorly-graded, reddish-brown, trace pea-sized gravel, trace silt, wet. (SP) SPTs (5-6-7-7)		2" PVC Screen slot 0.010" 5-15 ft-bgs
655.0									
	fine to coarse brown SAND, trace gravel, trace silt		3	SS		1.42 / 2	10-12': SAND, fine to coarse, well-graded, sub-angular to sub-rounded, brown, trace gravel, trace silt, wet, loose. (SW) SPTs (4-5-5-6)		
650.0									
645.0									
640.0									
635.0									

LITHOLOGY LEGEND

USCS Low Plasticity Organic silt or clay (OL)
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)
USCS Silty Sand (SM)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: AP
CHECKED BY: CEM
DATE: 7/27/15

Golder Associates

BOREHOLE LOG: GAMW-12

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169576.844 E: 2968314.48
GROUND SURFACE ELEV.: 664.35
TOP OF CASING ELEV.: 667.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/23/2016 11:45:00 AM
END DATE/TIME: 5/23/2016 12:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	black silty fine SAND, organics, trace gravel								Bentonite grout mix 0-1 ft-bgs
	light grey to dark brown fine SAND, trace gravel, trace silt		1	SS		1.6 / 2	0-0.8': SILTY SAND, fine, organics, poorly-graded; black; trace gravel, non-cohesive, moist, very loose. (SM) 0.8-2': SAND, poorly-graded; dark brown; trace silt, moist, very loose. (SP) SPTs (1-0-3-5)		Bentonite chips 1-3 ft-bgs
									Filter Pack #5 Sand 3-15 ft-bgs
660.0			2	SS		1.5 / 2	5-7': SAND, fine, poorly-graded; grey; trace silt, wet, compact. (SP) SPTs (3-5-6-5)		2 PVC Screen slot 0.010 5-15 ft-bgs
655.0			3	SS		1.8 / 2	10-12': SAND, fine, poorly-graded; light grey; trace gravel, trace silt, saturated, loose. (SP) SPTs (1-2-4-7)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Low Plasticity Organic silt or clay (OL)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-12B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169580.32 E: 2968309.536
GROUND SURFACE ELEV.: 664.23
TOP OF CASING ELEV.: 666.79
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 8:05:00 AM
END DATE/TIME: 7/31/2018 8:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND, some gravel, some organics			RS			0-0.75': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, some organics, dry. (SM)		Bentonite Grout 0-21 ft bgs
	light brown medium SAND			RS			0.75-1.9': SAND, medium, light brown, moist. (SW)		
	dark brown fine SILTY SAND			RS			1.9-2.6': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
660.0									
655.0									
650.0				RS			15-15.5': SILTY SAND, fine, poorly-graded, dark brown, cohesive, wet. (SM)		
	light gray fine to coarse SAND, some gravel			RS			15.5-19.6': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
645.0				RS			20-23.5': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		Bentonite Chips 21-23 ft bgs #5 Sand Filter Pack 23-35 ft bgs
640.0				RS			24-27.25': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Well-graded Gravelly Sand (SWG)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-12B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2169580.32 E: 2968309.536
GROUND SURFACE ELEV.: 664.23
TOP OF CASING ELEV.: 666.79
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 8:05:00 AM
END DATE/TIME: 7/31/2018 8:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, some gravel			RS					2" PVC Screen slot 0.010 25-35 ft bgs
	light gray medium to coarse SAND and rounded GRAVEL			RS			27.25-27.6': SAND and rounded GRAVEL <1 cm, coarse sand, well-graded, light gray, some medium sand, wet. (SW)		
635.0				RS			28-31.1': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 cm, wet. (SW)		
				RS			31.1-31.3': SAND and rounded GRAVEL <1 cm, coarse sand, well-graded, light gray, some medium sand, wet. (SW)		
			SB-12B-32'-34'	RS			32-33.75': SAND, medium to coarse, well-graded, light gray, some rounded gravel <4 inches, wet. (SW)		
630.0									
	light gray clayey SHALE			RS			35-36': CLAYEY SHALE, light gray, very weathered, wet.		#5 Sand 35-36 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Well-graded Gravelly Sand (SWG)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-13

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170059.98 E: 2968285.455
GROUND SURFACE ELEV.: 664.31
TOP OF CASING ELEV.: 667.24
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/24/2016 10:04:00 AM
END DATE/TIME: 5/24/2016 10:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, organics, trace gravel		1	SS		1.1 / 2	0-1.7': SAND, fine, organics, poorly-graded; dark brown; trace gravel, trace silt, very loose. (SP) 1.7-2': SAND, poorly-graded; dark brown; trace silt, very loose. (SP) SPTs (2-3-3-5)		Bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs
	grey to dark brown fine SAND, trace gravel								Filter Pack #5 Sand 3-15 ft-bgs
660.0			2	SS		1.1 / 2	5-6.6': SAND, fine, poorly-graded; brown; trace silt, moist, loose. (SP) 6.6-7': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (7-4-4-5)		2 PVC Screen slot 0.010 5-15 ft-bgs
655.0	GRAVEL, trace organics, trace silt gray to brown fine SAND, trace silt		3	SS		1.8 / 2	10-10.7': GRAVEL, angular, well-graded; trace organics, trace silt, wet, very loose. (GW) 10.7-12': SAND, fine, poorly-graded; brown; trace silt, wet, very loose. (SP) SPTs (1-2-2-4)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Poorly-graded Sand (SP) | USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-13B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170055.875 E: 2968285.691
GROUND SURFACE ELEV.: 664.23
TOP OF CASING ELEV.: 667.12
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/23/2016 2:27:00 PM
END DATE/TIME: 5/23/2016 4:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, organics, trace gravel		1	SS		1.1 / 2	0-1.7': SAND, fine, organics, poorly-graded; dark brown; trace gravel, trace silt, very loose. (SP) 1.7-2': SAND, poorly-graded; dark brown; trace silt, very loose. (SP) SPTs (2-3-3-5)		Bentonite grout mix 0-21 ft-bgs
	grey to dark brown fine SAND, trace gravel								
660.0			2	SS		1.1 / 2	5-6.6': SAND, fine, poorly-graded; brown; trace silt, moist, loose. (SP) 6.6-7': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (7-4-4-5)		
655.0			3	SS		1.8 / 2	10-10.7': GRAVEL, angular, well-graded; trace organics, trace silt, wet, very loose. (GW) 10.7-12': SAND, fine, poorly-graded; brown; trace silt, wet, very loose. (SP) SPTs (1-2-2-4)		
	grey to brown fine to medium SAND, trace gravel, trace silt								
650.0			4	SS		2 / 2	15-17': SAND, fine, poorly-graded; brown; trace gravel, trace silt, wet, loose. (SP) SPTs (3-3-5-5)		
645.0			5	SS		0.8 / 2	20-22': SAND, medium poorly-graded; grey to brown; trace silt, wet, very loose. (SP) SPTs (1-1-2-2)		Bentonite chips 21-23 ft-bgs
640.0									Filter Pack #5 Sand 23-35 ft-bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Poorly-graded Sand (SP) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-13B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170055.875 E: 2968285.691
GROUND SURFACE ELEV.: 664.23
TOP OF CASING ELEV.: 667.12
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/23/2016 2:27:00 PM
END DATE/TIME: 5/23/2016 4:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	grey to brown fine to medium SAND, trace gravel, trace silt		6	SS		1.4 / 2	25-26': SAND, fine, poorly-graded; brown; trace silt, wet, loose. (SP) 26-27': SAND, medium, poorly-graded; grey to brown; trace silt, moist, loose. (SP) SPTs (2-5-4-6)		2 PVC Screen slot 0.010 25-35 ft-bgs
	grey to brown medium SAND, clay lens, trace silt								
635.0			7	SS		1.8 / 2	30-30.4': SAND, medium, poorly graded; grey to brown; trace silt, moist, compact. (SP) 30.4-30.7': CLAY; grey to dark brown; cohesive, w~PL, stiff. (CL) 30.7-32': SAND, medium, well-graded; grey to brown; trace silt, moist, compact. (SW) 35': auger refusal in SHALE; dark grey to black. SPTs (2-5-7-9)		
630.0	SHALE								
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Poorly-graded Sand (SP) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-14

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170532.489 E: 2968467.959
GROUND SURFACE ELEV.: 664.76
TOP OF CASING ELEV.: 667.96
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/23/2016 3:25:00 PM
END DATE/TIME: 5/23/2016 4:40:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, organics, trace silt		1	SS		1.5 / 2	0-1.4': SAND, organics, fine, poorly-graded; dark brown; trace silt, loose. (SP) 1.4-2': SAND, fine, poorly-graded; brown; trace silt, loose. (SP) SPTs (3-4-4-3)		Bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #5 Sand 3-15 ft-bgs 2 PVC Screen slot 0.010 5-15 ft-bgs
	brown fine SAND, trace organics, trace silt								
660.0	brown fine SAND, trace silt		2	SS		1.1 / 2	5-7': SAND, fine, poorly-graded; brown; trace silt, moist, compact. (SP) SPTs (4-6-6-2)		
655.0			3	SS		1.3 / 2	10-11.6': SAND, fine, poorly-graded; brown; trace organics, trace silt, moist, compact. (SP) 11.6-12': SAND, fine, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (5-7-7-4)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-14B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170534.66 E: 2968471.602
GROUND SURFACE ELEV.: 664.62
TOP OF CASING ELEV.: 667.94
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/23/2016 11:07:00 AM
END DATE/TIME: 5/23/2016 1:43:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, organics		1	SS		1.5 / 2	0-1.4': SAND, organics, fine, poorly-graded; dark brown; trace silt, loose. (SP) 1.4-2': SAND, fine, poorly-graded; brown; trace silt, loose. (SP) SPTs (3-4-4-3)		Bentonite grout mix 0-22 ft-bgs
	brown fine SAND, trace organics, trace silt								
660.0									
	brown fine SAND, 3" angular gravel layer at 20 ft, trace silt		2	SS		1.1 / 2	5-7': SAND, fine, poorly-graded; brown; trace silt, moist, compact. (SP) SPTs (4-6-6-2)		
655.0			3	SS		1.3 / 2	10-11.6': SAND, fine, poorly-graded; brown; trace organics, trace silt, moist, compact. (SP) 11.6-12': SAND, fine, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (5-7-7-4)		
650.0			4	SS		1.2 / 2	15-17': SAND, fine, poorly-graded; brown; trace silt, wet, very loose. (SP) SPTs (1-2-1-2)		
645.0			5	SS		2 / 2	20-20.25': GRAVEL, angular, well-graded; grey; trace silt, wet, compact. (GW) 20.25-22': SAND, fine, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (5-5-6-9)		Bentonite chips 22-24 ft-bgs
640.0									Filter Pack #5 Sand 24-36 ft-bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-14B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170534.66 E: 2968471.602
GROUND SURFACE ELEV.: 664.62
TOP OF CASING ELEV.: 667.94
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/23/2016 11:07:00 AM
END DATE/TIME: 5/23/2016 1:43:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine SAND, 3" angular gravel layer at 20 ft, trace silt		6	SS		1.3 / 2	25-27': SAND, fine, poorly-graded; brown; trace silt, wet, loose. (SP) SPTs (3-3-5-4)		2 PVC Screen slot 0.010 26-36 ft-bgs
635.0			7	SS		0.9 / 2	30-32': SAND, fine, poorly-graded; brown; trace silt, wet, loose. (SP) 36': auger refusal in SHALE; dark grey to black. SPTs (3-3-5-6)		
630.0									
	SHALE								
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-15

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172753.762 E: 2970258.353
GROUND SURFACE ELEV.: 665.01
TOP OF CASING ELEV.: 668.25
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/25/2016 8:37:00 AM
END DATE/TIME: 5/25/2016 9:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- black FLY ASH, grey SAND, some boiler slag, some fine to coarse gravel, trace silt		1	SS		1.8 / 2	0-1.4': FLY ASH, some boiler slag, poorly-graded; black; trace medium angular gravel, trace silt, moist, compact. (FILL) 1.4-2': FLY ASH, some fine to coarse angular gravel, poorly-graded; black; trace silt, moist, compact. (FILL) SPTs (3-9-12-13)		Bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #5 Sand 3-15 ft-bgs
660.0			2	SS		2 / 2	5-5.8': FLY ASH, some slag, poorly-graded; black; trace fine rounded gravel, trace silt, moist, loose. (FILL) 5.8-7': SAND; fine, poorly-graded, light grey; trace silt, moist, loose. (FILL) SPTs (1-3-4-4)		2 PVC Screen slot 0.010 5-15 ft-bgs
655.0			3	SS		1.8 / 2	10-10.2': FLY ASH; black; trace silt, wet, loose. (FILL) 10.2-10.8': SAND, little coarse rounded gravel, poorly-graded; grey; trace silt, wet, loose. (FILL) 10.8-12': SAND, little fine rounded gravel, poorly-graded; light grey; trace silt, wet, loose. (FILL) SPTs (1-1-4-4)		
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-15B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.7
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172749.68 E: 2970258.917
GROUND SURFACE ELEV.: 665.14
TOP OF CASING ELEV.: 668.05
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/24/2016 11:15:00 AM
END DATE/TIME: 5/24/2016 4:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- black FLY ASH, grey SAND, some boiler slag, some fine to coarse gravel, trace silt		1	SS		1.8 / 2	0-1.4': FLY ASH, some boiler slag, poorly-graded; black; trace medium angular gravel, trace silt, moist, compact. (FILL) 1.4-2': FLY ASH, some fine to coarse angular gravel, poorly-graded; black; trace silt, moist, compact. (FILL) SPTs (3-9-12-13)		Bentonite grout mix 0-23.7 ft-bgs
660.0			2	SS		2 / 2	5-5.8': FLY ASH, some slag, poorly-graded; black; trace fine rounded gravel, trace silt, moist, loose. (FILL) 5.8-7': SAND; fine, poorly-graded, light grey; trace silt, moist, loose. (FILL) SPTs (1-3-4-4)		
655.0			3	SS		1.8 / 2	10-10.2': FLY ASH; black; trace silt, wet, loose. (FILL) 10.2-10.8': SAND, little coarse rounded gravel, poorly-graded; grey; trace silt, wet, loose. (FILL) 10.8-12': SAND, little fine rounded gravel, poorly-graded; light grey; trace silt, wet, loose. (FILL) SPTs (1-1-4-4)		
650.0			4	SS		1.6 / 2	15-16.2': SAND, some fine angular gravel, some boiler slag, poorly-graded; grey; trace silt, wet, loose. (FILL) 16.2-17': SAND, some fine subrounded gravel, poorly-graded; light tan; trace silt, wet, loose. (FILL) SPTs (1-3-6-8)		
645.0			5	SS		0.3 / 2	20-22': GRAVEL and BOILER SLAG, some sand, fine, subrounded and angular, poorly-graded; light grey; trace silt, wet, compact. (FILL) SPTs (1-6-12-15)		Bentonite chips 23.7-25.7 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-15B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.7
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172749.68 E: 2970258.917
GROUND SURFACE ELEV.: 665.14
TOP OF CASING ELEV.: 668.05
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/24/2016 11:15:00 AM
END DATE/TIME: 5/24/2016 4:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light grey fine to medium SAND, some gravel, trace silt		6	SS		1.1 / 2	25-26.5': SAND, fine, poorly-grade; light grey; trace silt, wet, loose. (SP) 26.5-27': SAND, some fine angular gravel, medium, poorly-graded; light grey; trace silt, wet, loose. (SP) SPTs (1-3-4-7)		Filter Pack #5 Sand 25.7-37.7 ft-bgs
									2 PVC Screen slot 0.010 27.7-37.7 ft-bgs
635.0			7	SS		2 / 2	30-31.25': SAND, fine to medium, poorly-graded; light grey; trace silt, wet, loose. (SP) 31.25-31.4': SAND and GRAVEL, fine, subrounded, well-graded; light grey; trace silt, wet, dense. (SW) 31.4-32': SAND, some silt, fine, poorly-graded; light grey; non-cohesive, wet, dense. (SP) SPTs (4-12-23-27)		
630.0			8	SS		1.3 / 2	35-36.6': SAND, fine to medium, poorly-graded; light grey; trace silt, wet, compact. (SP) 36.6-36.9': SAND, fine subrounded gravel, poorly-graded; light grey; trace silt, wet, compact. (SP)		
	light grey CLAY, some fine rounded gravel		9	SS		0.7 / 0.7	36.9-37': CLAY, some fine rounded gravel, poorly-graded; light grey; cohesive, wet, very stiff. (CL) SPTs (3-11-12-22)		
	grey SHALE						37-37.7': SHALE; grey; cohesive, moist, dense. SPTs (30-50/2)		
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-16

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 37.75

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173199.798 E: 2970398.723
GROUND SURFACE ELEV.: 665.20
TOP OF CASING ELEV.: 668.37
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/26/2016 1:26:00 PM
END DATE/TIME: 5/26/2016 1:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- black FLY ASH, some dark brown sand, little gravel, trace silt		1	SS		2 / 2	0-0.25': FLY ASH; black; trace silt, dry, compact. (FILL) 0.25-0.4': SAND, poorly-graded; dark brown; trace silt, moist, compact. (FILL) 0.4-0.9': FLY ASH, little medium angular gravel, poorly-graded; black; trace silt, moist, compact. (FILL) 0.9-2': SAND, 1" dark brown silt seam; fine, poorly-graded: brown; trace silt, moist, compact. (FILL) SPTs (3-7-7-8)		Bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs Filter Pack #5 Sand 3-15 ft-bgs
660.0	light orange to dark brown fine to medium SAND, some silt, some gravel		2	SS		2 / 2	5-5.4': FLY ASH; black; trace silt, dry, very loose. (FILL) 5.4-5.7': SAND; fine, poorly-graded; dark brown; trace silt, moist, very loose. (SP) 5.7-7': SAND, little orange mottling, fine, poorly-graded; light brown; trace silt, wet very loose. (SP) SPTs (1-1-1-1)		2 PVC Screen slot 0.010 5-15 ft-bgs
655.0			3	SS		1.2 / 2	10-11.25': SAND, fine, well-graded; grey; trace silt, wet, very loose. (SW) 11.25-11.7': SAND, some silt, poorly-graded; black; non-cohesive, wet, very loose. (SP) 11.7-12': SAND, fine rounded, some gravel, medium, poorly-graded; light orange; trace silt, wet, very loose. (SP) SPTs (0-0-0-3)		
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-16B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.75
DEPTH TO BEDROCK: 37.75

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173203.857 E: 2970398.828
GROUND SURFACE ELEV.: 665.16
TOP OF CASING ELEV.: 667.76
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/25/2016 1:10:00 PM
END DATE/TIME: 5/25/2016

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- black FLY ASH, some dark brown sand, little gravel, trace silt		1	SS		2 / 2	0-0.25': FLY ASH; black; trace silt, dry, compact. (FILL) 0.25-0.4': SAND, poorly-graded; dark brown; trace silt, moist, compact. (FILL) 0.4-0.9': FLY ASH, little medium angular gravel, poorly-graded; black; trace silt, moist, compact. (FILL) 0.9-2': SAND, 1" dark brown silt seam; fine, poorly-graded: brown; trace silt, moist, compact. (FILL) SPTs (3-7-7-8)		Bentonite grout mix 0-23.75 ft-bgs
660.0	light orange to dark brown fine to medium SAND, some silt, some gravel		2	SS		2 / 2	5-5.4': FLY ASH; black; trace silt, dry, very loose. (FILL) 5.4-5.7': SAND; fine, poorly-graded; dark brown; trace silt, moist, very loose. (SP) 5.7-7': SAND, little orange mottling, fine, poorly-graded; light brown; trace silt, wet very loose. (SP) SPTs (1-1-1-1)		
655.0			3	SS		1.2 / 2	10-11.25': SAND, fine to medium, well-graded; grey; trace silt, wet, very loose. (SW) 11.25-11.7': SAND, some silt, poorly-graded; black; non-cohesive, wet, very loose. (SP) 11.7-12': SAND, fine rounded, some gravel, medium, poorly-graded; light orange; trace silt, wet, very loose. (SP) SPTs (0-0-0-3)		
650.0	light to dark brown fine to medium SAND, trace silt		4	SS		1.8 / 2	15.4-16': SAND, fine, poorly-graded; light brown; trace silt, wet, compact. (SP) 16-17': SAND, fine to medium, poorly-graded; dark brown; trace silt, wet, compact. (SP) SPTs (3-4-6-9)		
645.0	brown fine to coarse SAND, some gravel, trace silt		5	SS		1.4 / 2	20-21.3': SAND, fine to medium, poorly-graded; brown; trace silt, wet, compact. (SP) 21.3-22': SAND, some fine rounded gravel, fine to medium, well-graded; dark brown; trace silt, wet, compact. (SW) SPTs (4-7-9-12)		Bentonite chips 23.75-25.75 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-16B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.75
DEPTH TO BEDROCK: 37.75

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173203.857 E: 2970398.828
GROUND SURFACE ELEV.: 665.16
TOP OF CASING ELEV.: 667.76
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/25/2016 1:10:00 PM
END DATE/TIME: 5/25/2016

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	brown fine to coarse SAND, some gravel, trace silt		6	SS		0 / 2	25-27': No recovery. SPTs (4-7-10-14)		Filter Pack #5 Sand 25.75-37.75 ft-bgs
635.0			7	SS		1.3 / 2	30-31.6': SAND, fine to medium, well-graded; brown; trace silt, wet, compact. (SW) 31.6-32': SAND, little small subrounded gravel, fine to medium, poorly-graded; grey; trace silt, wet, compact. (SP) SPTs (1-3-10-12)		2 PVC Screen slot 0.010 27.75-37.75 ft-bgs
	grey to brown medium to coarse SAND, little gravel, trace silt								
630.0	grey CLAY		8	SS		2 / 2	34-34.6': SAND, fine, poorly-graded; brown; trace silt, wet, dense. (SP) 34.6-35': SAND, some fine rounded gravel, medium, poorly-graded; dark grey; trace silt, wet, dense. (SP) 35-36': CLAY; grey; cohesive, dry, hard. (CL) SPTs (12-15-22-7)		
			9	SS		0 / 0.25			
							37.75': auger refusal in SHALE; dark grey to black. SPTs (50/3")		
	SHALE								
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-17

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 38

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173164.442 E: 2970944.074
GROUND SURFACE ELEV.: 668.81
TOP OF CASING ELEV.: 671.93
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/25/2016
END DATE/TIME: 5/25/2016

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- SAND, GRAVEL, ORGANICS, trace fly ash/ boiler slag, trace silt		1	SS		1.6 / 2	0-1.1': SAND, organics, fine, poorly-graded; light brown; trace silt, dry, loose. (FILL) 1.1-2': SAND, fine, poorly-graded; light brown; trace fly ash, trace silt moist, loose. (FILL) SPTs (1-3-2-2)		Bentonite grout mix 0-1 ft-bgs Bentonite chips 1-3 ft-bgs
665.0			2	SS		0.9 / 2	5-6.6': SAND, fine, poorly-graded; light brown; trace silt, moist, loose. (FILL) 6.6-6.7': GRAVEL, fly ash/ boiler slag, angular, medium, well-graded; trace silt, loose. (FILL) 6.7-7': SAND, fine, poorly-graded; light brown; trace fly ash/ boiler slag, trace silt, moist, loose. (FILL) SPTs (3-7-3-5)		Filter Pack #5 Sand 3-15 ft-bgs 2 PVC Screen slot 0.010 5-15 ft-bgs
660.0			3	SS		1.6 / 2	10-11.1': SAND, fine, well-graded; light brown to brown; trace organics, trace fly ash/boiler slag, trace silt, wet, loose. (FILL) 11.1-12': SAND, fine, poorly-graded; dark brown to grey; trace iron oxides, trace silt, wet, loose. (SP) SPTs (3-5-1-2)		
	dark brown to grey fine SAND, trace iron oxides, trace organics, trace silt								
655.0									
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-17B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 38
DEPTH TO BEDROCK: 38

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173164.838 E: 2970947.442
GROUND SURFACE ELEV.: 668.86
TOP OF CASING ELEV.: 670.60
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/25/2016 8:23:00 AM
END DATE/TIME: 5/25/2016 9:13:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- SAND, GRAVEL, ORGANICS, trace fly ash/ boiler slag, trace silt		1	SS		1.6 / 2	0-1.1': SAND, organics, fine, poorly-graded; light brown; trace silt, dry, loose. (FILL) 1.1-2': SAND, fine, poorly-graded; light brown; trace fly ash, trace silt moist, loose. (FILL) SPTs (1-3-2-2)		Bentonite grout mix 0-24 ft-bgs
665.0			2	SS		0.9 / 2	5-6.6': SAND, fine, poorly-graded; light brown; trace silt, moist, loose. (FILL) 6.6-6.7': GRAVEL, fly ash/ boiler slag, angular, medium, well-graded; trace silt, loose. (FILL) 6.7-7': SAND, fine, poorly-graded; light brown; trace fly ash/ boiler slag, trace silt, moist, loose. (FILL) SPTs (3-7-3-5)		
660.0	dark brown to grey fine SAND, trace iron oxides, trace organics, trace silt		3	SS		1.6 / 2	10-11.1': SAND, fine, well-graded; light brown to brown; trace organics, trace fly ash/boiler slag, trace silt, wet, loose. (FILL) 11.1-12': SAND, fine, poorly-graded; dark brown to grey; trace iron oxides, trace silt, wet, loose. (SP) SPTs (3-5-1-2)		
655.0			4	SS		1.8 / 2	15-17': SAND, fine, poorly-graded; dark brown to grey; trace organics, trace silt, wet, very loose. (SP) SPTs (1-2-2-3)		
650.0	dark brown fine to medium SAND, trace silt		5	SS		1 / 2	20-22': SAND, fine to medium, well-graded; dark brown; trace silt, wet, loose. (SW) SPTs (2-4-4-6)		
645.0									Bentonite chips 24-26 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-17B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 38
DEPTH TO BEDROCK: 38

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173164.838 E: 2970947.442
GROUND SURFACE ELEV.: 668.86
TOP OF CASING ELEV.: 670.60
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/25/2016 8:23:00 AM
END DATE/TIME: 5/25/2016 9:13:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine to medium SAND, trace silt		6	SS		1.6 / 2	25-27': SAND, fine to medium, well-graded; dark brown; trace silt, wet, very loose. (SW) SPTs (1-1-2-2)		Filter Pack #5 Sand 26-38 ft-bgs
640.0			7	SS		1.3 / 2	30-32': SAND, fine to medium, well-graded; dark brown; trace silt, wet, loose. (SW) 38': auger refusal in SHALE; dark grey to black. SPTs (3-4-4-5)		2 PVC Screen slot 0.010 28-38 ft-bgs
635.0									
	SHALE								
630.0									
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-18

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK:

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171919.782 E: 2971272.405
GROUND SURFACE ELEV.: 666.04
TOP OF CASING ELEV.: 669.07
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/24/2016 11:12:00 AM
END DATE/TIME: 5/24/2016 11:28:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- dark brown SAND, trace fly ash/ boiler slag, trace organics, trace silt		1	SS		2 / 2	0-2': SAND, fine to medium; poorly-graded; dark brown; trace fly ash/boiler slag, trace organics, trace silt, moist, loose. (FILL) SPTs (3-3-3-3)		Bentonite grout mix 0-1 ft-bgs; Bentonite chips 1-3 ft-bgs; Filter Pack #5 Sand 3-15 ft-bgs; 2 PVC Screen slot 0.010 5-15 ft-bgs
660.0	brown fine SAND, trace silt		2	SS		2 / 2	5-6.1': SAND, fine to medium, poorly-graded; dark brown; trace fly ash/ boiler slag, trace organics, trace silt, moist, loose. (FILL) 6.1-7': SAND; fine, poorly-graded; brown; trace silt, moist, loose. (SP) SPTs (2-4-5-6)		
655.0			3	SS		1.3 / 2	10-12': SAND; fine, poorly-graded; brown; trace silt, wet, loose. (SP) SPTs (2-4-4-7)		
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-18B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171910.003 E: 2971272.53
GROUND SURFACE ELEV.: 665.94
TOP OF CASING ELEV.: 668.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/26/2018 9:35:00 AM
END DATE/TIME: 7/26/2018 10:35:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown SILTY SAND, some organics			RS			0-1.7': SILTY SAND, well-graded, dark brown, some organics, dry. (SM)		Bentonite Grout 0-21 ft bgs
	orange to dark brown fine SAND, some silt			RS			1.7-2.3': SAND, fine, poorly-graded, orange to dark brown, some silt, moist. (SP)		
	light brown fine to medium SAND			RS			2.3-4.2': SAND, fine to medium, well-graded, light brown, moist. (SW)		
660.0				RS			5-7.4': SAND, fine to medium, well-graded, light brown, wet. (SW)		
	light brown fine CLAYEY SAND			RS			7.4-8.75': CLAYEY SAND, fine, poorly-graded, light brown, cohesive, wet. (SC)		
655.0				RS			10-13': CLAYEY SAND, fine, poorly-graded, light brown, cohesive, wet. (SC)		
	light brown to light gray fine to coarse SAND, trace to some gravel			RS			13-13.7': SAND, fine to coarse, well-graded, light brown, wet. (SW)		
				RS			13.7-14.8': SAND, medium to coarse, well-graded, light brown, some rounded gravel <1 inch, some fine sand, wet. (SW)		
650.0				RS			16-20': SAND, fine to coarse, well-graded, light brown, some rounded gravel <1 inch, wet. (SW)		
645.0				RS			20-23.7': SAND, medium to coarse, well-graded, light brown, some rounded gravel <1 inch, little fine sand, wet. (SW)		Bentonite Chips 21-23 ft bgs #5 Sand Filter Pack 23-35 ft bgs
				RS					

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Clayey Sand (SC)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-18B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171910.003 E: 2971272.53
GROUND SURFACE ELEV.: 665.94
TOP OF CASING ELEV.: 668.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/26/2018 9:35:00 AM
END DATE/TIME: 7/26/2018 10:35:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light brown to light gray fine to coarse SAND, trace to some gravel			RS			24-24.9': SAND, medium to coarse, well-graded, light brown, some rounded gravel <1 inch, some fine sand, wet. (SW)		2" PVC Screen slot 0.010 25-35 ft bgs
				RS			24.9-25.3': SAND, medium to coarse, well-graded, light gray, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
							25.3-28': SAND, fine to coarse, well-graded, light gray, trace rounded gravel, wet. (SW)		
635.0				RS			28-32': SAND, fine to coarse, well-graded, light gray, trace rounded gravel, wet. (SW)		
			SB-18B-32'-34'	RS			32-33.75': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
	light gray SHALE			RS		2 / 1	35-35.5': SHALE, light gray, wet, little weathering.		#5 Sand 35-36 ft bgs
630.0	light gray clayey SHALE						35.5-36': CLAYEY SHALE, light gray, wet, little weathering.		
625.0									
620.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Clayey Sand (SC)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/12/18

Golder Associates

BOREHOLE LOG: GAMW-19

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 33.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171634.271 E: 2974035.798
GROUND SURFACE ELEV.: 663.77
TOP OF CASING ELEV.: 666.71
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/27/2016 1:00:00 PM
END DATE/TIME: 5/27/2016 1:46:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- dark brown SAND, some silt, some organics, little gravel		1	SS		1.7 / 2	0-1.1': SAND, some silt, some organics, little angular medium gravel, fine, poorly-graded; dark brown; non-cohesive, dry, loose. (FILL) 1.1-1.75': SAND, some silt, poorly-graded; dark brown; non-cohesive, dry, loose. (FILL) 1.75-2': CLAYEY SAND; dark brown; trace silt, dry, loose. (FILL) SPTs (4-4-5-5)		Bentonite grout mix 0-2 ft-bgs Bentonite chips 2-4 ft-bgs
660.0			2	SS		0 / 2	5-7': No Recovery. Notes: Groundwater fills borehole to ground surface		Filter Pack #5 Sand 4-16 ft-bgs 2 PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.2 / 2	10-11': SAND, little medium angular gravel, fine to medium, poorly-graded; dark brown; trace silt, wet, loose. (FILL) 11-12': SAND, fine to medium, poorly-graded; dark brown; trace silt, saturated, loose. (FILL) SPTs (2-2-2-2)		
650.0									
645.0									
640.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-19B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33.25
DEPTH TO BEDROCK: 33.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171632.026 E: 2974037.912
GROUND SURFACE ELEV.: 663.64
TOP OF CASING ELEV.: 666.74
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/27/2016 10:33:00 AM
END DATE/TIME: 5/27/2016 12:11:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- dark brown SAND, some silt, some organics, some fly ash/ boiler slag, little gravel		1	SS		1.7 / 2	0-1.1': SAND, some silt, some organics, little angular medium gravel, fine, poorly-graded; dark brown; non-cohesive, dry, loose. (FILL) 1.1-1.75': SAND, some silt, poorly-graded; dark brown; non-cohesive, dry, loose. (FILL) 1.75-2': CLAYEY SAND; dark brown; trace silt, dry, loose. (FILL) SPTs (4-4-5-5)		Bentonite grout mix 0-19 ft-bgs
660.0			2	SS		0 / 2	5-7': No Recovery. Notes: Groundwater fills borehole to ground surface		
655.0			3	SS		1.2 / 2	10-11': SAND, little medium angular gravel, fine to medium, poorly-graded; dark brown; trace silt, wet, loose. (FILL) 11-12': SAND, fine to medium, poorly-graded; dark brown; trace silt, saturated, loose. (FILL) SPTs (2-2-2-2)		
650.0			4	SS		0 / 2	15-17': No Recovery. HDPE fragments returned. SPTs (1-2-2-5)		
645.0			5	SS		1.6 / 2	20-20.25': SAND, fine to medium, poorly-graded; light brown; trace silt, wet, loose. (FILL) 21.25-22': SAND, some fine to medium subrounded gravel, some fly ash/ boiler slag, medium to coarse, poorly-graded; grey; trace silt, saturated, loose. (FILL) SPTs (2-3-5-7)		Bentonite chips 19-21 ft-bgs Filter Pack #5 Sand 21-33 ft-bgs
640.0									2 PVC Screen slot 0.010 23-33 ft-bgs

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-19B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33.25
DEPTH TO BEDROCK: 33.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171632.026 E: 2974037.912
GROUND SURFACE ELEV.: 663.64
TOP OF CASING ELEV.: 666.74
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 75
START DATE/TIME: 5/27/2016 10:33:00 AM
END DATE/TIME: 5/27/2016 12:11:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine to medium SAND, some gravel, trace silt		6	SS		2 / 2	25-25.3': SAND, some fine subrounded gravel, some fly ash/ boiler slag, fine to medium, poorly-graded; brown; trace silt, saturated, compact. (FILL) 25.3-25.8': SAND, some fine to medium subrounded to rounded gravel, medium, poorly-graded; grey; trace silt, saturated, compact. (SP) 25.8-27': SAND, little fine rounded gravel, fine to medium, poorly-graded; brown; trace silt, saturated, compact. (SP) SPTs (2-5-13-16)		
635.0									
	grey fine to medium SAND, little gravel, trace silt		7	SS		2 / 2	30-31.3': SAND, fine to medium, poorly-graded; grey; trace silt, saturated, compact. (SP) 31.3-31.5': fine gravelly SAND, little organics, little fly ash/ boiler slag, medium, well-graded; grey; trace silt, saturated, compact. (SP) 31.5-31.8': SAND, fine to medium, poorly-graded; grey; trace silt, saturated, compact. (SP) 31.8-33.3': CLAY; grey; cohesive, moist, very stiff. (FILL) 33.3: auger refusal in SHALE; dark grey to black. SPTs (12-12-13-13)		
	grey CLAY								
630.0	SHALE								
625.0									
620.0									
615.0									

DECOMMISSIONED

LITHOLOGY LEGEND

- Fill (made ground)
- Shale
- USCS Poorly-graded Sand (SP)
- USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 75

LOGGED BY: DSD
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-20

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 32.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171579.615 E: 2974761.601
GROUND SURFACE ELEV.: 664.61
TOP OF CASING ELEV.: 667.21
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/27/2016
END DATE/TIME: 5/27/2016

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- SAND, trace gravel, trace fly ash/boiler slag, trace silt		1	SS		1.7 / 2	0-1.8': SAND, organics, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 1.8-2': FLY ASH/ BOILER SLAG, moist, loose. (FILL) SPTs (3-4-4-5)		Bentonite grout mix 0-2 ft-bgs Bentonite chips 2-4 ft-bgs
660.0			2	SS		2 / 2	5-5.9': SAND, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 5.9-6.2': FLY ASH/ BOILER SLAG, moist, loose. (FILL) 6.2-6.3': SAND, fine, poorly-graded; brown; trace gravel, trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 6.3-6.7': FLY ASH/ BOILER SLAG, moist, loose. (FILL) 6.7-7': SAND, fine, poorly-graded; brown; trace silt, moist, loose. (FILL) (SP) SPTs (2-2-4-3)		Filter Pack #5 Sand 4-16 ft-bgs 2 PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.5 / 2	10.8-11.1': SAND, clay lens, fine, poorly-graded; grey; trace fly ash/ boiler slag, trace silt, moist, loose. (FILL) 11.1-12': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (7-3-3-4)		
	grey fine SAND, trace silt								
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-20B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32.5
DEPTH TO BEDROCK: 32.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171579.945 E: 2974757.369
GROUND SURFACE ELEV.: 664.48
TOP OF CASING ELEV.: 667.40
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/27/2016 8:48:00 AM
END DATE/TIME: 5/27/2016 9:39:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- SAND, trace gravel, trace fly ash/boiler slag, trace silt		1	SS		1.7 / 2	0-1.8': SAND, organics, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 1.8-2': FLY ASH/ BOILER SLAG, moist, loose. (FILL) SPTs (3-4-4-5)		Bentonite grout mix 0-18.5 ft-bgs
660.0			2	SS		2 / 2	5-5.9': SAND, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 5.9-6.2': FLY ASH/ BOILER SLAG, moist, loose. (FILL) 6.2-6.3': SAND, fine, poorly-graded; brown; trace gravel, trace fly ash/ boiler slag, trace silt, dry, loose. (FILL) 6.3-6.7': FLY ASH/ BOILER SLAG, moist, loose. (FILL) 6.7-7': SAND, fine, poorly-graded; brown; trace silt, moist, loose. (FILL) (SP) SPTs (2-2-4-3)		
655.0	grey fine SAND, trace silt		3	SS		1.5 / 2	10.8-11.1': SAND, clay lens, fine, poorly-graded; grey; trace fly ash/ boiler slag, trace silt, moist, loose. (FILL) 11.1-12': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (7-3-3-4)		
650.0			4	SS		1.8 / 2	15-17': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (2-2-3-4)		
645.0			5	SS		2 / 2	20-22': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (6-3-5-4)		Bentonite chips 18.5-20.5 ft-bgs Filter Pack #5 Sand 20.5-32.5 ft-bgs
640.0									2 PVC Screen slot 0.010 22.5-32.5 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-20B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32.5
DEPTH TO BEDROCK: 32.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171579.945 E: 2974757.369
GROUND SURFACE ELEV.: 664.48
TOP OF CASING ELEV.: 667.40
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/27/2016 8:48:00 AM
END DATE/TIME: 5/27/2016 9:39:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	grey fine to medium SAND, trace gravel, trace silt		6	SS		1.2 / 2	25-27': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, loose. (SW) SPTs (2-4-4-5)		
635.0			7	SS		1.8 / 2	30-30.9': SAND, fine, poorly-graded; grey; trace silt, moist, loose. (SP) 30.9-31.3': SAND, medium, well-graded; grey; trace silt, wet, loose. (SW) 31.3-31.6': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) 31.6-31.9': GRAVEL, angular, well-graded; grey; poorly-graded, fine sand, trace fine sand, trace silt, moist, loose. (GP) 31.9-32': CLAY, trace gravel; grey; cohesive, plastic, soft, moist. (CL) 32.5': auger refusal in SHALE; dark grey to black. SPTs (4-4-5-5)		
	grey CLAY, trace gravel								
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

- Fill (made ground)
- USCS Low Plasticity Clay (CL)
- USCS Poorly-graded Sand (SP)
- Shale
- USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-21

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 18
DEPTH TO BEDROCK: 34

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172668.506 E: 2974488.987
GROUND SURFACE ELEV.: 666.60
TOP OF CASING ELEV.: 668.38
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/31/2016
END DATE/TIME: 5/31/2016

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- SAND, occasional lenses of fly ash/ boiler slag and organics, trace silt		1	SS		2 / 2	0-1.7': SAND, organics, fine, poorly-graded; black; trace fly ash/boiler slag, trace silt. loose, dry. (FILL) 1.7-2': SAND, fine, poorly-graded; light to dark brown; trace silt. loose, dry. (FILL) SPTs (2-3-5-6)		Bentonite grout mix 0-4 ft-bgs
660.0			2	SS		1.8 / 2	5-6.25': SAND, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace organics, trace silt, loose, dry. (FILL) 6.25-7': SAND, 2" thick lens fly ash/ boiler slag, fine poorly-graded; grey; trace silt, moist, compact. (FILL) SPTs (6-6-7-8)		Bentonite chips 4-6 ft-bgs Filter Pack #5 Sand 6-18 ft-bgs 2 PVC Screen slot 0.010 8-18 ft-bgs
655.0	grey fine to medium SAND, trace gravel, trace silt		3	SS		1.3 / 2	10-11': SAND, 1" thick lens fly ash/ boiler slag, fine, poorly-graded; light brown, trace silt, moist, loose. (FILL) 11-11.3': SAND, fine to medium, poorly-graded; light brown; trace silt, wet, loose. (FILL) 11.3-12': SAND, fine to medium, well-graded; grey; trace silt, moist, loose. (SW) SPTs (2-2-3-4)		
650.0			4	SS		2 / 2	15-16.1': SAND, medium, well-graded; grey; trace silt, moist, compact. (SW) 16.1-17': SAND, fine, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) SPTs (5-5-6-5)		
645.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-21B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 34

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172668.924 E: 2974493.241
GROUND SURFACE ELEV.: 666.66
TOP OF CASING ELEV.: 669.37
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/31/2016 10:10:00 AM
END DATE/TIME: 5/31/2016 12:11:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- SAND, occasional lenses of fly ash/ boiler slag and organics, trace silt		1	SS		2 / 2	0-1.7': SAND, organics, fine, poorly-graded; black; trace fly ash/boiler slag, trace silt. loose, dry. (FILL) 1.7-2': SAND, fine, poorly-graded; light to dark brown; trace silt. loose, dry. (FILL) SPTs (2-3-5-6)		Bentonite grout mix 0-20 ft-bgs
660.0			2	SS		1.8 / 2	5-6.25': SAND, fine, poorly-graded; dark brown; trace fly ash/ boiler slag, trace organics, trace silt, loose, dry. (FILL) 6.25-7': SAND, 2" thick lens fly ash/ boiler slag, fine poorly-graded; grey; trace silt, moist, compact. (FILL) SPTs (6-6-7-8)		
655.0	grey fine to medium SAND, trace gravel, trace silt		3	SS		1.3 / 2	10-11': SAND, 1" thick lens fly ash/ boiler slag, fine, poorly-graded; light brown, trace silt, moist, loose. (FILL) 11-11.3': SAND, fine to medium, poorly-graded; light brown; trace silt, wet, loose. (FILL) 11.3-12': SAND, fine to medium, well-graded; grey; trace silt, moist, loose. (SW) SPTs (2-2-3-4)		
650.0			4	SS		2 / 2	15-16.1': SAND, medium, well-graded; grey; trace silt, moist, compact. (SW) 16.1-17': SAND, fine, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) SPTs (5-5-6-5)		
645.0			5	SS		2 / 2	20-22': SAND, fine, poorly-graded; grey, trace gravel, trace silt, wet, loose. (SP) SPTs (4-4-5-7)		Bentonite chips 20-22 ft-bgs Filter Pack #5 Sand 22-34 ft-bgs 2 PVC Screen slot 0.010 24-34 ft-bgs

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-21B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 34

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172668.924 E: 2974493.241
GROUND SURFACE ELEV.: 666.66
TOP OF CASING ELEV.: 669.37
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/31/2016 10:10:00 AM
END DATE/TIME: 5/31/2016 12:11:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	grey fine to medium SAND, trace gravel, trace silt		6	SS		1.1 / 2	25-27': SAND, fine, poorly graded; grey; trace organics, trace silt, wet, compact. (SP) SPTs (7-8-9-12)		
635.0			7	SS		1.5 / 2	30-32': SAND, fine, poorly graded; grey; trace gravel, trace silt, wet, compact. (SP) 34': auger refusal in SHALE; dark grey to black. SPTs (7-8-11-12)		
630.0	SHALE								
625.0									
620.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-22

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 18
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172668.965 E: 2974888.857
GROUND SURFACE ELEV.: 666.33
TOP OF CASING ELEV.: 668.64
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/31/2016 3:19:00 PM
END DATE/TIME: 5/31/2016 4:15:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- SAND, organics, trace fly ash/boiler slag, trace silt		1	SS		1.6 / 2	0-2': SAND, organics, fine, poorly-graded; brown to dark brown; trace fly ash/ boiler slag, trace silt, moist, very loose. (FILL) SPTs (3-4-4-4)		Bentonite grout mix 0-4 ft-bgs
660.0			2	SS		2 / 2	5-5.9': SAND, fine, poorly-graded; dark brown to black; trace fly ash/ boiler slag, trace silt, moist, compact. (FILL) 5.9-6.1': SAND, fine, poorly-graded; light brown; trace silt, moist, compact. (FILL) 6.1-7': SAND, fine, poorly-graded; dark brown to black; trace fly ash/ boiler slag, trace silt, moist, compact. (FILL) SPTs (4-5-5-5)		Bentonite chips 4-6 ft-bgs; Filter Pack #5 Sand 6-18 ft-bgs; 2 PVC Screen slot 0.010 8-18 ft-bgs
655.0	dark grey to light brown fine SAND, trace silt		3	SS		1.9 / 2	10-10.25': SAND, fine, poorly-graded; light brown to dark brown; trace silt, dry, loose. (FILL) 10.25-11': SAND, fine, poorly-graded; dark grey; trace silt, wet, loose. (SP) 11-12': SAND, fine, poorly-graded; light brown; trace silt, wet, loose. (SP) SPTs (4-4-5-5)		
650.0	grey to light brown fine to medium SAND, trace gravel, trace silt		4	SS		2 / 2	15-16.1': SAND, fine, well-graded; grey to light brown; trace silt, wet, compact. (SW) 16.1-17': SAND, fine to medium, well-graded; grey to light brown; trace gravel, trace silt, wet, compact.(SW) SPTs (8-8-8-9)		
645.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground) | USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-22B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172669.323 E: 2974894.389
GROUND SURFACE ELEV.: 666.39
TOP OF CASING ELEV.: 669.38
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 6/2/2016 8:03:00 AM
END DATE/TIME: 6/2/2016 9:45:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- SAND, organics, trace fly ash/boiler slag, trace silt		1	SS		1.6 / 2	0-2': SAND, organics, fine, poorly-graded; brown to dark brown; trace fly ash/ boiler slag, trace silt, moist, very loose. (FILL) SPTs (3-4-4-4)		Bentonite grout mix 0-21 ft-bgs
660.0			2	SS		2 / 2	5-5.9': SAND, fine, poorly-graded; dark brown to black; trace fly ash/ boiler slag, trace silt, moist, compact. (FILL) 5.9-6.1': SAND, fine, poorly-graded; light brown; trace silt, moist, compact. (FILL) 6.1-7': SAND, fine, poorly-graded; dark brown to black; trace fly ash/ boiler slag, trace silt, moist, compact. (FILL) SPTs (4-5-5-[illegible])		
655.0	dark grey to light brown fine SAND, trace silt		3	SS		1.9 / 2	10-10.25': SAND, fine, poorly-graded; light brown to dark brown; trace silt, dry, loose. (FILL) 10.25-11': SAND, fine, poorly-graded; dark grey; trace silt, wet, loose. (SP) 11-12': SAND, fine, poorly-graded; light brown; trace silt, wet, loose. (SP) SPTs (4-4-5-5)		
650.0	grey to light brown fine to medium SAND, trace gravel, trace silt		4	SS		2 / 2	15-16.1': SAND, fine, well-graded; grey to light brown; trace silt, wet, compact. (SW) 16.1-17': SAND, fine to medium, well-graded; grey to light brown; trace gravel, trace silt, wet, compact.(SW) SPTs (8-8-8-9)		
645.0			5	SS		2 / 2	20-22': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) SPTs (6-10-8-9)		Bentonite chips 21-23 ft-bgs
									Filter Pack #5 Sand 23-35 ft-bgs

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-22B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172669.323 E: 2974894.389
GROUND SURFACE ELEV.: 666.39
TOP OF CASING ELEV.: 669.38
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 6/2/2016 8:03:00 AM
END DATE/TIME: 6/2/2016 9:45:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	grey to light brown fine to medium SAND, trace gravel, trace silt		6	SS		1.1 / 2	25-27': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) SPTs (6-7-6-6)		2 PVC Screen slot 0.010 25-35 ft-bgs
635.0			7	SS		1.4 / 2	30-32': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) 35': auger refusal in SHALE; dark grey to black. SPTs (10-11-12-12)		
630.0	SHALE								
625.0									
620.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-23

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 19
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172680.878 E: 2975296.245
GROUND SURFACE ELEV.: 667.02
TOP OF CASING ELEV.: 668.34
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 6/2/2016 1:17:00 PM
END DATE/TIME: 6/2/2016 2:12:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- FLY ASH/ BOILER SLAG, SAND, gravel and clay layers, trace silt		1	SS		1.3 / 2	0-1.4': FLY ASH/ BOILER SLAG; trace silt, dry, loose. (FILL) 1.4-1.75': FLY ASH/ BOILER SLAG, clay lens; trace silt, dry, loose. (FILL) 1.75-2': GRAVEL, angular, well-graded; white to grey; trace silt, dry, loose. (FILL) SPTs (2-3-6-8)		Bentonite grout mix 0-5 ft-bgs
665.0			2	SS		1.8 / 2	5-6.4': FLY ASH/ BOILER SLAG; trace silt, dry, loose. (FILL) 6.4-6.7': CLAY; dark grey; w<PL, moist, soft. (FILL) 6.7-7': SAND, fine, poorly-graded; white to light grey; trace silt, dry, loose. (FILL) SPTs (5-4-4-2)		Bentonite chips 5-7 ft-bgs
660.0			3	SS		1.7 / 2	16-17.2': FLY ASH/ BOILER SLAG, fine to medium sand, poorly-graded; black; trace gravel, trace silt, wet, loose. (FILL) SPTs (3-4-4-5)		Filter Pack #5 Sand 7-19 ft-bgs 2 PVC Screen slot 0.010 9-19 ft-bgs
655.0			4	SS		2 / 2	15-16.25': FLY ASH/ BOILER SLAG, fine to medium sand, poorly-graded; black; trace silt, loose. (FILL) 16.25-17': SAND, trace fines, fine to medium, well-graded; grey; trace silt, wet, loose. (SW) SPTs (4-4-5-7)		
	grey fine to medium SAND, trace fines, trace silt								
650.0									
645.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-23B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172676.249 E: 2975297.048
GROUND SURFACE ELEV.: 667.03
TOP OF CASING ELEV.: 670.02
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 6/2/2016 10:37:00 AM
END DATE/TIME: 6/2/2016 12:53:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- FLY ASH/ BOILER SLAG, SAND, gravel and clay layers, trace silt		1	SS		1.3 / 2	0-1.4': FLY ASH/ BOILER SLAG; trace silt, dry, loose. (FILL) 1.4-1.75': FLY ASH/ BOILER SLAG, clay lens; trace silt, dry, loose. (FILL) 1.75-2': GRAVEL, angular, well-graded; white to grey; trace silt, dry, loose. (FILL) SPTs (2-3-6-8)		Bentonite grout mix 0-21 ft-bgs
665.0			2	SS		1.8 / 2	5-6.4': FLY ASH/ BOILER SLAG; trace silt, dry, loose. (FILL) 6.4-6.7': CLAY; dark grey; w<PL, moist, soft. (FILL) 6.7-7': SAND, fine, poorly-graded; white to light grey; trace silt, dry, loose. (FILL) SPTs (5-4-4-2)		
660.0			3	SS		1.7 / 2	16-17': FLY ASH/ BOILER SLAG, fine to medium sand, trace gravel, poorly-graded; black; trace silt, wet, loose. (FILL) SPTs (3-4-4-5)		
655.0			4	SS		2 / 2	15-16.25': FLY ASH/ BOILER SLAG, fine to medium sand, poorly-graded; black; trace silt, loose. (FILL) 16.25-17': SAND, trace fines, fine to medium, well-graded; grey; trace silt, wet, loose. (SW) SPTs (4-4-5-7)		
650.0	grey fine to medium SAND, trace fines, trace silt		5	SS		2 / 2	20-22': SAND, fine to medium, poorly-graded; dark grey; trace silt, wet, compact. (SP) SPTs (4-5-7-8)		Bentonite chips 21-23 ft-bgs
645.0									Filter Pack #5 Sand 23-35 ft-bgs

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-23B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172676.249 E: 2975297.048
GROUND SURFACE ELEV.: 667.03
TOP OF CASING ELEV.: 670.02
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 6/2/2016 10:37:00 AM
END DATE/TIME: 6/2/2016 12:53:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	grey fine to medium SAND, trace fines, trace silt		6	SS		2 / 2	25-27': SAND, fine to medium, well-graded; dark grey; trace silt, wet, compact. (SW) SPTs (4-8-12-15)		2 PVC Screen slot 0.010 25-35 ft-bgs
640.0			7	SS		1.3 / 2	30-31.2': SAND, fine to medium, well-graded; dark grey; trace silt, wet, compact. (SW) 31.2-31.5': GRAVEL, rounded, poorly-graded; grey to brown; trace silt, wet, compact. (GP) 31.5-32': SAND, fine to medium, poorly-graded; light grey; trace silt, wet, compact. (SP) 35': auger refusal in SHALE; dark grey to black SPTs (7-8-10-10)		
635.0									
	SHALE								
630.0									
625.0									
620.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Doug Carlson
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-24

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171048.7173 E: 2974868.6827
GROUND SURFACE ELEV.: 662.09
TOP OF CASING ELEV.: 665.39
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/26/2016 3:34:00 PM
END DATE/TIME: 9/26/2016 4:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to black fine SAND, trace organics, trace silt		1	SS		1.6 / 2	0-1.58': SAND, trace organics, fine, poorly-graded; dark brown to black; trace silt, moist, loose. (SP) SPTs (1-1-1-1)		Bentonite grout mix 0-2 ft-bgs
660.0									Bentonite chips 2-4 ft-bgs
	grey to dark grey fine to medium SAND, trace silt		2	SS		2 / 2	5-7': SAND, fine to medium, poorly-graded; grey to dark grey; trace silt, moist to wet, loose. (SP) SPTs (2-3-4-4)		Filter Pack #4 Sand 4-16 ft-bgs; 2" PVC Screen slot 0.010 6-16 ft-bgs
655.0									
	light to dark brown fine to medium SAND, trace silt		3	SS		2 / 2	10-11.33': SAND, fine, poorly-graded; light to dark brown; trace silt, moist, compact. (SP) 11.33-12': SILT loam, very fine, light brown sand lenses, well-graded; grey; trace silt, wet, compact. (ML) SPTs (3-5-10-14)		
	grey SILT loam, light brown sand lenses, trace silt								
650.0									
	tan to dark brown SAND, trace silt								
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Silt (ML)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-24B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171050.6688 E: 2974866.8932
GROUND SURFACE ELEV.: 662.13
TOP OF CASING ELEV.: 665.33
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/26/2016 12:00:00 PM
END DATE/TIME: 9/26/2016 2:02:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to black SAND, trace organics, trace silt		1	SS		1.6 / 2	0-1.58': SAND, trace organics, fine, poorly-graded; dark brown to black; trace silt, moist, loose. (SP) SPTs (1-1-1-1)		Bentonite grout mix 0-17 ft-bgs
660.0									
	grey to dark grey fine to medium SAND, trace silt		2	SS		2 / 2	5-7': SAND, fine to medium, poorly-graded; grey to dark grey; trace silt, moist to wet, loose. (SP) SPTs (2-3-4-4)		
655.0									
	light to dark brown fine to medium SAND, trace silt		3	SS		2 / 2	10-11.33': SAND, fine to medium, poorly-graded; light to dark brown; trace silt, moist, compact. (SP) 11.33-12': SILT loam, very fine, light brown sand lenses, well-graded; grey; trace silt, wet, compact. (ML) SPTs (3-5-10-14)		
	grey SILT loam, light brown sand lenses, trace silt								
650.0									
	tan to brown to dark brown fine to medium SAND, trace silt		4	SS		1.3 / 2	15-16.25': SAND, fine to medium, poorly-graded; brown to dark brown; trace silt, moist, compact. (SP) SPTs (1-3-9-12)		
645.0									Bentonite chips 17-19 ft-bgs
									Filter Pack #4 Sand 19-31 ft-bgs
			5	SS		1.8 / 2	20-22': SAND, fine to medium, poorly-graded; tan to brown to dark brown; trace silt, moist, dense. (SP) SPTs (3-13-24-24)		2" PVC Screen slot 0.010 21-31 ft-bgs
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Silt (ML) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-24B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171050.6688 E: 2974866.8932
GROUND SURFACE ELEV.: 662.13
TOP OF CASING ELEV.: 665.33
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/26/2016 12:00:00 PM
END DATE/TIME: 9/26/2016 2:02:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	tan to brown to dark brown fine to medium SAND, trace silt		6	SS		1.6 / 2	25-26.58': SAND, fine to medium with trace gravel from 25'-25'6, poorly-graded; brown to dark brown; trace silt, moist, compact. (SP) SPTs (3-4-22-22)		
635.0			7	SS		0.3 / 2	30-30.25': SAND, fine to medium, poorly-graded; brown to dark brown; trace silt, moist, dense. (SP) 31': auger refusal in SHALE; dark grey to black. SPTs (5-15-27-50/5)		
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Silt (ML) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-25

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171586.0299 E: 2973730.3404
GROUND SURFACE ELEV.: 665.26
TOP OF CASING ELEV.: 668.05
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 4:17:00 PM
END DATE/TIME: 10/5/2016 9:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- light brown to orangey tan, fine SAND, trace fly ash, trace silt		1	SS		0.3 / 2	0-0.33': SAND, fine, poorly-graded; light brown to black; trace silt, dry, loose. (FILL) SPTs (1-2-4-3)		Bentonite grout mix 0-2 ft-bgs
									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
660.0			2	SS		2 / 2	5-7': SAND, fine, poorly-graded; light brown to orange-y tan; trace silt, moist, loose. (FILL) SPTs (1-3-3-3)		2" PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.8 / 2	10.25-12': SAND, fine, poorly-graded; light brown to orange-y tan; trace fly ash, trace silt, wet, very loose. (FILL) SPTs (1-1-1-1)		
650.0	light brown to orange-y tan, fine SAND, trace silt								
645.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-25B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171588.4863 E: 2973730.6633
GROUND SURFACE ELEV.: 665.26
TOP OF CASING ELEV.: 667.95
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/5/2016 9:23:00 AM
END DATE/TIME: 10/5/2016 10:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- light brown to orangey tan, fine SAND, trace fly ash, trace silt		1	SS		0.3 / 2	0-0.33': SAND, fine, poorly-graded; light brown to black; trace silt, dry, loose. (FILL) SPTs (1-2-4-3)		Bentonite grout mix 0-21 ft-bgs
660.0			2	SS		2 / 2	5-7': SAND, fine, poorly-graded; light brown to orange-y tan; trace silt, moist, loose. (FILL) SPTs (1-3-3-3)		
655.0			3	SS		1.8 / 2	10.25-12': SAND, fine, poorly-graded; light brown to orange-y tan; trace fly ash, trace silt, wet, very loose. (FILL) SPTs (1-1-1-1)		
650.0	light brown to orange-y tan, fine SAND, trace silt		4	SS		1.3 / 2	15.67-17': SAND, fine, poorly-graded; light brown to orange-y tan; trace silt, wet, very loose. (SP) SPTs (8-1-2-2)		
645.0	grey, fine SAND, trace silt		5	SS		1.3 / 2	20.75-22': SAND, fine, poorly-graded; grey; trace silt, wet, loose. (SP) SPTs (1-3-4-5)		Bentonite chips 21-23 ft-bgs Filter Pack #4 Sand 23-35 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-25B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171588.4863 E: 2973730.6633
GROUND SURFACE ELEV.: 665.26
TOP OF CASING ELEV.: 667.95
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/5/2016 9:23:00 AM
END DATE/TIME: 10/5/2016 10:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	grey, fine SAND, trace silt						25.83-26': SAND, fine, well-graded; grey; trace silt, wet, loose. (SW) 26-26.17': GRAVEL, well-graded; grey; trace silt, wet, loose. (GW) 26.17-27': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, loose. (SP) SPTs (1-2-4-8)		2" PVC Screen slot 0.010 25-35 ft-bgs
	grey fine to medium SAND, trace gravel, trace silt		6	SS		1.2 / 2			
635.0			7	SS		1.5 / 2	30.5-31.67': SAND, fine to medium, well-graded; grey; trace silt, wet, dense. (SW) 31.67-32': SAND, fine, poorly-graded; grey; trace silt, wet, dense.(SP) 35': auger refusal in SHALE; dark grey to black. SPTs (5-14-23-22)		
	grey fine SAND, trace silt								
630.0	SHALE								
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-26

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172243.8327 E: 2973744.7976
GROUND SURFACE ELEV.: 664.89
TOP OF CASING ELEV.: 667.71
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 2:54:00 PM
END DATE/TIME: 10/4/2016 3:23:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- fine, light brown to black SAND, trace organics, trace silt		1	SS		1.5 / 2	0.5-1.17': SAND, fine, poorly-graded; dark brown; trace organics, trace silt, dry, loose. (FILL) 1.17-1.46': black FLY ASH/BOILER SLAG. (FILL) 1.46-2': SAND, fine, poorly-graded; light brown to black; trace silt, dry, loose. (FILL) SPTs (1-1-1-1)		Bentonite grout mix 0-2 ft-bgs Bentonite chips 2-4 ft-bgs
660.0			2	SS		1.5 / 2	5-5.17': SAND, fine, poorly-graded; light brown to black; trace silt, moist, compact. (FILL) 5.17-5.29': GRAVEL, angular, poorly-graded; white; trace silt, moist, compact. (FILL) 5.29-6.58': SAND, fine, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (2-7-8-9)		Filter Pack #4 Sand 4-16 ft-bgs 2" PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.3 / 2	10-11.33': SAND, fine, poorly-graded; brown to dark brown to black; trace fly ash, trace silt, wet, compact. (SP) SPTs (2-7-5-7)		
650.0	brown to dark grey, fine SAND, trace gravel, trace silt								
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-26B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172245.8652 E: 2973744.6631
GROUND SURFACE ELEV.: 664.91
TOP OF CASING ELEV.: 667.75
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 12:30:00 PM
END DATE/TIME: 10/4/2016 2:01:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- fine to medium, light brown to black SAND, trace organics, trace silt		1	SS		1.5 / 2	0.5-1.17': SAND, fine, poorly-graded; dark brown; trace organics, trace silt, dry, loose. (FILL) 1.17-1.46': black FLY ASH/BOILER SLAG. (FILL) 1.46-2': SAND, fine, poorly-graded; light brown to black; trace silt, dry, loose. (FILL) SPTs (1-1-1-1)		Bentonite grout mix 0-19 ft-bgs
660.0			2	SS		1.5 / 2	5-5.17': SAND, fine, poorly-graded; light brown to black; trace silt, moist, compact. (FILL) 5.17-5.29': GRAVEL, angular, poorly-graded; white; trace silt, moist, compact. (FILL) 5.29-6.58': SAND, fine, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (2-7-8-9)		
655.0			3	SS		1.3 / 2	10-11.33': SAND, fine, poorly-graded; brown to dark brown to black; trace fly ash, trace silt, wet, compact. (SP) SPTs (2-7-5-7)		
650.0	brown to dark grey, fine to medium SAND, trace gravel, trace silt		4	SS		2 / 2	15-17': SAND, fine to medium, poorly-graded; brown; trace silt, wet, compact. (SP) SPTs (5-5-8-11)		
645.0			5	SS		1.1 / 2	20.92-22': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) SPTs (1-6-10-12)		Bentonite chips 19-21 ft-bgs Filter Pack #4 Sand 21-33 ft-bgs
640.0									2" PVC Screen slot 0.010 23-33 ft-bgs

LITHOLOGY LEGEND

Fill (made ground) | USCS Poorly-graded Sand (SP) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

NIPSCO RMSGS 1648171 - NIPSCO CCR RMSGS - WITH NON-CCR WELLS.GPJ GOLDER NH 2011.GDT 1/16/19

BOREHOLE LOG: GAMW-26B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172245.8652 E: 2973744.6631
GROUND SURFACE ELEV.: 664.91
TOP OF CASING ELEV.: 667.75
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 12:30:00 PM
END DATE/TIME: 10/4/2016 2:01:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark grey, fine to medium SAND, trace gravel, trace silt		6	SS		1.8 / 2	25.25-27': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) SPTs (1-5-12-24)		
635.0			7	SS		1.4 / 2	30.58-31.5': SAND, fine, poorly-graded; light grey; trace silt, wet, compact. (SP) 31.5-32': SAND, trace gravel, fine to medium, well-graded; dark grey; trace silt, wet, compact. (SW) 33': auger refusal in SHALE; dark grey to black. SPTs (1-7-20-31)		
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Poorly-graded Sand (SP) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-27

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172624.6761 E: 2973958.3233
GROUND SURFACE ELEV.: 662.68
TOP OF CASING ELEV.: 665.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/3/2016 3:48:00 PM
END DATE/TIME: 10/3/2016 4:34:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- light brown to black fine to medium SAND, FLY ASH/ BOILER SLAG, trace organics, trace silt		1	SS		1.3 / 2	0-1.08': SAND, fine, poorly-graded; dark to light brown; trace organics, trace silt, dry, very loose. (FILL) 1.08-1.17': black FLY ASH/BOILER SLAG. (FILL) 1.17-1.25': SAND, fine, poorly-graded; light brown; trace silt, dry, very loose. (FILL) SPTs (1-1-1-2)		Bentonite grout mix 0-2 ft-bgs Bentonite chips 2-4 ft-bgs
660.0			2	SS		2 / 2	5-5.83': SAND with FLY ASH/BOILER SLAG, fine, well-graded; dark brown to black; trace silt, moist, loose. (FILL) 5.83-7': SAND, fine to medium, well-graded; brown; trace silt, moist, loose. (FILL) SPTs (4-2-2-3)		Filter Pack #4 Sand 4-16 ft-bgs 2" PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.8 / 2	10-10.25': FLY ASH/ BOILER SLAG; black; wet. (FILL) 10.25-11.75': SAND, fine to medium, well-graded; dark brown; trace fly ash, trace silt, wet, very loose. (FILL) SPTs (3-1-1-1)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-27B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172624.9467 E: 2973960.2089
GROUND SURFACE ELEV.: 662.65
TOP OF CASING ELEV.: 665.44
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 8:46:00 AM
END DATE/TIME: 10/4/2016 10:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- light brown to black fine to medium SAND, FLY ASH/ BOILER SLAG, trace organics, trace silt		1	SS		1.3 / 2	0-1.08': SAND, fine, poorly-graded; dark to light brown; trace organics, trace silt, dry, very loose. (FILL) 1.08-1.17': black FLY ASH/BOILER SLAG. (FILL) 1.17-1.25': SAND, fine, poorly-graded; light brown; trace silt, dry, very loose. (FILL) SPTs (1-1-1-2)		Bentonite grout mix 0-17 ft-bgs
660.0			2	SS		2 / 2	5-5.83': SAND with FLY ASH/BOILER SLAG, fine, well-graded; dark brown to black; trace silt, moist, loose. (FILL) 5.83-7': SAND, fine to medium, well-graded; brown; trace silt, moist, loose. (FILL) SPTs (4-2-2-3)		
655.0			3	SS		1.8 / 2	10-10.25': FLY ASH/ BOILER SLAG; black; wet. (FILL) 10.25-11.75': SAND, fine to medium, well-graded; dark brown; trace fly ash, trace silt, wet, very loose. (FILL) SPTs (3-1-1-1)		
650.0			4	SS		0 / 2	15-17': No Recovery. SPTs (1-1-1-1)		Bentonite chips 17-19 ft-bgs
645.0	dark brown to grey, fine to medium SAND, trace silt		5	SS		1.4 / 2	20.58-22': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, loose. (SW) SPTs (2-2-5-7)		Filter Pack #4 Sand 19-31 ft-bgs 2" PVC Screen slot 0.010 21-31 ft-bgs
640.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-27B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172624.9467 E: 2973960.2089
GROUND SURFACE ELEV.: 662.65
TOP OF CASING ELEV.: 665.44
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/4/2016 8:46:00 AM
END DATE/TIME: 10/4/2016 10:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to grey, fine to medium SAND, trace silt		6	SS		1.5 / 2	25.5-27': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, dense. (SW) SPTs (7-17-20-21)		
635.0			7	SS		1.5 / 2	30.5-31': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, dense. (SW) 31': auger refusal in SHALE; dark grey to black. SPTs (6-16-23-31)		
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-28

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172777.9712 E: 2974048.467
GROUND SURFACE ELEV.: 662.24
TOP OF CASING ELEV.: 665.48
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 3:34:00 PM
END DATE/TIME: 9/29/2016 3:37:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- black FLY ASH/ BOILER SLAG, fine dark brown to black SAND, some organics, trace gravel, trace silt		1	SS		1.6 / 2	0.42-0.67': SAND, some organics, fine, well-graded; dark brown to black; trace gravel, trace silt, dry, loose. (FILL) 0.67-1.75': black FLY ASH/BOILER SLAG. (FILL) 1.75-2': SAND, fine, poorly-graded; brown to dark brown; trace fly ash, trace silt, moist, loose. (FILL) SPTs (2-2-3-4)		Bentonite grout mix 0-2 ft-bgs
660.0									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
			2	SS		1.9 / 2	5.08-6': FLY ASH/ BOILER SLAG, some sand, fine, poorly-graded; dark brown; trace gravel, trace silt, moist, loose. (FILL) 6-7': SAND, fine, well-graded; tan to brown; trace silt, wet, loose. (FILL) SPTs (1-3-4-5)		2" PVC Screen slot 0.010 6-16 ft-bgs
655.0									
							10.58-10.83': SAND, fine, poorly-graded; brown; trace fly ash, trace silt, wet, loose. (FILL) 10.83-12': SAND, fine to medium, well-graded; brown to grey; trace silt, wet, loose. (FILL) SPTs (1-2-2-4)		
	brown to grey fine to medium SAND, trace gravel, trace silt		3	SS		2 / 2			
650.0									
645.0									
640.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-28B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.5
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172779.4577 E: 2974046.8178
GROUND SURFACE ELEV.: 662.32
TOP OF CASING ELEV.: 665.6
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 1:16:00 PM
END DATE/TIME: 9/29/2016 2:23:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- black FLY ASH/ BOILER SLAG, fine dark brown to black SAND, some organics, trace gravel, trace silt		1	SS		1.6 / 2	0.42-0.67': SAND, some organics, fine, well-graded; dark brown to black; trace gravel, trace silt, dry, loose. (FILL) 0.67-1.75': black FLY ASH/BOILER SLAG. (FILL) 1.75-2': SAND, fine, poorly-graded; brown to dark brown; trace fly ash, trace silt, moist, loose. (FILL) SPTs (2-2-3-4)		Bentonite grout mix 0-15 ft-bgs
660.0			2	SS		1.9 / 2	5.08-6': FLY ASH/ BOILER SLAG, some sand, fine, poorly-graded; dark brown; trace gravel, trace silt, moist, loose. (FILL) 6-7': SAND, fine, well-graded; tan to brown; trace silt, wet, loose. (FILL) SPTs (1-3-4-5)		
655.0			3	SS		2.7 / 2	10.08-10.83': SAND, fine, poorly-graded; brown; trace fly ash, trace silt, wet, loose. (FILL) 10.83-12': SAND, fine to medium, well-graded; brown to grey; trace silt, wet, loose. (SW) SPTs (1-2-2-4)		
	brown to grey fine to medium SAND, trace gravel, trace silt								
650.0			4	SS		0.3 / 2	15.83-16.17': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) SPTs (3-6-9-8)		Bentonite chips 15-17 ft-bgs
645.0			5	SS		1.7 / 2	20.58-22': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, loose. (SW) SPTs (2-7-8-10)		Filter Pack #4 Sand 17-29 ft-bgs 2" PVC Screen slot 0.010 19-29 ft-bgs
640.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Gravel (GP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-28B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.5
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172779.4577 E: 2974046.8178
GROUND SURFACE ELEV.: 662.32
TOP OF CASING ELEV.: 665.6
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 1:16:00 PM
END DATE/TIME: 9/29/2016 2:23:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to grey fine to medium SAND, trace gravel, trace silt		6	SS		2 / 2	25.5-27': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, dense. (SW) SPTs (3-5-12-17)		
635.0									
	grey medium GRAVEL, trace silt		7	SS		1.2 / 2	30.5-31': GRAVEL, medium, well-rounded, poorly sorted, grey, compact, wet. (GP) 31': auger refusal in SHALE; dark grey to black. SPTs (11-7-20-50/5)		
	clayey SHALE								
630.0									
625.0									
620.0									
615.0									

DECOMMISSIONED

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Gravel (GP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-29

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173593.4072 E: 2975290.478
GROUND SURFACE ELEV.: 666.58
TOP OF CASING ELEV.: 669.49
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/3/2016 1:13:00 PM
END DATE/TIME: 10/3/2016 1:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- grey to black fine SAND with FLY ASH/BOILER SLAG, some clay, some gravel, trace silt		1	SS		1.3 / 2	0.67-2': SAND with FLY ASH/BOILER SLAG, some clay, some gravel, fine, angular, poorly-sorted; grey to black; trace silt, dry, loose. (FILL) SPTs (1-1-8-15)		Bentonite grout mix 0-2 ft-bgs
									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
	grey to white CLAY, some gravel		2	SS		2 / 2	5-7': CLAY, some gravel, stiff, poorly-sorted; grey to white; cohesive, dry to moist, silt-like. (CL) SPTs (1-8-6-4)		2" PVC Screen slot 0.010 6-16 ft-bgs
660.0									
			3	SS		1.6 / 2	10.42-10.96': CLAY, silt-like, poorly-sorted; grey to white; trace gravel, cohesive, dry to moist, firm. (CL) 10.96-12': SAND, fine, well-graded; tan to brown; trace coarser fragments, cohesive, wet, compact. (SW) SPTs (2-4-6-7)		
655.0	brown to grey, fine to medium SAND, trace coarser fragments, trace silt								
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Low Plasticity Clay (CL) | USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-29B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173594.6882 E: 2975292.8798
GROUND SURFACE ELEV.: 666.64
TOP OF CASING ELEV.: 669.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/3/2016 10:57:00 AM
END DATE/TIME: 10/3/2016 12:23:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL- grey to black fine SAND with FLY ASH/BOILER SLAG, some clay, some gravel, trace silt		1	SS		1.3 / 2	0.67-2': SAND with FLY ASH/BOILER SLAG, some clay, some gravel, fine, angular, poorly-sorted; grey to black; trace silt, dry, loose. (FILL) SPTs (1-1-8-15)		Bentonite grout mix 0-22 ft-bgs
660.0	grey to white CLAY, some gravel		2	SS		2 / 2	5-7': CLAY, some gravel, stiff, poorly-sorted; grey to white; cohesive, dry to moist, silt-like. (CL) SPTs (1-8-6-4)		
655.0	brown to grey, fine to medium SAND, trace coarser fragments, trace silt		3	SS		1.6 / 2	10.42-10.96': CLAY, silt-like, poorly-sorted; grey to white; trace gravel, cohesive, dry to moist, firm. (CL) 10.96-12': SAND, fine, well-graded; tan to brown; trace coarser fragments, cohesive, wet, compact. (SW) SPTs (2-4-6-7)		
650.0			4	SS		2 / 2	15-17': SAND, brown to grey, well-graded; fine to medium; trace silt, wet, loose. (SW) SPTs (2-2-2-4)		
645.0	grey GRAVEL, trace silt brown to grey fine SAND, trace silt		5	SS		1.3 / 2	20.75-21.42': GRAVEL, well-rounded, poorly-sorted; grey; trace silt, wet, compact. (GP) 21.42-22': SAND, fine, poorly-graded; brown to grey; trace silt, wet, compact. (SP) SPTs (2-5-8-10)		Bentonite chips 22-24 ft-bgs Filter Pack #4 Sand 24-36 ft-bgs

LITHOLOGY LEGEND

Fill (made ground)
USCS Well-graded Gravel (GW)
USCS Low Plasticity Clay (CL)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-29B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173594.6882 E: 2975292.8798
GROUND SURFACE ELEV.: 666.64
TOP OF CASING ELEV.: 669.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/3/2016 10:57:00 AM
END DATE/TIME: 10/3/2016 12:23:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to grey fine SAND, trace silt		6	SS		1.3 / 2	25.75-26.38': SAND, fine, poorly-graded; brown to grey; trace silt, wet, compact. (SP) 26.38-26.67': GRAVEL, some brown sand, well-rounded, well-graded; grey; trace silt, wet, compact. (GW) 26.67-27': SAND, fine, poorly-graded; brown to grey; trace silt, wet, compact. (SP) SPTs (3-4-8-12)		2" PVC Screen slot 0.010 26-36 ft-bgs
640.0	grey fine GRAVEL, some brown sand, trace silt								
	grey GRAVEL, trace silt		7	SS		1.4 / 2	30.58-31.08': GRAVEL, well-rounded, well-graded; grey; trace silt, wet, dense. (GW) 31.08-32': SAND, fine to medium, well-graded; dark brown to grey; trace silt, wet, dense. (SW) SPTs (7-16-17-19)		
635.0	dark brown, fine to medium SAND, trace silt								
	SHALE		8	SS		0.8 / 2	35-36': No Recovery. Auger refusal in SHALE; dark grey to black. SPTs (1-7-16-22)		
630.0									
625.0									
620.0									

LITHOLOGY LEGEND

- Fill (made ground)
- USCS Well-graded Gravel (GW)
- USCS Low Plasticity Clay (CL)
- Shale
- USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-30

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 30.92

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173602.0685 E: 2974396.0195
GROUND SURFACE ELEV.: 664.27
TOP OF CASING ELEV.: 666.92
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/30/2016 10:41:00 AM
END DATE/TIME: 9/30/2016 11:15:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- CLAY, SAND, FLY ASH/ BOILER SLAG, trace gravel, trace silt		1	SS		1.8 / 2	0.17-1.08': FLY ASH/ BOILER SLAG, medium, well-graded; dark brown to black; trace gravel, cohesive, dry, compact. (FILL) 1.08-2': CLAY, trace gravel, W<PL; grey; cohesive, stiff. (FILL) SPTs (3-5-10-15)		Bentonite grout mix 0-2 ft-bgs Bentonite chips 2-4 ft-bgs
660.0			2	SS		1.9 / 2	5-5.75': CLAY, trace gravel, trace fly ash, W<PL; grey; cohesive, stiff (FILL) 5.75-7': SAND, fine, poorly-graded; dark brown to black; trace fly ash, trace silt, moist, loose. (FILL) SPTs (1-1-3-4)		Filter Pack #4 Sand 4-16 ft-bgs 2" PVC Screen slot 0.010 6-16 ft-bgs
655.0	fine to medium brown SAND, trace silt		3	SS		1.5 / 2	10-10.75': SAND, fine, poorly-graded; dark brown to grey; trace boiler slag, trace silt, moist, loose. (FILL) 10.75-11.5': SAND, fine to medium, well-graded; brown; trace silt, wet, loose. (SW) SPTs (1-2-2-5)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-30B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 30.92

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173601.5341 E: 2974399.2253
GROUND SURFACE ELEV.: 664.27
TOP OF CASING ELEV.: 666.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/30/2016 8:32:00 AM
END DATE/TIME: 9/30/2016 9:22:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- CLAY, SAND, FLY ASH/ BOILER SLAG, trace gravel, trace silt		1	SS		1.8 / 2	0.17-1.08': FLY ASH/ BOILER SLAG, medium, well-graded; dark brown to black; trace gravel, cohesive, dry, compact. (FILL) 1.08-2': CLAY, trace gravel, W<PL; grey; cohesive, stiff. (FILL) SPTs (3-5-10-15)		Bentonite grout mix 0-18 ft-bgs
660.0			2	SS		1.9 / 2	5-5.75': CLAY, trace gravel, trace fly ash, W<PL; grey; cohesive, stiff (FILL) 5.75-7': SAND, fine, poorly-graded; dark brown to black; trace fly ash, trace silt, moist, loose. (FILL) SPTs (1-1-3-4)		
655.0	fine to medium brown SAND, trace silt		3	SS		1.5 / 2	10-10.75': SAND, fine, poorly-graded; dark brown to grey; trace boiler slag, trace silt, moist, loose. (FILL) 10.75-11.5': SAND, fine to medium, well-graded; brown; trace silt, wet, loose. (SW) SPTs (1-2-2-5)		
650.0			4	SS		1.5 / 2	15-15.58': SAND, fine to medium, well-graded; brown; trace silt, wet, loose. (SW) 15.58-16.5': SAND, medium, well-graded; brown; trace silt, wet, loose. (SW) SPTs (2-2-2-2)		Bentonite chips 18-20 ft-bgs
645.0	grey GRAVEL, trace silt light brown to grey fine to medium SAND, grey gravel lenses, trace silt		5	SS		0.8 / 2	21.25-21.67': GRAVEL, well-rounded, poorly-sorted; grey; trace silt, wet, compact. (GW) 21.67-22': SAND, some gravel, fine to medium, well-graded; dark brown to grey; trace silt, wet, compact. (SW) SPTs (3-4-6-8)		Filter Pack #4 Sand 20-32 ft-bgs 2" PVC Screen slot 0.010 22-32 ft-bgs
640.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-30B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 30.92

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173601.5341 E: 2974399.2253
GROUND SURFACE ELEV.: 664.27
TOP OF CASING ELEV.: 666.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/30/2016 8:32:00 AM
END DATE/TIME: 9/30/2016 9:22:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to grey fine to medium SAND, grey gravel lenses, trace silt		6	SS		1.3 / 2	25.75-26': GRAVEL, well-rounded, well-graded; grey; trace silt, wet, compact. (GW) 26-27': SAND, trace gravel, fine to medium, well-graded; dark brown to grey; trace silt, wet, compact. (SW) SPTs (4-6-10-12)		
635.0			7	SS		1.3 / 2	30.67-30.92': SAND, trace gravel, fine to medium, well-graded; light brown to brown; trace silt, wet, compact. (SW) 30.92-31.08': GRAVEL, well-rounded, poorly-sorted; grey; trace silt, wet, compact. (GP) 31.08-32': SAND, trace gravel, fine to medium, well-graded; dark brown to grey; trace silt, wet, compact. (SW) 32': auger refusal in SHALE; dark grey to black. SPTs (7-9-15-20)		
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-31

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174043.9313 E: 2974076.4256
GROUND SURFACE ELEV.: 662.68
TOP OF CASING ELEV.: 665.4
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/5/2016 3:39:00 PM
END DATE/TIME: 10/5/2016 4:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to brown fine SAND, trace organics, trace silt		1	SS		1.6 / 2	0-1': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, dry, very loose. (SP) 1-1.58': SAND, fine, poorly-graded; dark brown to black; trace silt, dry, very loose. (SP) SPTs (1-1-1-1)		Bentonite grout mix 0-2 ft-bgs
	tan to black fine SAND, trace silt								Bentonite chips 2-4 ft-bgs
660.0									Filter Pack #4 Sand 4-16 ft-bgs
			2	SS		2 / 2	5-5.67': SAND, fine, poorly-graded; dark brown to black/grey; trace silt, dry, very loose. (SP) 5.67-7': SAND, medium, poorly-graded; brown to tan; trace silt, moist, loose. (SP) SPTs (1-1-3-4)		2" PVC Screen slot 0.010 6-16 ft-bgs
655.0									
	brown to grey fine SAND, trace silt		3	SS		2 / 2	10-10.67': SAND, fine, poorly-graded; dark brown to black/grey; trace silt, wet, loose. (SP) 10.67-12': SAND, fine, poorly-graded; brown to grey; trace silt, wet, loose. (SP) SPTs (1-4-5-8)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-31B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 30
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174041.6795 E: 2974075.8315
GROUND SURFACE ELEV.: 662.69
TOP OF CASING ELEV.: 665.41
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/5/2016 1:38:00 PM
END DATE/TIME: 10/5/2016 2:33:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to brown fine SAND, trace organics, trace silt		1	SS		1.6 / 2	0-1': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, dry, very loose. (SP) 1-1.58': SAND, fine, poorly-graded; dark brown to black; trace silt, dry, very loose. (SP) SPTs (1-1-1-1)		Bentonite grout mix 0-16 ft-bgs
	tan to black fine SAND, trace silt								
660.0			2	SS		2 / 2	5-5.67': SAND, fine, poorly-graded; dark brown to black/grey; trace silt, dry, very loose. (SP) 5.67-7': SAND, medium, poorly-graded; brown to tan; trace silt, moist, loose. (SP) SPTs (1-1-3-4)		
655.0			3	SS		2 / 2	10-10.67': SAND, fine, poorly-graded; dark brown to black/grey; trace silt, wet, loose. (SP) 10.67-12': SAND, fine, poorly-graded; brown to grey; trace silt, wet, loose. (SP) SPTs (1-4-5-8)		
	brown to grey fine SAND, trace silt								
650.0			4	SS		0.4 / 2	16.58-17': SAND, fine, poorly-graded; brown to grey; trace silt, wet, compact. (SP) SPTs (14-8-14-17)		Bentonite chips 16-18 ft-bgs
645.0									Filter Pack #4 Sand 18-30 ft-bgs
			5	SS		1.8 / 2	20.25-21.33': SAND, fine, well-graded; brown to grey; trace silt, wet, compact. (SW) 21.33-21.71': SAND, fine to medium, well-graded; grey; trace silt, wet, loose. (SW) 21.71-21.8': GRAVEL, well rounded, poorly-sorted; wet, loose. (GW) 21.8-22': SAND, fine to medium, well-graded; grey; trace silt, wet, loose. (SW) SPTs (1-4-5-8)		2" PVC Screen slot 0.010 20-30 ft-bgs
	grey SAND, fine gravel, trace silt								
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-31B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 30
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174041.6795 E: 2974075.8315
GROUND SURFACE ELEV.: 662.69
TOP OF CASING ELEV.: 665.41
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 10/5/2016 1:38:00 PM
END DATE/TIME: 10/5/2016 2:33:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	grey SAND, fine gravel, trace silt		6	SS		1.1 / 2	25.9-26.46': SAND, fine to medium gravel, well-graded; grey; trace silt, wet, compact. (SW) 26.46-27': SAND, fine to medium, well-graded; grey; trace silt, wet, loose. 31': auger refusal in SHALE; dark grey to black. (SW) SPTs (8-13-15-18)		
635.0									
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-32

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 18
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174364.5854 E: 2974353.1359
GROUND SURFACE ELEV.: 665.44
TOP OF CASING ELEV.: 668.08
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 5:08:00 PM
END DATE/TIME: 9/27/2016 6:01:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	light brown to black fine SAND, trace organics, trace silt		1	SS		1.7 / 2	0-1': SAND, fine, poorly-graded; dark brown to black; trace organics, trace silt, dry, very loose. (SP) 1-2': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, dry, very loose. (SP) SPTs (1-2-2-4)		Bentonite grout mix 0-4 ft-bgs
660.0	black fine to medium SAND, trace silt		2	SS		1.8 / 2	5.17-6.33': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, moist, loose. (SP) 6.33-7': SAND, fine to medium, poorly-graded; grey to black; trace silt, wet, loose. (SP) SPTs (1-1-2-3)		Bentonite chips 4-6 ft-bgs Filter Pack #4 Sand 6-18 ft-bgs 2" PVC Screen slot 0.010 8-18 ft-bgs
655.0	fine to medium dark brown SAND, trace silt		3	SS		1.8 / 2	10-11.25': SAND, fine, poorly-graded; light brown to black; trace silt, moist, loose. (SP) 11.25-12': SAND, fine to medium, poorly-graded; dark brown; trace silt, moist, loose. (SP) SPTs (2-4-3-6)		
650.0	grey fine to medium SAND, trace gravel, trace silt CLAY		4	SS		1.5 / 2	15.5-16.33': SAND, fine, poorly-graded; dark brown; trace silt, wet, loose. (SP) 16.33-16.83': SAND, fine to medium, well-graded; grey; trace gravel, trace silt, wet, loose. (SW) 16.83-17': CLAY, W<PL; cohesive, wet, soft. (CL) SPTs (5-4-6-8)		
645.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-32B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174364.6987 E: 2974350.0919
GROUND SURFACE ELEV.: 665.53
TOP OF CASING ELEV.: 668.28
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 2:47:00 PM
END DATE/TIME: 9/27/2016 3:47:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	light brown to black fine SAND, trace organics, trace silt		1	SS		1.7 / 2	0-1': SAND, fine, poorly-graded; dark brown to black; trace organics, trace silt, dry, very loose. (SP) 1-2': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, dry, very loose. (SP) SPTs (1-2-2-4)		Bentonite grout mix 0-20 ft-bgs
660.0	black fine to medium SAND, trace silt		2	SS		1.8 / 2	5.17-6.33': SAND, fine, poorly-graded; light brown to brown; trace organics, trace silt, moist, loose. (SP) 6.33-7': SAND, fine to medium, poorly-graded; grey to black; trace silt, wet, loose. (SP) SPTs (1-1-2-3)		
655.0	fine to medium dark brown SAND, trace silt		3	SS		1.8 / 2	10-11.25': SAND, fine, poorly-graded; light brown to black; trace silt, moist, loose. (SP) 11.25-12': SAND, fine to medium, poorly-graded; dark brown; trace silt, moist, loose. (SP) SPTs (2-4-3-6)		
650.0	grey fine to medium SAND, trace gravel, trace silt CLAY		4	SS		1.5 / 2	15.5-16.33': SAND, fine, poorly-graded; dark brown; trace silt, wet, loose. (SP) 16.33-16.83': SAND, fine, well-graded; grey; trace gravel, trace silt, wet, loose. (SW) 16.83-17': CLAY, W<PL; cohesive, wet, soft. (CL) SPTs (5-4-6-8)		
645.0	dark brown fine to medium SAND, trace organics, trace gravel, trace silt		5	SS		0.7 / 2	20-20.67': SAND, fine, well-graded; dark brown to grey; trace organics, trace gravel, trace silt, wet, compact. (SW) SPTs (4-8-9-12)		Bentonite chips 20-22 ft-bgs Filter Pack #4 Sand 22-34 ft-bgs 2" PVC Screen slot 0.010 24-34 ft-bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-32B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174364.6987 E: 2974350.0919
GROUND SURFACE ELEV.: 665.53
TOP OF CASING ELEV.: 668.28
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 2:47:00 PM
END DATE/TIME: 9/27/2016 3:47:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	dark brown fine to medium SAND, trace organics, trace gravel, trace silt		6	SS		2 / 2	25-27': SAND, fine to medium, well-graded; dark brown to grey; trace organics, trace gravel, trace silt, wet, compact. (SW) SPTs (3-7-13-19)		
635.0	brown to grey fine to medium SAND, trace gravel, trace silt		7	SS		1.3 / 2	30-31': Not Sampled. Auger refusal in SHALE; dark grey to black. SPTs (6-14-15-14)		
	SHALE								
630.0									
625.0									
620.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-33

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174015.7087 E: 2976811.1491
GROUND SURFACE ELEV.: 662.63
TOP OF CASING ELEV.: 665.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 12:16:00 PM
END DATE/TIME: 9/27/2016 12:48:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to black fine SAND with organics, trace silt		1	SS		1.3 / 2	0-2': SAND with organics, black soil, fine, poorly-graded; dark brown to black; trace silt, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-2 ft-bgs
660.0									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
	light brown to brown fine SAND, trace silt		2	SS		2 / 2	5-6': SILTY SAND, fine, poorly-graded; dark brown to black; trace silt, wet, very loose (SM). 6-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (1-1-2-2)		2" PVC Screen slot 0.010 6-16 ft-bgs
655.0			3	SS		1.5 / 2	10.5-12': SAND, fine to medium, poorly-graded; light brown to brown; trace silt, wet, loose. (SP) SPTs (1-3-4-5)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-33B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174015.8544 E: 2976814.0104
GROUND SURFACE ELEV.: 662.43
TOP OF CASING ELEV.: 665.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 9:20:00 AM
END DATE/TIME: 9/27/2016 10:23:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown to black fine SAND with organics, trace silt		1	SS		1.3 / 2	0-2': SAND with organics, black soil, fine, poorly-graded; dark brown to black; trace silt, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-17 ft-bgs
660.0			2	SS		2 / 2	5-6': SILTY SAND, fine, poorly-graded; dark brown to black; trace silt, wet, very loose (SM). 6-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (1-1-2-2)		
	light brown to brown fine SAND, trace silt								
655.0			3	SS		1.5 / 2	10.5-12': SAND, fine to medium, poorly-graded; light brown to brown; trace silt, wet, loose. (SP) SPTs (1-3-4-5)		
650.0			4	SS		1 / 2	16-17': SAND, medium, poorly-graded; light brown to grey; trace gravel, trace silt, wet, very loose. (SP) SPTs (1-2-2-3)		
	light brown to grey medium to coarse SAND, some gravel, trace silt								
645.0			5	SS		1 / 2	21-22': SAND, medium, well-graded; grey; trace gravel, trace silt, wet, compact. (SW) SPTs (6-4-8-10)		Bentonite chips 17-19 ft-bgs Filter Pack #4 Sand 19-31 ft-bgs 2" PVC Screen slot 0.010 21-31 ft-bgs
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-33B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174015.8544 E: 2976814.0104
GROUND SURFACE ELEV.: 662.43
TOP OF CASING ELEV.: 665.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/27/2016 9:20:00 AM
END DATE/TIME: 9/27/2016 10:23:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to grey medium to coarse SAND, some gravel, trace silt		6	SS		1.1 / 2	25.92-26.75': SAND, medium to coarse, poorly-graded; grey; trace gravel, trace silt, wet, compact. (SP) 26.75-27': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, compact. (SP) SPTs (2-11-15-18)		
635.0	light brown to brown, fine SAND, trace silt								
			7	SS		2 / 2	30-31': Not Sampled. Auger refusal in SHALE; dark grey to black. SPTs (4-5-13-50/4)		
	SHALE								
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-34

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173123.8017 E: 2976637.5824
GROUND SURFACE ELEV.: 661.78
TOP OF CASING ELEV.: 664.82
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 1:15:00 PM
END DATE/TIME: 9/28/2016 1:51:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to black fine SAND, trace organics, trace silt		1	SS		1.4 / 2	0.58-2': SAND, fine, poorly-graded; light brown to black; trace organics, trace silt, dry, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-2 ft-bgs
660.0									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
	brown fine SAND, trace silt		2	SS		2 / 2	5-5.88': SAND, fine, poorly-graded; light brown to black; trace silt, moist, very loose. (SP) 5.88-7': SAND, fine, poorly graded; light brown to brown; trace silt, moist, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (1-1-3-4)		2" PVC Screen slot 0.010 6-16 ft-bgs
655.0									
			3	SS		0.9 / 2	11.08-12': SAND, fine to medium, poorly-graded; brown to grey; trace to some silt, moist, compact. (SP) SPTs (4-5-10-10)		
	brown to gray fine to medium SAND, trace silt								
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-34B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173126.747 E: 2976637.8425
GROUND SURFACE ELEV.: 661.65
TOP OF CASING ELEV.: 664.84
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 11:21:00 AM
END DATE/TIME: 9/28/2016 12:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	light brown to black fine SAND, trace organics, trace silt		1	SS		1.4 / 2	0.58-2': SAND, fine, poorly-graded; light brown to black; trace organics, trace silt, dry, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-15 ft-bgs
655.0	brown fine SAND, trace silt		2	SS		2 / 2	5-5.88': SAND, fine, poorly-graded; light brown to black; trace silt, moist, very loose. (SP) 5.88-7': SAND, fine, poorly graded; light brown to brown; trace silt, moist, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (1-1-3-4)		
650.0	brown to gray fine to medium SAND, trace silt		3	SS		0.9 / 2	11.08-12': SAND, fine to medium, poorly-graded; brown to grey; trace to some silt, moist, compact. (SP) SPTs (4-5-10-10)		
645.0	brown to gray GRAVELLY SAND, trace silt		4	SS		0.8 / 2	16.25-17': GRAVELLY SAND, fine to coarse, predominately medium, poorly-graded; brown to grey; trace silt, moist, compact. (SP) SPTs (1-2-2-7)		Bentonite chips 15-17 ft-bgs Filter Pack #4 Sand 17-29 ft-bgs 2" PVC Screen slot 0.010 19-29 ft-bgs
640.0			5	SS		1.5 / 2	20.5-22': GRAVELLY SAND, fine to coarse, predominately medium, poorly-graded; brown to grey; trace silt, moist, compact. (SP) SPTs (1-3-6-11)		

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-34B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173126.747 E: 2976637.8425
GROUND SURFACE ELEV.: 661.65
TOP OF CASING ELEV.: 664.84
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 11:21:00 AM
END DATE/TIME: 9/28/2016 12:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	brown to gray GRAVELLY SAND, trace silt		6	SS		1.1 / 2	25.92-27': GRAVELLY SAND, fine to coarse, predominately medium, poorly-graded; brown to grey; trace silt, moist, compact. (SP) 29': auger refusal in SHALE; dark grey to black. SPTs (4-5-11-13)		
630.0	SHALE								
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-35

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 24
DEPTH TO BEDROCK: 24

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172046.6383 E: 2976576.9707
GROUND SURFACE ELEV.: 661.78
TOP OF CASING ELEV.: 664.62
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 8:57:00 AM
END DATE/TIME: 9/28/2016 9:55:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown to black, fine SAND, trace organics, trace silt		1	SS		1.6 / 2	0.33-1.92': SAND, fine, poorly-graded; dark brown to black; trace organics, trace silt, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-10 ft-bgs
655.0	light brown to brown fine to medium SAND, trace silt		2	SS		2 / 2	5-5.67': SAND, fine, poorly-graded; dark brown to black; trace organics, trace silt, moist, very loose. (SP) 5.67-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) SPTs (1-1-2-4)		
650.0	light brown to grey, fine to medium SAND, some gravel, trace silt		3	SS		1.5 / 2	10-11.42': SAND, fine to medium, poorly-graded; light brown to grey; trace silt, wet, loose. (SP) 11.42-11.5': GRAVEL, well-rounded, poorly-sorted; light brown to grey; trace silt, wet, loose. (GP) SPTs (2-3-5-5)		Bentonite chips 10-12 ft-bgs Filter Pack #4 Sand 12-24 ft-bgs 2" PVC Screen slot 0.010 14-24 ft-bgs
645.0	grey medium SAND, trace gravel, trace silt		4	SS		1.5 / 2	15.5-16.17': SAND, medium, poorly-graded; light brown to grey; trace silt, wet, compact. (SP) 16.17-17': SAND, medium, poorly-graded; grey; trace gravel, trace to some silt, wet, compact. (SP) SPTs (2-6-11-16)		
640.0	light brown to grey medium SAND, trace silt		5	SS		1.5 / 2	20-20.83': SAND, fine to medium, predominately medium, poorly-graded; grey; trace coarse sand, trace silt, wet, compact. (SW) 20.83-21.5': SAND, medium, poorly-graded; light brown to grey; trace silt, wet, loose. (SW) 24': auger refusal in SHALE; dark grey to black. SPTs (3-4-9-16)		
	SHALE								

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-35

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 24
DEPTH TO BEDROCK: 24

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2172046.6383 E: 2976576.9707
GROUND SURFACE ELEV.: 661.78
TOP OF CASING ELEV.: 664.62
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 8:57:00 AM
END DATE/TIME: 9/28/2016 9:55:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	SHALE								
635.0									
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-36

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 34.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174145.142 E: 2977866.7207
GROUND SURFACE ELEV.: 662.24
TOP OF CASING ELEV.: 665
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 10:54:00 AM
END DATE/TIME: 9/29/2016 11:21:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to black fine SAND, trace organics, trace silt		1	SS		2 / 2	0-2': SAND, trace organics, fine, poorly-graded; light brown to black; trace silt, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-2 ft-bgs
660.0									Bentonite chips 2-4 ft-bgs
									Filter Pack #4 Sand 4-16 ft-bgs
			2	SS		1.9 / 2	5.08-6.08': SAND, medium, poorly-graded; light brown to black; trace organics, trace silt, moist, very loose. (SP) 6.08-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (2-1-1-1)		2" PVC Screen slot 0.010 6-16 ft-bgs
	light brown to brown, fine to medium SAND, trace silt								
655.0									
			3	SS		1.9 / 2	10.08-12': SAND, fine to medium, poorly-graded; light brown to brown; trace to some silt, wet, loose. (SP) SPTs (3-5-5-6)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-36B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34.5
DEPTH TO BEDROCK: 34.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174142.5054 E: 2977866.949
GROUND SURFACE ELEV.: 662.35
TOP OF CASING ELEV.: 665.07
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 9:14:00 AM
END DATE/TIME: 9/29/2016 10:18:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to black fine SAND, trace organics, trace silt		1	SS		2 / 2	0-2': SAND, trace organics, fine, poorly-graded; light brown to black; trace silt, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite grout mix 0-20.5 ft-bgs
660.0			2	SS		1.9 / 2	5.08-6.08': SAND, fine, poorly-graded; light brown to black; trace organics, trace silt, moist, very loose. (SP) 6.08-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (2-1-1-1)		
	light brown to brown fine to medium SAND, trace silt								
655.0			3	SS		1.9 / 2	10.08-12': SAND, fine to medium, poorly-graded; light brown to brown; trace to some silt, wet, loose. (SP) SPTs (3-5-5-6)		
650.0			4	SS		1.5 / 2	15.5-17': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) SPTs (2-4-8-9)		
	brown to grey fine to medium SAND, trace gravel, trace silt								
645.0			5	SS		1.2 / 2	20.83-21.42': GRAVELLY SAND, well-rounded, fine to coarse, predominately medium to coarse, poorly-sorted; grey; trace silt, wet, compact. (SW) 21.42-22': SAND, some gravel, fine to medium, well-graded; brown to grey; trace silt, wet, compact. (SW) SPTs (2-4-9-11)		Bentonite chips 20.5-22.5 ft-bgs
	grey GRAVELLY SAND, trace silt								
	brown to grey fine to medium SAND, trace gravel, trace silt								
640.0									Filter Pack #4 Sand 22.5-34.5 ft-bgs
									2" PVC Screen slot

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-36B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34.5
DEPTH TO BEDROCK: 34.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174142.5054 E: 2977866.949
GROUND SURFACE ELEV.: 662.35
TOP OF CASING ELEV.: 665.07
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/29/2016 9:14:00 AM
END DATE/TIME: 9/29/2016 10:18:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to grey fine to medium SAND, trace gravel, trace silt		6	SS		1.1 / 2	25.92-27': SAND, some gravel, medium to coarse, well-graded; brown to grey; trace silt, wet, loose. (SW) SPTs (4-3-4-11)		0.010 24.5-34.5 ft-bgs
635.0									
	light brown to brown fine to medium SAND, trace silt grey GRAVEL, trace silt light brown to brown fine SAND, trace gravel, trace silt		7	SS		1.4 / 2	30.58-31.25': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, compact. (SP) 31.25-31.46': GRAVEL, well-rounded, poorly-sorted; grey; trace silt, wet, compact. (SP) 31.46-32': SAND, fine, poorly-graded; light brown to brown; trace to some medium to coarse sand and fine gravel, trace silt, wet, compact. (SP) 34.5': auger refusal in SHALE; dark grey to black. SPTs (1-3-16-24)		
630.0									
	SHALE								
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-37

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 25
DEPTH TO BEDROCK: 25

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173307.5408 E: 2977852.5437
GROUND SURFACE ELEV.: 662.68
TOP OF CASING ELEV.: 665.32
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 3:59:00 PM
END DATE/TIME: 9/28/2016 4:44:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to black fine SAND, trace organics, trace silt		1	SS		1.8 / 2	0-1.75': SAND, fine, poorly-graded; light brown to black; trace organics, trace silt, dry, very loose. (SP) SPTs (1-1-1-1)		Bentonite grout mix 0-11 ft-bgs
660.0			2	SS		1.9 / 2	5-6.08': SILTY SAND, fine, poorly-graded; light brown to black; trace organics, trace silt, moist, very loose. (SM) 6.08-7': SAND, fine, poorly-graded; light brown to brown; trace silt, wet, very loose. (SP) COMPOSITE: (SP), F=31.4° SPTs (1-1-1-1)		
	light brown to brown fine SAND, trace silt								
655.0			3	SS		2 / 2	10-12': SAND, fine, poorly-graded; tan to brown; trace silt, wet, loose. (SP) SPTs (1-2-5-7)		Bentonite chips 11-13 ft-bgs
650.0									Filter Pack #4 Sand 13-25 ft-bgs
	brown to gray fine to medium SAND, trace gravel, trace silt		4	SS		1.3 / 2	15.67-17': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) SPTs (2-7-11-15)		2" PVC Screen slot 0.010 15-25 ft-bgs
645.0			5	SS		1.7 / 2	20.33-20.83': SAND, fine to medium, well-graded; brown to grey; trace gravel, trace silt, wet, compact. (SW) 25': auger refusal in SHALE; dark grey to black. SPTs (2-7-12-11)		
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-37

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 25
DEPTH TO BEDROCK: 25

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173307.5408 E: 2977852.5437
GROUND SURFACE ELEV.: 662.68
TOP OF CASING ELEV.: 665.32
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 9/28/2016 3:59:00 PM
END DATE/TIME: 9/28/2016 4:44:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	SHALE								
635.0									
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: HV
CHECKED BY: JMR
DATE: 3/22/17

Golder Associates

BOREHOLE LOG: GAMW-38

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 29.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173106.902 E: 2974209.725
GROUND SURFACE ELEV.: 660.93
TOP OF CASING ELEV.: 663.27
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/3/2018 2:25:00 PM
END DATE/TIME: 4/4/2018 8:55:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown fine SAND, some organics, some silt		1	SS		1 / 2	0-1': SAND, fine, poorly-graded; dark brown; some organics, some silt, moist, very loose. (SP) SPTs (1-2-1-2)		Bentonite Chips 0-3 ft-bgs
	light brown fine to medium SAND, trace gravel		2	SS		1.25 / 2	2-2.25': SAND, fine, poorly-graded, dark brown; some organics, some silt, moist, loose. (SP) 2.25-3.25': SAND, fine, poorly-graded, light brown; trace rounded gravel <1 inch, rounded gravel >1 inch at 3.25', wet, loose. (SP) SPTs (2-3-4-5)		#5 Sand Filter Pack 3-15 ft-bgs
			3	SS		1.58 / 2	4-5.58': SAND, fine to medium, well-graded, light brown; trace rounded gravel <1 cm, 1/2 inch thick red staining at 5', wet, loose. (SW) SPTs (3-3-3-4)		2" PVC Screen slot 0.010 5-15 ft-bgs
655.0	light brown SILT, trace fine sand gray fine to medium SAND, trace gravel, trace silt		4	SS		0.83 / 2	6-6.33': SILT, light brown; trace fine sand, wet, very loose. (ML) 6.33-6.83': SAND, fine to medium, poorly-graded, gray; trace rounded gravel <1/2 inch, trace rounded gravel >1/2 inch, trace silt, wet, very loose. (SP). SPTs (1-1-2-3)		
	light brown fine to medium SAND, trace silt light brown fine SILT and SAND gray fine to coarse SAND, trace rounded gravel, trace silt		5	SS		2 / 2	8-8.5': SAND, fine to medium, well-graded, light brown; trace silt, wet loose. (SW) 8.5-9': SILT and SAND, fine, poorly-graded, light brown; wet, loose. (ML) 9-10': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, wet, lo		
650.0			6	SS		1.83 / 2			
			7	SS		2 / 2	10-11.83': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, wet, loose. (SW) SPTs (3-5-7-7)		
	gray fine to coarse SAND and rounded GRAVEL, trace silt		8	SS		0.75 / 2	12-14': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, with brown sand and silt lenses 1/2 inch thick at 12.67' and 13', wet, loose. (SW) SPTs (3-5-7-12)		
645.0							14-14.75': SAND and GRAVEL, fine to coarse sand, rounded gravel <1 cm, well-graded, gray: trace silt, wet, loose. (SW) SPTs (2-3-3-5)		
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
USCS Well-graded Gravelly Sand (SWG)
USCS Silt (ML)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-38B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.5
DEPTH TO BEDROCK: 29.33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173104.461 E: 2974206.659
GROUND SURFACE ELEV.: 660.81
TOP OF CASING ELEV.: 663.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/3/2018 11:30:00 AM
END DATE/TIME: 4/3/2018 1:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown fine SAND, some organics, some silt		1	SS		1 / 2	0-1': SAND, fine, poorly-graded; dark brown; some organics, some silt, moist, very loose. (SP) SPTs (1-2-1-2)		CETCO grout 0-15.5 ft-bgs
	light brown fine to medium SAND, trace gravel		2	SS		1.25 / 2	2-2.25': SAND, fine, poorly-graded, dark brown; some organics, some silt, moist, loose. (SP) 2.25-3.25': SAND, fine, poorly-graded, light brown; trace rounded gravel <1 inch, rounded gravel >1 inch at 3.25', wet, loose. (SP) SPTs (2-3-4-5)		
			3	SS		1.58 / 2	4-5.58': SAND, fine to medium, well-graded, light brown; trace rounded gravel <1 cm, 1/2 inch thick red staining at 5', wet, loose. (SW) SPTs (3-3-3-4)		
655.0	light brown SILT, trace fine sand gray fine to medium SAND, trace gravel, trace silt		4	SS		0.83 / 2	6-6.33': SILT, light brown; trace fine sand, wet, very loose. (ML) 6.33-6.83': SAND, fine to medium, poorly-graded, gray; trace rounded gravel <1/2 inch, trace rounded gravel >1/2 inch, trace silt, wet, very loose. (SP). SPTs (1-1-2-3)		
	light brown fine to medium SAND, trace silt light brown fine SILT and SAND gray fine to coarse SAND, trace rounded gravel, trace silt		5	SS		2 / 2			
650.0			6	SS		1.83 / 2	8-8.5': SAND, fine to medium, well-graded, light brown; trace silt, wet loose. (SW) 8.5-9': SILT and SAND, fine, poorly-graded, light brown; wet, loose. (ML)		
			7	SS		2 / 2	9-10': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, wet, loose. (SW) SPTs (1-2-4-5)		
	gray fine to coarse SAND and rounded GRAVEL, trace silt		8	SS		0.75 / 2	10-11.83': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, wet, loose. (SW) SPTs (3-5-7-7)		
645.0	gray medium to coarse SAND, trace fine sand, trace rounded gravel		9	SS		1.083 / 2	12-14': SAND, fine to coarse, well-graded, gray; trace rounded gravel <1 cm, trace silt, with brown sand and silt lenses 1/2 inch thick at 12.67' and 13', wet, loose. (SW) SPTs (3-5-7-12)		Bentonite Chips 15.5-18 ft-bgs
			10	SS		1 / 2	14-14.75': SAND and GRAVEL, fine to coarse sand, rounded gravel <1 cm, well-graded, gray: trace silt, wet, loose. (SW) SPTs (2-3-3-5)		#5 Sand Filter Pack 18-29.5 ft-bgs
640.0	gray to brown fine to medium SAND, trace rounded gravel, trace silt		11	SS		1 / 2	16-17.083': SAND, medium to coarse, well-graded, gray: some fine sand, trace rounded <1 cm gravel, wet, compact. (SW) SPTs (5-4-7-9)		2" PVC Screen slot 0.010 19.5-29.5 ft-bgs
			12	SS		0.83 / 2	18-19': SAND, medium to coarse, well-graded, gray: some fine sand, trace rounded <1 cm gravel, wet, compact. (SW) SPTs (3-4-8-11)		
			13	SS		1.25 / 2	20-21': SAND, fine to medium, well-graded, gray to brown: trace rounded <1 cm gravel, trace silt, wet, compact. (SW) SPTs (3-4-8-10)		

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
USCS Well-graded Gravelly Sand (SWG)
USCS Silt (ML)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-38B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.5
DEPTH TO BEDROCK: 29.33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173104.461 E: 2974206.659
GROUND SURFACE ELEV.: 660.81
TOP OF CASING ELEV.: 663.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/3/2018 11:30:00 AM
END DATE/TIME: 4/3/2018 1:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	gray to brown fine to medium SAND, trace rounded gravel, trace silt		13	SS		1.25 / 2	22-22.83': SAND, fine to medium, well-graded, gray to brown: trace rounded <1 cm gravel, trace silt, wet, compact. (SW) SPTs (5-6-9-14)		
			14	SS		0.83 / 2	24-25.25': SAND, fine to medium, well-graded, gray to brown: trace rounded <1 cm gravel, trace silt, wet, loose. (SW) SPTs (1-2-7-14)		
			15	SS		1.42 / 1.5	26-26.83': SAND, fine to medium, well-graded, gray to brown: trace rounded gravel, trace silt, wet, compact. (SW) SPTs (5-11-16-21)		
	brown to gray SHALE						28-29.33': SAND, fine to medium, well-graded, gray to brown: trace rounded gravel, trace silt, wet, compact. (SW) 29.33-29.42': SHALE, brown to gray, wet, cohesive SPTs (7-11-50/6)		
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
USCS Well-graded Gravelly Sand (SWG)
USCS Silt (ML)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-39

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173099.95 E: 2974491.988
GROUND SURFACE ELEV.: 661.04
TOP OF CASING ELEV.: 663.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/4/2018 12:30:00 PM
END DATE/TIME: 4/4/2018 1:15:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown SILT and fine SAND, trace organics		1	SS		1.83 / 2	2-3.33': SILT and SAND, fine, well-graded, dark brown, trace organics, very loose, moist. (ML) 3.33-3.83': SAND, fine to medium, well-graded, light brown, trace rounded <1 cm gravel, very loose, wet. (SW) SPTs (1-1-1-1)		Bentonite Chips 0-3 ft-bgs
	light brown fine to medium SAND, trace rounded gravel								#5 Sand Filter Pack 3-15 ft-bgs
	light brown SILT and SAND		2	SS		1.83 / 2	5-5.83': SILT and SAND, fine, poorly-graded, brown, wet, loose. (ML) 5.83-6.83': SAND, fine, poorly-graded, light brown, some silt, wet, loose. (SP) SPTs (2-3-4-5)		2" PVC Screen slot 0.010 5-15 ft-bgs
655.0	light brown fine SAND, some silt								
	light brown fine SILT and SAND		3	SS		1.58 / 2	10-10.25': SILT and SAND, fine, poorly-graded, dark brown, wet, very loose. (ML) 10.25-11.58': SAND, medium to coarse, well-graded, gray, some rounded <1/2 inch gravel, trace rounded <1 cm gravel, wet, very loose. (SW) SPTs (1-2-2-2)		
	gray fine to coarse SAND, little rounded gravel, trace silt								
	dark brown SILT and fine SAND								
650.0	gray fine to coarse SAND, some rounded gravel								
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silt (ML) | USCS Well-graded Sand (SW) | USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-39B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.92
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173103.206 E: 2974490.702
GROUND SURFACE ELEV.: 660.96
TOP OF CASING ELEV.: 663.47
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/4/2018 9:30:00 AM
END DATE/TIME: 4/4/2018 11:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown SILT and fine SAND, trace organics		1	SS		1.83 / 2	2-3.33': SILT and SAND, fine, well-graded, dark brown, trace organics, very loose, moist. (ML) 3.33-3.83': SAND, fine to medium, well-graded, light brown, trace rounded <1 cm gravel, very loose, wet. (SW) SPTs (1-1-1-1)		CETCO Grout 0-15 ft-bgs
	light brown fine to medium SAND, trace rounded gravel								
	light brown SILT and SAND		2	SS		1.83 / 2	5-5.83': SILT and SAND, fine, poorly-graded, brown, wet, loose. (ML) 5.83-6.83': SAND, fine, poorly-graded, light brown, some silt, wet, loose. (SP) SPTs (2-3-4-5)		
655.0	light brown fine SAND, some silt								
	light brown fine SILT and SAND		3	SS		1.58 / 2	10-10.25': SILT and SAND, fine, poorly-graded, dark brown, wet, very loose. (ML) 10.25-11.58': SAND, medium to coarse, well-graded, gray, some rounded <1/2 inch gravel, trace rounded <1 cm gravel, wet, very loose. (SW) SPTs (1-2-2-2)		
	gray fine to coarse SAND, little rounded gravel, trace silt								
	dark brown SILT and fine SAND								
650.0	gray fine to coarse SAND, some rounded gravel								
645.0			4	SS		0.67 / 2	15-15.67': SAND, medium to coarse, well-graded, gray, some rounded <1 cm gravel, wet, loose. (SW) SPTs (3-4-5-7)		Bentonite Chips 15-17 ft-bgs
									#5 Sand Filter Pack 17-29.75 ft-bgs
640.0			5	SS		1 / 2	20-21': SAND, fine to coarse, well-graded, gray, some rounded <1 cm gravel, wet, compact. (SW) SPTs (3-5-6-9)		2" PVC Screen slot 0.010 19.75-29.75 ft-bgs

LITHOLOGY LEGEND

USCS Silt (ML)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-39B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 29.92
DEPTH TO BEDROCK: 29

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173103.206 E: 2974490.702
GROUND SURFACE ELEV.: 660.96
TOP OF CASING ELEV.: 663.47
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/4/2018 9:30:00 AM
END DATE/TIME: 4/4/2018 11:20:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	gray fine to coarse SAND, some rounded gravel		6	SS		1 / 2	20-21': SAND, fine to coarse, well-graded, gray, some rounded <1 cm gravel, wet, compact. (SW) SPTs (4-8-10-14)		
	gray SHALE		7	SS		0.92 / 0.92	29-29.92': SHALE, gray, clayey. SPTs (11-50/5)		
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silt (ML)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-40

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 17
DEPTH TO BEDROCK: 30.25

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173336.206 E: 2974705.878
GROUND SURFACE ELEV.: 664.11
TOP OF CASING ELEV.: 666.54
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/5/2018 8:05:00 AM
END DATE/TIME: 4/5/2018 8:55:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND and SILT, some organics		1	SS		1.5 / 2	0-1.5': SAND and SILT, fine, poorly-graded, dark brown, some organics, moist, very loose. (SP) SPTs (1-1-1-2)		Bentonite Chips 0-5 ft-bgs
660.0			2	SS		2 / 2	5-5.5': SILT, dark brown, some fine sand, trace organics, trace rounded <1 cm gravel, moist, loose. (ML) 5.5-6.08': SAND and SILT, fine, poorly-graded, brown, moist, loose. (SP) 6.08-7': SAND, fine to medium, well-graded, light brown, trace rounded <1 c		#5 Sand Filter Pack 5-17 ft-bgs
	light brown fine to medium SAND, trace rounded gravel								2" PVC Screen slot 0.010 7-17 ft-bgs
655.0			3	SS		1.5 / 2	10-10.83': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1 cm gravel, wet, loose. (SW) 10.83-11.08': SAND and SILT, fine, poorly-graded, dark brown. (SP) 11.08-11.5': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1		
	brown to gray fine to coarse SAND, trace rounded gravel								
650.0			4	SS		0.42 / 2	15-15.42': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1 cm gravel, wet, very loose. (SW) SPTs (1-1-2-3)		
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-40B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31.5
DEPTH TO BEDROCK: 30.25

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173336.053 E: 2974709.344
GROUND SURFACE ELEV.: 664.05
TOP OF CASING ELEV.: 666.38
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/4/2018 3:50:00 PM
END DATE/TIME: 4/4/2018 4:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND and SILT, some organics		1	SS		1.5 / 2	0-1.5': SAND and SILT, fine, poorly-graded, dark brown, some organics, moist, very loose. (SP) SPTs (1-1-1-2)		Cetgo Grout 0-17.5 ft bgs
660.0			2	SS		2 / 2	5-5.5': SILT, dark brown, some fine sand, trace organics, trace rounded <1 cm gravel, moist, loose. (ML) 5.5-6.08': SAND and SILT, fine, poorly-graded, brown, moist, loose. (SP) 6.08-7': SAND, fine to medium, well-graded, light brown, trace rounded <1 cm gravel, wet, loose. (SW) SPTs (2-5-4-5)		
	light brown fine to medium SAND, trace rounded gravel								
655.0			3	SS		1.5 / 2	10-10.83': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1 cm gravel, wet, loose. (SW) 10.83-11.08': SAND and SILT, fine, poorly-graded, dark brown. (SP) 11.08-11.5': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1 cm gravel, wet, loose. (SW) SPTs (1-2-3-5)		
	brown to gray fine to coarse SAND, trace rounded gravel								
650.0			4	SS		0.42 / 2	15-15.42': SAND, fine to coarse, well-graded, brown to gray, trace rounded <1 cm gravel, wet, very loose. (SW) SPTs (1-1-2-3)		
645.0									Bentonite Chips 17.5-19.5 ft bgs #5 Sand Filter Pack 19.5-31.5 ft bgs
	light gray fine to coarse SAND, some rounded gravel		5	SS		1.17 / 2	20-21.17': SAND, fine to medium, well-graded, light brown, trace rounded <1 cm gravel, some silt, wet, compact. (SW) SPTs (5-9-18-21)		2" PVC Screen slot 0.010 21.5-31.5 ft-bgs
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-40B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 31.5
DEPTH TO BEDROCK: 30.25

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173336.053 E: 2974709.344
GROUND SURFACE ELEV.: 664.05
TOP OF CASING ELEV.: 666.38
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 4/4/2018 3:50:00 PM
END DATE/TIME: 4/4/2018 4:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, some rounded gravel		6	SS		1.08 / 2	25-26.08': SAND, fine to coarse, well-graded, gray, some rounded <1 cm gravel, wet, compact. (SW) SPTs (5-9-14-15)		
635.0	gray clayey SHALE		7	SS		1 / 2	30-30.25': SAND, fine to coarse, well-graded, gray, some rounded <1 cm gravel, wet, compact. (SW) 30.25-31': SHALE, gray, clayey SPTs (5-10-15-16)		
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Craig Neilson
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-41

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 27

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173334.044 E: 2975014.682
GROUND SURFACE ELEV.: 660.09
TOP OF CASING ELEV.: 662.41
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/17/2018 2:10:00 PM
END DATE/TIME: 5/17/2018 2:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	fine dark brown SAND, some silt		1			2 / 2	0-0.33': SAND, fine, poorly-graded, dark brown, some silt, some sandstone gravel, moist, compact. (SP) 0.33-1.75': SAND, fine, poorly-graded, dark brown, some silt, moist, compact. (SP) 1.75-2': SAND, fine to medium, well-graded, light brown, moist comp		Bentonite Chips 0-3 ft-bgs
	fine to medium light brown SAND								#5 Sand Filter Pack 3-15 ft-bgs
655.0			2			1.17 / 2	5-6.17': SAND, fine to medium, well-graded, light brown, wet, loose. (SW) SPTs (3-4-4-5)		2" PVC Screen slot 0.010 5-15 ft-bgs
650.0	fine to coarse light gray SAND		3			2 / 2	10-12': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) SPTs (3-5-7-9)		
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-41B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 27.83
DEPTH TO BEDROCK: 27

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173337.097 E: 2975019.417
GROUND SURFACE ELEV.: 660.08
TOP OF CASING ELEV.: 662.15
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/17/2018 11:55:00 AM
END DATE/TIME: 5/17/2018 12:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	fine dark brown SAND, some silt		1			2 / 2	0-0.33': SAND, fine, poorly-graded, dark brown, some silt, some sandstone gravel, moist, compact. (SP) 0.33-1.75': SAND, fine, poorly-graded, dark brown, some silt, moist, compact. (SP) 1.75-2': SAND, fine to medium, well-graded, light brown, moist compact. (SW) SPTs (4-6-6-8)		Cetgo Grout 0-13 ft bgs
	fine to medium light brown SAND								
655.0			2			1.17 / 2	5-6.17': SAND, fine to medium, well-graded, light brown, wet, loose. (SW) SPTs (3-4-4-5)		
650.0	fine to coarse light gray SAND		3			2 / 2	10-12': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) SPTs (3-5-7-9)		
645.0			4			0.58 / 2	15-15.58': SAND, fine to coarse, well-graded, light gray, wet, loose. (SW) SPTs (3-3-4-5)		Bentonite Chips 13-15 ft bgs #5 Sand Filter Pack 15-27 ft bgs 2" PVC Screen slot 0.010 17-27 ft-bgs
640.0	fine to coarse light gray SAND, trace to some rounded gravel		5			1.33 / 2	20-21.33': SAND, fine to coarse, well-graded, light gray, trace rounded <1 inch gravel, wet, compact. (SW) SPTs (5-8-12-15)		

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-41B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 27.83
DEPTH TO BEDROCK: 27

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173337.097 E: 2975019.417
GROUND SURFACE ELEV.: 660.08
TOP OF CASING ELEV.: 662.15
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/17/2018 11:55:00 AM
END DATE/TIME: 5/17/2018 12:45:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	fine to coarse light gray SAND, trace to some rounded gravel		6			1.42 / 2	25-26.42': SAND, fine to coarse, well-graded, light gray, some rounded <1.5 inch gravel, wet, compact. (SW) SPTs (5-8-12-13)		
	light gray clayey SHALE		7			0.83 / 1.17	27-27.83': SHALE, clayey, light gray SPTs (5-15-50/2)		
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-42

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170186.913 E: 2967937.39
GROUND SURFACE ELEV.: 663.12
TOP OF CASING ELEV.: 665.78
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/24/2018 3:40:00 PM
END DATE/TIME: 7/24/2018 3:55:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND, some organics			RS			0-1.6': SILTY SAND, fine, poorly-graded, dark brown, some organics, moist. (SP) 1.6-2': SAND, fine, poorly-graded, light gray, moist. (SP)		Bentonite Chips 0-4 ft bgs
	light gray fine SAND								
	dark brown fine SAND, some silt						2-3.2': SAND, fine, poorly-graded, dark brown, some silt, cohesive, moist. (SP)		
660.0	light brown to light gray fine to medium SAND, trace gravel			RS			3.2-5': SAND, fine to medium, well-graded, light brown to light gray, trace rounded gravel <1 cm (0.4 inch), wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs 2" PVC Screen slot 0.010 5-15 ft bgs
655.0							10.8-10.9': CLAY, light gray (CL)		
	light gray CLAY light gray fine to coarse SAND, some gravel			RS					
650.0				RS			12-12.2': SAND, medium to coarse, light gray, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-42B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 38
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170182.551 E: 2967943.169
GROUND SURFACE ELEV.: 663.15
TOP OF CASING ELEV.: 665.64
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/24/2018 12:30:00 PM
END DATE/TIME: 7/24/2018 1:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND, some organics			RS			0-1.6': SILTY SAND, fine, poorly-graded, dark brown, some organics, moist. (SP) 1.6-2': SAND, fine, poorly-graded, light gray, moist. (SP)		Bentonite Grout 0-22 ft bgs
	light gray fine SAND								
	dark brown fine SAND, some silt			RS			2-3.2': SAND, fine, poorly-graded, dark brown, some silt, cohesive, moist. (SP) 3.2-5': SAND, fine to medium, well-graded, light brown to light gray, trace rounded gravel <1 cm (0.4 inch), wet. (SW)		
660.0	light brown to light gray fine to medium SAND, trace gravel								
655.0				RS			10.8-10.9': CLAY, light gray (CL)		
	light gray CLAY light gray fine to coarse SAND, some gravel								
650.0				RS			12-12.2': SAND, medium to coarse, light gray, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
				RS			16-17.5': SAND, medium to coarse, light gray, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
645.0				RS			18-20': SAND, medium to coarse, light gray, some rounded gravel <1 inch, trace fine sand, wet. (SW)		
640.0				RS			22-26': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		Bentonite Chips 22-24 ft bgs #5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-42B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 38
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170182.551 E: 2967943.169
GROUND SURFACE ELEV.: 663.15
TOP OF CASING ELEV.: 665.64
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/24/2018 12:30:00 PM
END DATE/TIME: 7/24/2018 1:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, some gravel			RS					2" PVC Screen slot 0.010 26-36 ft bgs
635.0				RS			28-30': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
630.0			SB-42B-30'-34'	RS			30-32': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
	light gray SHALE		SB-42B-34'-36'				34-34.25': CLAYEY SHALE, light gray, very weathered, wet.		
			SB-42B-36'-38'				36-38': SHALE, light gray, dry.		#5 Sand 36-38 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Low Plasticity Clay (CL)
USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-42C

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 50
DEPTH TO BEDROCK: 32.3

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170207.085 E: 2967974.69
GROUND SURFACE ELEV.: 663.20
TOP OF CASING ELEV.: 666.28
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 3:04:00 PM
END DATE/TIME: 6/8/2019 9:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown to light gray fine SAND		1	RS			0' to 1': SAND, fine, dark brown, dry, some silt, well graded, non cohesive, organics (SP). 1' to 5': SAND, fine, light gray to brown, dry, well graded, non cohesive (SP).		Bentonite Grout 0-36 ft bgs
655.0	gray fine SAND, some medium sand		2	RS			5' to 10': SAND, fine, gray, trace media sand, well graded, wet (SP).		
650.0 645.0			3	RS			10' to 20': SAND, fine, gray, trace media sand, well graded, wet (SP).		
640.0			4	RS			20' to 21': SAND, fine, gray, poorly graded, wet (SP). 21' to 23': SAND, fine, gray, well graded, wet (SP). 23' to 24': SAND, medium, gray, some fine sand, poorly graded, wet (SP). 24' to 30': SAND, fine, gray, trace medium sand, well graded, wet (SP).		

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: LAYNE
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 12/12/19

Golder Associates

BOREHOLE LOG: GAMW-42C

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 50
DEPTH TO BEDROCK: 32.3

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170207.085 E: 2967974.69
GROUND SURFACE ELEV.: 663.20
TOP OF CASING ELEV.: 666.28
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 3:04:00 PM
END DATE/TIME: 6/8/2019 9:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	gray fine SAND, some medium sand								
635.0			4	RS					
							30' to 32.3': SAND, fine, gray, wet, well graded (SP). 32.3' to 38: SHALE, gray (SHALE).		
	gray SHALE								
630.0			5	RS					Bentonite Chips 36-38 ft bgs
625.0							38' to 40': SHALE, gray (SHALE).		#5 Sand Filter Pack 38-50 ft bgs
			6	RS					
							40' to 50" SHALE, gray (SHALE).		2" PVC Screen slot 0.010 40-50 ft bgs
620.0			7	RS					
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: LAYNE
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 12/12/19

Golder Associates

BOREHOLE LOG: GAMW-43

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 36.4

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170878.633 E: 2967926.918
GROUND SURFACE ELEV.: 663.14
TOP OF CASING ELEV.: 665.57
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 5:10:00 PM
END DATE/TIME: 5/16/2018 5:25:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	fine dark brown SAND, some silt		1			1.75 / 2	0-0.42': SAND, fine, poorly-graded, dark brown, some silt, some organics, moist, loose. (SP) 0.42-1.5': SAND, fine, poorly-graded, brown, some silt, moist, loose. (SP) 1.5-1.75': SAND, fine to medium, well-graded, light brown, moist, loose. (SW) SPTs (		Bentonite Chips 0-3 ft bgs
	fine to medium light brown SAND								
660.0									#5 Sand Filter Pack 3-15 ft bgs
			2			1.67 / 2	5-6.67': SAND, fine to medium, well-graded, light brown, wet, very loose. (SW) SPTs (2-2-2-3)		2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
	light gray CLAY		3			1.83 / 2	10-11': SAND, fine to medium, well-graded, light and dark brown, some silt, wet, very loose. (SW) 11-11.5': CLAY, light gray, soft. (CL) 11.5-11.83': SAND, fine to coarse, well-graded, light gray, wet, very loose. (SW) SPTs (2-1-2-2)		
	fine to coarse light gray SAND, trace gravel								
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-43B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36.75
DEPTH TO BEDROCK: 36.4

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170876.906 E: 2967926.657
GROUND SURFACE ELEV.: 663.12
TOP OF CASING ELEV.: 665.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 3:15:00 PM
END DATE/TIME: 5/16/2018 4:15:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	fine dark brown SAND, some silt		1			1.75 / 2	0-0.42': SAND, fine, poorly-graded, dark brown, some silt, some organics, moist, loose. (SP) 0.42-1.5': SAND, fine, poorly-graded, brown, some silt, moist, loose. (SP) 1.5-1.75': SAND, fine to medium, well-graded, light brown, moist, loose. (SW) SPTs (3-4-4-6)		Cetgo Grout 0-22 ft bgs
	fine to medium light brown SAND								
660.0			2			1.67 / 2	5-6.67': SAND, fine to medium, well-graded, light brown, wet, very loose. (SW) SPTs (2-2-2-3)		
655.0			3			1.83 / 2	10-11': SAND, fine to medium, well-graded, light and dark brown, some silt, wet, very loose. (SW) 11-11.5': CLAY, light gray, soft. (CL) 11.5-11.83': SAND, fine to coarse, well-graded, light gray, wet, very loose. (SW) SPTs (2-1-2-2)		
	light gray CLAY								
	fine to coarse light gray SAND, trace gravel								
650.0			4			1.25 / 2	15-16.25': SAND, fine to coarse, well-graded, light gray, trace rounded <1 inch gravel, wet, very loose. (SW) SPTs (3-1-2-2)		
645.0			5			1.42 / 2	20-21.42': SAND, fine to coarse, well-graded, light gray, trace rounded <1 inch gravel, wet, compact. (SW) SPTs (1-5-6-7)		
640.0									Bentonite Chips 22-24 ft bgs # 5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-43B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36.75
DEPTH TO BEDROCK: 36.4

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2170876.906 E: 2967926.657
GROUND SURFACE ELEV.: 663.12
TOP OF CASING ELEV.: 665.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 3:15:00 PM
END DATE/TIME: 5/16/2018 4:15:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	fine to coarse light gray SAND, trace gravel		6			2 / 2	25-27': SAND, fine to coarse, well-graded, light gray, trace rounded <1 inch gravel, wet, compact. (SW) SPTs (1-3-5-7)		2" PVC Screen slot 0.010 26-36 ft bgs
635.0			7			1.83 / 2	30-31.83': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) SPTs (4-8-12-19)		
630.0	gray clayey SHALE		8			0.58 / 1.75	35-35.25': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) 35.25-35.58': clayey SHALE, gray, dense, weathered. SPTs (8-29-15-50/3)		
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Well-graded Sand (SW)
USCS Low Plasticity Clay (CL)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-44

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 36.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171240.722 E: 2967833.092
GROUND SURFACE ELEV.: 664.11
TOP OF CASING ELEV.: 666.29
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 2:10:00 PM
END DATE/TIME: 5/16/2018 2:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark to light brown fine SAND, some silt		1	SS		1.2 / 2	0-0.3': SAND, fine, poorly-graded, dark brown, some silt, moist, very loose. (SP) 0.3-1.2': SAND, fine, poorly-graded, light brown, some silt, moist, very loose. (SP) SPTs (2-2-2-2)		Bentonite Chips 0-3 ft bgs
			2	SS		2 / 2	2-3.5': SAND, fine, poorly-graded, light brown, some orange staining, trace silt, moist, compact. (SP) 3.5-4': SAND, fine, poorly-graded, light brown, moist, compact. (SP) SPTs (4-5-7-6)		# 5 Sand 3-15 ft bgs
	light brown fine to medium SAND		3	SS		1.5 / 2	4-5': SAND, fine, poorly-graded, light brown, some orange staining, moist, loose. (SP) 5-5.5': SAND, fine, poorly-graded, light brown, some orange staining, wet, loose. (SP) SPTs (2-3-3-5)		2" PVC Screen slot 0.010 5-15 ft bgs
660.0			4	SS		1.4 / 2	6-7.4': SAND, fine to medium, well-graded, light brown, wet, compact. (SW) SPTs (4-5-7-7)		
	light gray fine to coarse SAND, trace gravel		5	SS		1.8 / 2	8-9.8': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, loose. (SW) SPTs (3-3-4-5)		
655.0			6	SS		2 / 2	10-12': SAND, fine to coarse, well-graded, light gray, wet, loose. (SW) SPTs (3-3-5-5)		
			7	SS		1.1 / 2	12-13': SAND, fine to medium, well-graded, light gray, some silt, 1 inch clay lens at 12.5', wet, compact. (SW-SM) SPTs (1-6-7-9)		
650.0			8	SS		1.25 / 2	14-15.25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (3-5-6-8)		
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-44B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.3
DEPTH TO BEDROCK: 36.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171239.722 E: 2967834.346
GROUND SURFACE ELEV.: 664.11
TOP OF CASING ELEV.: 666.23
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 10:50:00 AM
END DATE/TIME: 5/16/2018 12:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark to light brown fine SAND, some silt		1	SS		1.2 / 2	0-0.3': SAND, fine, poorly-graded, dark brown, some silt, moist, very loose. (SP) 0.3-1.2': SAND, fine, poorly-graded, light brown, some silt, moist, very loose. (SP) SPTs (2-2-2-2)		Cetgo Grout 0-22 ft bgs
			2	SS		2 / 2	2-3.5': SAND, fine, poorly-graded, light brown, some orange staining, trace silt, moist, compact. (SP) 3.5-4': SAND, fine, poorly-graded, light brown, moist, compact. (SP) SPTs (4-5-7-6)		
660.0	light brown fine to medium SAND		3	SS		1.5 / 2	4-5': SAND, fine, poorly-graded, light brown, some orange staining, moist, loose. (SP) 5-5.5': SAND, fine, poorly-graded, light brown, some orange staining, wet, loose. (SP) SPTs (2-3-3-5)		
			4	SS		1.4 / 2	6-7.4': SAND, fine to medium, well-graded, light brown, wet, compact. (SW) SPTs (4-5-7-7)		
	light gray fine to coarse SAND, trace gravel		5	SS		1.8 / 2	8-9.8': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, loose. (SW) SPTs (3-3-4-5)		
655.0			6	SS		2 / 2	10-12': SAND, fine to coarse, well-graded, light gray, wet, loose. (SW) SPTs (3-3-5-5)		
			7	SS		1.1 / 2	12-13': SAND, fine to medium, well-graded, light gray, some silt, 1 inch clay lens at 12.5', wet, compact. (SW-SM) SPTs (1-6-7-9)		
650.0			8	SS		1.25 / 2	14-15.25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (3-5-6-8)		
			9	SS		1 / 2	16-17.8': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (4-5-6-8)		
645.0			10	SS		0 / 2	18-20': No recovery, all gravel washout from above. SPTs (4-6-8-8)		
			11	SS		1.2 / 2	20-21.2': SAND, medium to coarse, well-graded, light gray, trace rounded gravel <1 inch, trace fine sand, wet, compact. (SW) SPTs (4-6-7-9)		
			12	SS		1.3 / 2	22-23.3': SAND, fine to coarse, well-graded, dark gray, wet, compact. (SW) SPTs (3-5-5-6)		Bentonite Chips 22-24 ft bgs
640.0			13	SS		1 / 2			#5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-44B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37.3
DEPTH TO BEDROCK: 36.2

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171239.722 E: 2967834.346
GROUND SURFACE ELEV.: 664.11
TOP OF CASING ELEV.: 666.23
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/16/2018 10:50:00 AM
END DATE/TIME: 5/16/2018 12:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, trace gravel		13	SS		1 / 2	24-25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (3-6-9-10)		2" PVC Screen slot 0.010 26-36 ft bgs
			14	SS		1.3 / 2	26-27.25': Same as 24-25'. 27.25-27.3': SAND, fine to medium, well-graded, dark gray, wet, compact. (SW) SPTs (5-8-9-10)		
635.0			15	SS		1 / 2	28-29': Same as 24-25'. At 28.5', 1-inch thick lens of SAND, fine to medium, well-graded, dark gray, wet, compact. (SW) SPTs (7-8-10-11)		
			16	SS		1.6 / 2	30-31.6': Same as 24-25'. SPTs (9-12-16-2)		
			17	SS		1.4 / 2	32-33.4': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) SPTs (7-8-9-9)		
630.0			18	SS		1.5 / 2	34-35.5': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) SPTs (8-9-10-12)		
	gray clayey SHALE		19	SS		0.8 / 1.3	36-36.2': SAND, fine to coarse, well-graded, light gray, wet, compact. (SW) 36.2-37.3': CLAYEY SHALE, gray, very hard. SPTs (9-30-50/2)		
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-46

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178839.026 E: 2973531.388
GROUND SURFACE ELEV.: 661.99
TOP OF CASING ELEV.: 664.78
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/15/2018 4:00:00 PM
END DATE/TIME: 5/15/2018 4:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, some silt								
	light brown fine CLAYEY SAND								
	light brown to orange fine to medium SAND		1	SS		1.7 / 2	0-0.3': SAND, fine, poorly-graded, dark brown, some silt, moist, loose. (SP) 0.3-1': CLAYEY SAND, fine, poorly-graded, light brown, moist, loose. (SC) 1-1.7': SAND, fine, poorly-graded, orange, moist, loose. (SP) SPTs (2-2-3-4)		Bentonite Chips 0-3 ft bgs
660.0									
									#5 Sand Filter Pack 3-15 ft bgs
			2	SS		1.8 / 2	5-6.8': SAND, fine to medium, well-graded, light brown to orange, moist, loose. (SW) SPTs (2-2-3-4)		2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
	light brown to light gray fine to coarse SAND, trace rounded gravel		3	SS		1.4 / 2	10-11.4': SAND, fine to coarse, well-graded, light brown, wet, compact. (SW) SPTs (4-5-7-8)		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP) | USCS Clayey Sand (SC) | USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-46B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178838.974 E: 2973532.878
GROUND SURFACE ELEV.: 661.98
TOP OF CASING ELEV.: 664.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/15/2018 2:20:00 PM
END DATE/TIME: 5/15/2018 3:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SAND, some silt light brown fine CLAYEY SAND light brown to orange fine to medium SAND		1	SS		1.7 / 2	0-0.3': SAND, fine, poorly-graded, dark brown, some silt, moist, loose. (SP) 0.3-1': CLAYEY SAND, fine, poorly-graded, light brown, moist, loose. (SC) 1-1.7': SAND, fine, poorly-graded, orange, moist, loose. (SP) SPTs (2-2-3-4)		CETCO Grout 0-18 ft bgs
660.0			2	SS		1.8 / 2	5-6.8': SAND, fine to medium, well-graded, light brown to orange, moist, loose. (SW) SPTs (2-2-3-4)		
655.0	light brown to light gray fine to coarse SAND, trace rounded gravel		3	SS		1.4 / 2	10-11.4': SAND, fine to coarse, well-graded, light brown, wet, compact. (SW) SPTs (4-5-7-8)		
650.0			4	SS		2 / 2	15-17': SAND, fine to coarse, well-graded, light brown, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (2-4-7-6)		
645.0			5	SS		1.2 / 2	20-21.2': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, compact. (SW) SPTs (8-10-9-10)		Bentonite Chips 18-20 ft bgs #5 Sand Filter Pack 20-32 ft bgs
640.0									2" PVC Screen slot 0.010 22-32 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Clayey Sand (SC)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-46B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178838.974 E: 2973532.878
GROUND SURFACE ELEV.: 661.98
TOP OF CASING ELEV.: 664.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: Hollow-stem auger
CORING METHOD:
DRILL RIG: CME 55
START DATE/TIME: 5/15/2018 2:20:00 PM
END DATE/TIME: 5/15/2018 3:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light brown to light gray fine to coarse SAND, trace rounded gravel		6	SS		1 / 2	25-26': SAND, fine to coarse, well-graded, light gray, trace rounded gravel up to 2 inches, wet, compact. (SW) SPTs (7-7-8-10)		
635.0									
	light gray clayey SHALE		7	SS		2 / 2	30-31': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet, loose. (SW) 31-32': CLAYEY SHALE, light gray, very soft from 31-31.5'. SPTs (3-3-3-4)		
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
Shale
USCS Clayey Sand (SC)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Earth Exploration
DRILLER: Jeff Silcox
DRILL RIG: CME 55

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-48

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178605.716 E: 2975279.248
GROUND SURFACE ELEV.: 660.81
TOP OF CASING ELEV.: 663.36
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 3:20:00 PM
END DATE/TIME: 8/1/2018 3:40:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown fine SILTY SAND, some organics			RS			0-0.3': SILTY SAND, fine, poorly-graded, dark brown, some organics, moist. (SM)		Bentonite Chips 0-4 ft bgs
	light brown to brown fine to coarse SAND			RS			0.3-2.7': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		
				RS			2.7-7': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs 2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
				RS			7-9.1': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		
	light gray fine to coarse SAND, trace rounded gravel			RS			9.1-11.2': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
650.0				RS			12-15.25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-48B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178606.458 E: 2975283.237
GROUND SURFACE ELEV.: 660.44
TOP OF CASING ELEV.: 663.31
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 1:20:00 PM
END DATE/TIME: 8/1/2018 2:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
660.0	dark brown fine SILTY SAND, some organics			RS			0-0.3': SILTY SAND, fine, poorly-graded, dark brown, some organics, moist. (SM)		Bentonite Grout 0-16 ft bgs
	light brown to brown fine to coarse SAND			RS			0.3-2.7': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		
				RS			2.7-7': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		
655.0				RS			7-9.1': SAND, fine to medium, well-graded, light brown to brown, some coarse sand, wet. (SW)		
	light gray fine to coarse SAND, trace rounded gravel			RS			9.1-11.2': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
650.0				RS			12-15.25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
645.0				RS			16-20.8': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		Bentonite Chips 16-18 ft bgs #5 Sand Filter Pack 18-30 ft bgs 2" PVC Screen slot 0.010 20-30 ft bgs
640.0				RS			21-25.5': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-48B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 30

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2178606.458 E: 2975283.237
GROUND SURFACE ELEV.: 660.44
TOP OF CASING ELEV.: 663.31
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 1:20:00 PM
END DATE/TIME: 8/1/2018 2:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	light gray fine to coarse SAND, trace rounded gravel			RS					
				RS			26-28.2': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
				RS			29-30': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
630.0	gray clayey SHALE			RS		6.5 / 6	30-36': CLAYEY SHALE, gray, very hard, with rounded gravel up to 3 in. at 30', wet.		#5 Sand 30-36 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-49

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2176111.214 E: 2976600.944
GROUND SURFACE ELEV.: 662.00
TOP OF CASING ELEV.: 664.62
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 4:10:00 PM
END DATE/TIME: 7/31/2018 4:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND, some organics			RS			0-1': SILTY SAND, fine, poorly-graded, brown, some organics, dry. (SM)		Bentonite Chips 0-4 ft bgs
660.0				RS			1-2.4': SILTY SAND, fine, poorly-graded, brown, moist. (SM)		
				RS			2.4-3.3': SILTY SAND, poorly-graded, dark brown, cohesive, moist. (SM)		
	light gray fine to medium SAND			RS			3.3-4.2': SAND, fine to medium, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs
655.0									2" PVC Screen slot 0.010 5-15 ft bgs
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-49B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2176115.757 E: 2976600.61
GROUND SURFACE ELEV.: 662.12
TOP OF CASING ELEV.: 664.50
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 2:35:00 PM
END DATE/TIME: 7/31/2018 3:05:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND, some organics			RS			0-1': SILTY SAND, fine, poorly-graded, brown, some organics, dry. (SM)		Bentonite Grout 0-19 ft bgs
				RS			1-2.4': SILTY SAND, fine, poorly-graded, brown, moist. (SM)		
660.0				RS			2.4-3.3': SILTY SAND, poorly-graded, dark brown, cohesive, moist. (SM)		
	light gray fine to medium SAND			RS			3.3-4.2': SAND, fine to medium, well-graded, light gray, wet. (SW)		
655.0									
650.0									
	light gray fine to coarse SAND, trace to some gravel			RS			16-16.7': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
645.0							16.7-16.8': SILTY SAND, dark brown. (SM)		
									Bentonite Chips 19-21 ft bgs
							20-23.2': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
640.0				RS					#5 Sand Filter Pack 21-33 ft bgs
	light gray coarse SAND and rounded GRAVEL, some medium sand			RS			23.2-24.2': SAND and rounded GRAVEL <1 inch, coarse sand, poorly-graded, light gray, some medium sand, wet. (SP)		2" PVC Screen slot 0.010 23-33 ft bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Poorly-graded Gravelly Sand (SPG)
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)
USCS Well-graded Gravelly Sand (SWG)
Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-49B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 34
DEPTH TO BEDROCK: 33

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2176115.757 E: 2976600.61
GROUND SURFACE ELEV.: 662.12
TOP OF CASING ELEV.: 664.50
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/31/2018 2:35:00 PM
END DATE/TIME: 7/31/2018 3:05:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, trace to some gravel						25-29.3': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
635.0				RS					
				RS			30-32': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
630.0	light gray GRAVEL, some fine to coarse sand			RS			32-32.5': GRAVEL, rounded <4 inch, well-graded, light gray, some fine to coarse sand, wet. (GW)		
	gray SHALE			RS		0.4 / 1	33-34': SHALE, gray, wet, little weathering.		#5 Sand 33-34 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
USCS Poorly-graded Gravelly Sand (SPG)
USCS Well-graded Sand (SW)
USCS Well-graded Gravel (GW)
USCS Well-graded Gravelly Sand (SWG)
Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-50

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174957.138 E: 2977953.352
GROUND SURFACE ELEV.: 662.52
TOP OF CASING ELEV.: 665.15
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 11:15:00 AM
END DATE/TIME: 8/1/2018 11:25:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND, some organics			RS			0-1.25': SILTY SAND, fine, poorly-graded, brown, some organics, dry. (SM)		Bentonite Chips 0-4 ft bgs
				RS			1.25-2.75': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
660.0	light gray fine to coarse SAND			RS			2.75-4.2': SAND, fine to coarse, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs
	light gray fine to coarse SAND, some rounded gravel			RS			5-8': SAND, fine to coarse, well-graded, light gray, some rounded gravel up to 3 inches, wet. (SW)		2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-50B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174961.01 E: 2977953.312
GROUND SURFACE ELEV.: 662.28
TOP OF CASING ELEV.: 664.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 9:35:00 AM
END DATE/TIME: 8/1/2018 10:05:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND, some organics			RS			0-1.25': SILTY SAND, fine, poorly-graded, brown, some organics, dry. (SM)		Bentonite Grout 0-17 ft bgs
660.0				RS			1.25-2.75': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
	light gray fine to coarse SAND			RS			2.75-4.2': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
	light gray fine to coarse SAND, some rounded gravel			RS			5-8': SAND, fine to coarse, well-graded, light gray, some rounded gravel up to 3 inches, wet. (SW)		
655.0									
650.0									
645.0				RS			15-19': SAND, fine to coarse, well-graded, light gray, some rounded gravel up to 3 inches, wet. (SW)		Bentonite Chips 17-19 ft bgs
									#5 Sand Filter Pack 19-31 ft bgs
640.0				RS			20-24.4': SAND, fine to coarse, well-graded, light gray, some rounded gravel up to 3 inches, wet. (SW)		2" PVC Screen slot 0.010 21-31 ft bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravelly Sand (SWG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-50B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 32
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174961.01 E: 2977953.312
GROUND SURFACE ELEV.: 662.28
TOP OF CASING ELEV.: 664.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 8/1/2018 9:35:00 AM
END DATE/TIME: 8/1/2018 10:05:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	light gray fine to coarse SAND, some rounded gravel								
635.0									
	light gray fine to coarse SAND and rounded GRAVEL			RS			30-30.75': SAND and rounded GRAVEL <1 inch, medium to coarse sand, well-graded, light gray, some fine sand, wet. (SW)		
	gray SHALE			RS		1.2 / 1	31-32': SHALE, gray, wet, little weathering.		#5 Sand 31-32 ft bgs
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Gravelly Sand (SWG)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/14/18

Golder Associates

BOREHOLE LOG: GAMW-51

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171145.474 E: 2968512.124
GROUND SURFACE ELEV.: 666.15
TOP OF CASING ELEV.: 668.75
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 10:30:00 AM
END DATE/TIME: 7/25/2018 10:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL - black BOILER SLAG and dark brown fine SILTY SAND, some organics			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some organics, dry. (SM)		Bentonite Chips 0-4 ft bgs
				RS			0.8-3.2': BOILER SLAG, black, moist. (FILL)		
	light to dark brown SAND, some silt			RS			3.2-4.5': SAND, fine, poorly-graded, light to dark brown, some silt, moist. (SP)		#5 Sand Filter Pack 4-15 ft bgs
660.0	light brown to light gray fine to medium SAND, trace coarse sand, trace silt			RS			6-7.8': SAND, fine to medium, well-graded, light brown, wet. (SW)		2" PVC Screen slot 0.010 5-15 ft bgs
				RS			7.8-10.5': SAND, fine to medium, well-graded, light gray, trace coarse sand, trace silt, wet. (SW)		
655.0				RS			11-14.8': SAND, fine to medium, well-graded, light gray, trace coarse sand, trace silt, wet. (SW)		
650.0									
645.0									

LITHOLOGY LEGEND

Fill (made ground)

USCS Poorly-graded Sand (SP)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-51B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171147.99 E: 2968515.783
GROUND SURFACE ELEV.: 666.03
TOP OF CASING ELEV.: 668.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 8:35:00 AM
END DATE/TIME: 7/25/2018 9:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	FILL - black BOILER SLAG and dark brown fine SILTY SAND, some organics			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some organics, dry. (SM)		Bentonite Grout 0-23 ft bgs
				RS			0.8-3.2': BOILER SLAG, black, moist. (FILL)		
	light to dark brown SAND, some silt			RS			3.2-4.5': SAND, fine, poorly-graded, light to dark brown, some silt, moist. (SP)		
660.0	light brown to light gray fine to medium SAND, trace coarse sand, trace silt			RS			6-7.8': SAND, fine to medium, well-graded, light brown, wet. (SW)		
				RS			7.8-10.5': SAND, fine to medium, well-graded, light gray, trace coarse sand, trace silt, wet. (SW)		
655.0				RS			11-14.8': SAND, fine to medium, well-graded, light gray, trace coarse sand, trace silt, wet. (SW)		
650.0	light gray to light brown fine to coarse SAND, trace gravel			RS			16-20': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		
645.0				RS			20-25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		Bentonite Chips 23-25 ft bgs

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-51B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 37

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171147.99 E: 2968515.783
GROUND SURFACE ELEV.: 666.03
TOP OF CASING ELEV.: 668.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/25/2018 8:35:00 AM
END DATE/TIME: 7/25/2018 9:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light gray to light brown fine to coarse SAND, trace gravel			RS			25-27': SAND, fine to coarse, well-graded, light brown to light gray, trace rounded gravel <1 inch, wet. (SW)		#5 Sand Filter Pack 25-37 ft bgs
				RS			27-29': SAND, fine to medium, well-graded, light gray, trace rounded gravel <1 inch, trace coarse sand, wet. (SW)		2" PVC Screen slot 0.010 27-37 ft bgs
635.0			SB-51B-30'-32'	RS			30-31.4': SAND, fine to medium, well-graded, light gray, trace rounded gravel <1 inch, trace coarse sand, wet. (SW) 31.4-32.2': SAND, fine to coarse, well-graded, light gray, some rounded gravel <1 inch, wet. (SW)		
630.0	light gray SHALE					5 / 3	37-40': SHALE, light gray, very hard, little to moderate weathering.		#5 Sand 37-40 ft bgs
625.0									
620.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 10/30/18

Golder Associates

BOREHOLE LOG: GAMW-52

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 39

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2175030.9 E: 2970079.13
GROUND SURFACE ELEV.: 664.07
TOP OF CASING ELEV.: 666.77
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 2:00:00 PM
END DATE/TIME: 7/30/2018 2:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND			RS			0-1.5': SILTY SAND, fine, poorly-graded, brown to dark brown, dry. (SM)		Bentonite Chips 0-4 ft bgs
	light gray to light brown fine to coarse SAND			RS			1.5-4': SAND, fine to coarse, well-graded, light brown, moist. (SW)		
660.0				RS			4-8': SAND, medium to coarse, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs 2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fehrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 3/4/19

Golder Associates

BOREHOLE LOG: GAMW-52B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 39

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2175031.998 E: 2970073.234
GROUND SURFACE ELEV.: 664.5
TOP OF CASING ELEV.: 666.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 11:30:00 AM
END DATE/TIME: 7/30/2018 12:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to dark brown fine SILTY SAND			RS			0-1.5': SILTY SAND, fine, poorly-graded, brown to dark brown, dry. (SM)		Bentonite Grout 0-23 ft bgs
	light gray to light brown fine to coarse SAND			RS			1.5-4': SAND, fine to coarse, well-graded, light brown, moist. (SW)		
660.0				RS			4-8': SAND, medium to coarse, well-graded, light gray, wet. (SW)		
655.0				RS			16-20': SAND, medium to coarse, well-graded, light gray, wet. (SW)		
650.0									
645.0									
	light gray coarse SAND, some gravel			RS			20-22': SAND, coarse, poorly-graded, light gray, some rounded gravel <1 inch, wet. (SP)		
	gray fine to coarse SAND			RS			22-24': SAND, fine to coarse, well-graded, gray, wet. (SW)		Bentonite Chips 23-25 ft bgs
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-52B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 39

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2175031.998 E: 2970073.234
GROUND SURFACE ELEV.: 664.5
TOP OF CASING ELEV.: 666.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 11:30:00 AM
END DATE/TIME: 7/30/2018 12:20:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	gray fine to coarse SAND			RS			25-29': SAND, fine to coarse, well-graded, gray, wet. (SW)		#5 Sand Filter Pack 25-37 ft bgs 2" PVC Screen slot 0.010 27-37 ft bgs. Broke PVC in well; trouble with well floating so well is set 2 feet above top of shale.
635.0				RS			30-34': SAND, fine to coarse, well-graded, gray, wet. (SW)		
630.0			SB-52B-35'-37'	RS			35-37': SAND, fine to coarse, well-graded, gray, wet. (SW)		
				RS			37-39': SAND, fine to coarse, well-graded, gray, wet. (SW)		#5 Sand 37-40 ft bgs
625.0	gray clayey SHALE			RS			CLAYEY SHALE, gray, wet.		
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-53

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174535.339 E: 2971036.469
GROUND SURFACE ELEV.: 664.68
TOP OF CASING ELEV.: 667.22
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 10:30:00 AM
END DATE/TIME: 7/30/2018 10:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- dark brown SILTY SAND, some gravel			RS			0-1': SILTY SAND, well-graded, dark brown, some angular gravel <2 inch, dry. (FILL)		Bentonite Chips 0-4 ft bgs
	dark brown SILTY SAND			RS			1-2': SILTY SAND, well-graded, dark brown, dry. (SM)		
	light brown fine to medium SAND			RS			2-2.5': SAND, fine to medium, well-graded, light brown, dry. (SW)		
	dark brown fine SILTY SAND			RS			2.5-3': SILTY SAND, fine, poorly-graded, dark brown, dry. (SM)		
	light gray to gray fine to coarse SAND			RS			3-4': SAND, fine to medium, well-graded, light gray, moist. (SW)		
660.0				RS			4-5.75': SAND, fine to medium, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs 2" PVC Screen slot 0.010 5-15 ft bgs
				RS			5.75-7': SAND, fine to coarse, well-graded, gray, wet. (SW)		
655.0									
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

Fill (made ground) | USCS Silty Sand (SM) | USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-53B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174536.542 E: 2971032.602
GROUND SURFACE ELEV.: 664.62
TOP OF CASING ELEV.: 667.27
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 8:40:00 AM
END DATE/TIME: 7/30/2018 9:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	FILL- dark brown SILTY SAND, some gravel			RS			0-1': SILTY SAND, well-graded, dark brown, some angular gravel <2 inch, dry. (FILL)		Bentonite Grout 0-22 ft bgs
	dark brown SILTY SAND			RS			1-2': SILTY SAND, well-graded, dark brown, dry. (SM)		
	light brown fine to medium SAND			RS			2-2.5': SAND, fine to medium, well-graded, light brown, dry. (SW)		
	dark brown fine SILTY SAND			RS			2.5-3': SILTY SAND, fine, poorly-graded, dark brown, dry. (SM)		
	light gray to gray fine to coarse SAND			RS			3-4': SAND, fine to medium, well-graded, light gray, moist. (SW)		
660.0				RS			4-5.75': SAND, fine to medium, well-graded, light gray, wet. (SW)		
				RS			5.75-7': SAND, fine to coarse, well-graded, gray, wet. (SW)		
655.0									
650.0									
				RS			16-20': SAND, fine to coarse, well-graded, gray, wet. (SW)		
645.0									
				RS			20-22': SAND, fine to coarse, well-graded, gray, wet. (SW)		
	dark gray to black with black staining fine to coarse SAND			RS			22-24': SAND, fine to coarse, well-graded, dark gray to black with black staining, no odor, wet. (SW)		Bentonite Chips 22-24 ft bgs
640.0									#5 Sand Filter Pack 24-36 ft bgs

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Silty Sand (SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-53B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 37
DEPTH TO BEDROCK: 36

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174536.542 E: 2971032.602
GROUND SURFACE ELEV.: 664.62
TOP OF CASING ELEV.: 667.27
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 8:40:00 AM
END DATE/TIME: 7/30/2018 9:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark gray to black with black staining fine to coarse SAND		SB-53B-25'-27'	RS			25-27': SAND, fine to coarse, well-graded, dark gray to black with black staining, no odor, wet. (SW)		2" PVC Screen slot 0.010 26-36 ft bgs
				RS			27-29': SAND, fine to coarse, well-graded, dark gray to black with black staining, no odor, wet. (SW)		
635.0	gray fine to coarse SAND, some gravel		SB-53B-30'-32'	RS			30-31': SAND, fine to coarse, well-graded, gray, some rounded gravel <2 inch, wet. (SW)		
630.0									
	gray SHALE			RS		3 / 1	36-37': SHALE, gray, weathered, wet.		#5 Sand 36-37 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

Fill (made ground)
Shale
USCS Silty Sand (SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: TGB
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-54

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 32

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174080.28 E: 2971911.363
GROUND SURFACE ELEV.: 663.87
TOP OF CASING ELEV.: 666.35
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/30/2018 7:40:00 AM
END DATE/TIME: 7/30/2018 8:00:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND, some organics			RS			0-0.8': SILTY SAND, fine, well-graded, dark brown, some organics, moist. (SM)		Bentonite Chips 0-4 ft bgs
	light brown fine to medium SAND			RS			0.8-1.5': SAND, fine to medium, well-graded, light brown, moist. (SW)		
	dark brown fine SILTY SAND			RS			1.5-2.7': SILTY SAND, fine, well-graded, dark brown, cohesive, moist. (SM)		
	light gray fine to medium SAND			RS			2.7-3.3': SAND, fine to medium, well-graded, light gray, wet. (SW)		
660.0				RS			4-7.4': SAND, fine to medium, well-graded, light gray, wet. (SW)		#5 Sand Filter Pack 4-15 ft bgs 2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-54B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 32

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174081.639 E: 2971906.899
GROUND SURFACE ELEV.: 663.98
TOP OF CASING ELEV.: 666.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/27/2018 10:10:00 AM
END DATE/TIME: 7/27/2018 10:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND, some organics			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some organics, moist. (SM)		Bentonite Grout 0-18 ft bgs
	light brown fine to medium SAND			RS			0.8-1.5': SAND, fine to medium, well-graded, light brown, moist. (SW)		
	dark brown fine SILTY SAND			RS			1.5-2.7': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
	light gray fine to medium SAND			RS			2.7-3.3': SAND, fine to medium, well-graded, light gray, wet. (SW)		
660.0				RS			4-7.4': SAND, fine to medium, well-graded, light gray, wet. (SW)		
655.0									
650.0									
	light gray fine to coarse SAND, trace to some gravel			RS			16-20': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		Bentonite Chips 18-20 ft bgs
645.0									#5 Sand Filter Pack 20-32 ft bgs
				RS			20-23.7': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 22-32 ft bgs
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-54B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 35
DEPTH TO BEDROCK: 32

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2174081.639 E: 2971906.899
GROUND SURFACE ELEV.: 663.98
TOP OF CASING ELEV.: 666.45
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/27/2018 10:10:00 AM
END DATE/TIME: 7/27/2018 10:40:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
635.0	light gray fine to coarse SAND, trace to some gravel		SB-54B-30'-32'	RS			30-31.8': SAND, medium to coarse, well-graded, light gray, some rounded gravel <2 inch, some fine sand, wet. (SW)		
630.0	light gray clayey SHALE			RS		7 / 3	32-34': CLAYEY SHALE, light gray, weathered. 34-35': CLAYEY SHALE, light gray, little weathering.		#5 Sand 32-35 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-55

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173632.566 E: 2972217.554
GROUND SURFACE ELEV.: 665.06
TOP OF CASING ELEV.: 667.62
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/26/2018 2:40:00 PM
END DATE/TIME: 7/26/2018 3:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND, some gravel			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, trace organics, moist. (SM)		Bentonite Chips 0-4 ft bgs
				RS			0.8-2.2': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
	light brown fine to medium SAND			RS			2.2-3.2': SAND, fine to medium, well-graded, light brown, moist. (SW)		
	light brown to light gray fine SAND, some silt			RS			3.2-3.75': SAND, fine, poorly-graded, light brown to light gray, some silt, cohesive, moist. (SP)		
	light brown fine to medium SAND			RS			4-4.9': SAND, fine to medium, well-graded, light brown, moist. (SW)		#5 Filter Pack Sand 4-15 ft bgs
660.0	light gray to light brown medium to coarse SAND, some fine sand, trace gravel			RS			4.9-6.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 in, wet. (SW) 6.8-6.9': SAND, medium, brown, (SP) 6.9-7.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
650.0									
645.0									

DECOMMISSIONED

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-55R

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173631.971 E: 2972230.541
GROUND SURFACE ELEV.: 665.36
TOP OF CASING ELEV.: 667.71
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/8/2019 11:45:00 AM
END DATE/TIME: 6/8/2019 12:30:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND, some gravel			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, trace organics, moist. (SM)		Bentonite Chips 0-4 ft bgs
				RS			0.8-2.2': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
	light brown fine to medium SAND			RS			2.2-3.2': SAND, fine to medium, well-graded, light brown, moist. (SW)		
	light brown to light gray fine SAND, some silt			RS			3.2-3.75': SAND, fine, poorly-graded, light brown to light gray, some silt, cohesive, moist. (SP)		
	light brown fine to medium SAND			RS			4-4.9': SAND, fine to medium, well-graded, light brown, moist. (SW)		#5 Filter Pack Sand 4-15 ft bgs
660.0	light gray to light brown medium to coarse SAND, some fine sand, trace gravel			RS			4.9-6.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 inch, wet. (SW) 6.8-6.9': SAND, medium, brown. (SP) 6.9-7.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 5-15 ft bgs
655.0									
650.0									
645.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fehrman
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: KMC
DATE: 12/3/19

Golder Associates

BOREHOLE LOG: GAMW-55B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173632.338 E: 2972222.718
GROUND SURFACE ELEV.: 665.18
TOP OF CASING ELEV.: 667.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/26/2018 1:00:00 PM
END DATE/TIME: 7/26/2018 1:35:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND, some gravel			RS			0-0.8': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, trace organics, moist. (SM)		Bentonite Grout 0-21 ft bgs
				RS			0.8-2.2': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
	light brown fine to medium SAND			RS			2.2-3.2': SAND, fine to medium, well-graded, light brown, moist. (SW)		
	light brown to light gray fine SAND, some silt			RS			3.2-3.75': SAND, fine, poorly-graded, light brown to light gray, some silt, cohesive, moist. (SP)		
	light brown fine to medium SAND			RS			4-4.9': SAND, fine to medium, well-graded, light brown, moist. (SW)		
660.0	light gray to light brown medium to coarse SAND, some fine sand, trace gravel			RS			4.9-6.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 inch, wet. (SW) 6.8-6.9': SAND, medium, brown. (SP) 6.9-7.8': SAND, medium to coarse, well-graded, light gray, some fine sand, trace rounded gravel <1 inch, wet. (SW)		
655.0									
650.0				RS			16-18': SAND, medium to coarse, well-graded, light brown, some fine sand, trace rounded gravel <1 inch, wet. (SW)		
	light gray coarse SAND, some rounded gravel, some medium sand			RS			18-20.7': SAND, coarse, poorly-graded, light gray, some rounded gravel <1 inch, some medium sand, wet. (SP)		
645.0	light gray fine to coarse SAND			RS			20.7-21.5': SAND, fine to coarse, well-graded, light gray, wet. (SW)		Bentonite Chips 21-23 ft bgs #5 Sand Filter Pack 23-35 ft bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-55B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173632.338 E: 2972222.718
GROUND SURFACE ELEV.: 665.18
TOP OF CASING ELEV.: 667.51
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/26/2018 1:00:00 PM
END DATE/TIME: 7/26/2018 1:35:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light gray fine to coarse SAND			RS			25-29.2': SAND, fine to coarse, well-graded, light gray, wet. (SW)		2" PVC Screen slot 0.010 25-35 ft bgs
635.0	light gray fine to coarse SAND, some gravel		SB-55B-30'-32'	RS			30-32': SAND, fine to coarse, well-graded, light gray, some rounded gravel <2 inch, wet. (SW)		
				RS			32-33.2': SAND, fine to coarse, well-graded, light gray, some rounded gravel <2 inch, wet. (SW)		
630.0	light gray SHALE			RS			35-36': SHALE, light gray, dry, very weathered.		#5 Sand 35-36 ft bgs
625.0									
620.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-56

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173343.43 E: 2972428.296
GROUND SURFACE ELEV.: 665.43
TOP OF CASING ELEV.: 667.89
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/27/2018 8:45:00 AM
END DATE/TIME: 7/27/2018 8:55:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND, some gravel, some organics and debris			RS			0-0.7': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, some organics and debris, dry. (SM)		Bentonite Chips 0-4 ft bgs
				RS					
	light gray to brown fine to coarse SAND			RS			0.7-1.6': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
				RS			1.6-2.4': SAND, fine to medium, well-graded, dark and light brown, moist. (SW)		
							2.4-3.1': SAND, fine to medium, well-graded, light gray, moist. (SW)		#5 Sand Filter Pack 4-15 ft bgs
660.0				RS			5-5.4' SAND, fine to medium, well-graded, light gray, moist. (SW)		2" PVC Screen slot 0.010 5-15 ft bgs
				RS			5.4-6.25': SAND, fine to medium, well-graded, light gray, wet. (SW)		
				RS			6.25-8.4': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
655.0				RS			10-13.8': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
650.0									
645.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-56B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173343.227 E: 2972423.771
GROUND SURFACE ELEV.: 665.33
TOP OF CASING ELEV.: 667.80
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/27/2018 7:10:00 AM
END DATE/TIME: 7/27/2018 7:35:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	dark brown fine SILTY SAND, some gravel, some organics and debris			RS			0-0.7': SILTY SAND, fine, poorly-graded, dark brown, some rounded gravel up to 3 inch, some organics and debris, dry. (SM)		Bentonite Grout 0-21 ft bgs
				RS					
	light gray to brown fine to coarse SAND			RS			0.7-1.6': SILTY SAND, fine, poorly-graded, dark brown, cohesive, moist. (SM)		
				RS			1.6-2.4': SAND, fine to medium, well-graded, dark and light brown, moist. (SW)		
							2.4-3.1': SAND, fine to medium, well-graded, light gray, moist. (SW)		
660.0				RS			5-5.4' SAND, fine to medium, well-graded, light gray, moist. (SW)		
				RS			5.4-6.25': SAND, fine to medium, well-graded, light gray, wet. (SW)		
				RS			6.25-8.4': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
655.0				RS			10-13.8': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
650.0				RS			16-20': SAND, fine to coarse, well-graded, light gray, wet. (SW)		
645.0	light to dark gray fine to coarse SAND, trace to some gravel			RS			20-23.8': SAND, fine to medium, well-graded, light gray, some coarse sand, trace rounded gravel <1 inch, wet. (SW)		Bentonite Chips 21-23 ft bgs #5 Sand Filter Pack 23-35 ft bgs

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-56B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 36
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2173343.227 E: 2972423.771
GROUND SURFACE ELEV.: 665.33
TOP OF CASING ELEV.: 667.80
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 7/27/2018 7:10:00 AM
END DATE/TIME: 7/27/2018 7:35:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	light to dark gray fine to coarse SAND, trace to some gravel			RS			25-28.25': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW)		2" PVC Screen slot 0.010 25-35 ft bgs
				RS			28.25-29': SAND, medium to coarse, well-graded, dark gray, some rounded gravel <1 inch, some fine sand. (SW)		
635.0			SB-56B-30'-32'	RS			30-31.75': SAND, fine to coarse, well-graded, light gray, trace rounded gravel <1 inch, wet. (SW) 31.75-32': SAND, medium to coarse, well-graded, dark gray, some rounded gravel <3 inch, trace fine sand, wet. (SW)		
				RS			32-33.2': SAND, medium to coarse, well-graded, dark gray, some rounded gravel <3 inch, trace fine sand, wet. (SW)		
630.0	light gray SHALE			RS		1.2 / 1	35-36': SHALE, light gray, moist, little weathering.		#5 Sand 35-36 ft bgs
625.0									
620.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM) | USCS Well-graded Sand (SW) | Shale

DRILLING COMPANY: Layne
DRILLER: K. Fahrman
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: KMC
DATE: 11/13/18

Golder Associates

BOREHOLE LOG: GAMW-57

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 45

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171592.091 E: 2967729.661
GROUND SURFACE ELEV.: 670.46
TOP OF CASING ELEV.: 672.97
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 12:46:00 PM
END DATE/TIME: 6/7/2019 1:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
670.0	brown fine SAND, some organics			RS			0 to 1.5': SAND, fine, wet, dark brown, trace silt, organic matter, roots, poorly graded, non-cohesive (SP).		Bentonite Chips 0-3 ft bgs
				RS			1.5' to 5': SAND, fine, yellow-brown, moist, poorly graded, non-cohesive (SP).		#5 Sand Filter Pack 3-16 ft bgs
665.0	gray fine SAND.			RS			5' to 7': SAND, fine, yellow-brown, moist, poorly graded, non-cohesive (SP).		2" PVC Screen slot 0.010 5-16 ft bgs
				RS			7' to 10': SAND, fine, gray, moist, poorly graded, non-cohesive (SP).		
660.0	brown fine to medium SAND			RS			10' to 11': SAND, fine, light brown, wet, some silt, poorly graded, non-cohesive (SP-SM).		
				RS			11' to 15': SAND, fine to medium, red-brown, wet, poorly graded, non-cohesive (SP).		
655.0									
650.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Poorly-graded Sand with Silt (SP-SM)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-57B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 50
DEPTH TO BEDROCK: 45

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171592.279 E: 2967726.723
GROUND SURFACE ELEV.: 670.45
TOP OF CASING ELEV.: 672.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 8:08:00 AM
END DATE/TIME: 6/7/2019 9:29:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
670.0	brown fine SAND, some organics			RS			0 to 1.5': SAND, fine, wet, dark brown, trace silt, organic matter, roots, poorly graded, non-cohesive (SP).		Bentonite Grout 0-21 ft bgs
				RS			1.5' to 5': SAND, fine, yellow-brown, moist, poorly graded, non-cohesive (SP).		
665.0	gray fine SAND.			RS			5' to 7': SAND, fine, yellow-brown, moist, poorly graded, non-cohesive (SP).		
				RS			7' to 10': SAND, fine, gray, moist, poorly graded, non-cohesive (SP).		
660.0	brown fine to medium SAND		SB-57B-10' - 12'	RS			10' to 11': SAND, fine, light brown, wet, some silt, poorly graded, non-cohesive (SP-SM).		
655.0				RS			11' to 20': SAND, fine to medium, red-brown, wet, poorly graded, non-cohesive (SP).		
650.0	light brown fine to medium SAND			RS			20' to 21': SAND, fine to medium, light brown, wet, poorly graded, non-cohesive (SW).		
				RS			21' to 30': SAND, fine to trace medium, light brown to gray-brown, wet, poorly graded, non-cohesive (SW).		Bentonite Chips 21-23 ft bgs #5 Sand Filter Pack 23-45 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Poorly-graded Sand with Silt (SP-SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-57B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 50
DEPTH TO BEDROCK: 45

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171592.279 E: 2967726.723
GROUND SURFACE ELEV.: 670.45
TOP OF CASING ELEV.: 672.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 8:08:00 AM
END DATE/TIME: 6/7/2019 9:29:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
645.0	light brown fine to medium SAND			RS					
640.0	light gray fine SAND			RS			30' to 40': SAND, fine, light gray, poorly graded, non-cohesive (SP).		2" PVC Screen slot 0.010 35-45 ft bgs
635.0									
630.0	gray fine to medium SAND			RS			45' to 50': SAND, fine to medium, gray, wet, well-graded, non-cohesive		
625.0				RS			45' to 50': SHALE, wet, gray		#5 Sand 45-50 ft bgs

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Poorly-graded Sand with Silt (SP-SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-57B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 50
DEPTH TO BEDROCK: 45

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171592.279 E: 2967726.723
GROUND SURFACE ELEV.: 670.45
TOP OF CASING ELEV.: 672.88
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 8:08:00 AM
END DATE/TIME: 6/7/2019 9:29:00 AM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
620.0	gray SHALE								
615.0									
610.0									
605.0									
600.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Poorly-graded Sand with Silt (SP-SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-58

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 16
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 217602.754 E: 2967863.875
GROUND SURFACE ELEV.: 664.99
TOP OF CASING ELEV.: 667.54
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/6/2019 2:30:00 PM
END DATE/TIME: 6/6/2019 5:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine SAND, some organics			RS			0 to 1': SAND, fine, orange brown to dark brown, dry, organic matter, non-cohesive (SP)		Bentonite Chips 0-3 ft bgs
				RS			1' to 5': SAND, fine, yellow-brown, some lenses of orange-brown fine sand, dry, non-cohesive (SP).		#5 Sand Filter Pack 3-16 ft bgs
660.0	gray to yellow brown fine SAND, some clay			RS			5' to 7': SAND, fine, gray, moist, well-graded, non-cohesive (SP).		2" PVC Screen slot 0.010 5-16 ft bgs
				RS			7' to 10': SAND, fine, yellow-brown, wet (SP). 8.5': CLAY, W < PL, orange-red/black zones, 4" thick (slighly plastic)		
655.0	light brown to gray fine to medium SAND			RS			10' to 15': SAND, fine, trace medium sand, light brown to red brown, wet, poorly graded, non-cohesive (SP).		
650.0									
645.0									
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-58B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171900.805 E: 2967867.002
GROUND SURFACE ELEV.: 664.88
TOP OF CASING ELEV.: 667.59
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/6/2019 11:10:00 AM
END DATE/TIME: 6/6/2019 12:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine SAND, some organics						0 to 1': SAND, fine, orange brown to dark brown, dry, organic matter, non-cohesive (SP)		Bentonite Grout 0-21 ft bgs
				RS			1' to 5': SAND, fine, yellow-brown, some lenses of orange-brown fine sand, dry, non-cohesive (SP).		
660.0	gray to yellow brown fine SAND, some clay			RS			5' to 7': SAND, fine, gray, moist, well-graded, non-cohesive (SP).		
							7' to 10': SAND, fine, yellow-brown, wet (SP). 8.5': CLAY, W < PL, orange-red/black zones, 4" thick (slighly plastic)		
				RS					
655.0	light brown to gray fine to medium SAND			RS			10' to 15': SAND, fine, trace medium sand, light brown to red brown, wet, poorly graded, non-cohesive (SP).		
650.0			SB-58B-15' - 17'	RS			15' to 20': SAND, medium, some fine sand, gray, wet, poorly graded, non-cohesive (SP).		
645.0	gray fine to medium SAND			RS			20' to 21': SAND, medium, some fine sand, gray, wet, poorly graded, non-cohesive (SP).		
				RS			21' to 30': SAND, fine, gray, wet, poorly graded, non-cohesive (SP).		Bentonite Chips 21-23 ft bgs; #5 Sand Filter Pack 23-35 ft bgs
640.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-58B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 35

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171900.805 E: 2967867.002
GROUND SURFACE ELEV.: 664.88
TOP OF CASING ELEV.: 667.59
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/6/2019 11:10:00 AM
END DATE/TIME: 6/6/2019 12:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	gray fine to medium SAND			RS					2" PVC Screen slot 0.010 25-35 ft bgs
635.0				RS			30' to 33': SAND, fine, gray, wet, poorly graded, non-cohesive (SP).		
				RS			33' to 35': SAND, medium, gray, wet, poorly graded, non-cohesive (SP).		
630.0	gray SHALE			RS			35' to 40': SHALE, gray, dry		#5 Sand 35-40 ft bgs
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

Shale

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: ANB
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-59

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171317.508 E: 2968668.034
GROUND SURFACE ELEV.: 668.49
TOP OF CASING ELEV.: 668.49
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/8/2019 5:20:00 PM
END DATE/TIME: 6/8/2019 5:30:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine SAND, some organics						0' to 0.2': SAND, fine, brown, trace gravel rounded <1cm, some organics, moist, non-cohesive, poorly-graded (SP).		Bentonite Chips 0-3 ft bgs
	brown fine to medium SILTY SAND						0.5' to 2': SILTY SAND, fine, brown, some fly ash, moist, non-cohesive, poorly graded (SP).		
							2' to 3.75': SILTLY SAND, fine to medium, brown, moist, some fly ash,cohesive, well-graded (SM).		#5 Sand Filter Pack 3-15 ft bgs
665.0	light brown to gray fine to medium SAND, some clay						3.75' to 4.75': SAND, fine to medium, light brown, wet, non-cohesive, well-graded (SW).		
									2" PVC Screen slot 0.010 5-15 ft bgs
660.0				RS			10' to 12': SAND, fine to medium, dark brown to brown, some clay, wet, non-cohesive, well-graded (SW-SC).		
655.0				RS			12.75' to 13.75': SAND, fine to coarse, brown, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
				RS			13.75' to 15': SAND, fine to coarse, gray, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
650.0									
645.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)

USCS Silty Sand (SM)

USCS Well-graded Sand with Clay (SW-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-59B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2968668.362 E: 2171313.72
GROUND SURFACE ELEV.: 665.95
TOP OF CASING ELEV.: 668.55
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/4/2019 3:10:00 PM
END DATE/TIME: 6/6/2019 4:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown fine SAND, some organics			RS			0' to 0.2': SAND, fine, brown, trace gravel rounded <1cm, some organics, moist, non-cohesive, poorly-graded (SP).		Bentonite Grout 0-26 ft bgs
665.0	brown fine to medium SILTY SAND			RS			0.5' to 2': SILTY SAND, fine, brown, some fly ash, moist, non-cohesive, poorly graded (SP).		
				RS			2' to 3.75': SILTLY SAND, fine to medium, brown, moist, some fly ash,cohesive, well-graded (SM).		
	light brown to gray fine to medium SAND, some clay			RS			3.75' to 4.75': SAND, fine to medium, light brown, wet, non-cohesive, well-graded (SW).		
660.0									
655.0				RS			10' to 12': SAND, fine to medium, dark brown to brown, some clay, wet, non-cohesive, well-graded (SW-SC).		
				RS			12.75' to 13.75': SAND, fine to coarse, brown, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
				RS			13.75' to 15': SAND, fine to coarse, gray, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
650.0				RS			16.5' to 17': SAND, some clay, fine to coarse, gray, trace rounded gravel <1cm, wet, non-cohesive, well graded (SW-SC).		
	gray fine to coarse SAND						20' to 23.25': SAND, medium to coarse, gray, trace fine sand, some rounded <2" gravel, wet, non-cohesive, well-graded (SW).		
645.0				RS					
				RS			23.25' to 23.6': SAND, fine to medium, wet, non-cohesive, well-graded (SW).		

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)
USCS Silty Sand (SM)
USCS Well-graded Sand with Clay (SW-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-59B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2968668.362 E: 2171313.72
GROUND SURFACE ELEV.: 665.95
TOP OF CASING ELEV.: 668.55
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/4/2019 3:10:00 PM
END DATE/TIME: 6/6/2019 4:00:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	gray fine to coarse SAND			RS			23.6' to 26.8': SAND gray, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		Bentonite Chips 26-28 ft bgs #5 Sand Filter Pack 28-40 ft bgs
635.0	gray fine to coarse SAND			RS			30' to 30.75': SAND, fine to coarse, gray, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		2" PVC Screen slot 0.010 30-40 ft bgs
630.0				RS RS			33.75' to 37.5': SAND, medium to coarse, gray, trace fine sand, some gravel rounded <1", wet, non-cohesive, well graded (SW).		
625.0				RS			40': SHALE, gray, slightly weathered with some rounded gravel <1"		
620.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand (SP)
USCS Well-graded Sand (SW)
USCS Silty Sand (SM)
USCS Well-graded Sand with Clay (SW-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-60

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 15
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171552.609 E: 2968698.921
GROUND SURFACE ELEV.: 665.08
TOP OF CASING ELEV.: 667.50
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/8/2019 1:40:00 PM
END DATE/TIME: 6/8/2019 2:22:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	brown fine to medium SILTY SAND, some organics			RS			0' to 0.7': SILTY SAND, fine, brown, some organics, trace gravel, dry, non-cohesive, poorly graded (SP).		Bentonite Chips 0-3 ft bgs
				RS			0.7' to 1.7': SILTY SAND, fine, dark brown, fly ash, moist (SM).		
				RS			1.7' to 2.5': SILTY SAND, fine, dark brown, moist, non-cohesive, poorly graded (SM).		
				RS			2.5' to 3.7': SAND, fine to medium, brown, moist, non-cohesive, well-graded (SW).		#5 Sand Filter Pack 3-15 ft bgs
660.0	brown to light brown fine to medium SILTY SAND			RS			5' to 5.8': SILTY SAND, fine, dark brown, trace gravel, wet, non-cohesive, poorly graded (SM).		2" PVC Screen slot 0.010 5-15 ft bgs
				RS			5.8' to 7.5': SAND, fine to medium, brown to light brown, moist, non-cohesive, well-graded (SW).		
				RS			7.5' to 8': SAND, fine to medium, light brown, wet, non-cohesive, well-graded (SW).		
655.0	brown to gray fine to coarse SAND			RS			10' to 12.5': SAND, fine to medium, brown, some coarse sand, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
				RS			12.5' to 15': SAND, fine to coarse, trace gravel rounded <1cm, gray, wet, non-cohesive, well-graded (SW).		
650.0									
645.0									

LITHOLOGY LEGEND

USCS Well-graded Sand with Silt (SW-SM)

USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-60B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171549.039 E: 2968699.958
GROUND SURFACE ELEV.: 665.06
TOP OF CASING ELEV.: 667.7
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/3/2019 9:35:00 AM
END DATE/TIME: 6/4/2019 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
665.0	brown fine to medium SILTY SAND, some organics			RS			0' to 0.7': SILTY SAND, fine, brown, some organics, trace gravel, dry, non-cohesive, poorly graded (SP).		Bentonite Grout 0-26 ft bgs
				RS			0.7' to 1.7': SILTY SAND, fine, dark brown, fly ash, moist (SM).		
				RS			1.7' to 2.5': SILTY SAND, fine, dark brown, moist, non-cohesive, poorly graded (SM).		
				RS			2.5' to 3.7': SAND, fine to medium, brown, moist, non-cohesive, well-graded (SW).		
660.0	brown to light brown fine to medium SILTY SAND			RS			5' to 5.8': SILTY SAND, fine, dark brown, trace gravel, wet, non-cohesive, poorly graded (SM).		
				RS			5.8' to 7.5': SAND, fine to medium, brown to light brown, moist, non-cohesive, well-graded (SW).		
				RS			7.5' to 8': SAND, fine to medium, light brown, wet, non-cohesive, well-graded (SW).		
655.0	brown to gray fine to coarse SAND			RS			10' to 12.5': SAND, fine to medium, brown, some coarse sand, trace rounded gravel <1cm, wet, non-cohesive, well-graded (SW).		
				RS			12.5' to 15': SAND, fine to coarse, trace gravel rounded <1cm, gray, wet, non-cohesive, well-graded (SW).		
650.0				RS			15' to 17.5': SAND, fine to coarse, trace rounded gravel <1cm, gray, wet, non-cohesive, well-graded (SW).		
645.0	gray medium to coarse SAND			RS			20' to 27': SAND, medium to coarse, gray, some fine sand, some rounded gravel < 1inch, wet, non-cohesive, well-graded (SW).		

LITHOLOGY LEGEND

USCS Poorly-graded Sand with Silt (SP-SM)
Shale
USCS Well-graded Sand with Silt (SW-SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-60B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 40
DEPTH TO BEDROCK: 40

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171549.039 E: 2968699.958
GROUND SURFACE ELEV.: 665.06
TOP OF CASING ELEV.: 667.7
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/3/2019 9:35:00 AM
END DATE/TIME: 6/4/2019 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
640.0	gray medium to coarse SAND			RS					Bentonite Chips 26-28 ft bgs
									#5 Sand Filter Pack 28-40 ft bgs
635.0	gray medium to coarse SAND			RS			30' to 37': SAND, medium to coarse, some fine sand, some rounded gravel < 1inch, gray, wet, non-cohesive, well-graded (SW).		2" PVC Screen slot 0.010 30-40 ft bgs
630.0									
625.0	gray clayey SHALE			RS			40' to 40.5': CLAYEY SHALE, gray, slightly weathered		#5 Sand 40-40.5 ft bgs
620.0									

LITHOLOGY LEGEND

USCS Poorly-graded Sand with Silt (SP-SM)
Shale
USCS Well-graded Sand with Silt (SW-SM)
USCS Well-graded Sand (SW)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-63B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33.5
DEPTH TO BEDROCK: 33.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171969.161 E: 2971860.966
GROUND SURFACE ELEV.: 669.02
TOP OF CASING ELEV.: 668.74
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 8:00:00 AM
END DATE/TIME: 6/7/2019 8:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	brown to gray fine to medium SILTY SAND			RS			0' to 1.75': SILTY SAND, fine, trace rounded gravel <1inch, brown, non-cohesive, moist, trace organics, poorly graded (SM).		Bentonite Grout 0-19 ft bgs
	gray fine to medium SAND			RS			3' to 4.75': SAND, fine to medium, some rounded gravel <1inch, light brown, trace coarse sand, well-graded (SW).		
665.0				RS			4.75' to 11': SAND, medium to coarse, light brown, some fine sand, wet, non-cohesive, well-graded (SW).		
660.0				RS					
				RS			11' to 11.5': SAND, medium to coarse, trace rounded gravel <1cm, gray, wet, non-cohesive, well graded (SW)		
655.0				RS			15' to 21.3': SAND, fine to coarse, gray, wet, non-cohesive, well-graded (SW).		
650.0									Bentonite Chips 19-21 ft bgs
	gray fine to coarse SAND			RS			21.3' to 22.8': CLAYEY SAND, fine to coarse, trace rounded gravel <1", gray, wet, non-cohesive, well-graded (SW-SC).		#5 Sand Filter Pack 21-23 ft bgs
				RS			22.8' to 23': SAND, fine to coarse, trace gravel rounded <1", gray, wet, non-cohesive, well-graded (SW).		2" PVC Screen slot 0.010 23-33 ft bgs
645.0									

LITHOLOGY LEGEND

USCS Well-graded Sand with Silt (SW-SM)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Sand with Clay (SW-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-63B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 33.5
DEPTH TO BEDROCK: 33.5

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171969.161 E: 2971860.966
GROUND SURFACE ELEV.: 669.02
TOP OF CASING ELEV.: 668.74
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 8:00:00 AM
END DATE/TIME: 6/7/2019 8:50:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	gray fine to coarse SAND			RS			25' to 31.75': SAND, fine to coarse, trace rounded gravel <1 inch, gray, wet, non-cohesive, well-graded (SW).		
640.0	gray CLAYEY SHALE								
				RS			33' to 33.5': CLAYEY SHALE, gray, weathered, soft		#5 Sand 33-33.5 ft bgs
635.0									
630.0									
625.0									
620.0									

LITHOLOGY LEGEND

USCS Well-graded Sand with Silt (SW-SM)
Shale
USCS Well-graded Sand (SW)
USCS Well-graded Sand with Clay (SW-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-64B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 30.5
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171789.81 E: 2972174.664
GROUND SURFACE ELEV.: 664.42
TOP OF CASING ELEV.: 666.83
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 11:30:00 AM
END DATE/TIME: 6/7/2019 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	dark brown fine SILTY SAND			RS			0' to 1': SILTY SAND, fine, dark brown, trace organics, moist, non-cohesive, poorly graded (SM).		Bentonite Grout 0-17 ft bgs
				RS			1' to 1.8': SILTY SAND, fine, trace rounded gravel <1", dark brown, moist, non-cohesive, poorly graded (SM).		
	light brown fine to medium SAND, some orange streaking			RS RS			1.8' to 2.8': SAND, fine to medium, light brown, some clay, some orange streaking, moist, cohesive, well-graded (SW-SC). 2.8' to 3.75': SAND, fine to coarse, light brown, some orange streaking, wet, non-cohesive, well-graded (SW).		
660.0									
				RS			7' to 8.5': SAND, fine to medium, light brown, trace coarse sand, wet, non-cohesive, well-graded (SW).		
	gray fine CLAYEY SAND, some dark gray streaks			RS			8.5' to 9': CLAYEY SAND, fine, gray with dark gray streaks, wet, non-cohesive, poorly graded (SC).		
655.0				RS			9' to 10.25': CLAYEY SAND, fine, gray, with dark gray streaks, wet, non-cohesive, poorly graded (SC).		
	gray fine to coarse SAND						10.25' to 17.5': SAND, fine to coarse, gray, wet, non-cohesive, well-graded (SW).		
				RS					
650.0									
									Bentonite Chips 17-19 ft bgs
							17.5' to 23.75': SAND, medium to coarse, gray, some rounded gravel <1cm, trace fine sand, non-cohesive, wet, well-graded (SW).		
645.0									#5 Sand Filter Pack 19-31 ft bgs
				RS					2" PVC Screen slot 0.010 21-30.5 ft bgs
640.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand with Clay (SP-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

BOREHOLE LOG: GAMW-64B

PROJECT: NIPSCO Schahfer
PROJECT NO.: 164-8171
HOLE DEPTH: 30.5
DEPTH TO BEDROCK: 31

BOREHOLE LOCATION: Wheatfield, IN
COORDINATES: N: 2171789.81 E: 2972174.664
GROUND SURFACE ELEV.: 664.42
TOP OF CASING ELEV.: 666.83
DATUM: Indiana West Zone NAD 83

DRILLING METHOD: ROTOSONIC
CORING METHOD:
DRILL RIG: SDC500-28EA
START DATE/TIME: 6/7/2019 11:30:00 AM
END DATE/TIME: 6/7/2019 12:10:00 PM

Depth Elev.	LITHOLOGY DESCRIPTION	Graphical Log	SAMPLE INFORMATION: Sample No. Or Run No.	Type	PID (ppm)	Soil Rec./Att. Or Core Rec. %	Soil Sample Description Or Discontinuity Data (Depth, Dip, Angle From Core Axis, Type, and Surface Description)	Well Graphic	Well Construction Information
	gray fine to coarse SAND			RS			27' to 30.5': SAND, medium to coarse, gray, some rounded gravel <1cm, trace fine sand, non-cohesive, wet, well-graded (SW).		
635.0									
	gray CLAYEY SHALE			RS			30.5' to 31': CLAYEY SHALE, gray, slighty weathered, hard		#5 Sand 30.5-31 ft bgs
630.0									
625.0									
620.0									
615.0									

LITHOLOGY LEGEND

USCS Silty Sand (SM)
Shale
USCS Well-graded Sand (SW)
USCS Poorly-graded Sand with Clay (SP-SC)

DRILLING COMPANY: Layne
DRILLER: M. Backhaus
DRILL RIG: SDC500-28EA

LOGGED BY: DFS
CHECKED BY: AMH
DATE: 9/16/19

Golder Associates

APPENDIX F

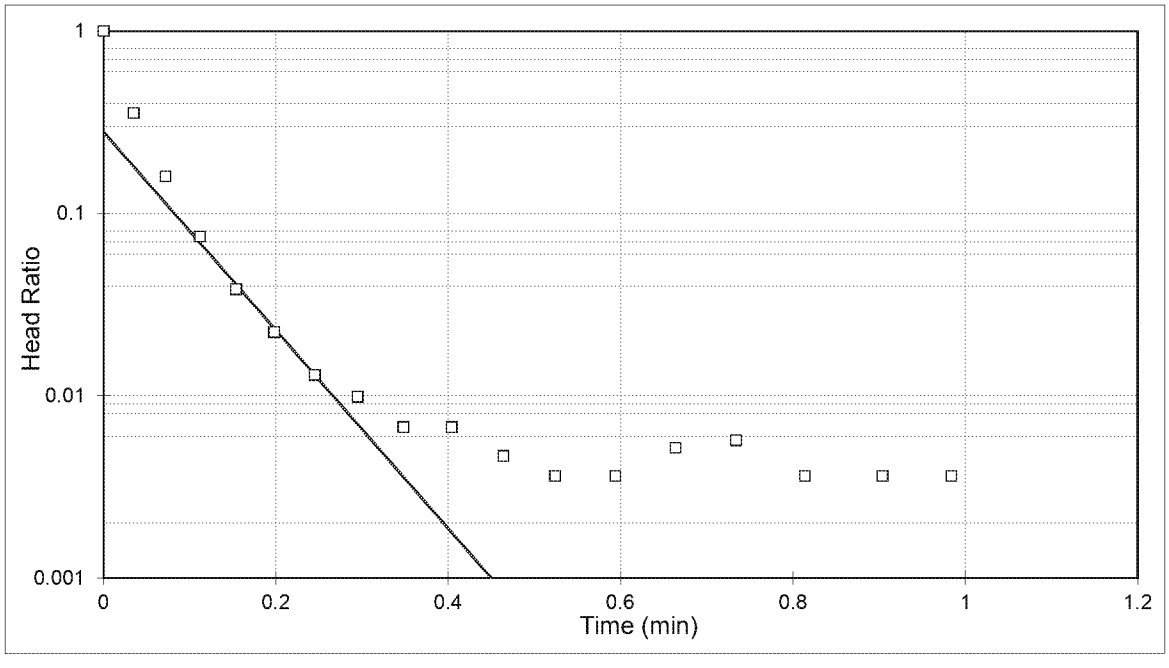
Slug Test Results

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	7.44E-03	cm/sec
t_1 =	0	K=	2.11E+01	ft/day
t_2 =	0.45			
h_1/h_0 =	0.28			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/25/2016

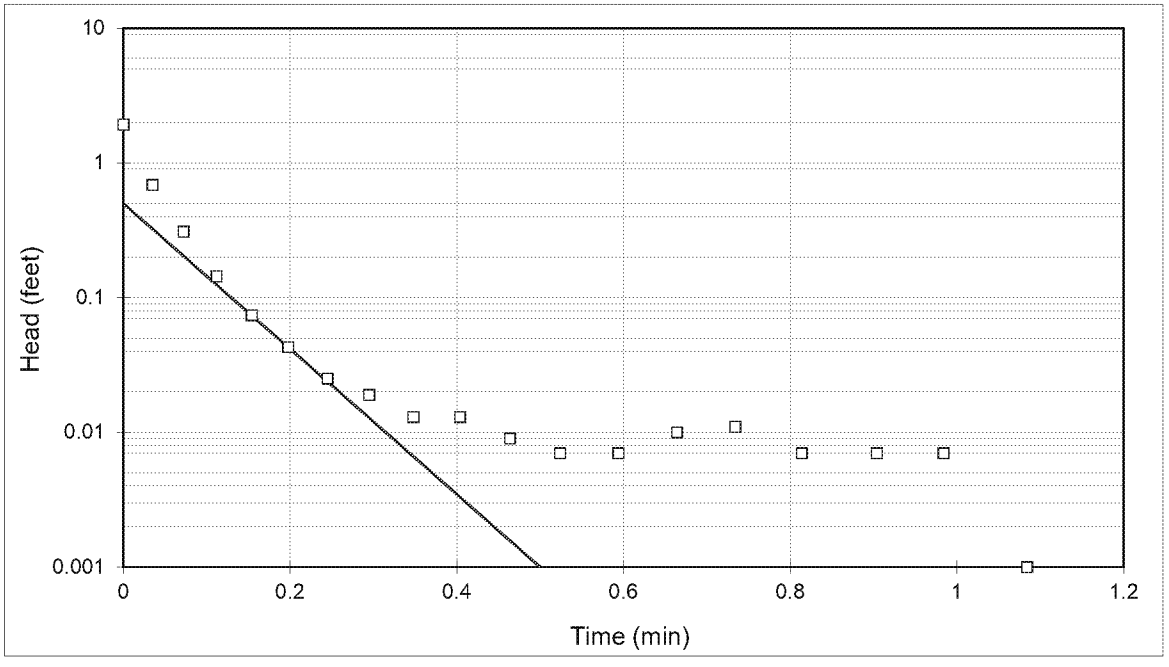
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	4.99E-03	cm/sec
$\ln(R_e/r_w)$=	2.28	K=	1.42E+01	ft/day
y_0 =	0.50			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

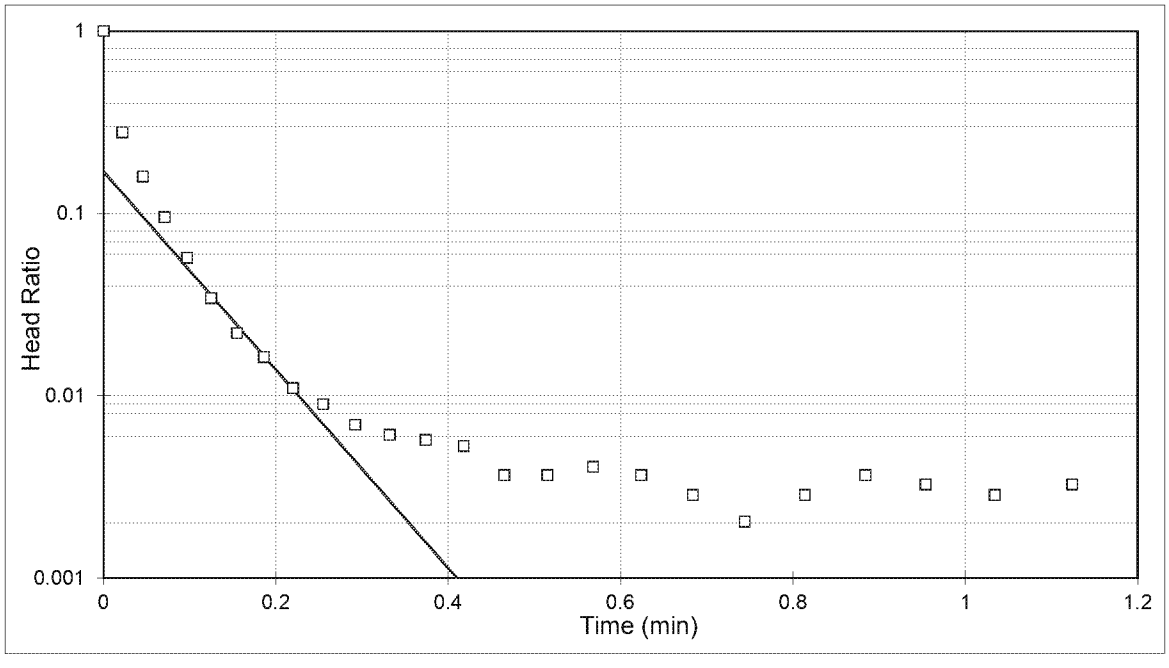
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	7.45E-03	cm/sec
t_1 =	0	K=	2.11E+01	ft/day
t_2 =	0.41			
h_1/h_0 =	0.17			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

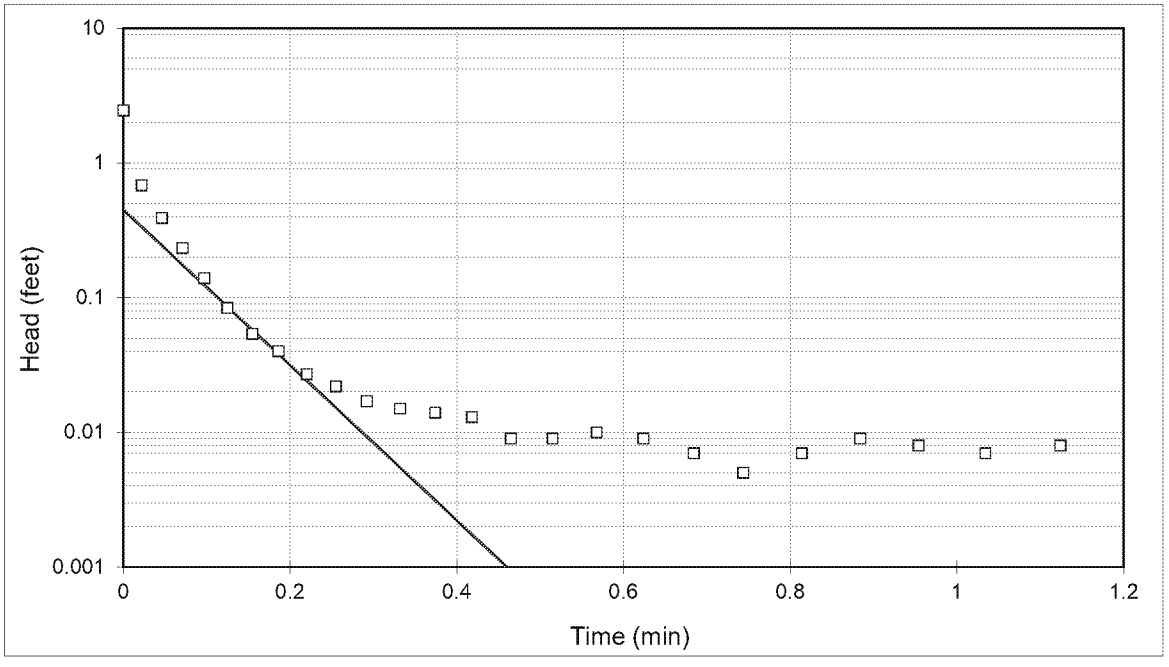
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	5.22E-03	cm/sec
$\ln(R_e/r_w)$=	2.23	K=	1.48E+01	ft/day
y_0 =	0.45			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

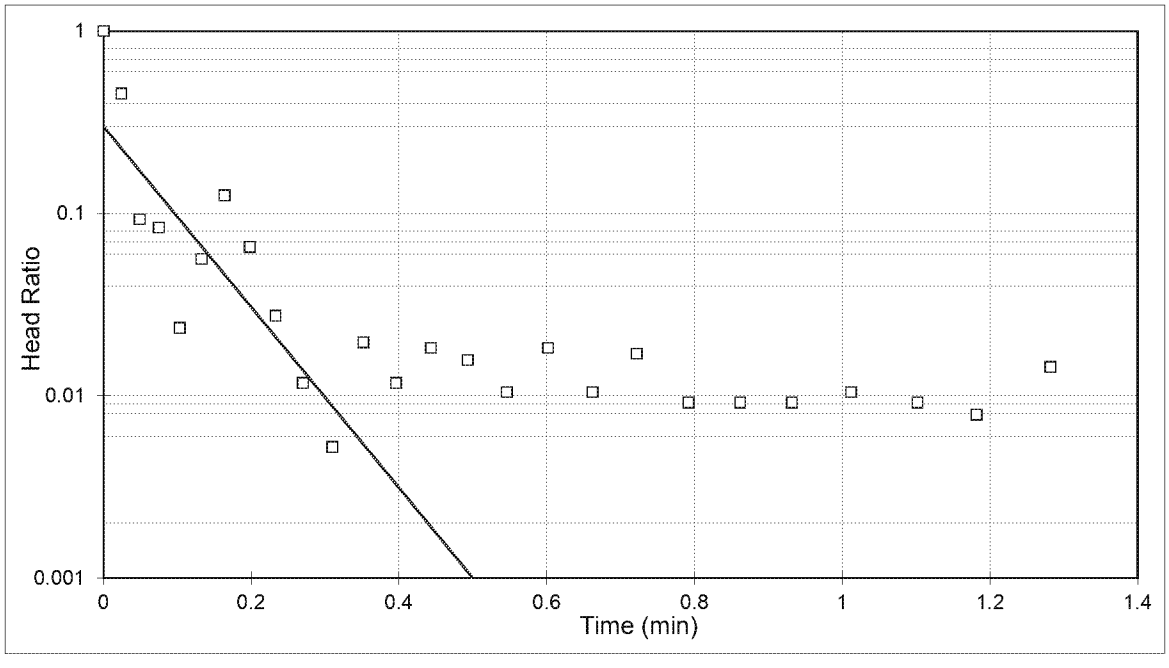
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-03B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	6.78E-03	cm/sec
t_1 =	0	K=	1.92E+01	ft/day
t_2 =	0.5			
h_1/h_0 =	0.30			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

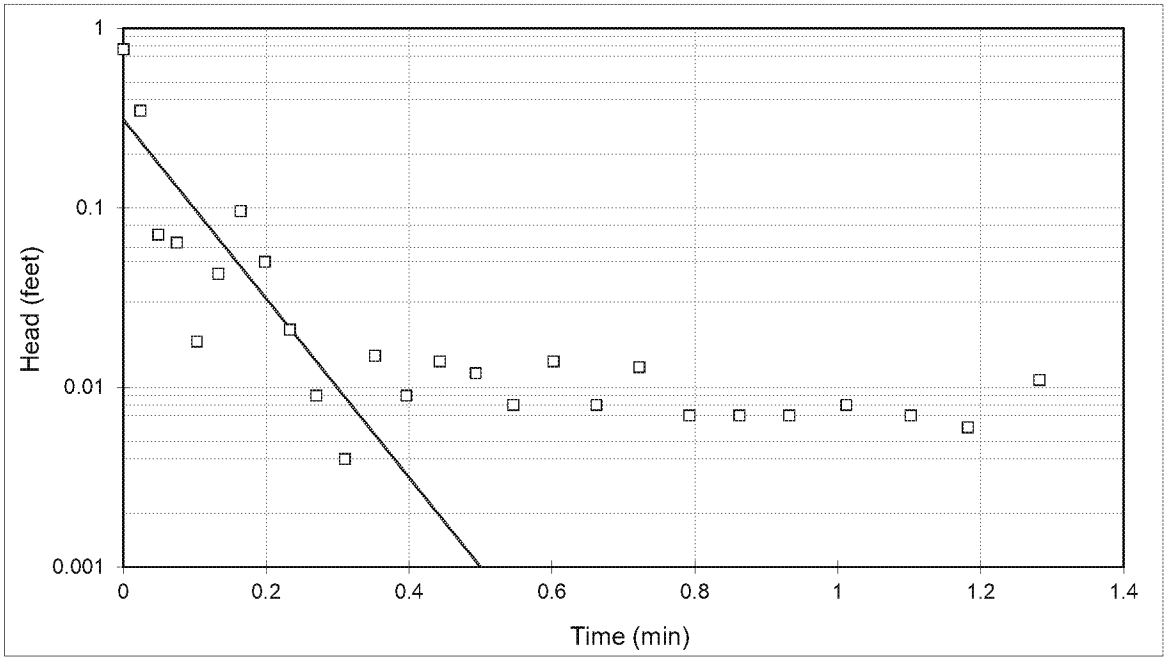
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-03B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	5.81E-03	cm/sec
$\ln(R_e/r_w)$=	2.87	K=	1.65E+01	ft/day
y_0 =	0.31			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

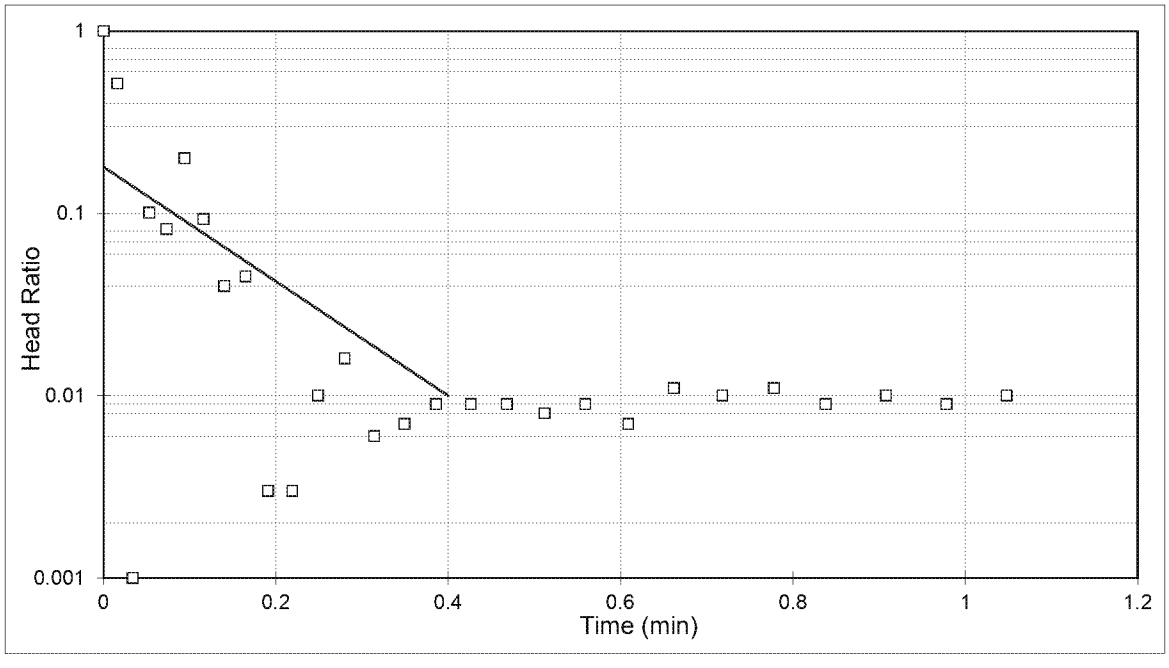
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-03B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	4.30E-03	cm/sec
t_1 =	0	K=	1.22E+01	ft/day
t_2 =	0.4			
h_1/h_0 =	0.18			
h_2/h_0 =	0.01			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

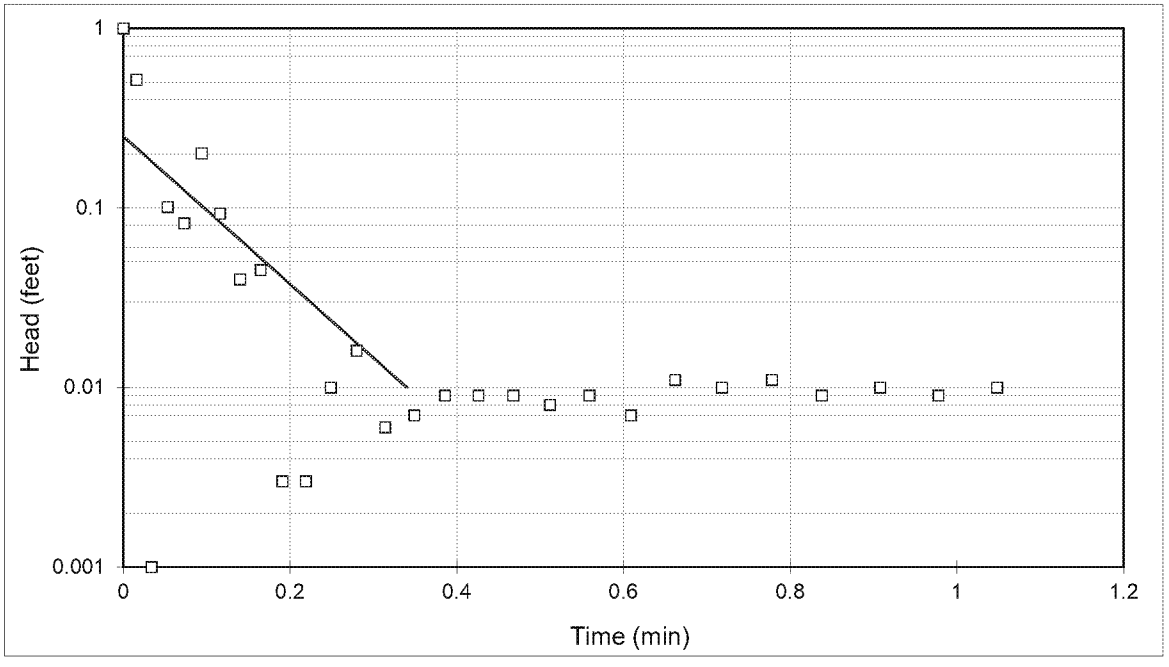
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-03B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	4.79E-03	cm/sec
$\ln(R_e/r_w)$=	2.87	K=	1.36E+01	ft/day
y_0 =	0.25			
y_t =	0.010			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

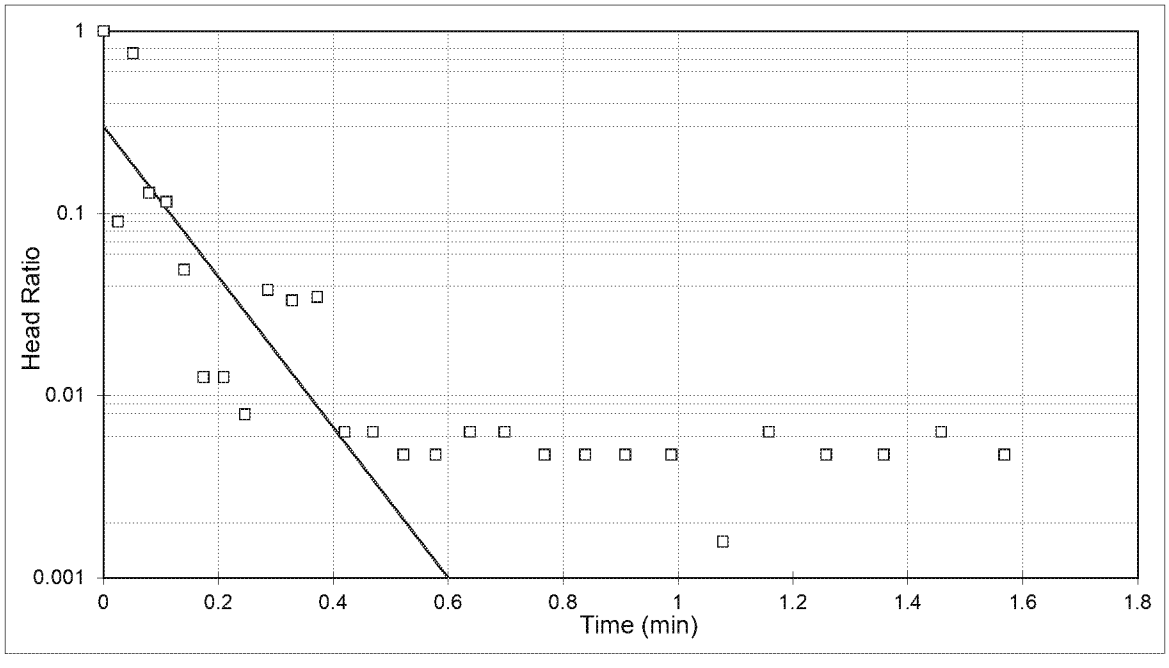
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03B (TEST 1)

$$K = \frac{r_c^{\,2}}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	5.65E-03	cm/sec
t_1 =	0	K=	1.60E+01	ft/day
t_2 =	0.6			
h_1/h_0 =	0.30			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

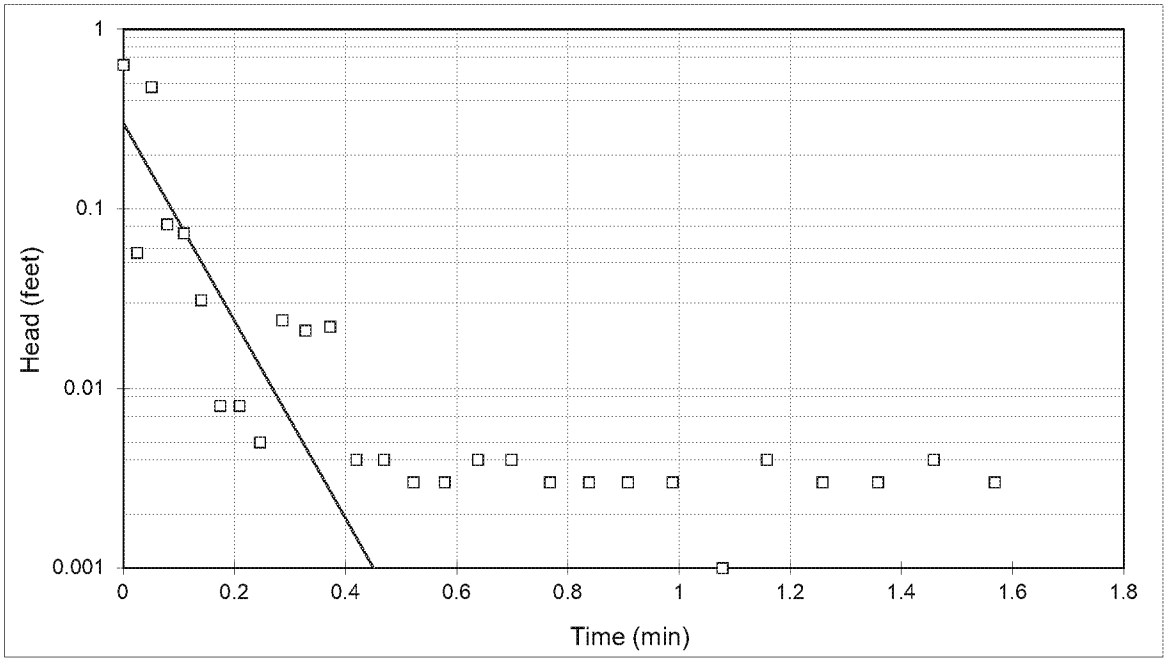
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	6.42E-03	cm/sec
$\ln(R_e/r_w)$=	2.87	K=	1.82E+01	ft/day
y_0 =	0.30			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-03B (TEST 2)

$$T = b + a \ln T$$

where:

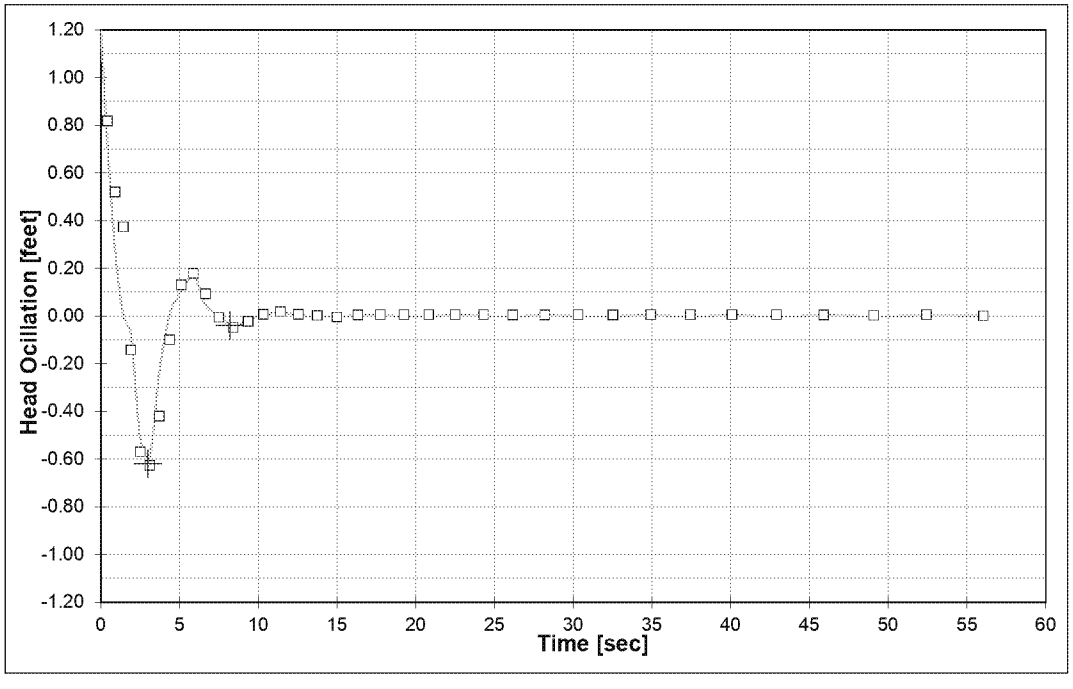
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / \left(g / L\right)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.31826	ft^2
r_s =	0.08	ft	d =	0.3998	ft^{-1}
L_c =	19.62	ft	a =	0.00286	ft^3
L_s =	10.00	ft	t_1 =	3.00	sec
ω =	1.2083	ft^{-1}	t_2 =	8.20	sec
γ =	0.5271	ft^{-1}	$h(t_1)$ =	0.62	ft
L =	18.52	ft^3/sec^2	$h(t_2)$ =	0.04	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	2.73E-02	ft^2/sec	α < 0.1?	YES
T =	1.53E-02	ft^2/sec	d < 0.7?	YES
T =	1.32E+03	ft^2/day	L_1 =	18.52
K =	4.22E+01	ft/day	L_2 =	24.62
K =	1.49E-02	cm/sec	L_1:L_2 Diff <20% ?	NO



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 8/8/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 2)

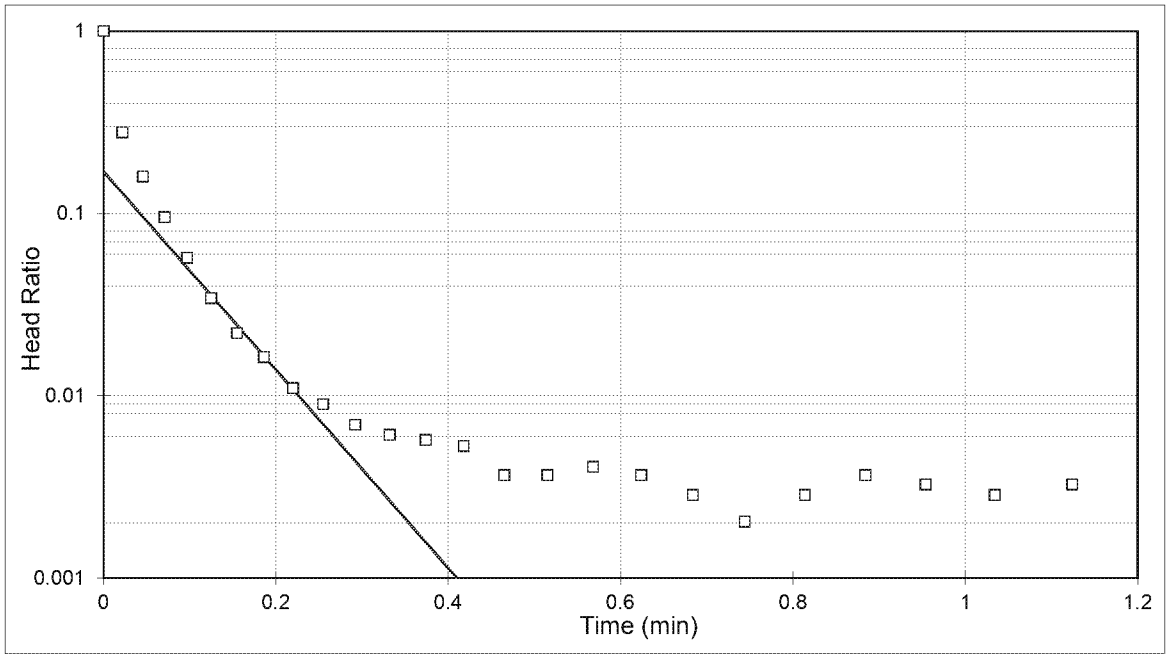
$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
r_c = casing radius (feet)
R_e = equivalent radius (feet)
L_e = length of screened interval (feet)
t = time (minutes)
h_t = head at time t (feet)

INPUT PARAMETERS	
r_c =	0.08
R_e =	0.34
L_e =	10
t_1 =	0
t_2 =	0.41
h_1/h_0 =	0.17
h_2/h_0 =	0.00

RESULTS

K=	7.45E-03	cm/sec
K=	2.11E+01	ft/day



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

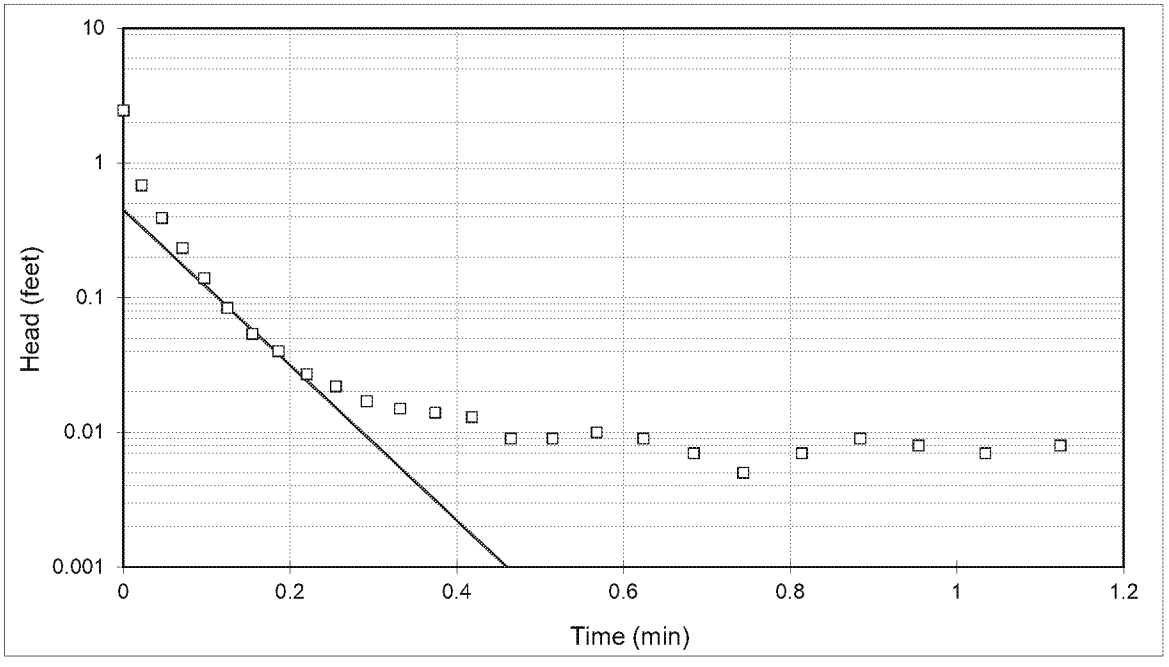
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-03 (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	5.22E-03	cm/sec
$\ln(R_e/r_w)$=	2.23	K=	1.48E+01	ft/day
y_0 =	0.45			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

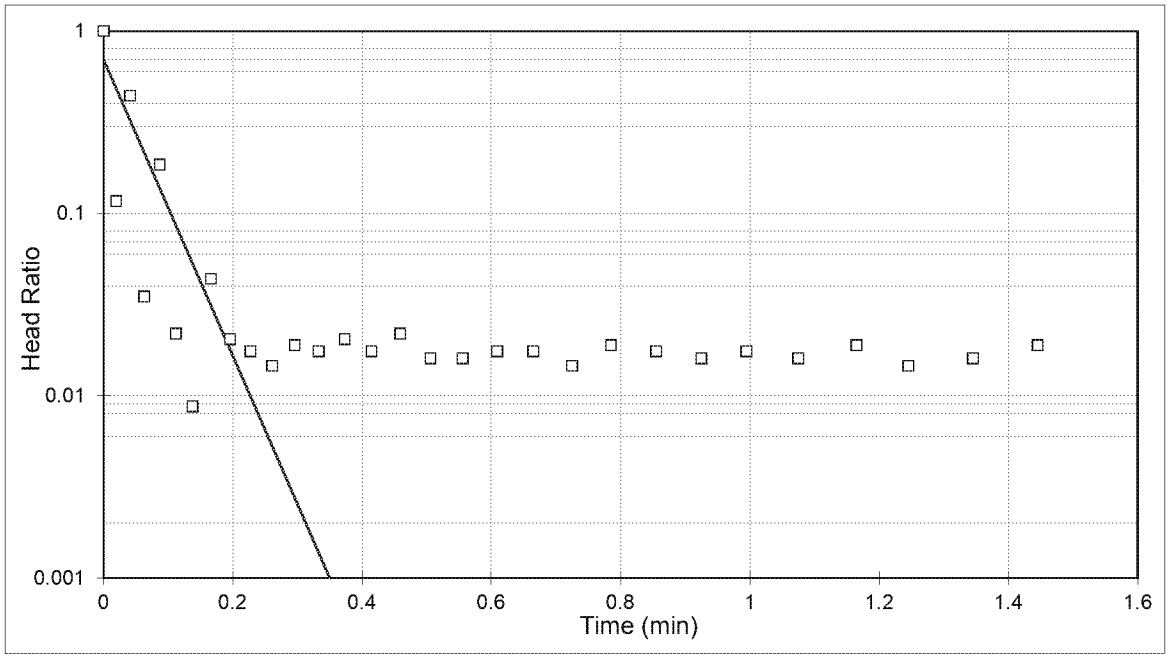
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.11E-02	cm/sec
t_1 =	0	K=	3.15E+01	ft/day
t_2 =	0.35			
h_1/h_0 =	0.70			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

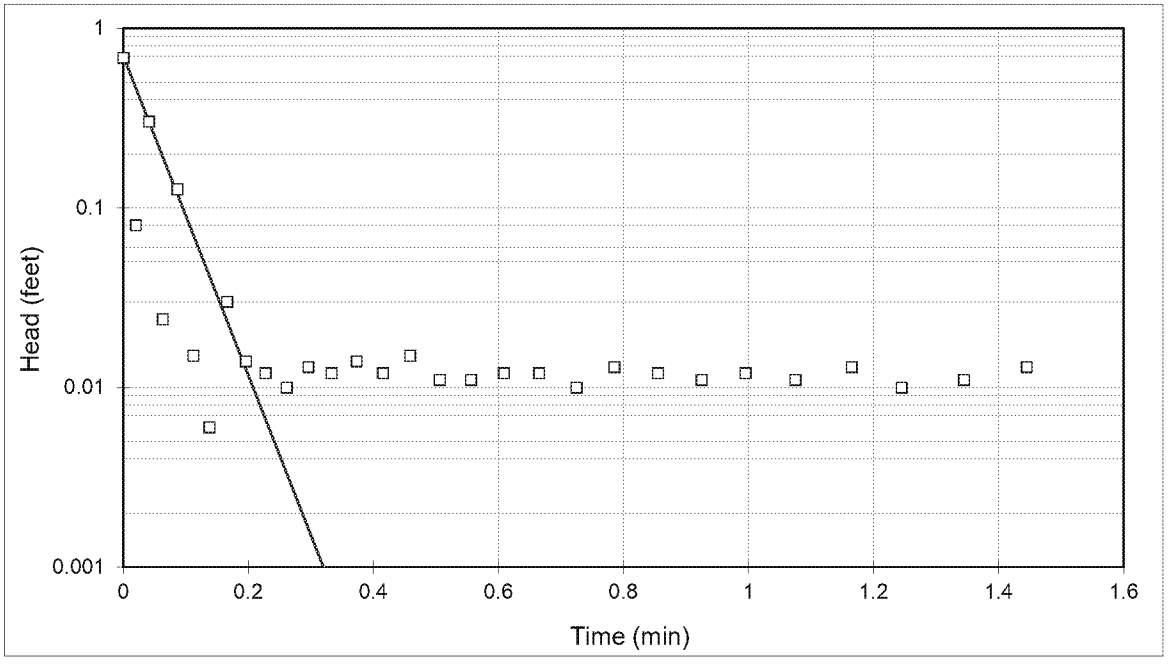
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.16E-02	cm/sec
$\ln(R_e/r_w)$=	3.22	K=	3.30E+01	ft/day
y_0 =	0.70			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

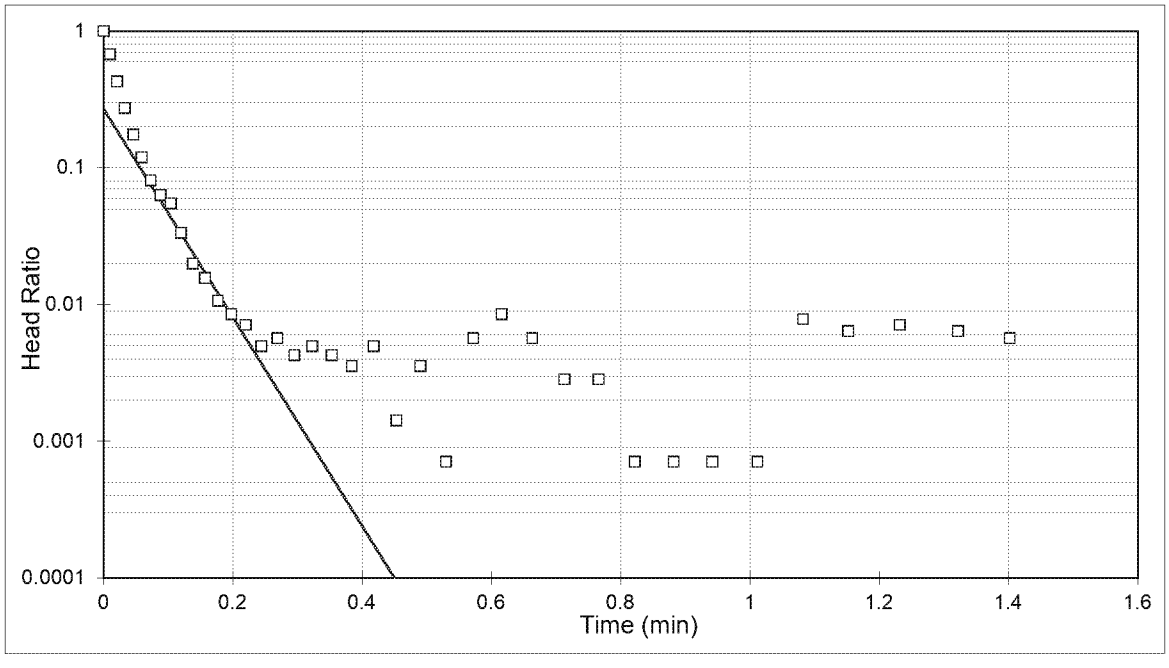
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13 (TEST 2)

$$K = \frac{r_c^{\,2}}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
R_e =	0.34			
L_e =	9.037	K=	6.50E-02	cm/sec
t_1 =	0	K=	1.84E+02	ft/day
t_2 =	0.45			
h_1/h_0 =	0.27			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

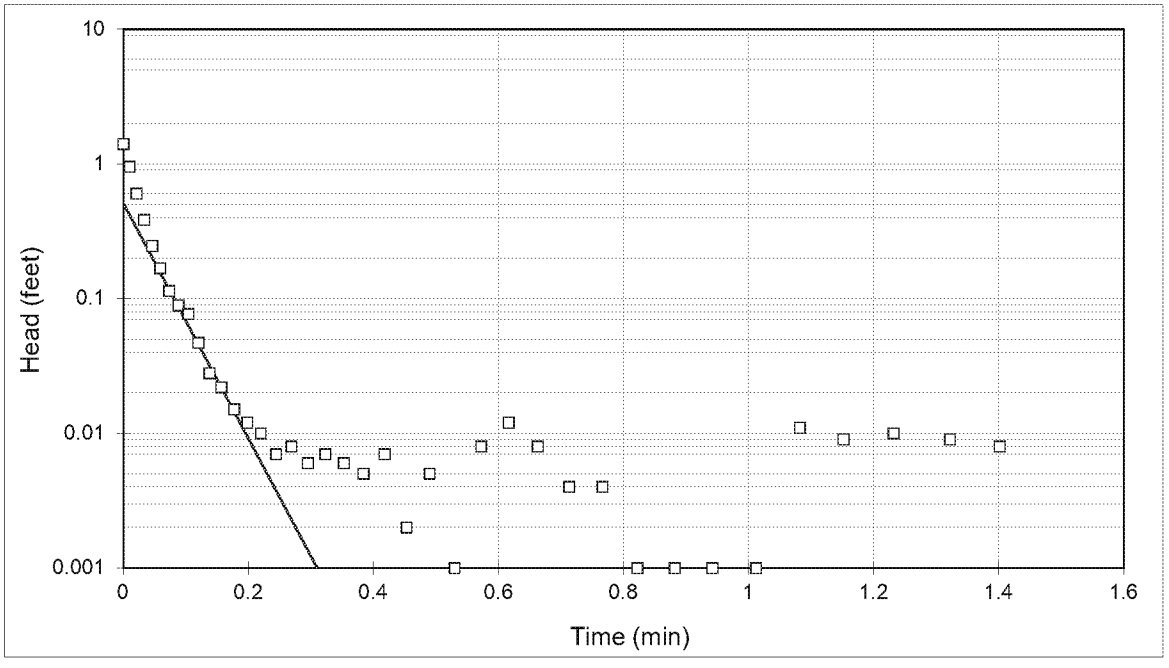
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13 (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
r_w =	0.34			
L_e =	9.037	K=	4.81E-02	cm/sec
$\ln(R_e/r_w)$=	2.11	K=	1.36E+02	ft/day
y_0 =	0.51			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

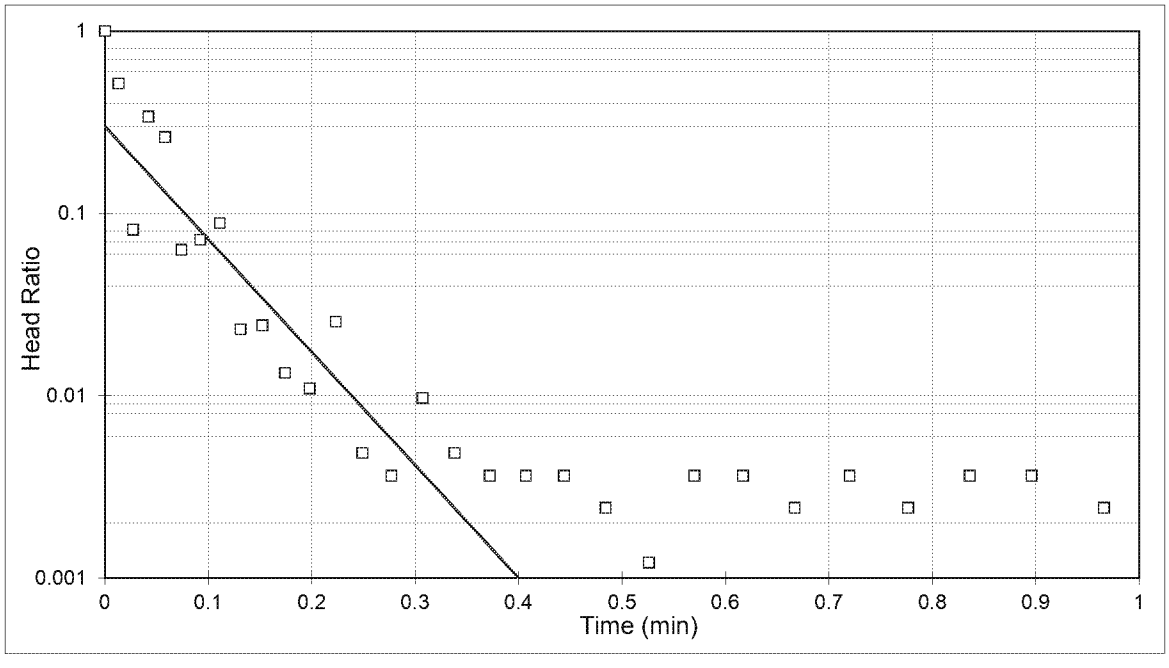
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	8.48E-03	cm/sec
t_1 =	0	K=	2.40E+01	ft/day
t_2 =	0.4			
h_1/h_0 =	0.30			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

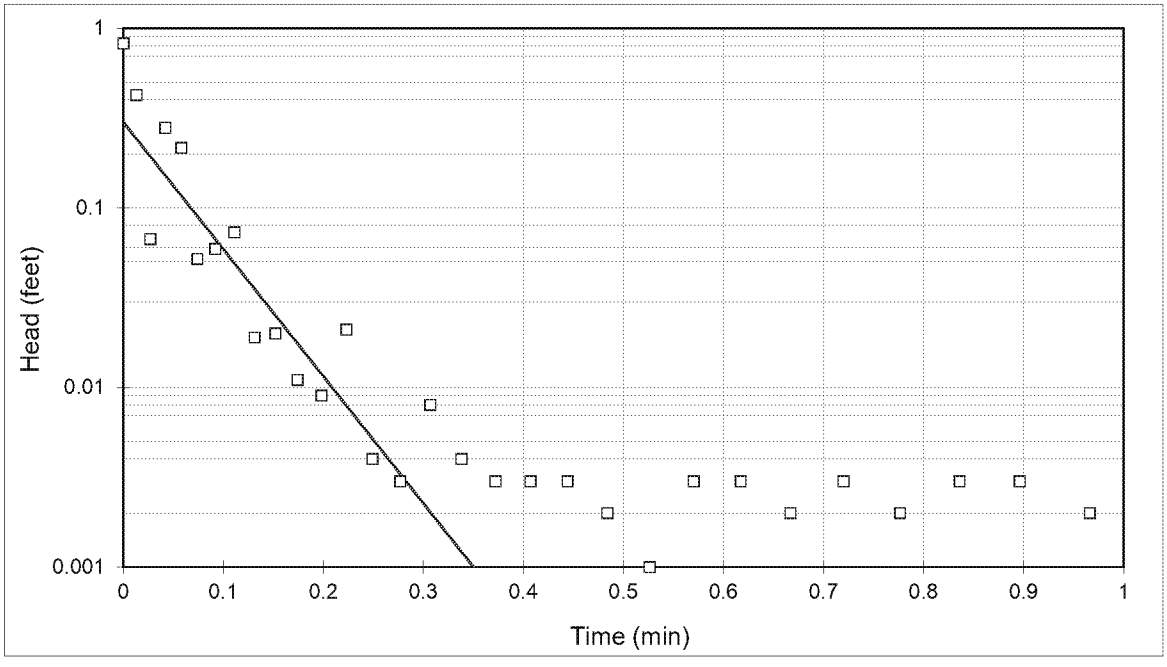
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	9.27E-03	cm/sec
$\ln(R_e/r_w)$=	3.22	K=	2.63E+01	ft/day
y_0 =	0.30			
y_t =	0.001			
t =	0.4			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

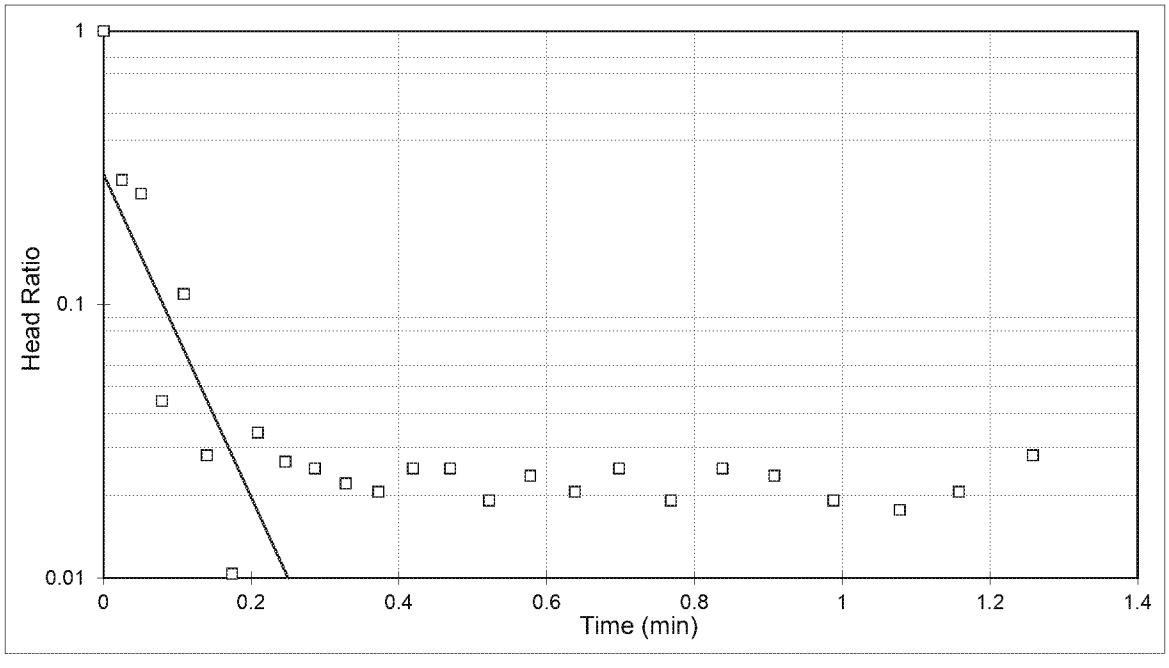
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-13B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	8.09E-03	cm/sec
t_1 =	0	K=	2.29E+01	ft/day
t_2 =	0.25			
h_1/h_0 =	0.30			
h_2/h_0 =	0.01			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

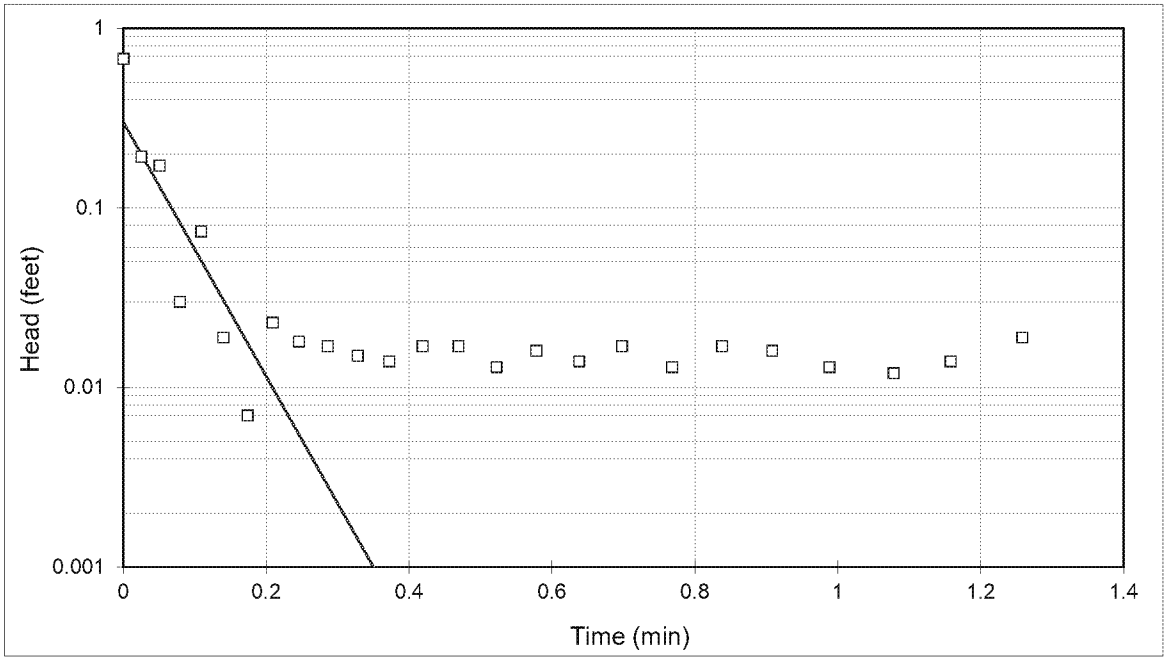
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-13B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	9.27E-03	cm/sec
$\ln(R_e/r_w)$=	3.22	K=	2.63E+01	ft/day
y_0 =	0.30			
y_t =	0.001			
t =	0.4			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-13B (TEST 1)

$$T = b + a \ln T$$

where:

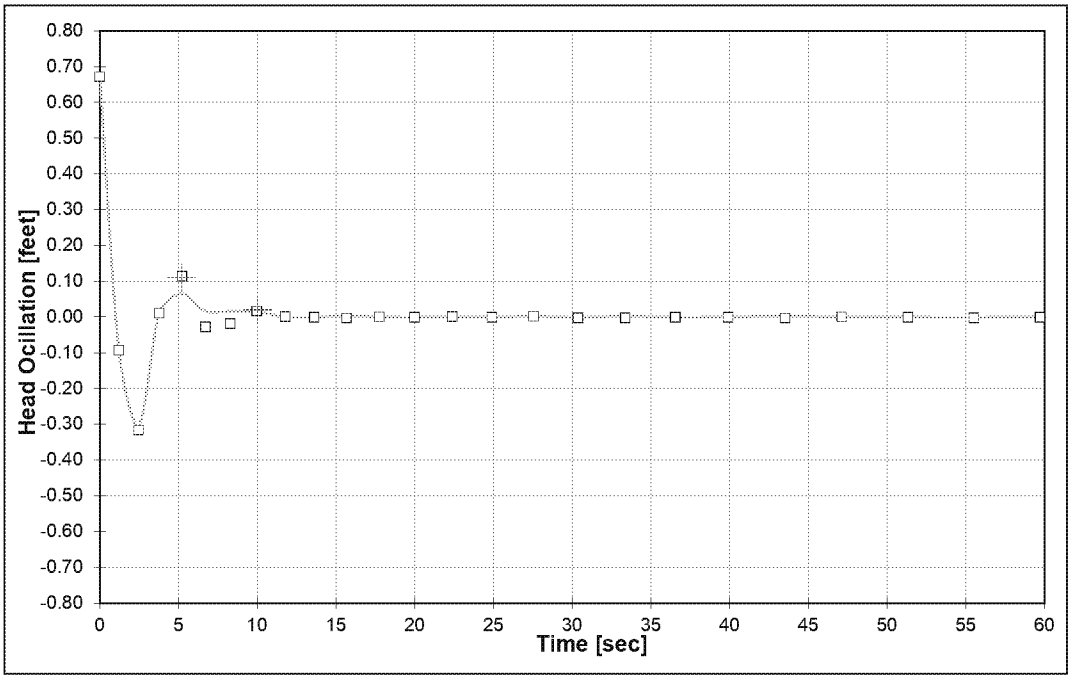
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.35632	ft^2
r_s =	0.08	ft	d =	0.2619	ft^{-1}
L_c =	19.45	ft	a =	0.00450	ft^3
L_s =	9.98	ft	t_1 =	5.20	sec
w =	1.3090	ft^{-1}	t_2 =	10.00	sec
g =	0.3552	ft^{-1}	$h(t_1)$ =	0.11	ft
L =	17.50	ft^3/sec^2	$h(t_2)$ =	0.02	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	4.27E-02	ft^2/sec	$a < 0.1$?	YES
T =	2.64E-02	ft^2/sec	$d < 0.7$?	YES
T =	2.28E+03	ft^2/day	L_1 =	17.50
K =	7.74E+01	ft/day	L_2 =	24.44
K =	2.73E-02	cm/sec	$L_1:L_2$ Diff <20% ?	NO



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/07/16

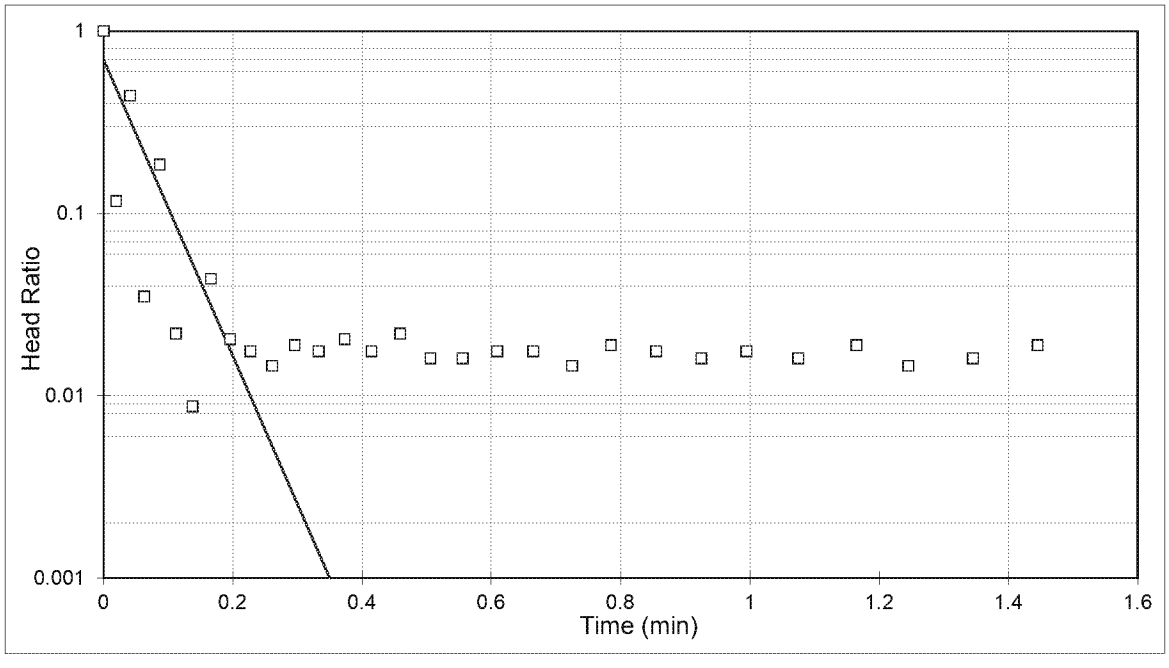
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.11E-02	cm/sec
t_1 =	0	K=	3.15E+01	ft/day
t_2 =	0.35			
h_1/h_0 =	0.70			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

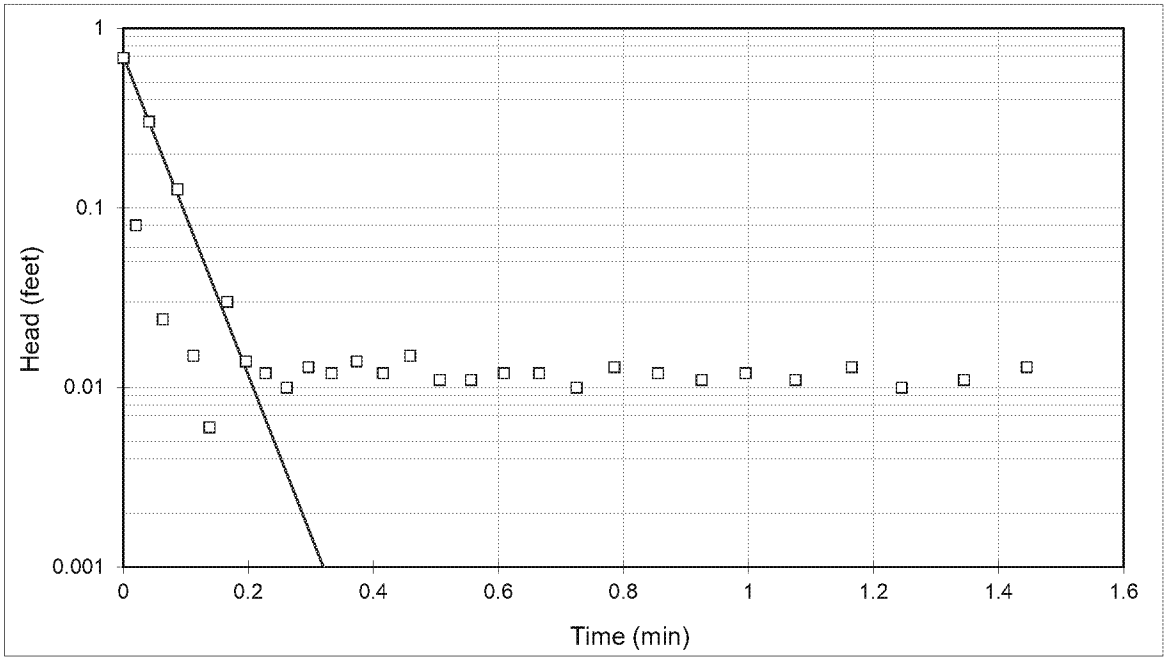
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.16E-02	cm/sec
$\ln(R_e/r_w)$=	3.22	K=	3.30E+01	ft/day
y_0 =	0.70			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-13B (TEST 2)

$$T = b + a \ln T$$

where:

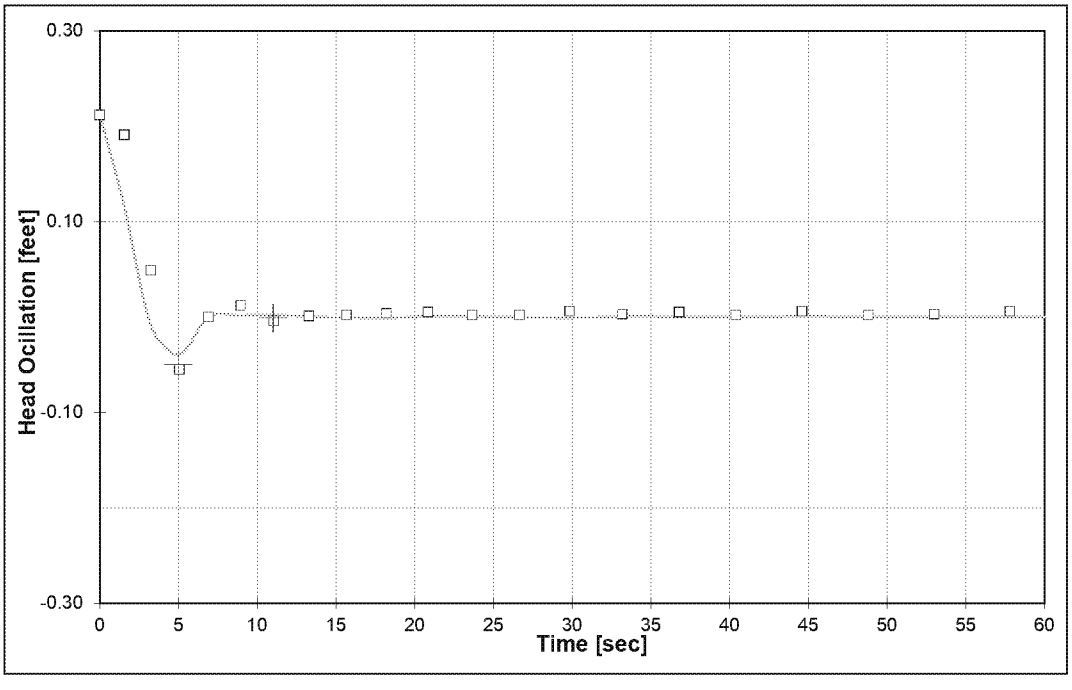
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.23358	ft^2
r_s =	0.08	ft	d =	0.5285	ft^{-1}
L_c =	19.14	ft	a =	0.00203	ft^3
L_s =	9.98	ft	t_1 =	5.00	sec
w =	1.0472	ft^{-1}	t_2 =	11.00	sec
g =	0.6520	ft^{-1}	$h(t_1)$ =	0.05	ft
L =	21.15	ft^3/sec^2	$h(t_2)$ =	0.00	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	1.95E-02	ft^2/sec	$a < 0.1$?	YES
T =	1.02E-02	ft^2/sec	$d < 0.7$?	YES
T =	8.77E+02	ft^2/day	L_1 =	21.15
K =	3.01E+01	ft/day	L_2 =	24.13
K =	1.06E-02	cm/sec	$L_1:L_2$ Diff <20% ?	YES



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/07/16

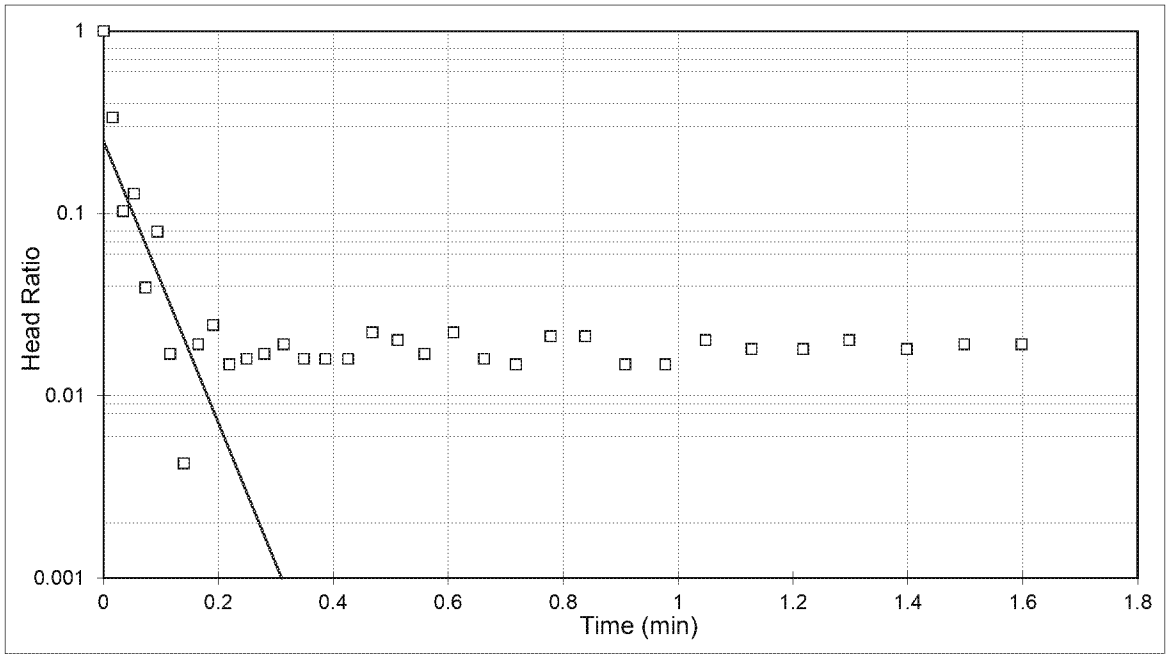
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.06E-02	cm/sec
t_1 =	0	K=	3.00E+01	ft/day
t_2 =	0.31			
h_1/h_0 =	0.25			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

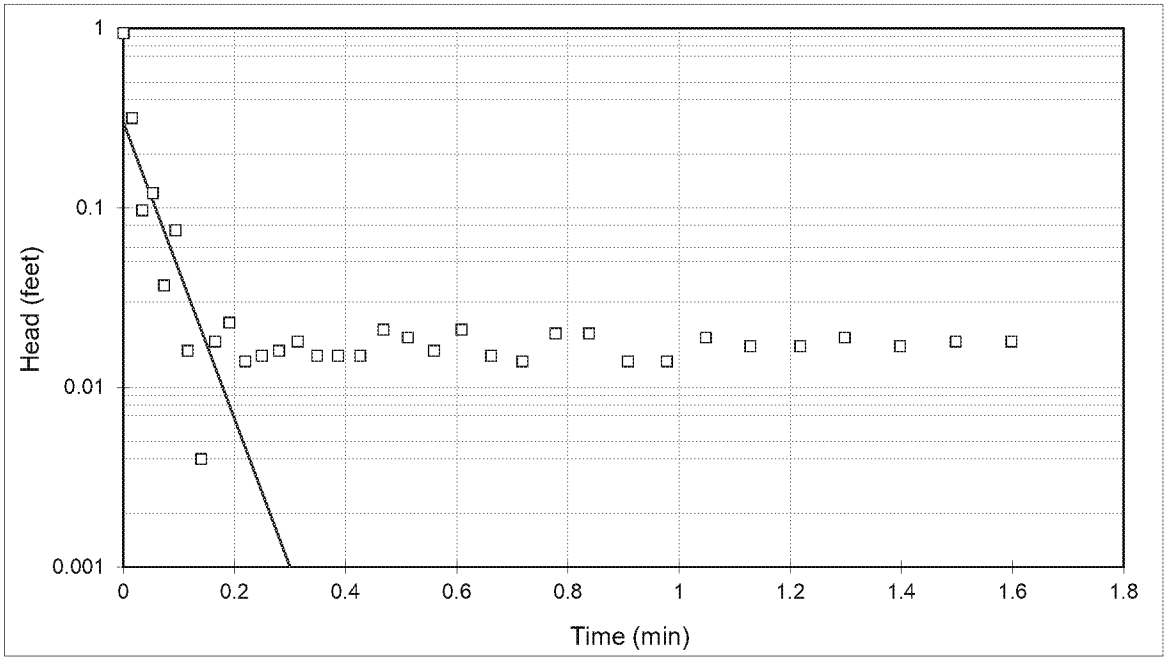
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-13B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.08E-02	cm/sec
$\ln(R_e/r_w)$=	3.22	K=	3.06E+01	ft/day
y_0 =	0.30			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

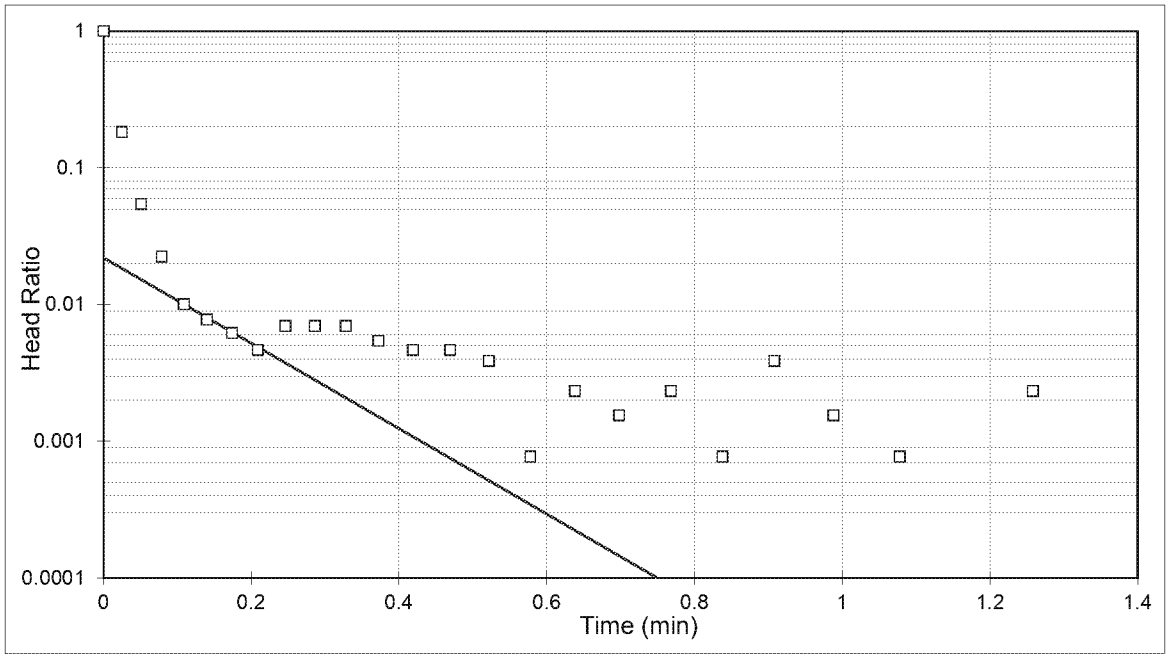
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15 (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
R_e =	0.34			
L_e =	9.417	K=	2.59E-02	cm/sec
t_1 =	0	K=	7.34E+01	ft/day
t_2 =	0.75			
h_1/h_0 =	0.02			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

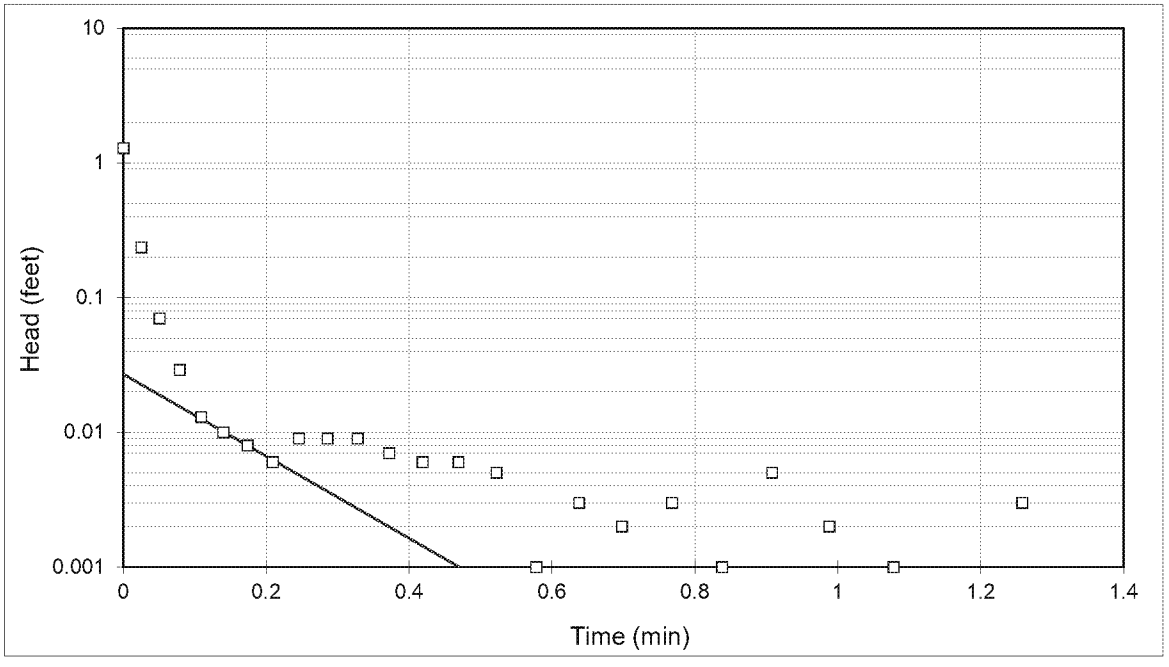
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15 (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
r_w =	0.34			
L_e =	9.417	K=	1.63E-02	cm/sec
$\ln(R_e/r_w)$=	2.14	K=	4.63E+01	ft/day
y_0 =	0.03			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

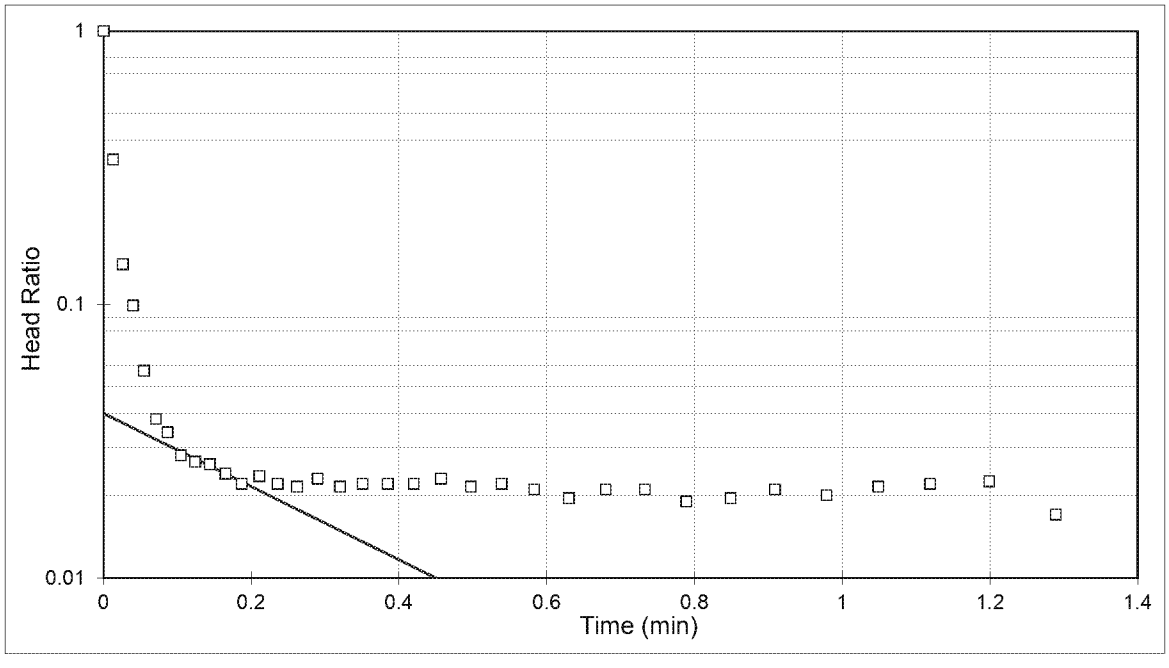
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15 (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
R_e =	0.34			
L_e =	9.348	K=	1.11E-02	cm/sec
t_1 =	0	K=	3.16E+01	ft/day
t_2 =	0.45			
h_1/h_0 =	0.04			
h_2/h_0 =	0.01			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

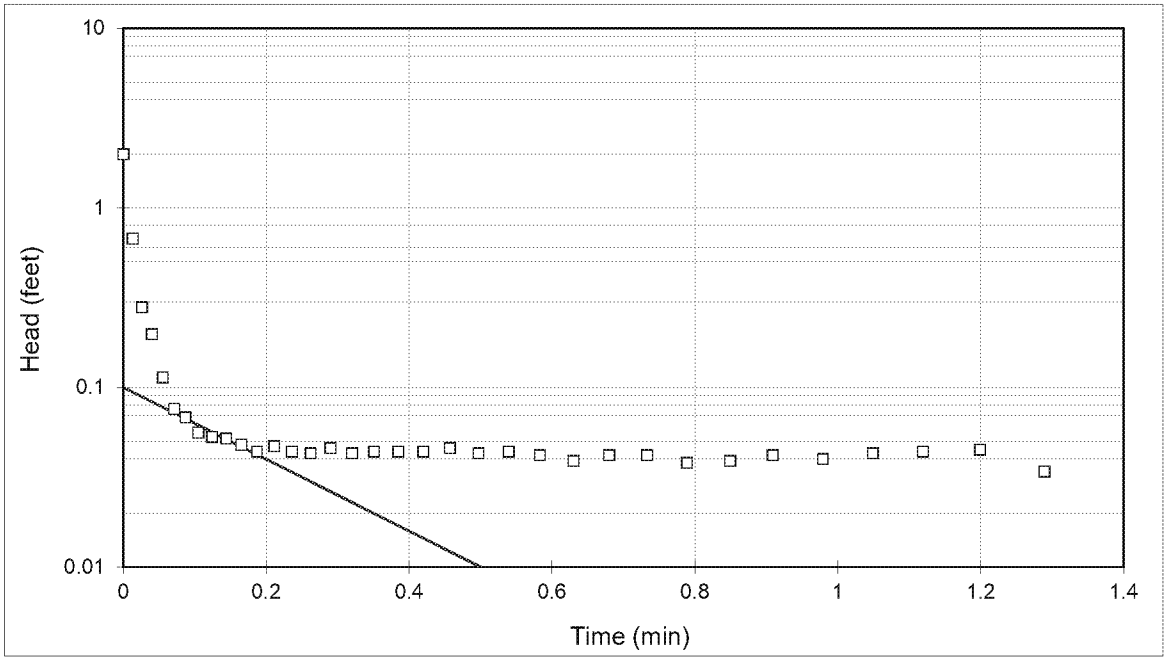
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15 (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
r_w =	0.34			
L_e =	9.348	K=	1.08E-02	cm/sec
$\ln(R_e/r_w)$=	2.13	K=	3.05E+01	ft/day
y_0 =	0.10			
y_t =	0.010			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

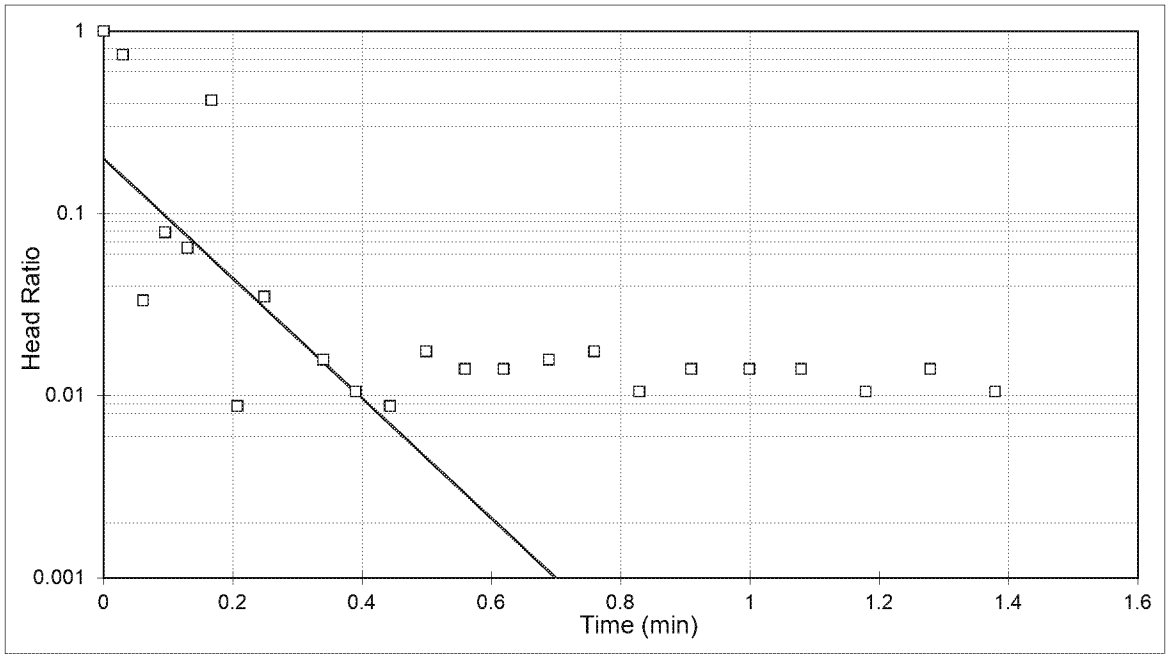
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-15B (TEST 1)

$$K = \frac{r_c^{\,2}}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	4.50E-03	cm/sec
t_1 =	0	K=	1.28E+01	ft/day
t_2 =	0.7			
h_1/h_0 =	0.20			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

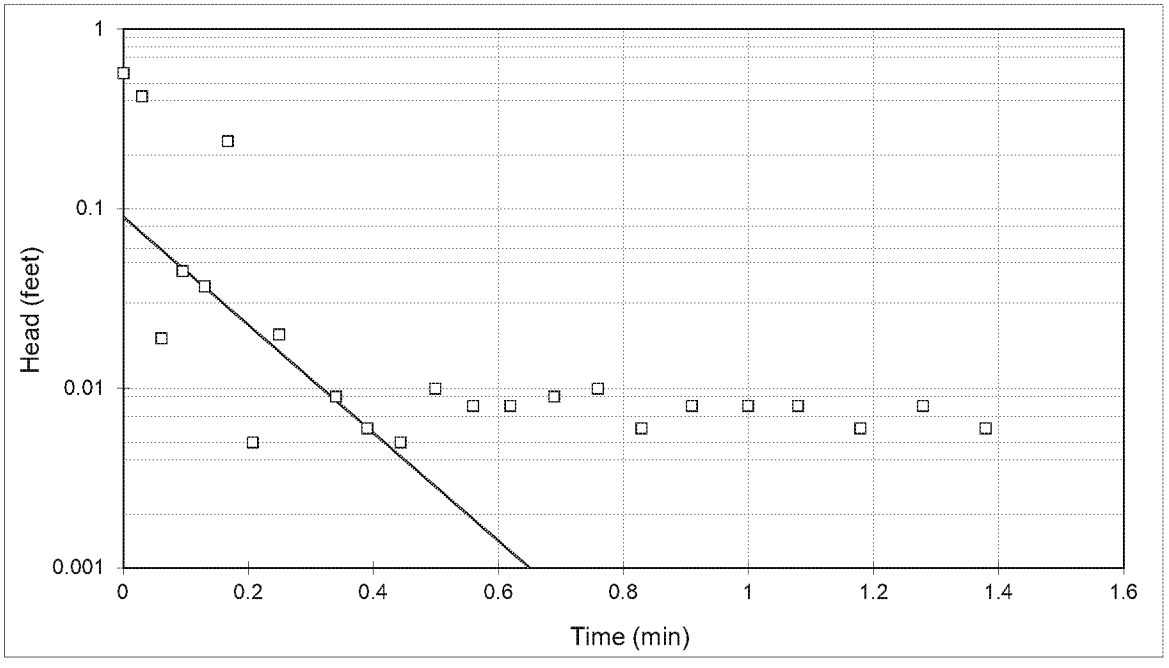
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-15B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	3.45E-03	cm/sec
$\ln(R_e/r_w)$=	2.83	K=	9.79E+00	ft/day
y_0 =	0.09			
y_t =	0.001			
t =	0.7			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP FALLING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-15B (TEST 2)

$$T = b + a \ln T$$

where:

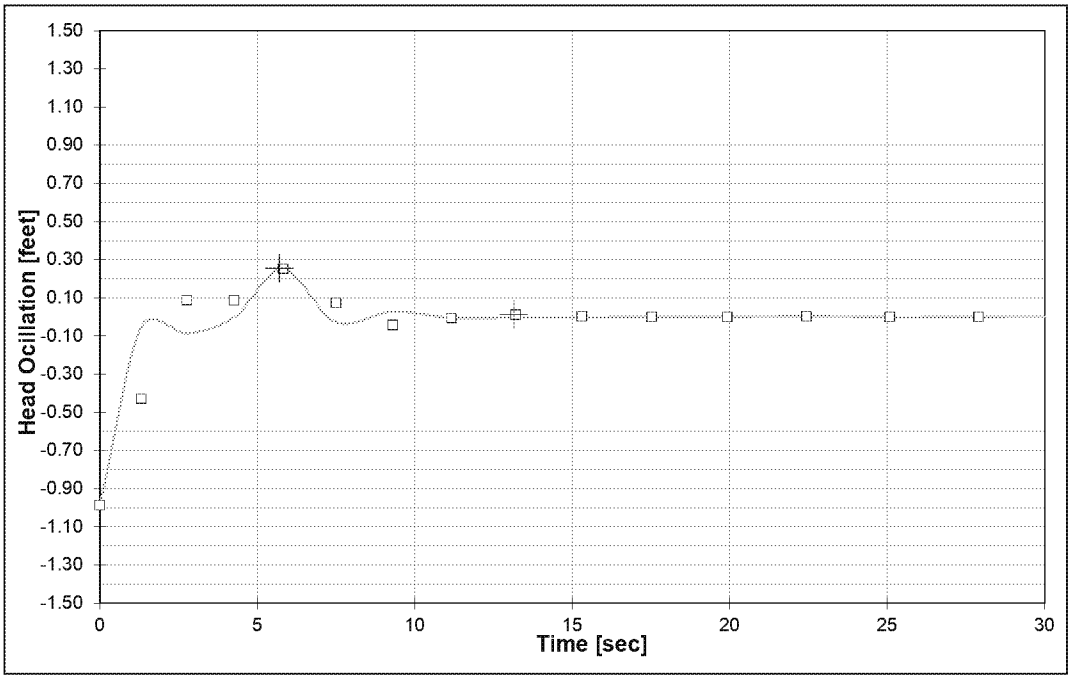
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	0.93787	ft^2
r_s =	0.08	ft	d =	0.4374	ft^{-1}
L_c =	19.23	ft	a =	0.00186	ft^3
L_s =	10.00	ft	t_1 =	5.70	sec
w =	0.8434	ft^{-1}	t_2 =	13.15	sec
g =	0.4102	ft^{-1}	$h(t_1)$ =	0.26	ft
L =	36.60	ft^3/sec^2	$h(t_2)$ =	0.01	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	1.84E-02	ft^2/sec	$a < 0.1$?	YES
T =	9.76E-03	ft^2/sec	$d < 0.7$?	YES
T =	8.44E+02	ft^2/day	L_1 =	36.60
K =	2.70E+01	ft/day	L_2 =	24.23
K =	9.53E-03	cm/sec	$L_1:L_2$ Diff <20% ?	NO



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/08/16

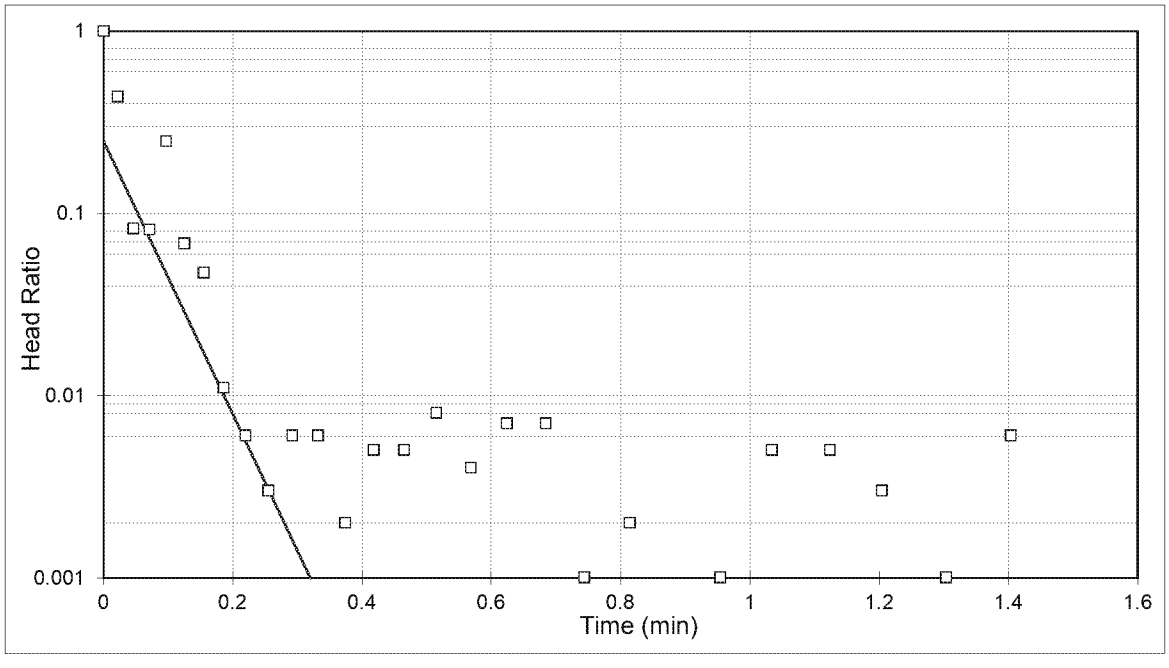
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-15B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.03E-02	cm/sec
t_1 =	0	K=	2.91E+01	ft/day
t_2 =	0.32			
h_1/h_0 =	0.25			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

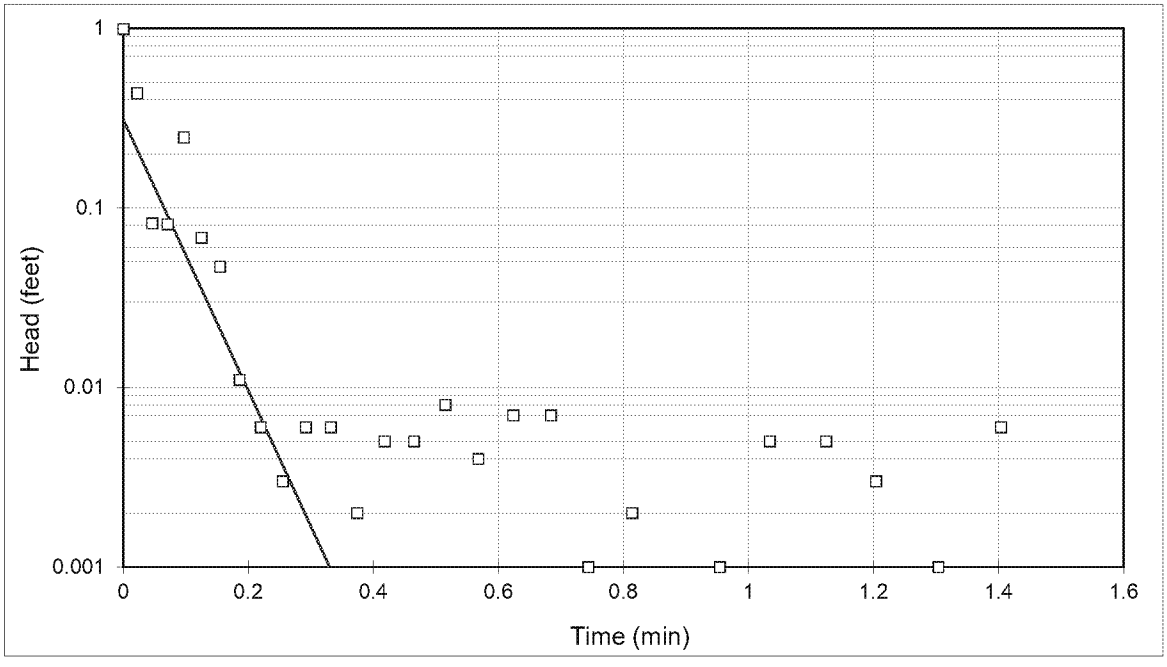
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-15B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	8.75E-03	cm/sec
$\ln(R_e/r_w)$=	2.85	K=	2.48E+01	ft/day
y_0 =	0.31			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-15B (TEST 1)

$$T = b + a \ln T$$

where:

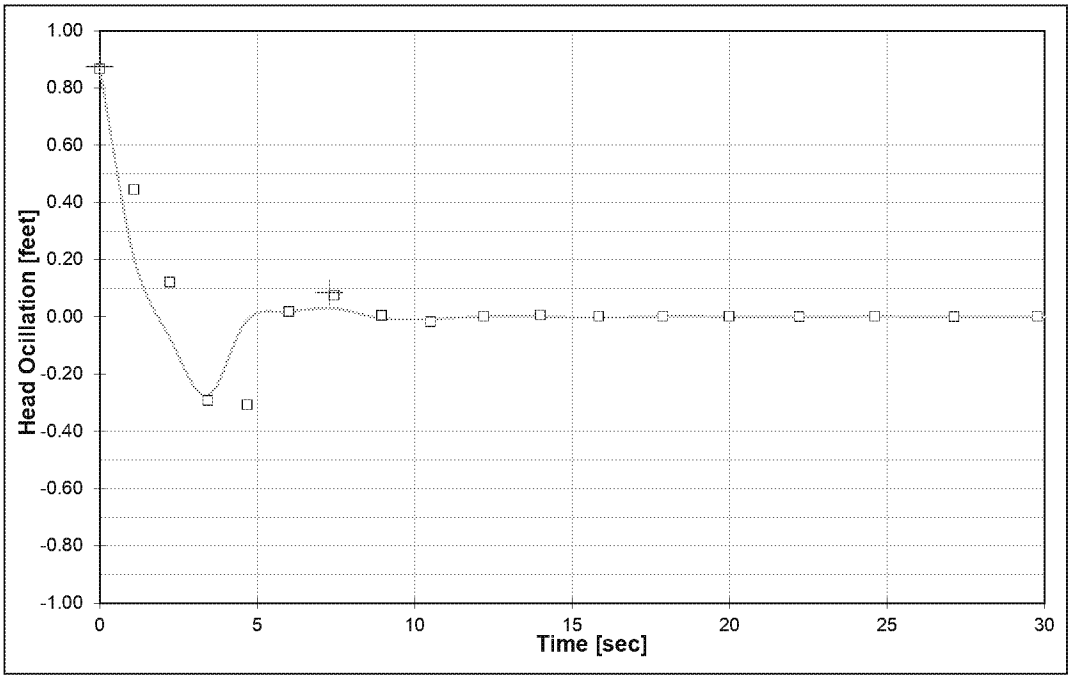
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	0.91806	ft^2
r_s =	0.08	ft	d =	0.3479	ft^{-1}
L_c =	19.23	ft	a =	0.00229	ft^3
L_s =	10.00	ft	t_1 =	0.00	sec
w =	0.8607	ft^{-1}	t_2 =	7.30	sec
g =	0.3194	ft^{-1}	$h(t_1)$ =	0.88	ft
L =	38.19	ft^3/sec^2	$h(t_2)$ =	0.09	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	2.27E-02	ft^2/sec	$a < 0.1$?	YES
T =	1.27E-02	ft^2/sec	$d < 0.7$?	YES
T =	1.09E+03	ft^2/day	L_1 =	38.19
K =	3.50E+01	ft/day	L_2 =	24.23
K =	1.24E-02	cm/sec	$L_1:L_2$ Diff <20% ?	NO



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/08/16

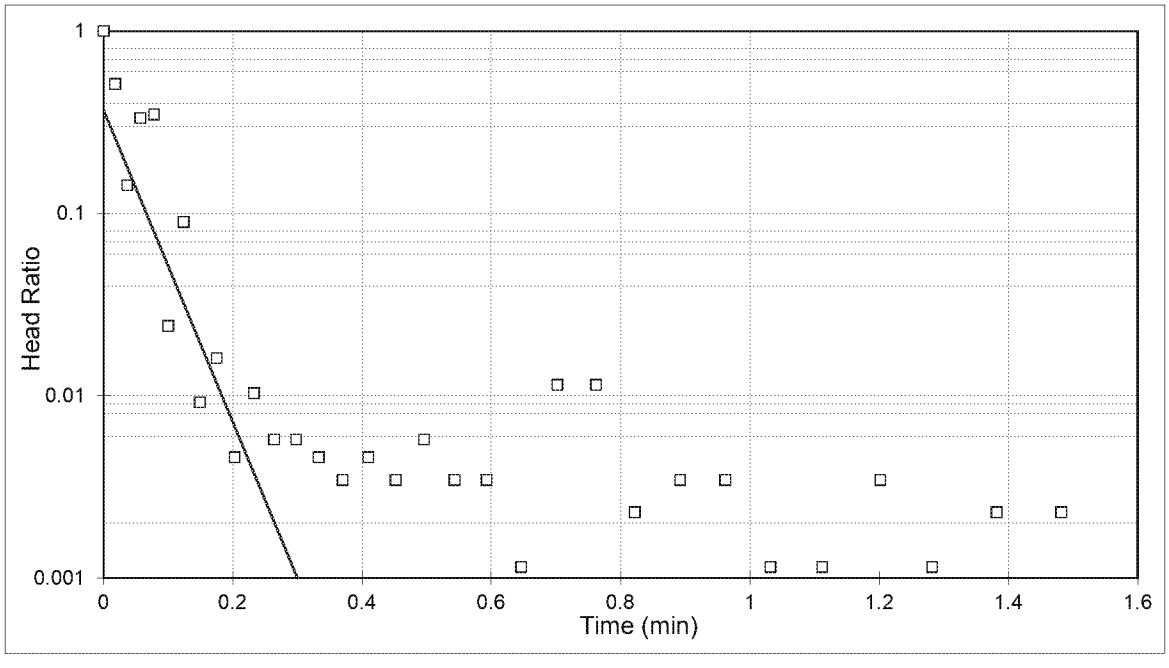
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
r_c = casing radius (feet)
R_e = equivalent radius (feet)
L_e = length of screened interval (feet)
t = time (minutes)
h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.17E-02	cm/sec
t_1 =	0	K=	3.32E+01	ft/day
t_2 =	0.3			
h_1/h_0 =	0.37			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

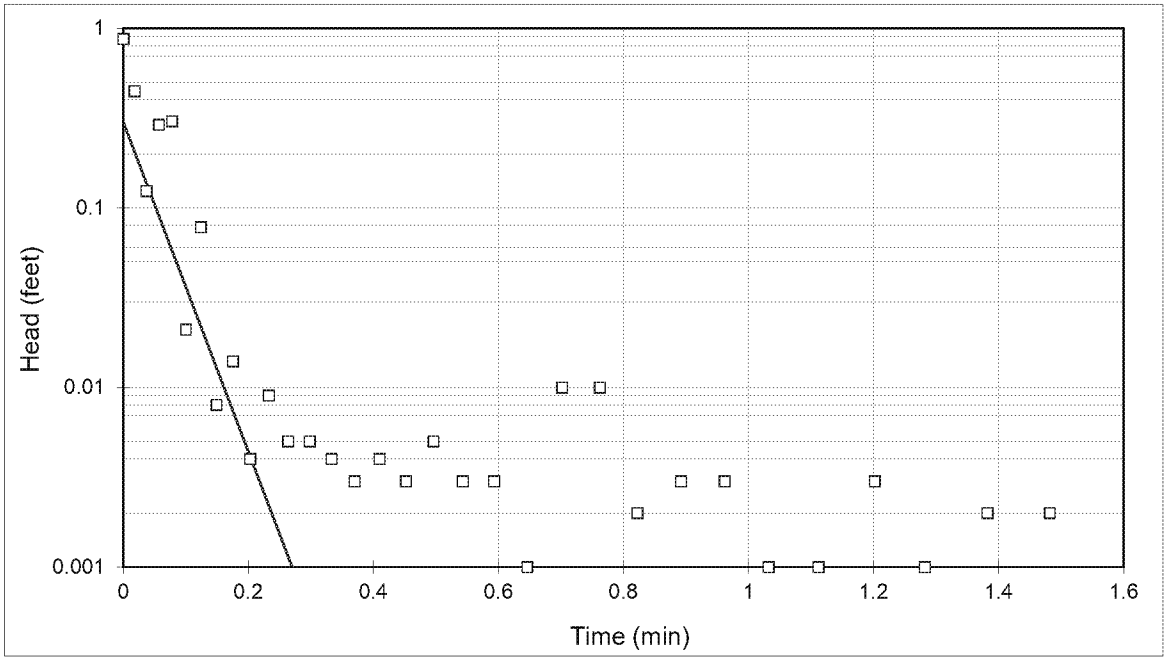
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.06E-02	cm/sec
$\ln(R_e/r_w)$=	2.85	K=	3.02E+01	ft/day
y_0 =	0.30			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-15B (TEST 2)

$$T = b + a \ln T$$

where:

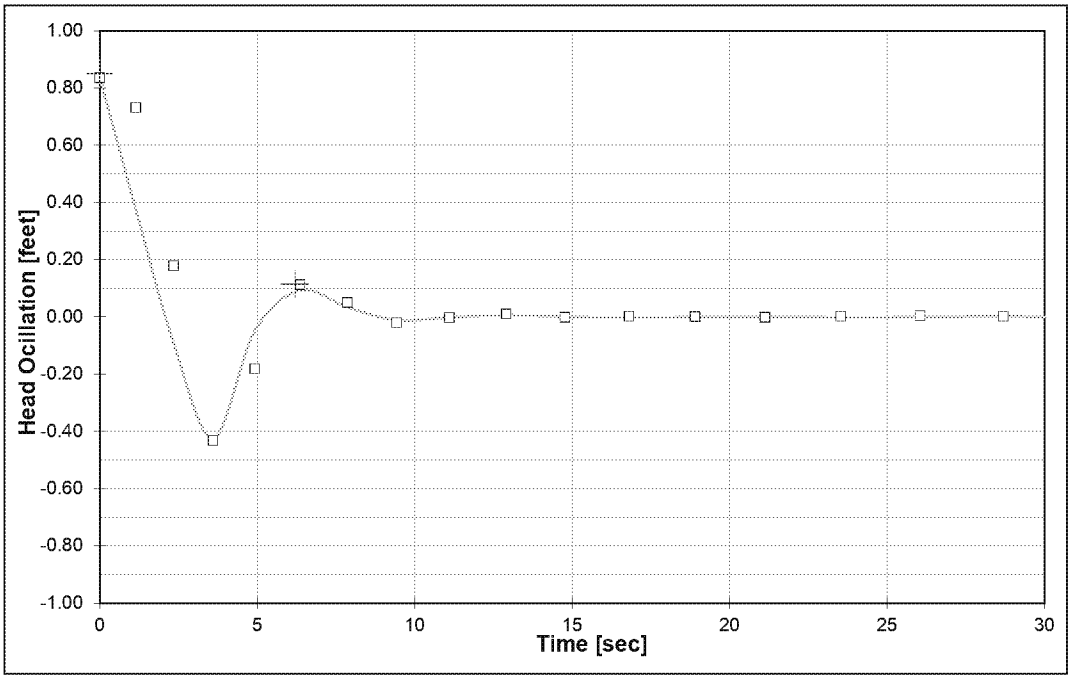
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.06353	ft^2
r_s =	0.08	ft	d =	0.3034	ft^{-1}
L_c =	19.22	ft	a =	0.00304	ft^3
L_s =	10.00	ft	t_1 =	0.00	sec
w =	1.0134	ft^{-1}	t_2 =	6.20	sec
g =	0.3226	ft^{-1}	$h(t_1)$ =	0.85	ft
L =	28.46	ft^3/sec^2	$h(t_2)$ =	0.12	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	2.97E-02	ft^2/sec	$a < 0.1$?	YES
T =	1.73E-02	ft^2/sec	$d < 0.7$?	YES
T =	1.50E+03	ft^2/day	L_1 =	28.46
K =	4.80E+01	ft/day	L_2 =	24.22
K =	1.69E-02	cm/sec	$L_1:L_2$ Diff <20% ?	YES



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/07/16

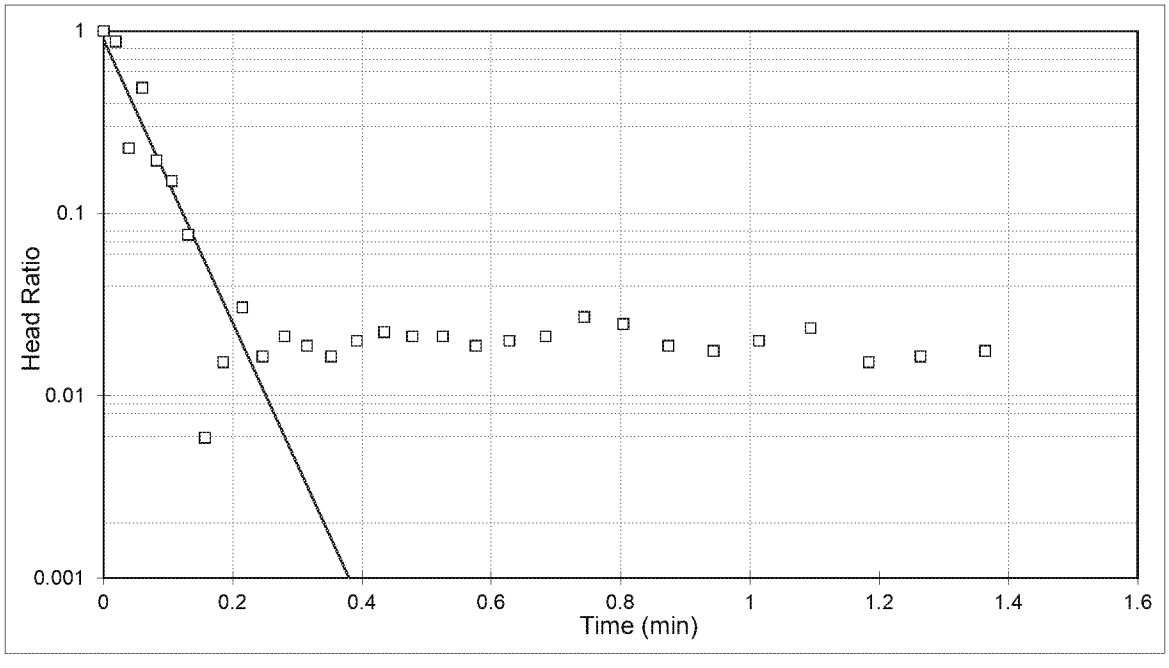
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.06E-02	cm/sec
t_1 =	0	K=	3.02E+01	ft/day
t_2 =	0.38			
h_1/h_0 =	0.90			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

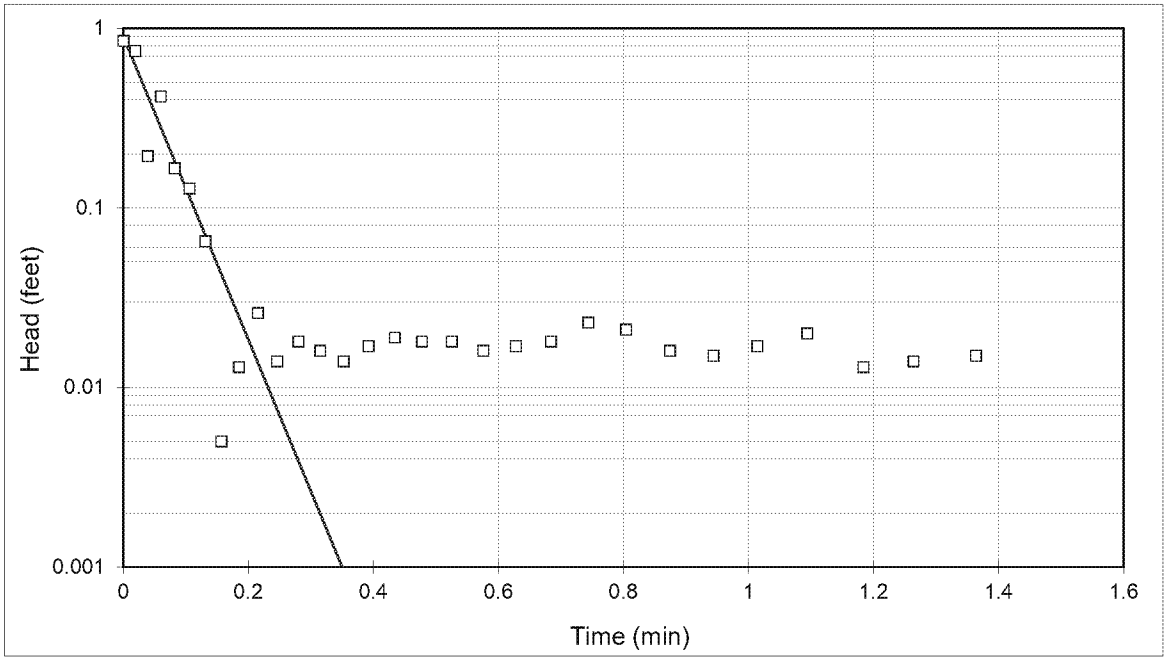
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-15B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	9.79E-03	cm/sec
$\ln(R_e/r_w)$=	2.85	K=	2.77E+01	ft/day
y_0 =	0.90			
y_t =	0.001			
t =	0.4			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/08/16

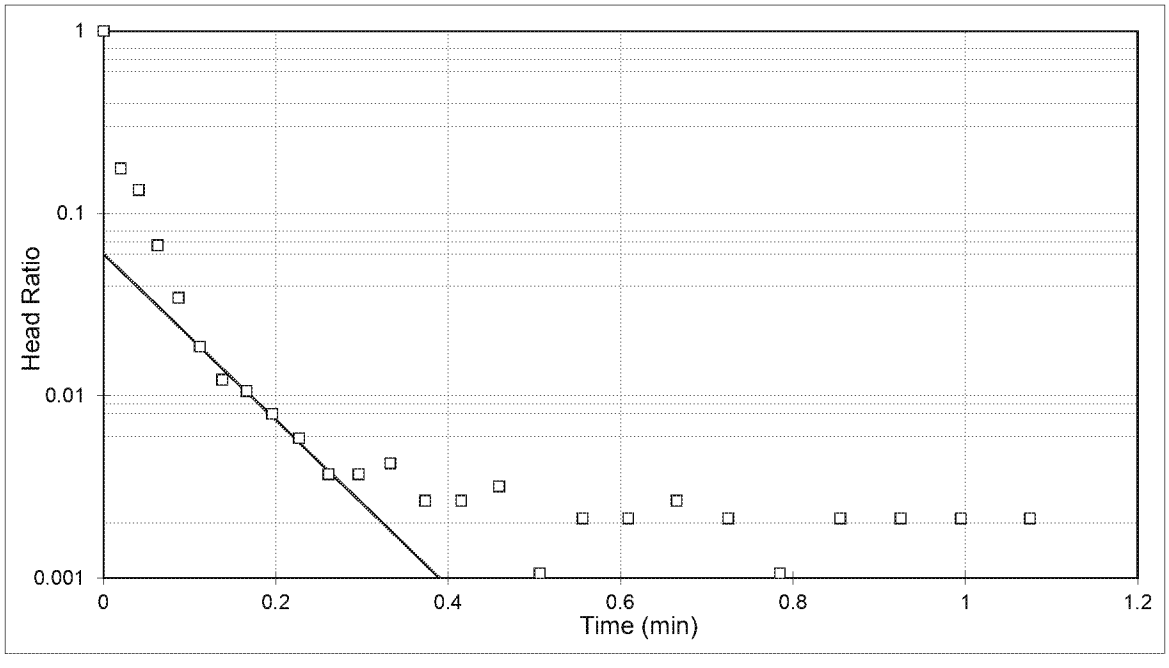
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19 (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
R_e =	0.34			
L_e =	9.705	K=	3.70E-02	cm/sec
t_1 =	0	K=	1.05E+02	ft/day
t_2 =	0.39			
h_1/h_0 =	0.06			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

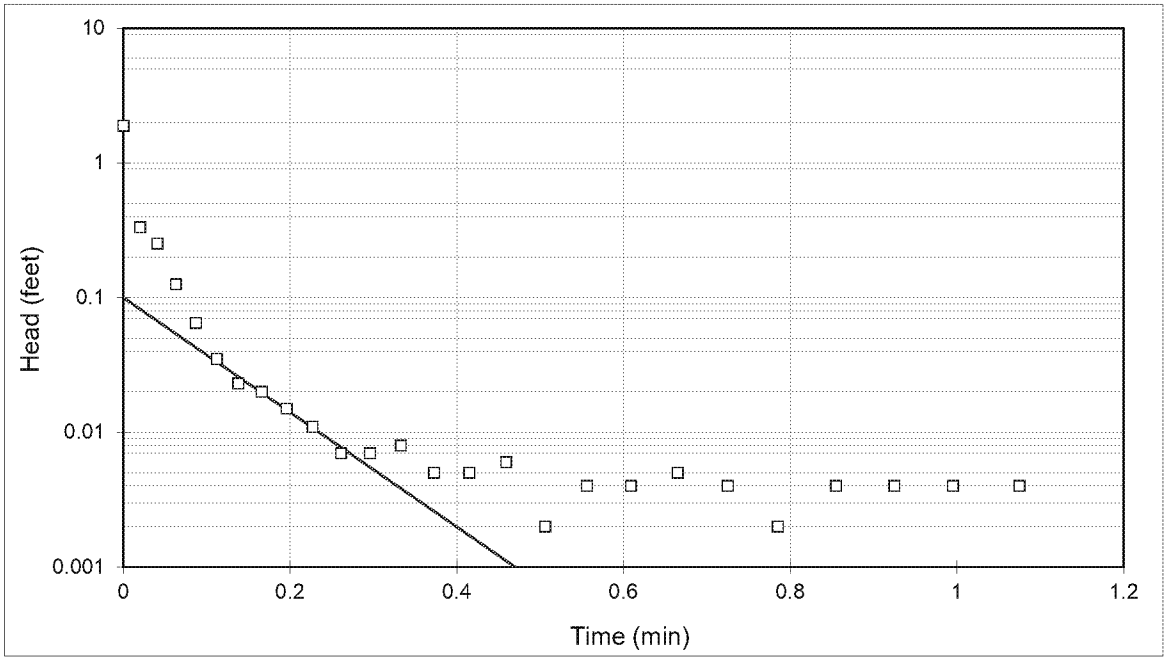
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19 (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
r_w =	0.34			
L_e =	9.705	K=	2.25E-02	cm/sec
$\ln(R_e/r_w)$=	2.18	K=	6.38E+01	ft/day
y_0 =	0.10			
y_t =	0.001			
t =	0.5			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

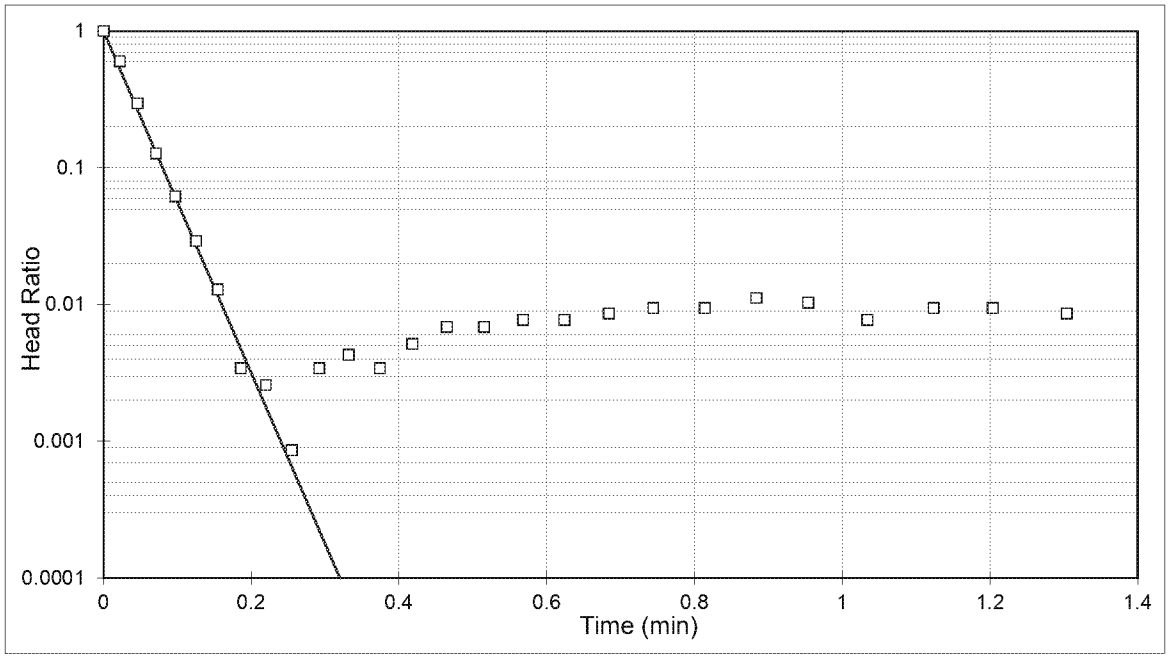
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19 (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
R_e =	0.34			
L_e =	9.735	K=	1.01E-01	cm/sec
t_1 =	0	K=	2.87E+02	ft/day
t_2 =	0.32			
h_1/h_0 =	1.00			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

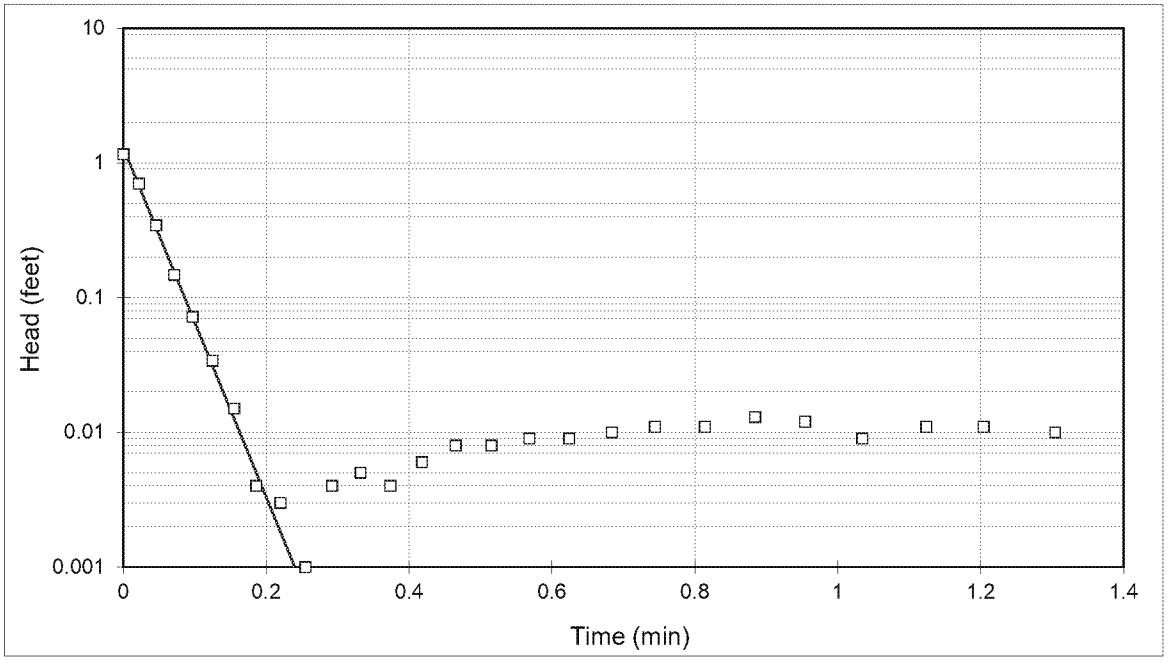
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19 (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.20			
r_w =	0.34			
L_e =	9.735	K=	6.85E-02	cm/sec
$\ln(R_e/r_w)$=	2.18	K=	1.94E+02	ft/day
y_0 =	1.30			
y_t =	0.001			
t =	0.2			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

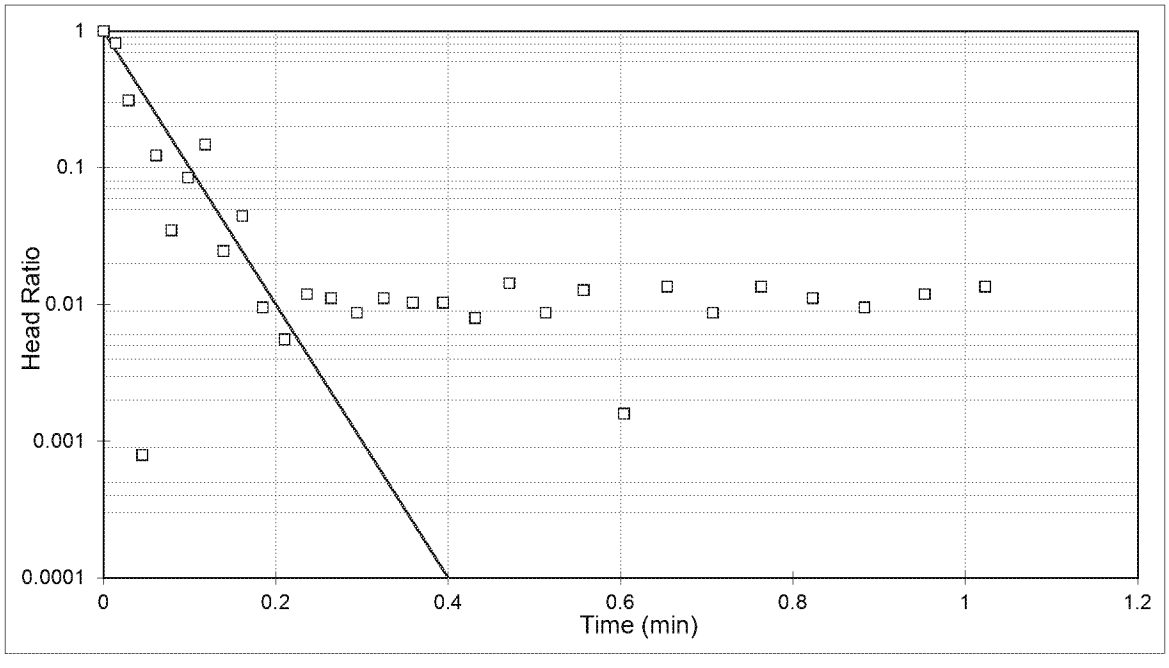
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-19B (TEST 1)

$$K = \frac{r_c^{\,2}}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.37E-02	cm/sec
t_1 =	0	K=	3.88E+01	ft/day
t_2 =	0.4			
h_1/h_0 =	1.00			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

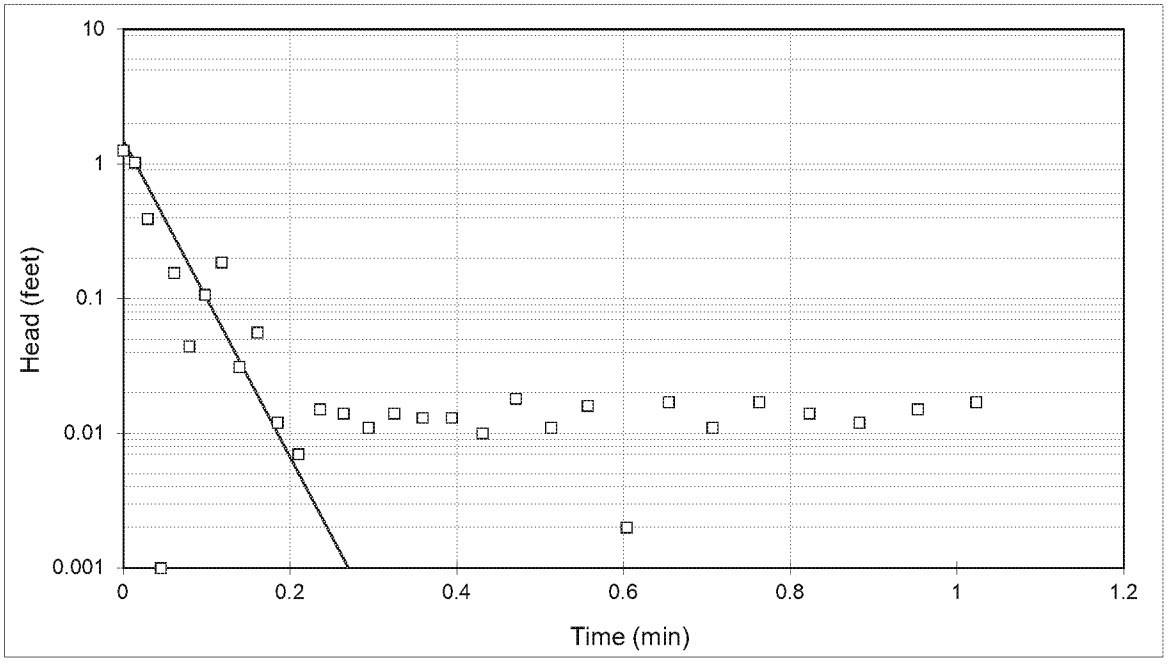
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-19B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.44E-02	cm/sec
$\ln(R_e/r_w)$=	3.02	K=	4.09E+01	ft/day
y_0 =	1.50			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

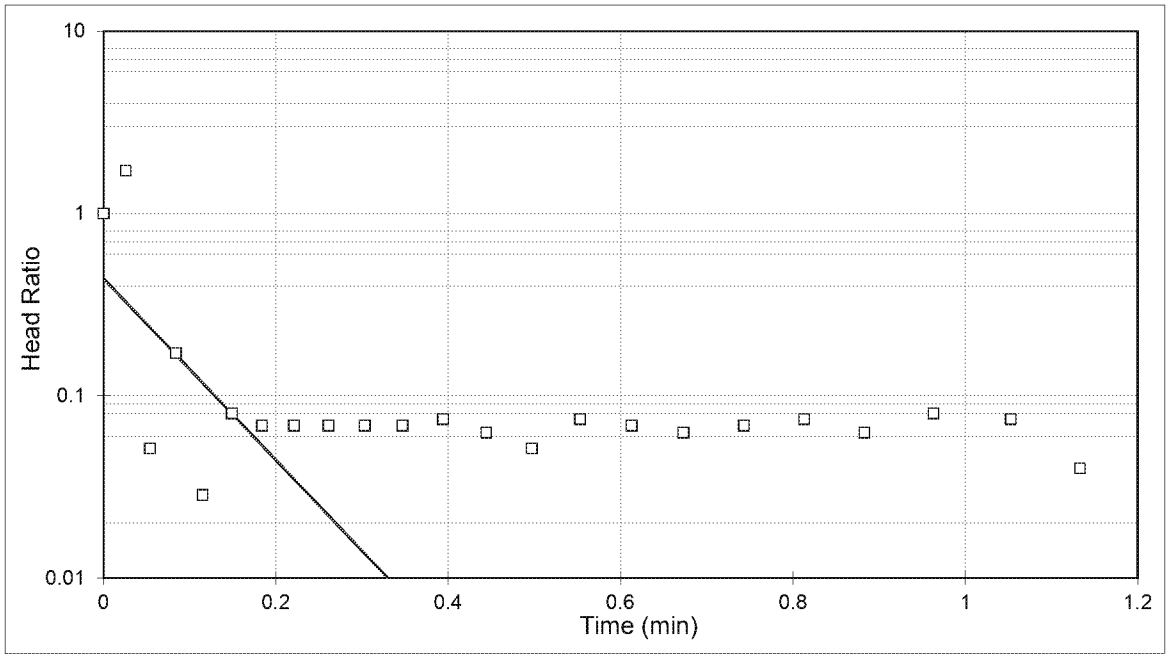
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

HVORSLEV SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-19B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
r_c = casing radius (feet)
R_e = equivalent radius (feet)
L_e = length of screened interval (feet)
t = time (minutes)
h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	6.82E-03	cm/sec
t_1 =	0	K=	1.93E+01	ft/day
t_2 =	0.33			
h_1/h_0 =	0.44			
h_2/h_0 =	0.01			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

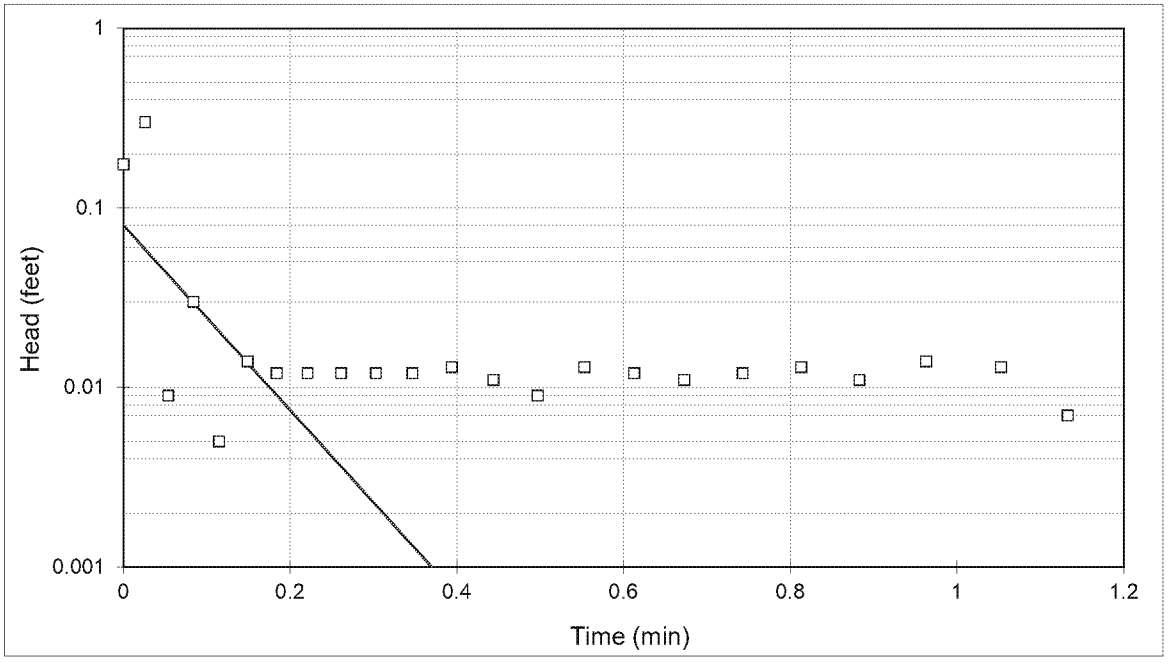
BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST GAMW-19B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	6.31E-03	cm/sec
$\ln(R_e/r_w)$=	3.02	K=	1.79E+01	ft/day
y_0 =	0.08			
y_t =	0.001			
t =	0.4			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-19B (TEST 1)

$$T = b + a \ln T$$

where:

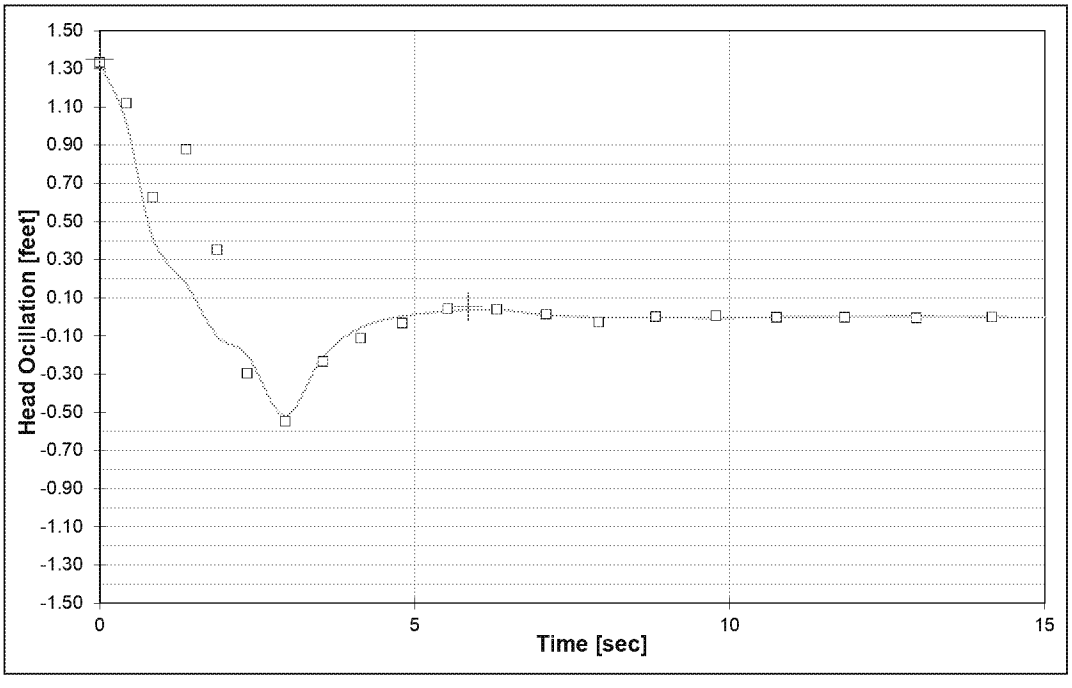
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.20536	ft^2
r_s =	0.08	ft	d =	0.4539	ft^{-1}
L_c =	17.92	ft	a =	0.00231	ft^3
L_s =	10.00	ft	t_1 =	0.00	sec
w =	1.0740	ft^{-1}	t_2 =	5.85	sec
g =	0.5471	ft^{-1}	$h(t_1)$ =	1.35	ft
L =	22.16	ft^3/sec^2	$h(t_2)$ =	0.06	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	2.22E-02	ft^2/sec	$a < 0.1$?	YES
T =	1.20E-02	ft^2/sec	$d < 0.7$?	YES
T =	1.04E+03	ft^2/day	L_1 =	22.16
K =	3.67E+01	ft/day	L_2 =	22.92
K =	1.29E-02	cm/sec	$L_1:L_2$ Diff <20% ?	YES



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/07/16

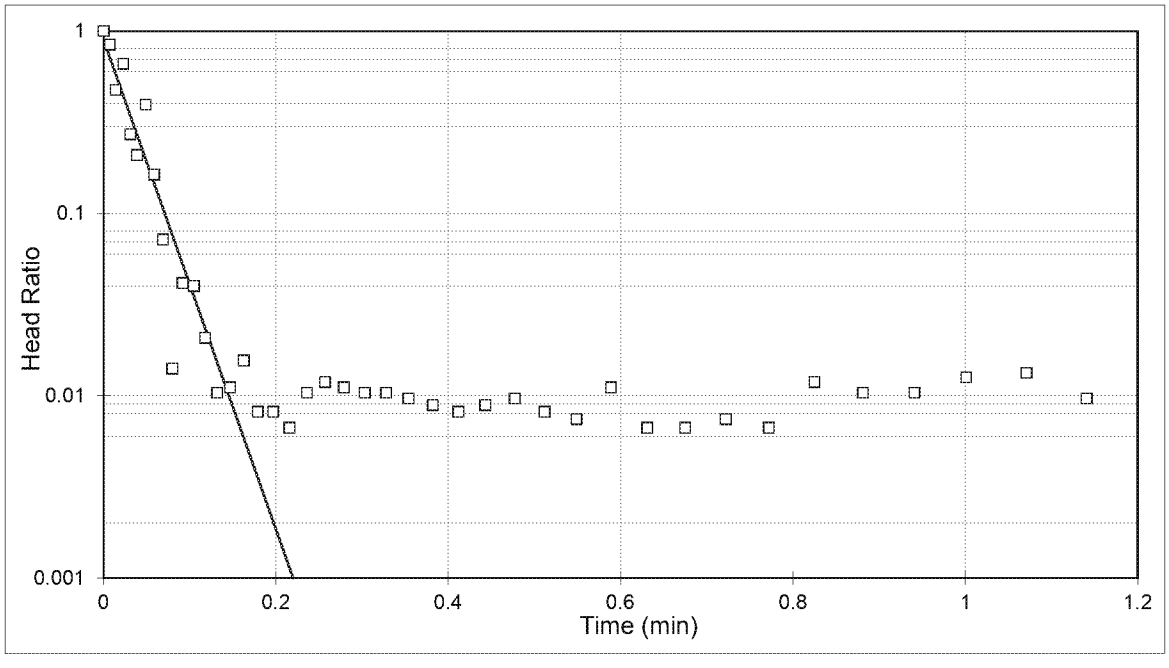
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19B (TEST 1)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.84E-02	cm/sec
t_1 =	0	K=	5.21E+01	ft/day
t_2 =	0.22			
h_1/h_0 =	0.90			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

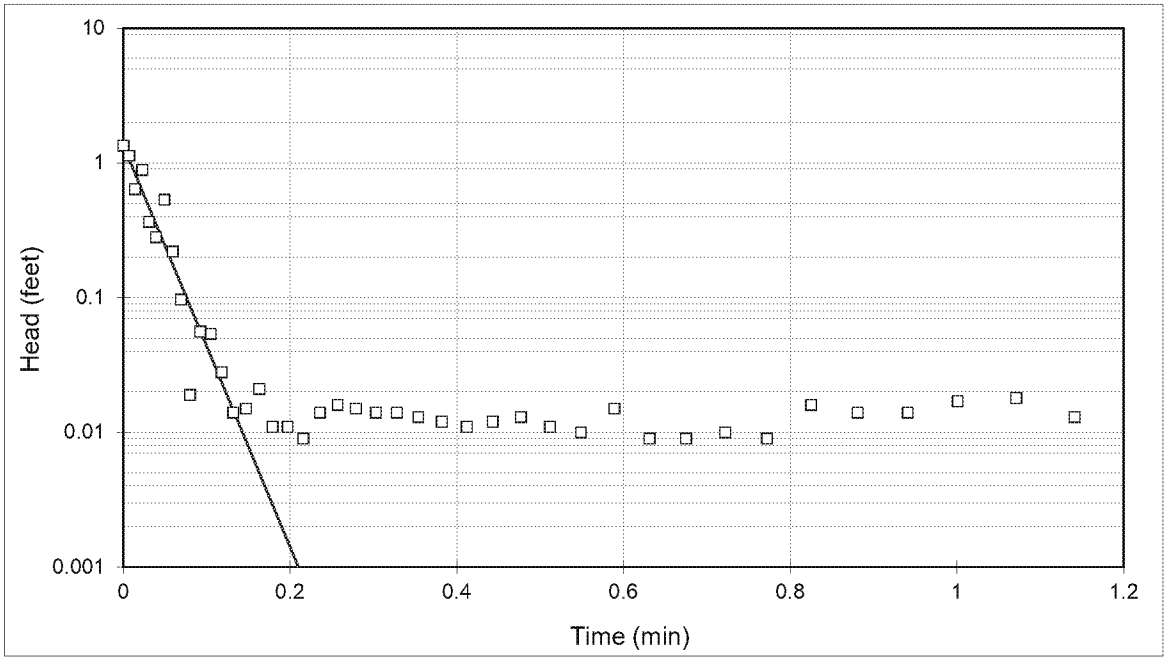
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19B (TEST 1)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.83E-02	cm/sec
$\ln(R_e/r_w)$=	3.02	K=	5.18E+01	ft/day
y_0 =	1.35			
y_t =	0.001			
t =	0.2			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

van der KAMP RISING HEAD SLUG TEST ANALYSIS
UNDERDAMPED SLUG TEST GAMW-19B (TEST 2)

$$T = b + a \ln T$$

where:

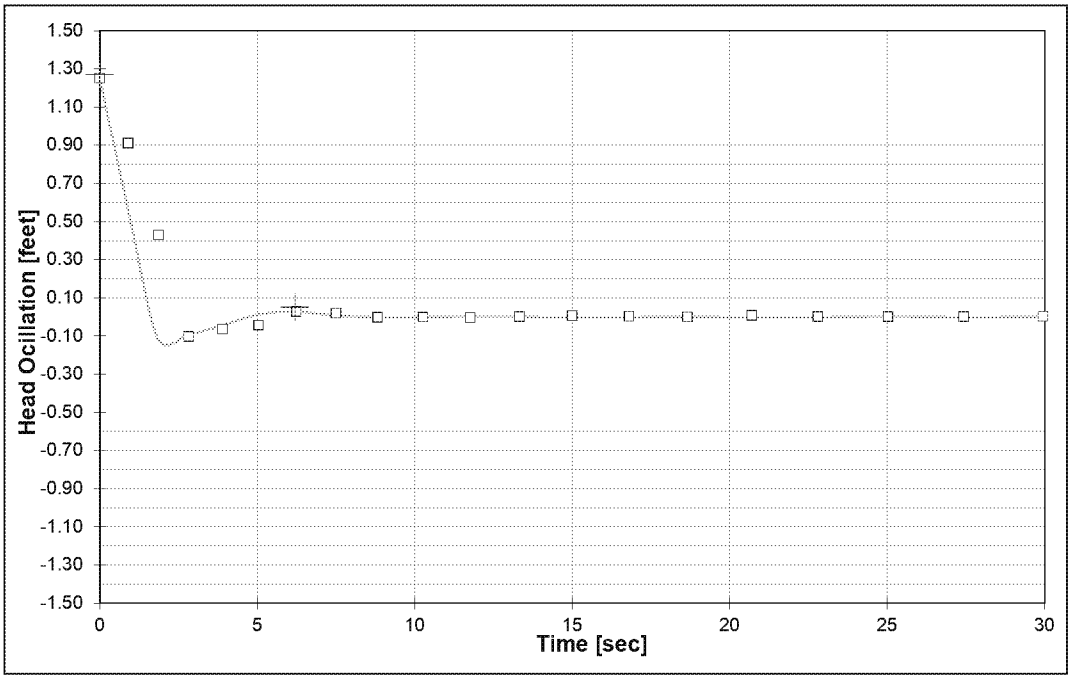
$$b = -a \ln\left[0.79 r_s^2 S (g/L)^{1/2}\right]$$
$$a = r_c^2 \left(g / L^{1/2}\right) / 8d$$
$$d = \gamma / (g/L)^{1/2}$$
$$L = g / \left(\omega^2 + \gamma^2\right)$$

INPUT PARAMETERS

r_c =	0.08	ft	$(g/L)^{1/2}$ =	1.13983	ft^2
r_s =	0.08	ft	d =	0.4577	ft^{-1}
L_c =	17.95	ft	a =	0.00216	ft^3
L_s =	10.00	ft	t_1 =	0.00	sec
w =	1.0134	ft^{-1}	t_2 =	6.20	sec
g =	0.5217	ft^{-1}	$h(t_1)$ =	1.27	ft
L =	24.78	ft^3/sec^2	$h(t_2)$ =	0.05	ft
g =	32.19	ft/sec^2	S =	1.00E-02	dim

RESULTS

$b = T_0$ =	2.09E-02	ft^2/sec	$a < 0.1$?	YES
T =	1.12E-02	ft^2/sec	$d < 0.7$?	YES
T =	9.69E+02	ft^2/day	L_1 =	24.78
K =	3.43E+01	ft/day	L_2 =	22.95
K =	1.21E-02	cm/sec	$L_1:L_2$ Diff <20% ?	YES



Project Name: NIPSCO RMSGS
Project No.: 164-8171
Test Date: 07/07/16

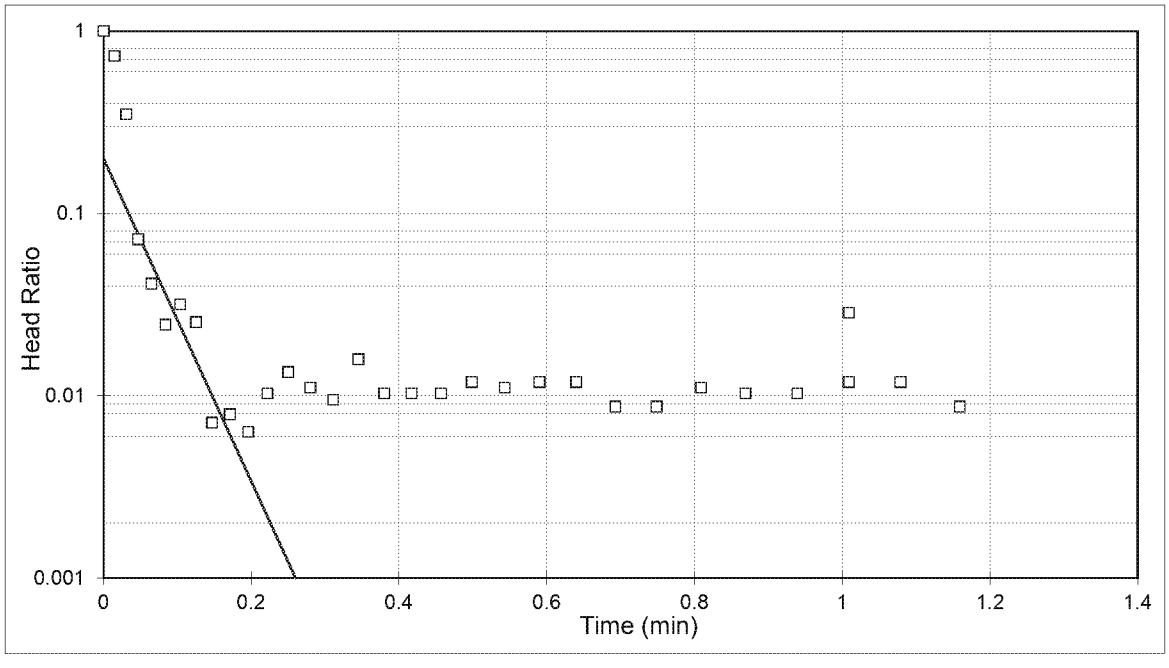
Analysis By: DFS
Checked By: JRS
Analysis Date: 7/31/2017

HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19B (TEST 2)

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
- r_c = casing radius (feet)
- R_e = equivalent radius (feet)
- L_e = length of screened interval (feet)
- t = time (minutes)
- h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.34			
L_e =	10	K=	1.21E-02	cm/sec
t_1 =	0	K=	3.43E+01	ft/day
t_2 =	0.26			
h_1/h_0 =	0.20			
h_2/h_0 =	0.00			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

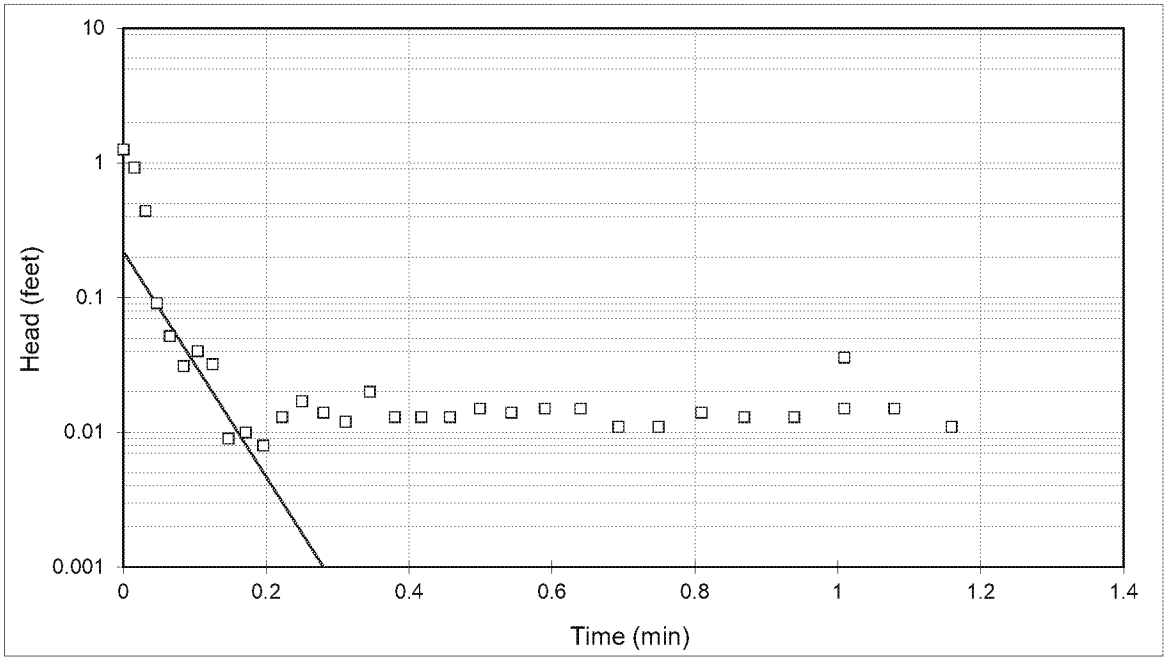
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST GAMW-19B (TEST 2)

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.34			
L_e =	10	K=	1.03E-02	cm/sec
$\ln(R_e/r_w)$=	3.02	K=	2.91E+01	ft/day
y_0 =	0.22			
y_t =	0.001			
t =	0.3			



Project Name: NIPSCO Schahfer
Project No.: 164-8171
Test Date: 07/07/16

Analysis By: DFS
Checked By: JRS
Analysis Date: 7/27/2016

APPENDIX G

2019 Annual Groundwater Monitoring and Corrective Action Report- Waste Disposal Area- January 2020

GOLDER

2019 Annual Groundwater Monitoring and Corrective Action Report - Waste Disposal Area

NIPSCO LLC R. M. Schahfer Generating Station

Prepared Pursuant to 40 CFR §257.90(e) and Corresponding Regulations under 329 Indiana Administrative Code 10-9-1

Submitted to:

Northern Indiana Public Service Company LLC
R.M. Schahfer Generating Station
Wheatfield, Indiana

Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101
+1 603 668-0880

191-21567

January 2020

Table of Contents

1.0 INTRODUCTION **1**

2.0 GROUNDWATER MONITORING AND CORRECTIVE MEASURES PROGRAM STATUS **1**

2.1 Key Actions Completed - 2019 1

2.2 Monitoring System Modifications 2

2.3 Background Monitoring (2016 to 2017) 3

2.4 Detection Monitoring 3

2.5 Assessment Monitoring 3

2.6 Statistical Evaluation 4

2.7 Problems Encountered and Follow-Up Corrective Actions 5

3.0 KEY ACTIVITIES PROJECTED FOR 2020 ..... **5**

4.0 REFERENCES **5**

TABLES

Table 1 Monitoring Well Network
Table 2 Summary of Sampling Events
Table 3 Analytical Data
Table 4 Groundwater Protection Standards

FIGURES

Figure 1 Site Location Map
Figure 2 Well Location Map Waste Disposal Area

APPENDICES

APPENDIX A
Waste Disposal Area Alternative Source Demonstration May 2019

APPENDIX B
Waste Disposal Area Alternative Source Demonstration November 2019

1.0 INTRODUCTION

On behalf of Northern Indiana Public Service Company LLC (NIPSCO LLC), Golder Associates Inc. (Golder) prepared this 2019 Annual Groundwater Monitoring and Corrective Action Report (2019 Annual Report) for the Rollin M. Schahfer Generating Station (RMSGS, Schahfer) Waste Disposal Area (WDA, the CCR Unit) located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (Latitude 41° 12' 36" and Longitude 87° 01' 48", see Figure 1). As shown in Figure 2, the WDA is an approximately 80-acre impoundment located in the southwest portion of the RMSGS facility. Golder prepared the 2019 Annual Report in accordance with 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule" (CCR Rule), as amended, and corresponding regulations under 329 Indiana Administrative Code (IAC) 10-9-1.

Routine monitoring activities performed during the reporting period include inspection of wells for integrity and security, measurement of groundwater levels prior to sample collection in order to assess groundwater flow direction, and collection of samples for laboratory analysis.

In conformance with the applicable requirements of 40 CFR §257.90(e)(1) through (5) and corresponding State of Indiana requirements, the 2019 Annual Report:

- Documents the status of the groundwater monitoring and corrective action program
- Provides figures showing the CCR Unit and monitoring well locations
- Summarizes key CCR Rule groundwater activities completed during calendar year 2019
- Includes CCR Rule groundwater monitoring data obtained in calendar year 2019
- Describes any problems encountered during the monitoring activities
- Discusses actions taken to resolve the problems, if applicable
- Projects key activities for the upcoming year

2.0 GROUNDWATER MONITORING AND CORRECTIVE MEASURES PROGRAM STATUS

Starting in 2016 following the installation of a groundwater monitoring system and throughout calendar year 2017, Golder collected background groundwater samples and performed Detection Monitoring around the CCR Unit pursuant to the requirements of 40 CFR §257.94. In 2018, Golder performed the first and second Assessment Monitoring sampling events pursuant to the requirements of 40 CFR §257.95. Following the first Assessment Monitoring sampling event, including verification sampling, Golder prepared an alternative source demonstration (ASD) indicating that the detections of Appendix IV parameters downgradient of the WDA are not due to a release from the WDA. In 2019, Golder completed the third and fourth Assessment Monitoring sampling events and completed ASDs following each sampling event. Based upon groundwater monitoring results collected pursuant to the CCR Rule to date, corrective measures program requirements have neither been triggered nor implemented at this CCR Unit.

2.1 Key Actions Completed - 2019

NIPSCO LLC completed the following key actions relative to CCR Rule groundwater monitoring at the WDA during calendar year 2019:

- Preparation of the of 2018 Groundwater Monitoring and Corrective Action Annual Report in January 2019 (2018 Annual Report, 40 CFR §257.90(e))
- Evaluation of the results of the second Assessment Monitoring event in February 2019 (40 CFR §257.95)
- Notification that constituents in 40 CFR Part 257 Appendix IV exceeded the groundwater protection standard (GWPS) in March 2019 (40 CFR §257.95(g))
- Performance of the third Assessment Monitoring event in April 2019 (40 CFR §257.95)
- Preparation of the second ASD in May 2019 (40 CFR §257.95(g))
- Evaluation of the results of the third Assessment Monitoring event in August 2019 (40 CFR §257.95)
- Notification that constituents in 40 CFR Part 257 Appendix IV exceeded the GWPS in September 2018 (40 CFR §257.95(g))
- Recertification of the second ASD in November 2019 (40 CFR §257.95(g))
- Performance of the fourth Assessment Monitoring event in November 2019 (40 CFR §257.95)

2.2 Monitoring System Modifications

Consistent with the requirements of 40 CFR §257.90 and 257.91, NIPSCO LLC modified the groundwater monitoring well network to include new deep well GAMW-42C and four assessment monitoring well pairs (GAMW-57/57B, GAMW-58/58B, GAMW-59/59B, and GAMW-60/60B) in June 2019 at the locations shown in Figure 2. Golder installed GAMW-42C to monitor groundwater in bedrock immediately underlying the primary focus of groundwater monitoring, the unconsolidated material, adjacent to existing well pair (GAMW-42/42B) near the property boundary. Two of the new well pairs (GAMW59/59B and GAMW60/60B) were installed downgradient of existing well pair GAMW-51/51B and the additional two new well pairs (GAMW57/57B and GAMW58/58B) were installed on the northern side of the existing property boundary wells. The four new well pairs were located to provide additional data on groundwater quality and flow direction, supplementing prior Assessment Monitoring (see Figure 2). An overview of the modified groundwater monitoring network is provided in the embedded table below.

Background Monitoring Wells	Downgradient Monitoring Wells	Assessment Monitoring Wells
GAMW-03 and GAMW-03B	GAMW-01, GAMW-01B, GAMW-12, GAMW-12B, GAMW-13, GAMW-13B, GAMW-14, and GAMW-14B	GAMW42, GAMW42B, GAMW42C*, GAMW43, GAMW43B, GAMW44, GAMW44B, GAMW51, GAMW51B, GAMW57*, GAMW57B*, GAMW58*, GAMW58B*, GAMW59*, GAMW59B*, GAMW60*, and GAMW60B*

*Monitoring well installed in 2019

Attached Table 1 provides a summary of the well rationale/purpose and date of installation. Golder installed, developed, and surveyed the wells in accordance with the CCR Groundwater Monitoring Program Implementation Manual prepared by Golder in October 2017.

2.3 Background Monitoring (2016 to 2017)

Per the requirements of 40 CFR §257.94, Golder collected eight independent background groundwater samples from each background and downgradient well between July 2016 and August 2017. Golder used the results of the background monitoring phase to develop appropriate, statistically valid background values for each constituent/monitoring well. Golder submitted the samples to a contract laboratory, in accordance with chain of custody and quality assurance/quality control procedures, for analysis of 40 CFR Part 257 Appendix III and Appendix IV constituents. In addition, Golder personnel measured field water quality parameters including specific conductance, temperature, dissolved oxygen, turbidity, oxidation-reduction potential, and pH. The background data set was included in the 2017 CCR Annual Groundwater Monitoring and Corrective Action Report, dated January 31, 2018 (2017 Annual Report).

2.4 Detection Monitoring

Golder performed the first Detection Monitoring event in October 2017, followed by a statistical evaluation and data analysis in January 2018. Golder collected groundwater samples from the CCR Unit background and downgradient monitoring wells for analysis of Appendix III constituents per 40 CFR §257.94 and included the results in the 2017 Annual Report. Following receipt and validation of laboratory results, Golder evaluated the results of the first Detection Monitoring sampling event to compare the concentration of 40 CFR Part 257 Appendix III constituents relative to facility background concentrations. Using Sanitas™ software, Golder pooled the background data to calculate prediction limits and compared the October 2017 results to the calculated prediction limits to identify statistically significant increases (SSIs). Due to the identification of SSIs, NIPSCO LLC established an Assessment Monitoring program in April 2018.

2.5 Assessment Monitoring

Golder performed the first Assessment Monitoring event (i.e. Assessment and Verification sampling) in March and April 2018, followed by a statistical evaluation and data analysis in August 2018. Golder collected groundwater samples from each background and downgradient monitoring well for analysis of Appendix IV constituents per 40 CFR §257.95 in March 2018. In April 2018, groundwater samples were collected at the downgradient monitoring well locations and analyzed for Appendix III and detected Appendix IV constituents per 40 CFR §257.95. In August 2018, Golder developed GWPS to use as a comparison against the Assessment Monitoring results. Following receipt and validation of laboratory results, Golder evaluated the 40 CFR Part 257 Appendix IV constituent results relative to CCR Unit-specific GWPS (Table 4). At the time of the statistical evaluation the GWPS was the higher value of either the Maximum Contaminant Level (MCL) or the CCR Unit-specific background concentration for each analyte calculated using a tolerance/prediction limit procedure in accordance with 40 CFR §257.95(h)(2). Results from the downgradient monitoring wells were evaluated by comparing the lower confidence limit (LCL) to the CCR Unit-specific GWPS for each Appendix IV analyte at each well. If the LCL exceeds the GWPS, there is statistical evidence of a statistically significant level (SSL). Golder determined that SSLs existed for the WDA but identified an alternative natural source for the elevated levels of molybdenum detected in downgradient monitoring wells and prepared an ASD. A qualified Indiana-licensed professional engineer certified the ASD in November 2018 (Appendix A of the 2018 Annual Report).

Golder performed the second Assessment Monitoring event in October 2018 by collecting groundwater samples from each background and downgradient monitoring well for analysis of Appendix III and Appendix IV constituents per 40 CFR §257.95. Golder performed the statistical evaluation of the analytical results of the second Assessment Monitoring sampling event in February 2019. Golder identified SSLs for arsenic (GAMW-01) and

cobalt (GAMW-14). In May 2019, Golder prepared and a qualified Indiana-licensed professional engineer certified an ASD demonstrating that the arsenic and cobalt levels observed in the downgradient monitoring wells were due to natural variation and not to a release from the WDA (see Appendix A).

Golder performed the third Assessment Monitoring event in April 2019 by collecting groundwater samples from each background and downgradient monitoring well for analysis of Appendix III and Appendix IV constituents per 40 CFR §257.95. Golder performed the statistical evaluation of the analytical results of the third Assessment Monitoring sampling event in August 2019. The results were consistent with the previous Assessment Monitoring event, therefore a qualified Indiana-licensed professional engineer recertified the ASD in November 2019 (see Appendix B).

Golder performed the fourth Assessment Monitoring event in November 2019 by collecting groundwater samples from each background and downgradient monitoring well for analysis of Appendix III and detected Appendix IV constituents per 40 CFR §257.95. Golder will perform the statistical evaluation of the analytical results of the fourth Assessment Monitoring sampling event in February 2020.

Assessment monitoring wells GAMW-42/42B, GAMW-43/43B, and GAMW-44/44B installed near the property boundary (see Figure 2), were sampled in March, April, June, July, August, October, and November 2019. Assessment monitoring wells GAMW-42C, GAMW-57/57B, and GAMW-58/58B installed near the property boundary in June 2019 (see Figure 2), were sampled in July, August, October, and November 2019. No SSLs were identified in these wells.

The sampling dates, number of groundwater samples collected from each background and downgradient well, and the purpose of sampling are provided in Table 2. The analytical results are presented in Table 3.

2.6 Statistical Evaluation

Subsequent to each monitoring event, Golder assessed the analytical data for outliers, anomalies, and trends that might be an indication of a sampling or analytical error. Outliers and anomalies are generally defined as inconsistently large or small values that can occur as a result of sampling, laboratory, transportation, or transcription errors, or even by chance alone. Significant trends may indicate natural geochemical variability, a source of systematic error, influence of an upgradient/off-site source, or an actual occurrence of CCR Unit influence upon groundwater quality. Appropriate statistical methods are used to remove outliers from the database and manage trends with detrending routines, prior to the calculation of statistical limits. To assess the data for outliers, anomalies, and trends, Golder assessed the data using time vs. concentration graphs, and statistical routines included in the Sanitas™ statistical analysis software package. Golder has not identified any additional outliers since the 2018 Annual Report.

Golder evaluated the background data set for trends using Sanitas™ software. Golder will continue to monitor all trends and apply detrending routines, if applicable, before using these data to calculate GWPSs. Golder identified the following 40 CFR Part 257 Appendix IV parameter trends in background monitoring wells:

- Arsenic concentrations detected in groundwater samples collected from GAMW-03B show a deceasing trend, however, all results are below the MCL, therefore the GWPS is equal to the MCL. No detrending routines are required.
- Beryllium concentrations detected in groundwater samples collected from GAMW-03 and GAMW-03B show a decreasing trend, however, beryllium has never been detected above the laboratory reporting limit in these wells. No detrending routines are required.

- Lithium concentrations detected in groundwater samples collected from GAMW-03B show a decreasing trend, however, lithium has never been detected above the laboratory reporting limit in this well. No detrending routines are required.
- Molybdenum concentrations detected in groundwater samples collected from GAMW-03B show an increasing trend, however, all results are below the MCL, therefore the GWPS is equal to the MCL. No detrending routines are required.

2.7 Problems Encountered and Follow-Up Corrective Actions

During the third Assessment Monitoring event (April 2019), groundwater samples were collected from monitoring wells GAMW-12 and GAMW-42 at turbidity levels greater than 5 nephelometric turbidity units (NTUs). In the fourth Assessment Monitoring event (October 2019), groundwater was sampled from GAMW-42C at a turbidity level of approximately 10 NTUs. According to the CCR Groundwater Monitoring Program Implementation Manual (Golder 2017), groundwater samples are to be collected once a well has achieved a turbidity level below 5 NTUs. Due to time constraints in the field, wells were purged for a minimum of two hours and sampled when turbidity appeared to stabilize (e.g., no downward or upward trend over three consecutive readings five minutes apart). Evaluation of the analytical results from these wells suggests that the slightly elevated turbidity levels had no significant effect on the representativeness of the samples of groundwater quality. Moving forward, wells will be purged for two hours or five well volumes, whichever is shorter. Professional judgement will then be used to determine when the purge water is representative of groundwater for sampling. In the event that an acceptable turbidity level cannot be achieved within a reasonable timeframe (e.g. three hours), Golder will redevelop the affected monitoring wells prior to the next sampling event.

3.0 KEY ACTIVITIES PROJECTED FOR 2020

During calendar year 2020, NIPSCO LLC anticipates conducting the following key CCR Rule groundwater monitoring activities for the WDA:

- Prepare and submit the appropriate notifications according to the CCR Rule;
- Continue semi-annual Assessment Monitoring groundwater sampling per CCR Rule requirements; and,
- Inspect and maintain monitoring system including wells, pumps, and equipment.

4.0 REFERENCES

Golder Associates, “2017 Annual Groundwater Monitoring and Corrective Action Report- Waste Disposal NIPSCO R. M. Schafer Generating Station”, January 31, 2017.

Golder Associates, “2018 Annual Groundwater Monitoring and Corrective Action Report- Waste Disposal NIPSCO R. M. Schafer Generating Station”, January 31, 2018.

Golder Associates, “Waste Disposal Area Alternative Source Demonstration,” November 19, 2018.

Golder and the G logo are trademarks of Golder Associates Corporation

Tables

Table 1: Monitoring Well Network
CCR Unit Schahfer Waste Disposal Area
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

CCR Unit	Well Purpose	Monitoring Well ID	Installation Date	Decommission Date (If Applicable)	Basis For Action
Waste Disposal Area	Background Monitoring Well	GAMW-03	6/27/2015	-	Installed for groundwater quality monitoring[1]
		GAMW-03B	5/24/2016	-	
	Downgradient Monitoring Well	GAMW-01	6/26/2015	-	Installed for groundwater quality monitoring[1]
		GAMW-12	5/23/2016	-	
		GAMW-13	5/24/2016	-	
		GAMW-13B	5/23/2016	-	
		GAMW-14	5/23/2016	-	
		GAMW-14B	5/23/2016	-	
		GAMW-01B	7/31/2018	-	Installed to characterize the nature and extent of a potential release[2]
		GAMW-12B	7/31/2018	-	
		GAMW-51	7/25/2018	-	
		GAMW-51B	7/25/2018	-	
		GAMW-42	7/24/2018	-	Installed to monitor groundwater quality at the property boundary[3]
		GAMW-42B	7/24/2018	-	
		GAMW-42C	6/8/2019	-	
		GAMW-43	5/16/2018	-	
		GAMW-43B	5/16/2018	-	
		GAMW-44	5/16/2018	-	
		GAMW-44B	5/16/2018	-	
		GAMW-57	6/7/2019	-	
		GAMW-57B	6/7/2019	-	
		GAMW-58	6/6/2019	-	
		GAMW-58B	6/6/2019	-	
		GAMW-59	6/8/2019	-	Installed to characterize the nature and extent of a potential release[2]
		GAMW-59B	6/6/2019	-	
		GAMW-60	6/8/2019	-	
		GAMW-60B	6/4/2019	-	

1) Per 40 CFR §257.93, Golder collected eight rounds of background data prior to October 17, 2017.
2) Per 40 CFR §257.95(g)(1)(i) Rule requirements, Golder collected additional data to further characterize the nature and extent of potential groundwater impacts.
3) Per 40 CFR §257.95(g)(1)(iii), Golder collected data to monitor groundwater quality in the direction of flow at the property boundary.

Prepared by: AMH
Checked by: KMC
Reviewed by: MAH

Table 2: Summary of Sampling Events
CCR Unit Schahfer Waste Disposal Area
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Well Purpose	Monitoring Well ID	Resample Event	Supplemental Sampling Event	Sample Event #12	Supplemental Sampling Event	Supplemental Sampling Event	Supplemental Sampling Event	Supplemental Sampling Event	Sample Event #13	Total Number of Samples
Purpose of Sample		Confirmation of previous sample results	Nature and Extent Characterization Sampling	Annual Assessment Monitoring	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Nature and Extent Characterization Sampling	Semi-Annual Assessment Monitoring	
Sample Parameters		Appendix III and detected Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Metals Only	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	Appendix III and Appendix IV	
Background Monitoring Well	GAMW03	NS	NS	4/25/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW03B	NS	NS	4/26/2019	NS	NS	NS	NS	11/6/2019	2
Downgradient Monitoring Well	GAMW01	NS	NS	4/23/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW01B	NS	NS	4/23/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW12	NS	NS	4/24/2019	NS	NS	NS	NS	11/7/2019	2
	GAMW12B	NS	NS	4/25/2019	NS	NS	NS	NS	11/7/2019	2
	GAMW13	NS	NS	4/24/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW13B	NS	NS	4/24/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW14	3/1/2019	NS	4/22/2019	NS	NS	NS	NS	11/6/2019	3
	GAMW14B	NS	NS	4/22/2019	NS	NS	NS	NS	11/6/2019	2
	GAMW42	NS	3/4/2019	4/18/2019	6/5/2019	7/17/2019	8/26/2019	10/2/2019	11/5/2019	7
	GAMW42B	NS	3/4/2019	4/18/2019	6/5/2019	7/17/2019	8/27/2019	10/2/2019	11/5/2019	7
	GAMW42C	NI	NI	NI	NI	7/18/2019	8/28/2019	10/3/2019	11/5/2019	4
	GAMW43	NS	3/5/2019	4/19/2019	6/5/2019	7/17/2019	8/27/2019	10/2/2019	11/19/2019	7
	GAMW43B	NS	3/5/2019	4/19/2019	6/6/2019	7/17/2019	8/27/2019	10/2/2019	11/19/2019	7
	GAMW44	NS	3/5/2019	4/22/2019	6/6/2019	7/24/2019	8/27/2019	10/1/2019	11/20/2019	7
	GAMW44B	NS	3/5/2019	4/22/2019	6/6/2019	7/24/2019	8/27/2019	10/2/2019	11/20/2019	7
	GAMW51	NS	NS	4/26/2019	NS	NS	NS	NS	11/12/2019	2
	GAMW51B	NS	NS	4/26/2019	NS	NS	NS	NS	11/12/2019	2
	GAMW57	NI	NI	NI	NI	7/23/2019	8/29/2019	10/1/2019	11/19/2019	4
	GAMW57B	NI	NI	NI	NI	7/23/2019	8/29/2019	10/1/2019	11/19/2019	4
	GAMW58	NI	NI	NI	NI	7/22/2019	8/29/2019	10/1/2019	11/20/2019	4
	GAMW58B	NI	NI	NI	NI	7/22/2019	8/29/2019	10/1/2019	11/20/2019	4
	GAMW59	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	2
	GAMW59B	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	2
	GAMW60	NI	NI	NI	NI	7/22/2019	NS	NS	11/11/2019	2
	GAMW60B	NI	NI	NI	NI	7/19/2019	NS	NS	11/11/2019	2
Total Number of Samples		1	6	18	6	15	11	11	27	95

Notes:
(1) Sample events #1-#11 were completed prior to 2019. The purpose, sample parameters, and sample dates are included in the 2017 Annual Report and the 2018 Annual Report.
(2) Semi-annual assessment monitoring parameters did not include radium
Sample counts do not include QC/QA samples.
NI= not installed
NS= not sampled

Prepared by: DFS
Checked by: AMH
Reviewed by: MAH

Table 3: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW01			GAMW01B		GAMW03		GAMW03B		GAMW12			GAMW12B			GAMW13		GAMW13B		GAMW14			GAMW14B		
		2019-04-23		2019-11-06	2019-04-23	2019-11-06	2019-04-25	2019-11-06	2019-04-26	2019-11-06	2019-04-24	2019-11-07		2019-04-25		2019-11-07	2019-04-24	2019-11-06	2019-04-24	2019-11-06	2019-03-01	2019-04-22	2019-11-06	2019-04-22	2019-11-06	
		FD	N	N	N	N	N	N	N	N	N	FD	N	FD	N	N	N	N	N	N	N	N	N	N	FD	N
CCR Appendix III																										
Boron	mg/L	1.1	1.1	1.6	0.35	0.38	0.16	0.35	0.25	0.31	0.073 J	0.071 J	0.069 J	0.31	0.3	0.33	0.18	0.13	0.71	0.7	0.2	0.22	0.16	2.9	3.4	3.3
Calcium	mg/L	110	110	94 J-	110	94 J-	84	110 J-	90	89 J-	88	76	76	100	100	88	75	71 J-	72	66 J-	38	38	59 J-	140	130 J-	130 J-
Chloride	mg/L	20	20	13	21	19	2.4	6.5	24	24	2.9	2.8	2.8	23	23	24	7.9	3.9	27	27	2.8	2.7	2.1	99	120	120
Fluoride	mg/L	0.31 J+	0.31 J+	0.41	0.14 J+	0.15	0.2	0.17	0.22	0.26	0.21	0.23	0.24	0.11	0.11	0.11	0.24	0.31	0.35	0.34	0.21	0.18	0.23	0.31	0.4	0.39
pH	SU		6.89	7.2	6.98	6.94	6.94	6.74	7.15	7.08	7.06		7.32		7	7.63	6.79	7.15	7.3	7.81	7.01	7.27	7.14	7.75		7.93
Sulfate	mg/L	220	230	180	73	67	86	150	74	80	22	14	16	120	120	130	52	40	150	150	35	37	27	1200	1300	1300
Total Dissolved Solids	mg/L	600	630	520	490	440	350	490	460	410	390	360	330	480	500	470	360	330	430	400	210	360	260	1900	1800	2200
CCR Appendix IV																										
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.015	0.014	0.013	0.005 U	0.005 U	0.0035 J	0.016	0.005 U	0.005 U	0.014	0.0077	0.008	0.005 U	0.005 U	0.005 U	0.005	0.006	0.0014 J	0.00091 J	0.012	0.0028 J	0.026	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.088	0.087	0.069	0.19	0.15	0.071	0.11	0.1	0.11	0.087	0.079	0.079	0.12	0.11	0.1	0.081	0.063	0.093	0.078	0.041	0.049	0.055	0.11	0.11	0.11
Beryllium	mg/L	0.001 U	0.0014	0.001 U	0.00086 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00089 J	0.001 U	0.0013	0.001 U	0.001 U	0.001 U	0.001 U	0.00083 J	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0044	0.002 U	0.002 U
Cobalt	mg/L	0.0016	0.0017	0.001	0.00033 J	0.00019 J	0.0099	0.0048	0.0005 J	0.001 U	0.0031	0.0027	0.0028	0.001 U	0.001 U	0.00044 J	0.0012	0.00057 J	0.001 U	0.001 U	0.0083	0.0026	0.014	0.00058 J	0.001 U	0.001 U
Fluoride	mg/L	0.31 J+	0.31 J+	0.41	0.14 J+	0.15	0.2	0.17	0.22	0.26	0.21	0.23	0.24	0.11	0.11	0.11	0.24	0.31	0.35	0.34	0.21	0.18	0.23	0.31	0.4	0.39
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0021 J	0.0023 J	0.0025 J	0.0047 J	0.0042 J	0.0038 J	0.0058 J	0.008 U	0.008 U	0.0027 J	0.0028 J	0.003 J	0.0043 J	0.0043 J	0.004 J	0.008 U	0.008 U	0.0019 J	0.0017 J	0.008 U	0.008 U	0.008 U	0.0058 J	0.0057 J	0.0059 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.033	0.033	0.031	0.0011 J	0.01 U	0.0071 J	0.0063 J	0.0068 J	0.0074 J	0.0034 J	0.0032 J	0.0036 J	0.0014 J	0.0013 J	0.0015 J	0.012	0.0068 J	0.021	0.017	0.0074 J	0.011	0.0084 J	0.028	0.017	0.017
Radium, Total	pci/l	1.21	0.781		2.11		0.373 U		0.596		0.474 U			1.03 J	0.544 J		0.473 U		0.529			0.345		2.05		
Radium-226	pci/l	0.693	0.474		1.13		0.314 U		0.38 U		0.307 U			0.439	0.426 U		0.241 U		0.436			0.318 U		0.802		
Radium-228	pci/l	0.517	0.388 U		0.982		0.373 U		0.442		0.474 U			0.592	0.373 U		0.473 U		0.435 U			0.328 U		1.25		
Selenium	mg/L	0.0075	0.0077	0.0057	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00093 J	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.00021 J	0.00046 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00039 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U
Sample Parameters																										
Dissolved Oxygen	mg/L		1.97	0.31	1.06	0.32	1.1	0.43	1.7	0.58	1.07		2.61		0.76	4.86	1.35	2.26	1.16	2.1	0.32	3.21	1.49	1.07		2.16
Oxidation-Reduction Potential	millivolts		27.1	-217.5	-23.6	-196.7	40.1	-182.6	7.6	-181.9	-12.7		-4.1		-10.2	-34.9	94.8	42	17.8	-45.2	-11.5	61.3	38.2	28.8		-21.4
pH	SU		6.89	7.2	6.98	6.94	6.94	6.74	7.15	7.08	7.06		7.32		7	7.63	6.79	7.15	7.3	7.81	7.01	7.27	7.14	7.75		7.93
Specific Conductivity	uS/cm		624	547	563	468	352	510	527	443	381		421		560	482	304	433	394	440	226	223	325	1887		2124
Temperature	deg c		2.4	15.9	9.88	13.8	3.28	15	9.03	13.1	0.8		12.97		11.5	1.39	1.7	9.2	3.39	11.67	8.79	10.3	14.71	12.8		13.37
Turbidity	ntu		4.48	3.8	3.15	1.2	3.49	4.41	3.56	1.92	12.6		3.1		3.56	4.02	4.63	1.38	4.07	2.03	4.43	4.68	2.51	2.79		0.71

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

Table 3: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW42									GAMW42B							GAMW42C				GAMW43							
		2019-03-04		2019-04-18	2019-06-05	2019-07-17	2019-08-26	2019-10-02	2019-11-05		2019-03-04	2019-04-18	2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-05	2019-07-18	2019-08-28	2019-10-03	2019-11-05	2019-03-05	2019-04-19		2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-19
		FD	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N
CCR Appendix III																													
Boron	mg/L	0.033 J	0.031 J	0.044 J	0.033 J	0.037 J	0.043 J	0.1 U	0.034 J	0.033 J	0.039 J	0.033 J	0.035 J	0.038 J	0.026 J	0.22	0.031 J	1	1	0.79	0.75	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.19	0.024 J
Calcium	mg/L	44	43	36	39	40	47	41	42	43	52	47	50	48	52	52	53	45	50	45	45	24	21	22	22	25	28	28	34
Chloride	mg/L	2.9	2.8	2.8		2.5	3.1	3.3	3.1	3.2	5	4.3		4	4.3	5.6	6.4	6.4	6.5	5.8	5.8	1.4	1.1	0.92 J		0.78 J	0.89 J	1.2	1.1
Fluoride	mg/L	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.18	0.18		0.19	0.18	0.18	0.18	0.3	0.25	0.25	0.26	0.11	0.11	0.1		0.14	0.13	0.14	0.14
pH	SU		6.93	7.1	6.85	7.58	7.54	7.41		7.83	7.23	7.7	7.12	8.25	7.57	7.67	8.25	7.81	7.28	7.48	7.64	6.8		7.07	6.62	7.35	7.1	6.98	6.94
Sulfate	mg/L	25	25	30		23	27	26	25	25	30	26		26	27	31	35	13	4.3	5.6	4.5	29	31	31		22	22	30	30
Total Dissolved Solids	mg/L	180	200	640		180	210	190	190	190	220	84		220	230	230	250	220	290	270	280	150	130	140		140	140	180	180
CCR Appendix IV																													
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00059 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00061 J	0.00077 J	0.00063 J	0.002 U	0.002 U	0.002 U	0.00077 J
Arsenic	mg/L	0.0026 J	0.0025 J	0.0023 J	0.0019 J	0.0016 J	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0036 J	0.0024 J	0.0024 J	0.0027 J	0.0025 J	0.0037 J	0.0033 J	0.0035 J
Barium	mg/L	0.023	0.022	0.024	0.018	0.019	0.021	0.02	0.021	0.022	0.011	0.0093	0.012	0.012	0.014	0.013	0.013	0.015	0.015	0.01	0.01	0.021	0.016	0.016	0.015	0.019	0.018	0.026	0.06
Beryllium	mg/L	0.0004 J	0.001 U	0.001 U	0.00056 J	0.001 U	0.001 U	0.00057 J	0.001 U	0.00072 J	0.001 U	0.001 U	0.0014	0.001 U	0.001 U	0.00074 J	0.001 U	0.001 U	0.00048 J	0.001 U	0.001 U	0.00097 J	0.001 U	0.00075 J	0.0019	0.001 U	0.001 U	0.001 U	0.0014
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.0012 J	0.0012 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0024	0.002 U	0.002 U	0.002 U	0.001 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.00044 J	0.0002 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0004 J	0.001 U	0.0003 J	0.02	0.013	0.014	0.0067	0.0034	0.0036	0.0045	0.0037
Fluoride	mg/L	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.18	0.18		0.19	0.18	0.18	0.18	0.3	0.25	0.25	0.26	0.11	0.11	0.1		0.14	0.13	0.14	0.14
Lead	mg/L	0.00045 J	0.001 U	0.00064 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.037	0.038	0.025	0.023	0.008 U	0.008 U	0.008 U	0.0023 J	0.008 U	0.008 U	0.0022 J	0.0026 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0024 J	0.0022 J	0.003 J	0.0023 J	0.0019 J	0.002 J	0.0029 J	0.0023 J	0.003 J	0.0031 J	0.0026 J	0.0031 J	0.0025 J	0.0035 J	0.0039 J	0.0033 J	0.0053 J	0.0049 J	0.0027 J	0.0031 J	0.0016 J	0.0015 J	0.0017 J	0.0017 J	0.01 U	0.0015 J	0.0035 J	0.0048 J
Radium, Total	pci/l	0.536	0.437 U	0.346 U		0.393 U	0.48 U	0.539			0.396 U	0.384 U		0.46	0.73	0.972		0.723	1.14	0.972		0.371 U	0.405 U	0.369 U		0.362 U	0.199	0.411 U	
Radium-226	pci/l	0.165	0.0922 U	0.0867 U		0.36 UJ	0.1 UJ	0.244 J+			0.233	0.139		0.278 UJ	0.165	0.428 J+		0.668 J-	0.701	0.752		0.0944 U	0.125	0.0973 U		0.268 UJ	0.524 U	0.151 U	
Radium-228	pci/l	0.436 U	0.437 U	0.346 U		0.393 UJ	0.48 UJ	0.408 U			0.396 U	0.384 U		0.413 UJ	0.462 U	0.544		0.42 U	0.437	0.433 U		0.371 U	0.405 U	0.369 U		0.362 UJ	0.524 U	0.411 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.001 J	0.005 U	0.005 U	0.005 U	0.0012 J
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U	0.00062 J	0.001 U	0.0007 J	0.001 U	0.001 U	0.00062 J	0.001 U	0.0005 J	0.0008 J	0.00023 J	0.00039 J	0.00061 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00073 J	0.001 U	0.001 U	0.00024 J	0.00091 J
Sample Parameters																													
Dissolved Oxygen	mg/L		0.06	0.79	0.29	2.19	1.95	0.22		1.25	0.07	0.65	0.27	1.46	0.9	0.18	0.8	0.83	0.29	0.04	0.22	0.1		0.99	0.17	0.88	0.63	0.31	0.32
Oxidation-Reduction Potential	millivolts		113.7	-38.9	-82.3	13.9	-94.6	75.7		108	-157.6	-133.1	-139.2	-132	-137.7	44.8	-60.2	-127.9	-205.2	-64.7	293.9	42.7		119.6	47.7	18.7	-18.6	87.7	-220.2
pH	SU		6.93	7.1	6.85	7.58	7.54	7.41		7.83	7.23	7.7	7.12	8.25	7.57	7.67	8.25	7.81	7.28	7.48	7.64	6.8		7.07	6.62	7.35	7.1	6.98	6.94
Specific Conductivity	uS/cm		184	192	198	211	229	220		208	244	245	245	246	262	254	255	360	350	292	259	148		141	150	171	203	235	197
Temperature	deg c		8.2	8.8	11.5	13.7	14.8	14.9		13.06	10.9	10.8	12.2	12.7	12.8	13.4	11.81	13.3	12.3	11.9	11.5	7.48		8.2	12	15.7	16.3	16.4	12.6
Turbidity	ntu		3.16	8.18	2.47	2.4	1.4	1.6		2.81	3.15	4.05	0.6	1.09	0.58	0.96	0.36	4.43	4.5	4.69	9.33	3.99		4.6	4.2	2.98	1.95	4.2	4.05

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

Table 3: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW43B								GAMW44									GAMW44B							GAMW51		GAMW51B	
		2019-03-05	2019-04-19	2019-06-06		2019-07-17	2019-08-27	2019-10-02	2019-11-19	2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-08-27		2019-10-01		2019-11-20	2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-08-27	2019-10-02	2019-11-20	2019-04-26	2019-11-12	2019-04-26	2019-11-12
		N	N	FD	N	N	N	N	N	N	N	N	N	FD	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N
CCR Appendix III																													
Boron	mg/L	0.029 J	0.036 J	0.1 U	0.1 U	0.035 J	0.024 J	0.16	0.035 J	0.025 J	0.032 J	0.1 U	0.036 J	0.1 U	0.032 J	0.026 J	0.03 J	0.034 J	0.024 J	0.03 J	0.1 U	0.024 J	0.1 U	0.12	0.1 U	0.5	0.61	7.6	0.028 J
Calcium	mg/L	42	43	38 J-	39 J-	37	38	36	38	24	24	20 J-	20	37	23	32	34	27	32	31	30	31	32	31	30	140	150	290	1 U
Chloride	mg/L	1.5	1.6			1.5	1.5	1.6	1.5	2.4	3.1		1.8	1.5	1.6	1.9 J+	1.9 J+	1.7	1.6	1.5		1.3	1.3	1.5	1.3	3.6	5.4	57	57
Fluoride	mg/L	0.17	0.17			0.18	0.18	0.19	0.18	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096	0.13	0.13		0.14	0.13	0.15	0.15	0.39	0.4	0.81	0.83
pH	SU	7.62	7.76		7.47	8.09	7.49	7.41	7.5	6.23	6.41	5.99	6.6		6.31		6.91	6.22	7.79	7.62	7.52	8.28	7.64	7.16	7.44	7.14	6.78	7.48	7.15
Sulfate	mg/L	31	35			28	24	22	29	57	68		42	24	42	51 J+	51 J+	44	14	16		11	7.8	7.6	10	190	240	1400	1500
Total Dissolved Solids	mg/L	140	170			160	160	160	170	170	200		170	170	160	190	200	170	120	160		150	130	120	130	620	680	2400	2300
CCR Appendix IV																													
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 J	0.00072 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0019 J	0.0019 J	0.0045 J	0.0087	0.005 U	0.01	0.0095	0.0091	0.054	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0016 J	0.0015 J	0.0034 J	0.005 U
Barium	mg/L	0.012	0.014	0.012	0.012	0.011	0.011	0.011	0.011	0.024	0.028	0.032	0.025	0.011	0.024	0.031	0.032	0.034	0.0098	0.0091	0.0084	0.0087	0.0087	0.0093	0.0081	0.096	0.1	0.085	0.005 U
Beryllium	mg/L	0.001 U	0.001 U	0.00075 J	0.0011	0.001 U	0.001 U	0.001 U	0.001 U	0.00073 J	0.00083 J	0.00099 J	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 J	0.00041 J	0.001 U	0.001 U	0.00031 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0028	0.0029	0.0031	0.0028	0.002 U	0.0017 J	0.0012 J	0.0016 J	0.0023	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0017	0.0019	0.0025	0.0025	0.001 U	0.0028	0.0039	0.0039	0.0079	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0031	0.003	0.001 U	0.001 U
Fluoride	mg/L	0.17	0.17			0.18	0.18	0.19	0.18	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096	0.13	0.13		0.14	0.13	0.15	0.15	0.39	0.4	0.81	0.83
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.00045 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0038 J	0.0043 J	0.0042 J	0.005 J	0.008 U	0.0047 J	0.0042 J	0.0052 J	0.0042 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0049 J	0.006 J	0.064	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0018 J	0.0018 J	0.0022 J	0.0025 J	0.0019 J	0.002 J	0.0022 J	0.0021 J	0.01 U	0.01 U	0.0013 J	0.0012 J	0.0019 J	0.002 J	0.0037 J	0.0049 J	0.0058 J	0.0025 J	0.0026 J	0.0026 J	0.0021 J	0.0019 J	0.002 J	0.0022 J	0.016	0.018	0.18	0.01 U
Radium, Total	pci/l	0.373 U	0.375 U			0.393 U	0.442 U	0.479 U		0.362 U	0.543		0.435 U	0.496 U	0.973	0.622 U	0.445 U		0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		0.536		2.74	
Radium-226	pci/l	0.0977 U	0.105 U			0.317 UJ	0.124 U	0.144 U		0.193	0.12		0.196 U	0.153 U	0.138 U	0.255	0.155 U		0.0972 U	0.105 U		0.175 U	0.162 U	0.147 U		0.323		1.37	
Radium-228	pci/l	0.373 U	0.375 U			0.393 UJ	0.442 U	0.479 U		0.362 U	0.423		0.435 U	0.496 U	0.518 U	0.622 U	0.445 U		0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		0.381 U		1.38	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00096 J	0.00092 J	0.00093 J	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.00042 J	0.00058 J	0.001 U	0.001 U	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00094 J	0.00046 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																													
Dissolved Oxygen	mg/L	0.05	0.99		0.22	0.77	0.67	0.82	0.27	0.05	3.85	1.95	3.04		1.06		0.96	0.39	0.04	1.53	1.19	1.75	0.65	0.28	0.14	1.12	0.09	1.69	0.1
Oxidation-Reduction Potential	millivolts	-85.9	-92.1		-114.5	-119.2	-87.8	78.7	-208.4	101.4	134.8	166.1	75.1		28.7		83.1	-148.8	-124	9.7	-126.1	-33.3	-122.7	115.3	-171.5	17.2	-191.3	25.8	-222.3
pH	SU	7.62	7.76		7.47	8.09	7.49	7.41	7.5	6.23	6.41	5.99	6.6		6.31		6.91	6.22	7.79	7.62	7.52	8.28	7.64	7.16	7.44	7.14	6.78	7.48	7.15
Specific Conductivity	uS/cm	187	197		193	186	190	175	154	140	170	140	151		189		279	156	148	150	144	143	154	153	122	661	640	2139	1796
Temperature	deg c	10.3	10		11.9	13	13.3	13.3	12	6.02	9.1	12.1	14.3		15.7		16.1	11.7	10.49	11.5	11.7	11.7	12.8	12.6	11.4	9.1	14.1	10	12.9
Turbidity	ntu	1.56	2.44		3.16	0.9	0.66	0.87	1.43	3.09	4.96	5.75	4.69		4.78		3.65	4.4	1.99	1.11	0.54	0.78	0.37	0.24	1.14	2.91	4.58	1.89	3.16

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

Table 3: Analytical Data
CCR Unit R. M. Schahfer Waste Disposal Area
NIPSCO LLC R. M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW57				GAMW57B				GAMW58					GAMW58B				GAMW59		GAMW59B		GAMW60			GAMW60B	
		2019-07-23	2019-08-29	2019-10-01	2019-11-19	2019-07-23	2019-08-29	2019-10-01	2019-11-19	2019-07-22		2019-08-29	2019-10-01	2019-11-20	2019-07-22	2019-08-29	2019-10-01	2019-11-20	2019-07-19	2019-11-11	2019-07-19	2019-11-11	2019-07-22	2019-11-11		2019-07-19	2019-11-11
		N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
CCR Appendix III																											
Boron	mg/L	0.037 J	0.042 J	0.023 J	0.038 J	0.095 J	0.19	0.031 J	0.16	0.043 J	0.046 J	0.047 J	0.028 J	0.037 J	0.047 J	0.043 J	0.029 J	0.026 J	1.2	1.4	4.8	5.4	2.1	1.4	1.5	8.1	7.2
Calcium	mg/L	22	25	23	24	46	48	39	46	10	10	13	38	8.8	38	39	39	36	250	280	310	330	330	350	350	280	300
Chloride	mg/L	1.5	1.2	1 J+	1.3	9.4	12	8.9 J+	11	1.2	1.3	1.1	3.9 J+	1.5	4	3.8	3.9 J+	3.7	6.5	9.8	38	44	7.8	11	11	19	18
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.14	0.13	0.14 J+	0.14	0.32	0.31	0.31	0.16 J+	0.29	0.17	0.17	0.17 J+	0.16	0.65	0.63	0.46	0.46	0.65	0.64	0.66	0.37	0.39
pH	SU	7.42	7.7	7.58	7.61	8.21	7.4	7.67	7.53		5.42	5.82	6.18	5.02	8.74	8.33	7.57	7.49	7.51	7.29	7.83	7.47	7.34		7.15	8.41	7.78
Sulfate	mg/L	33	35	31 J+	34	23	18	17 J+	14	43	43	41	25 J+	40	24	21	26 J+	25	580	770 J-	1400	1600 J-	890	880 J-	890 J-	1200	1200 J-
Total Dissolved Solids	mg/L	150	120	120	130	210	220	190	190	95 J+	100 J+	110	190	100	180	200	180	160	1100	1200	2100	2100	1400	1500 J	780 J	1700	1600
CCR Appendix IV																											
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00063 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00075 J	0.00076 J	0.005 U	0.005 U	0.005 U	0.005 U	0.00098 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0033 J	0.0024 J	0.0015 J	0.00081 J	0.005 U	0.0009 J	0.00086 J	0.00088 J	0.005 U
Barium	mg/L	0.012	0.008	0.006	0.0088	0.024	0.029	0.018	0.025	0.055	0.055	0.047	0.017	0.058	0.018	0.02	0.017	0.017	0.1	0.088	0.065	0.058	0.044	0.036	0.036	0.06	0.063
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0011	0.0013	0.00097 J	0.001 U	0.0015	0.00035 J	0.001 U	0.00055 J	0.001 U	0.001 U	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00031 J	0.00035 J	0.001 U	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.0014 J	0.002 U	0.002 U	0.002 U	0.0021	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00074 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.011	0.011	0.01	0.001 U	0.0096	0.00021 J	0.00019 J	0.001 U	0.001 U	0.0005 J	0.00081 J	0.0003 J	0.00023 J	0.0011	0.0019	0.002	0.00021 J	0.00024 J
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.14	0.13	0.14 J+	0.14	0.32	0.31	0.31	0.16 J+	0.29	0.17	0.17	0.17 J+	0.16	0.65	0.63	0.46	0.46	0.65	0.64	0.66	0.37	0.39
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0011	0.001	0.0011	0.001 U	0.0012	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.0029 J	0.0058 J	0.008 U	0.0044 J	0.0018 J	0.002 J	0.0017 J	0.0028 J	0.0021 J	0.0031 J	0.0025 J	0.0032 J	0.0019 J	0.015	0.016	0.019	0.019	0.0068 J	0.008 U	0.008 U	0.0067 J	0.008 U
Mercury	mg/L	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 UJ
Molybdenum	mg/L	0.016	0.022	0.0055 J	0.024	0.0061 J	0.011	0.0028 J	0.0073 J	0.01 U	0.01 U	0.0016 J	0.0059 J	0.0017 J	0.023	0.02	0.0069 J	0.011	0.03	0.046	0.06	0.092	0.042	0.035	0.035	0.37	0.39
Radium, Total	pci/l	0.419 U	0.453 U	0.548 U		0.502	0.435 U	0.543 U		0.54 U	0.599 U	0.457 U	1.2		0.504 U	0.506 U	0.603 U		1.11		2.3		0.504 U			2.25	
Radium-226	pci/l	0.161 U	0.118 U	0.193		0.213 U	0.233	0.295		0.286 U	0.282 U	0.243	0.307		0.232 U	0.118 U	0.174		0.607		0.981		0.298 U			1.63	
Radium-228	pci/l	0.419 U	0.453 U	0.548 U		0.492 U	0.435 U	0.543 U		0.54 U	0.599 U	0.457 U	0.895		0.504 U	0.506 U	0.603 U		0.499		1.32		0.504 U			0.622	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.0003 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J	0.001 U	0.001 U	0.00064 J	0.0005 J	0.001 U	0.00067 J	0.001 U	0.001 U	0.00049 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																											
Dissolved Oxygen	mg/L	5.56	3.89	3.94	2.67	1.12	0.78	0.35	0.22		4.29	1.88	0.63	3.38	1.21	8.56	0.43	0.19	0.77	0.21	0.55	0.11	1.06		0.32	0.67	0.14
Oxidation-Reduction Potential	millivolts	54.6	43.1	126.2	-127	-98.1	-109.6	94.6	-211.9		114.8	95.4	102.8	-53.6	-165	-248.6	90	-179.2	-94.6	154.8	-117.3	-214.4	23.5		-152.8	-160.7	-202.1
pH	SU	7.42	7.7	7.58	7.61	8.21	7.4	7.67	7.53		5.42	5.82	6.18	5.02	8.74	8.33	7.57	7.49	7.51	7.29	7.83	7.47	7.34		7.15	8.41	7.78
Specific Conductivity	uS/cm	127	152	133	124	237	277	213	190		8.6	99	105	67	204	214	204	168	1264	1132	2082	1837	1437		1182	1643	1320
Temperature	deg c	12.4	12.3	13.3	11.6	11.8	11.8	12.5	10.8		13.1	13.8	14.5	12	11	12.2	12.8	11.1	20.9	18	16	14.3	17.6		15.3	15.8	12.8
Turbidity	ntu	4.81	2.82	2.9	3.06	4.9	4.39	0.82	1.28		4.02	1.8	0.61	1.98	4.35	2.75	0.49	1.02	1.5	2.41	4.84	2.55	2.46		2.11	4.1	3.83

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter
"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.
"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.
"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

Prepared by: AMH
Checked by: DFS
Reviewed by: MAH

Table 4: Groundwater Protection Standards
CCR Unit Schahfer Waste Disposal Area
NIPSCO LLC Rollin M. Schahfer Generating Station
Wheatfield, Indiana

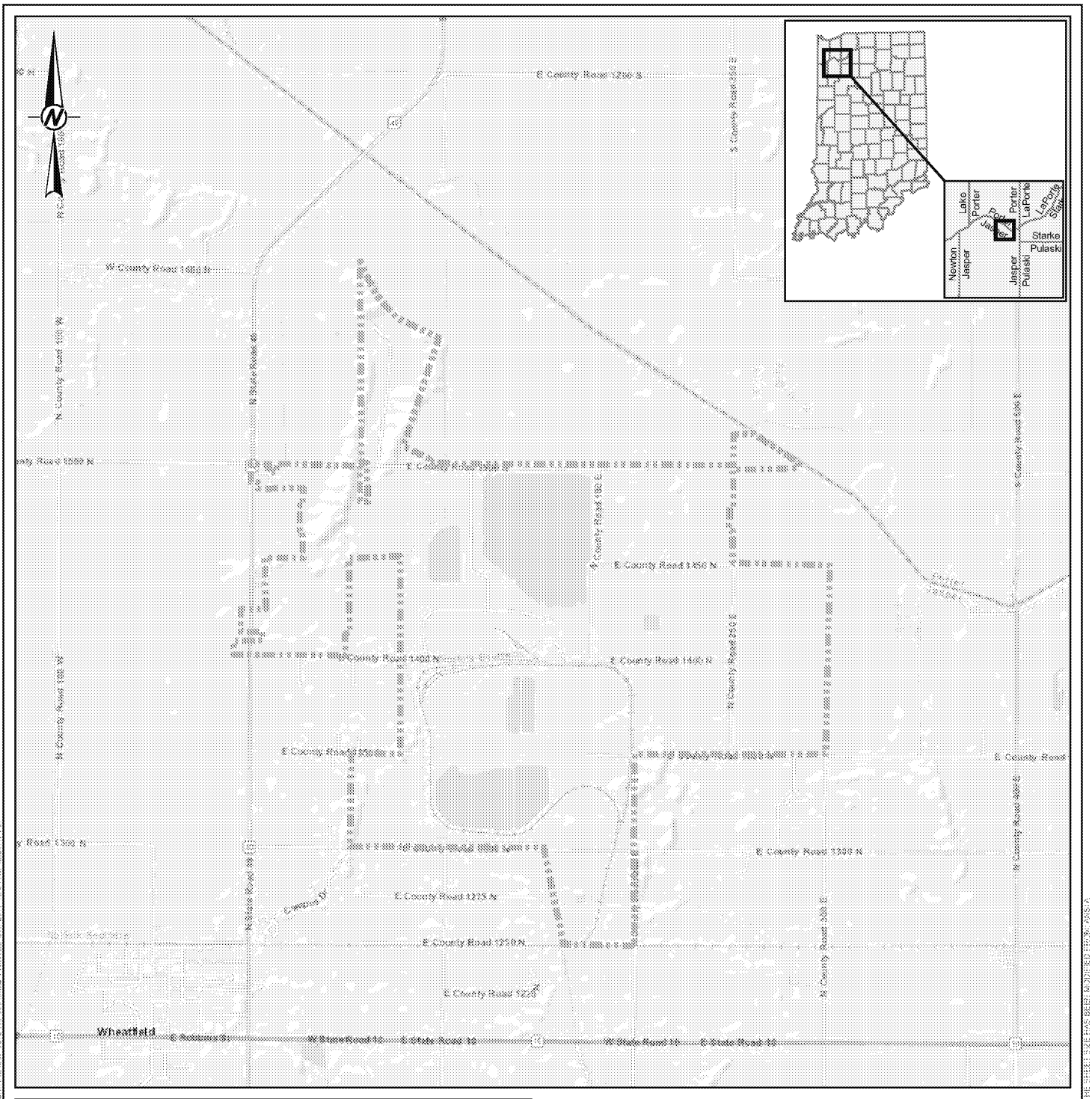
Analyte	MCL (mg/L)	GWPS (mg/L)
Antimony	0.006	0.006
Arsenic	0.01	0.015
Barium	2	2
Beryllium	0.004	0.004
Cadmium	0.005	0.005
Chromium	0.1	0.1
Cobalt(1)	0.006	0.015
Fluoride	4	4
Lead(1)	0.015	0.015
Lithium(1)	0.04	0.04
Mercury	0.002	0.002
Molybdenum(1)	0.1	0.1
Radium 226+228	5	5
Selenium	0.05	0.05
Thallium	0.002	0.002

Notes:
MCL= Environmental Protection Agency Maximum Contaminant Level
GWPS= Groundwater Protection Standard calculated in February 2019
mg/L= milligrams per liter

1) As of August 29, 2018, these four constituents have health-based standards that can be used when calculating the GWPS, these health-based standards are not MCLs but are provided in the MCL column.

Prepared by: DFS
Checked by: AMH
Reviewed by: MAH

Figures



LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	12/31/2019
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV	FIGURE
19121567	A	0	1

LEGEND

- Assessment Monitoring Well
- Background Monitoring Well
- Downgradient Monitoring Well
- Generalized Groundwater Flow Direction
- Approximate Property Line
- CCR Unit

0 410 820

1 " = 400 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

WELL LOCATION MAP
WASTE DISPOSAL AREA

CONSULTANT

GOLDER

YYYY-MM-DD	1/22/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
19121567	A	0	2

APPENDIX A

Waste Disposal Area Alternative Source Demonstration May 2019

Northern Indiana Public Service Company (NIPSCO)

R. M. Schahfer Generating Station – Waste Disposal Area

Wheatfield, Indiana

Certification of Alternative Source Demonstration

40 CFR §257.95

I have personally reviewed this alternative source demonstration (ASD), the subject of which is the Waste Disposal Area (WDA) at the NIPSCO R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated May 2019. Based on an inquiry of those individuals immediately responsible and on supporting data that I understand to be true, accurate, and complete, I verify the information in this ASD is accurate and meets the applicable requirements of the CCR Final Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the WDA meets the applicable requirements of 40 CFR §257.95.

JOSEPH BERNARD GORMLEY JR.
REGISTERED
No. PE 11900213
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Joseph Bernard Gormley, Jr.
Indiana Professional Engineer
License #: PE11900213

5/17/2019
Date

GOLDER

ALTERNATIVE SOURCE DEMONSTRATION - WASTE DISPOSAL AREA

Northern Indiana Public Service Company

Rollin M. Schahfer Generating Station

Wheatfield, Indiana

Submitted to:

Northern Indiana Public Service Company
801 East 86th Avenue
Merrillville, Indiana 46410

Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101
+1 603 668-0880

164817101.03

May 2019

Table of Contents

1.0 INTRODUCTION 1

2.0 CONCEPTUAL SITE MODEL 1

2.1 Description of Waste Disposal Area 1

2.2 Site Geology and Hydrogeology 2

2.3 Groundwater Monitoring Network 2

2.4 Groundwater Conditions 3

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS 4

3.1 Source Material Assessment 4

3.1.1 Sample Collection 4

3.1.2 Geochemical Characterization 5

3.2 Overburden Soil and Bedrock Shale Samples 5

3.3 Groundwater and Porewater Assessment 5

3.3.1 Sample Collection 5

3.3.2 Geochemical Characterization 6

4.0 DATA EVALUATION AND FINDINGS 6

4.1 Source Material Results 6

4.2 Overburden Soil and Bedrock Shale Results 7

4.3 Groundwater and Porewater Results 7

4.3.1 Geochemistry 7

4.3.2 Arsenic 9

4.3.3 Cobalt 10

4.3.4 Indicator Parameters 12

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE 13

6.0 CONCLUSION 15

7.0 REFERENCES 15

TABLES

Table 1 Source Material and Background Overburden Soil and Bedrock Shale Analytical Results
Table 2 Porewater Analytical Results
Table 3 Groundwater Analytical Results

FIGURES

Figure 1 Site Location Map
Figure 2 Sample Location Map

1.0 INTRODUCTION

On behalf of Northern Indiana Public Service Company (NIPSCO), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the second (October 2018) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS or Site) Waste Disposal Area (WDA, the CCR Unit), located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (see Figure 1). This evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule" (CCR Final Rule), as amended.

Statistical analyses of the Appendix IV Assessment Monitoring data for arsenic and cobalt indicated the lower confidence interval (LCI) exceeded the background concentration for those parameters in downgradient monitoring wells GAMW-01 and GAMW-14, respectively, which NIPSCO interpreted as apparent evidence of a statistically-significant level (SSL). Although determination of an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO) 90 days from the date of determination (February 18, 2019) to demonstrate a source other than the CCR Unit or another condition caused the SSLs.

Golder's initial review of the Site history and geologic conditions indicates the potential for SSLs to have resulted from a source other than the CCR Unit. To assess potential sources and natural variability of groundwater concentrations, Golder collected and analyzed porewater, CCR source materials, overburden, bedrock, and groundwater samples. Based upon this assessment and in accordance with provisions of the CCR Final Rule, Golder prepared this Alternative Source Demonstration (ASD) for the WDA. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding porewater and groundwater obtained from monitoring wells installed within and adjacent to the WDA.

The ASD conforms to the requirements of 40 CFR §257.95(g)(3) and provides the basis for concluding that the apparent SSLs are not a result of a release from the WDA. The following sections provide a summary of the RMSGS WDA Conceptual Site Model (CSM), sampling procedures and analytical methods, analytical and geochemical modeling results, and lines of evidence demonstrating an alternative source is responsible for the SSLs.

2.0 CONCEPTUAL SITE MODEL

Golder developed this CSM to help frame and support the ASD assessment approach. The CSM presents WDA construction and operational history, a summary of geologic and hydrogeologic information, and a discussion of groundwater monitoring data, which together lay the groundwork for consideration and development of the ASD.

2.1 Description of Waste Disposal Area

The WDA is an approximately 80-acre impoundment located in the southwestern corner of RMSGS as shown in Figure 2. According to NIPSCO construction drawings, the WDA is unlined and is surrounded by berms that were constructed with an approximate two-foot wide slurry wall that extends from just below the top of the berms to the underlying shale located approximately 30 to 35 feet below ground surface (ft bgs). NIPSCO designed and constructed the slurry walls to reduce potential migration of the CCR constituents out of the WDA.

The WDA receives primarily bottom ash/boiler slag that is slurried from all four active boilers. Most of the ash/slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to size of the

unit and settling/depositional properties of the CCR materials, preliminary studies have shown little, if any, ash/slag is present in the southern half of the WDA.

2.2 Site Geology and Hydrogeology

The Site is directly underlain by unconsolidated, upper-Pleistocene (post-Wisconsin) fine-grained sand and silt and outwash deposits of the Atherton Formation, occasionally overlain by alluvial and lacustrine deposits of the Martinsville Formation (Schneider and Keller, 1970). According to Fraser and Bleur (1991), during the late Pleistocene, the Site was occupied by a post-glacial lake followed by a broad, low-gradient outwash stream that deposited sand uniformly across the basin to form the Kankakee-Valparaiso Formation. Golder's interpretation of the Site geology is based on bedrock geology maps, prior reports, and CCR Final Rule-related well installation activities, and includes the following stratigraphy:

Overburden

- Brown fine- to medium-grained sand from the ground surface to approximately 14 ft bgs
- Grayish-brown fine to medium sand from approximately 14 ft bgs to 30-35 ft bgs (coarsens with depth)

Bedrock

- Black to dark gray shale with planar cleavage (Antrim Shale). Top of bedrock is approximately 30 to 35 ft bgs near the impoundments

Regional bedrock consists of more than 4,000 feet of sedimentary rocks that overly Precambrian granitic bedrock (Fennelon 1994). This assemblage is part of the north side of the Kankakee Arch, which is the major structural feature in the Kankakee River Basin. The first 3,500 feet of sedimentary rocks overlying the granitic bedrock are Cambrian and Ordovician in age. The uppermost 300 feet of Ordovician rocks are composed of shale and minor limestones and are referred to as the Maquoketa Group. The Maquoketa Group underlies Silurian, Devonian and Mississippian rocks and consist of a wide variety of sedimentary layers ranging from shaley to coarse-grained carbonate rocks. This carbonate sequence is overlain by a series of shales including the Antrim Shale, a brownish-black, non-calcareous shale (Fennelon, 1994).

Available groundwater elevation data indicate that groundwater in the uppermost aquifer near the WDA flows to the north and northwest (and possibly northeast, immediately adjacent to the WDA). Groundwater flow direction is influenced by the slurry walls that surround the WDA and adjacent Recycle Settling Basin and Inactive Retired Waste Disposal Basin (IRWDB - both of these latter impoundments are non-CCR Final Rule regulated). Hydraulic heads measured inside the slurry walls that surround the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates that the slurry walls significantly impede the flow of water from the CCR Unit to the uppermost aquifer.

2.3 Groundwater Monitoring Network

Design of the CCR Final Rule-compliant WDA monitoring program considered the size, disposal/operational history, hydraulic influence of the slurry walls, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer. Based on the available hydrogeologic information for the WDA, groundwater mounding is occurring within the slurry walls. NIPSCO's monitoring approach for the CCR surface impoundment featured the installation of well pairs including shallow (approximately 15 ft bgs) and deep (approximately 35 ft bgs – to the top of shale [signified with a "B" in Figure 2]) couplets at each background and downgradient monitoring well location outside of the perimeter slurry walls as shown in Figure 2. As-built drawings of the slurry walls are not available;

therefore, it is unknown if the slurry walls were keyed into the underlying shale. Depending upon the degree of contact between the slurry walls and shale, the higher hydraulic head observed within the slurry walls may result in the discharge of water beneath the slurry walls. Consequently, as illustrated in Figure 2-3, Golder installed deep monitoring wells to supplement shallow wells and monitor potential flow paths beneath the slurry walls into the aquifer.

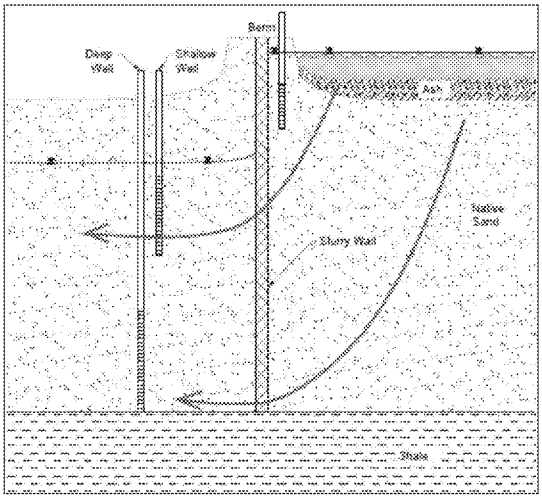


Figure 2-3: Conceptual Site Model

NIPSCO modified the groundwater monitoring well network to include two new deep wells (GAMW-01B, GAMW-12B) and four assessment monitoring well pairs (GAMW-42/42B, GAMW-43/43B, GAMW-44/44B, and GAMW-51/51B) in May and July 2018 at the locations shown in Figure 2. Golder installed the two new deep wells to monitor groundwater at the bedrock/overburden interface co-located with existing shallow wells (GAMW-01 and GAMW-12) near the waste boundary and four new well pairs further downgradient of the WDA to assess the extent of potential groundwater impacts detected during Assessment Monitoring (see Figure 2). The WDA monitoring network includes two background and eight downgradient monitoring wells. The groundwater monitoring network is summarized in Table 2-3.

Table 2-3: Waste Disposal Area Monitoring Well Network

Background Monitoring Wells	Downgradient Monitoring Wells	Assessment Monitoring Wells
GAMW-03 and GAMW-03B	GAMW-01, GAMW-01B*, GAMW-12, GAMW-12B*, GAMW-13, GAMW-13B, GAMW-14, and GAMW-14B	GAMW-42*, GAMW-42B*, GAMW-43*, GAMW-43B*, GAMW-44*, GAMW-44B*, GAMW-51*, and GAMW-51B*

*Monitoring well installed in 2018

Golder installed piezometer GAPIEZ04 in the northwest corner of the WDA within the slurry wall to assess groundwater elevations in the WDA. GAPIEZ04 is screened within the CCR materials.

2.4 Groundwater Conditions

Between July 2016 and August 2017, Golder collected eight independent background groundwater samples from each background and downgradient well, as required by 40 CFR §257.94. The results of the background

monitoring phase were used to develop appropriate, statistically-valid background values for each constituent/monitoring well. Following completion of the eight background monitoring events, Golder collected the first Detection Monitoring groundwater samples in October 2017 and compared the results to the calculated prediction limits to determine statistically significant increases (SSIs). Based on these results, NIPSCO established an Assessment Monitoring program in January 2018.

Golder performed the first Assessment Monitoring event in March 2018 (with verification sampling in April 2018). Following receipt and validation of laboratory results, Golder evaluated the results of the first Assessment Monitoring sampling event to determine the concentration of Appendix IV constituents relative to CCR Unit-specific calculated groundwater protection standards (GWPSs). The GWPS is the maximum contaminant level (MCL), if an MCL exists, or the unit-specific background concentration for each analyte using a tolerance/prediction limit procedure. Based on this statistical analysis, Golder concluded that the only constituent demonstrating an apparent SSL was molybdenum. The calculated GWPS (unit-specific background concentration) for molybdenum was 0.009 milligrams per liter (mg/L). However, the detected groundwater molybdenum concentrations did not exceed the new U. S. Environmental Protection Agency (USEPA) risk-based level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and became effective August 29, 2018 (CCR Final Rule Part 1 Phase 1 Addendum). Golder completed an ASD in November 2018 concluding that the molybdenum SSLs determined in August 2018 are not due to a release from the CCR Unit. The key supporting lines of evidence described in the ASD indicate that the molybdenum detected in monitoring wells downgradient of the WDA is due to a natural source and not the WDA.

Golder performed the second Assessment Monitoring event in October 2018 by collecting groundwater samples from each background and downgradient monitoring well, including the new Assessment Monitoring wells per 40 CFR §257.95. Golder performed the statistical evaluation in February 2019 and concluded that the only constituents demonstrating apparent SSLs were arsenic, in GAMW-14, and cobalt, in GAMW-01. A summary of the GWPSs for these compounds are provided in Table 2-4.

Table 2-4: Waste Disposal Area Groundwater Protection Standards

Analyte	USEPA MCL or risk-based level	GWPS
Arsenic	0.01 mg/L	0.015 mg/L
Cobalt	0.006 mg/L	0.015 mg/L

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS

To further assess potential groundwater impacts downgradient of the WDA, Golder performed supplemental assessment activities between July 24 and October 31, 2018. Golder conducted the supplemental assessment activities in accordance with the RMSGS Groundwater Monitoring Program Implementation Manual (GMPIM, Golder 2017). The following sections summarize the supplemental assessment activities.

3.1 Source Material Assessment

3.1.1 Sample Collection

Golder collected three WDA source material samples from the north side of the WDA (see Figure 2 for sample locations). Golder's field engineer composited three sub-samples into one sample per excavation area for submittal to the laboratory. The three WDA source material samples are described as follows:

- WDA-West Sample: Collected from approximately 1.5 ft below the top of a pile of recently dredged source material that originated from the northwestern corner of the WDA
- WDA-MID Sample: Collected from approximaterly one ft below the top of a pile from a recently dredged source material pile that originated near the effluent discharge pipes in the north-central portion of the WDA
- WDA-East Sample: Collected from approximately 1.5 ft below the top of a pile from a recently dredged source material pile that originated from the northeastern portion of the WDA

3.1.2 Geochemical Characterization

Golder used two geochemical analytical methods to characterize the source material samples: total metals analysis and leachability testing. The selected geochemical test methods are summarized in the following paragraphs. The analytical results for the WDA source material are provided in Table 1.

Total Metals: The purpose of this test was to assess the chemical composition of potential source and aquifer materials. The total mass of metals in combination with the results from leachability testing can be used to determine the provenance of the COC metals and their relative leachability. The laboratory analyzed a target analyte list (TAL) of metals following the USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000) and USEPA SW846 7471B Mercury in Solid or Semisolid Wastes (Manual Cold-Vapor Technique) Revision 2 (January 1998).

Leachability: The purpose of this test was to obtain an understanding of the fraction of total metals that is leachable, which is important for evaluating the long-term environmental stability of potential source materials. The analysis simulates the interaction between a solid and meteoric water, and thus provides the leachability potential of a material. This analysis was only conducted on source materials (i.e., samples collected from within the WDA, see Section 3.1.1). The laboratory used porewater collected by Golder from the WDA (piezometer GAPIEZ04) as the leaching medium to simulate natural conditions. The laboratory tested the leachability of the source materials using USEPA SW846 1312 Modified Synthetic Precipitation Leaching Procedure (SPLP) (September 1994).

3.2 Overburden Soil and Bedrock Shale Samples

Golder subcontracted a union-licensed well driller to advance borings and install monitoring wells using sonic drilling methods. Golder collected a composite overburden sample (i.e., two-foot interval) from within the well screen interval (i.e., 10-foot screened interval) of monitoring well GAMW-42B. Golder also collected two shale samples from boring GAMW-42B, including one shale sample located just below the contact between the overburden/shale (i.e., considered as "weathered" shale) and one shale sample located approximately two feet into the shale (i.e., "non-weathered" shale). Golder submitted the overburden and shale samples to a certified laboratory under chain-of-custody procedures for analysis of total metals (see Section 3.1.12 for analytical method). The overburden and bedrock analytical results are provided in Table 1.

3.3 Groundwater and Porewater Assessment

3.3.1 Sample Collection

Golder field personnel collected groundwater and porewater (i.e., water in direct contact with CCR materials) samples in accordance with the RMSGS GMPIM. Porewater samples were collected in August, September, and October 2018. Porewater analytical results are provided in Table 2 and groundwater analytical results are

provided in Table 3. Groundwater and porewater samples were analyzed for Appendix III and IV metals and other groundwater quality parameters, as described below.

3.3.2 Geochemical Characterization

The geochemical analytical methods Golder used to characterize the porewater and groundwater samples included total metals analyses and major cations and anions analyses. These selected analytical methods are summarized below.

Metals: Metals analyses (i.e., Appendix III and IV) are important to understand the geochemical properties of porewater and groundwater. In porewater, metal results can be used for geochemical modeling and provide an indication of the leachable fraction of the solids (ITRC, 2012). In groundwater, metals analysis allows for the delineation of a potential plume, and identification of background contributions from natural sources or off-site locations.

Major Cations and Anions/Field Parameters: Geochemical modeling of mineral solubility, metal attenuation and background contributions requires analysis of major cations and anions because they affect and participate in sorption and mineral dissolution/precipitation reactions. Required field parameters include pH, dissolved oxygen, oxidation reduction potential (ORP), conductivity, and temperature, which are needed to support geochemical modeling and serve an important quality assurance/quality control (QA/QC) function.

The laboratory analyzed porewater and groundwater samples using the following methods:

- Chloride, Fluoride, and Sulfide following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- pH following USEPA SW846 9040C pH Electrometric Measurement (November 2004)
- Total Target Analyte List (TAL) Metals following USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000), SW846 6020B Inductively Coupled Plasma- MS Revision 2 (July 2014), SW846 6020A Inductively Coupled Plasma- MS Revision 1 (January 1998), and SW846 7470A Mercury in Liquid Wastes (Manual Cold- Vapor Technique) Revision 1 (September 1994)
- Total Dissolved Solids following SM 2540C Total Dissolved Solids Dried at 180°C (1993)
- Alkalinity following SM 2320B Alkalinity by Titration (2005)

4.0 DATA EVALUATION AND FINDINGS

4.1 Source Material Results

Golder collected three WDA source material samples to assess the potential contribution of source materials to groundwater. The laboratory reported results as both total and leachable arsenic and cobalt concentrations. Total arsenic and cobalt concentrations were low, ranging from 3.4 to 5.2 milligram per kilogram (mg/kg) and 5.4 to 19 mg/kg, respectively. These WDA source material concentrations are less than the range of concentrations observed in the on-Site unimpacted soil and bedrock samples (described below in Section 4.2). In addition, the laboratory measured the leachability potential of the WDA source material samples using interstitial porewater collected from the WDA (i.e., GAPIEZ-04) following U.S. EPA Modified SPLP Method protocols (see Section 3.1.2). The arsenic and cobalt leachability levels were non-detect (<0.015 mg/L and <0.004 mg/L for arsenic and cobalt, respectively), indicating that the WDA source material has negligible to no leaching potential for either arsenic or cobalt. Therefore, constituents of the WDA source materials, if they have been released from the CCR

Unit, do not appear to be contributing to the downgradient groundwater arsenic and cobalt concentrations. The WDA CCR source material results are provided in Table 1.

4.2 Overburden Soil and Bedrock Shale Results

Golder collected soil and bedrock samples from boring/monitoring well GAMW-42B to assess the presence of naturally-occurring arsenic and cobalt. Boring/monitoring well GAMW-42B is located west of and in an area unimpacted by the WDA. Total arsenic and total cobalt concentrations ranged from 2 to 30 mg/kg and 3.7 to 41 mg/kg, respectively, across the three intervals samples (30-34 ft bgs, 34-36 ft bgs, and 36-38 ft bgs). The range of total arsenic and cobalt concentrations in the samples demonstrates the heterogeneity in the natural geology of the Site. Groundwater reaches equilibrium with the naturally-occurring metals as it flows through the media, which accounts for natural variability in the arsenic and cobalt groundwater concentrations. Both arsenic and cobalt are sensitive to changes in groundwater chemistry (e.g., pH or redox potential) and can be easily remobilized into groundwater (Hem 1989). As a consequence, seasonal or other natural fluctuations in groundwater chemistry will also lead to fluctuating arsenic and cobalt concentrations.

4.3 Groundwater and Porewater Results

As stated in the CSM (see Section 2.1), most of the bottom ash/boiler slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to size of the unit and settling/depositional properties of the CCR materials, very little, if any, ash/slag is present in the southern half of the WDA. Overall, Golder expects that if there was a release from the WDA, the highest concentrations would be expected in the groundwater samples collected from monitoring wells installed near the northwest corner of the WDA (e.g.,GAMW-14/14B), as compared to concentrations detected in monitoring wells installed near the southwest corner of the WDA (e.g., GAMW-01/01B). This expectation helps explain the groundwater findings and frames the porewater results as compared to groundwater quality. The porewater and groundwater analytical results are provided in Table 2 and Table 3, respectively, and described in the following sections.

4.3.1 Geochemistry

Golder evaluated groundwater and porewater data using the relative abundance of major cations and anions to differentiate between groundwater compositions. Golder generated Piper and Durov plots using Geochemist's Workbench software to visually depict major ion chemistry abundance and elucidate relationships between background groundwater, downgradient groundwater, and porewater.

Golder used the Spece8 package in Geochemist's Workbench to assess mineral saturation in groundwater samples and determine if mineral precipitation would impact relative ion abundance. The Spece8 analysis only used data from monitoring wells with a full suite of groundwater analytical results (i.e., all major ions), which is a prerequiste for reliable and defensible geochemical modeling. The evaluation of major ion composition indicates that there are three discrete groundwater groups:

- Background and downgradient groundwater
- Groundwater influenced by an alternative source
- WDA porewater

Groundwater quality observed in samples collected from downgradient GAMW-01B and GAMW-12B showed a closer relationship to groundwater quality in background monitoring wells GAMW-03 and GAMW-03B than the WDA porewater samples (see Figure 4-3(1)). This similarity in major ion composition suggests that downgradient

groundwater has the same source as background groundwater. As a comparison, in cases where groundwater is impacted by a potential large discrete source (e.g., unlined fly ash landfill), the major groundwater ions would plot between the background and source groundwater, indicating mixing of the two waters. Wells GAMW-13B, GAMW-14B, and GAMW-51B are deeper wells installed to the top of bedrock and their groundwater compositions are different with respect to relative ion abundance from those of other downgradient wells, suggesting a potential alternative source. Neither GAMW-13B, GAMW-14B, or GAMW-51B show exceedances of arsenic or cobalt. Based on the Piper plot, the composition of groundwater in GAMW-13B is the most closely related to that of WDA porewater, and if the WDA was the source of arsenic and cobalt in groundwater, it would most likely be present in GAMW-13B.

The WDA not being the source of arsenic and cobalt in wells GAMW-01 and GAMW-14 is also supported by the total dissolved solids (TDS) content measured in these wells. The TDS contents measured in GAMW-01 and GAMW-14 in October 2018 were 350 mg/L and 290 mg/L, respectively, which was lower than in both the WDA (710 mg/L) and groundwater from background well GAMW-03/03B (440 mg/L to 450 mg/L; Figure 4-3(2)). In the absence of attenuation reactions such as mineral precipitation (which would lower the TDS of a groundwater sample), the TDS of a mixture of two samples should range between the TDS values of both inputs. Based on geochemical modeling, mineral saturation is not achieved in GAMW-01 or GAMW-14, so the groundwater does not represent a mixture of WDA porewater and groundwater from GAMW-03/03B. The TDS content measured in monitoring wells GAMW-14B and GAMW-51B is much higher than in other monitoring wells and WDA porewater samples. The TDS concentrations from these wells group independently on both the Piper and Durov diagrams compared to TDS concentrations in other wells and are likely influenced by an alternative source affecting their groundwater chemistry while demonstrating no influences from the WDA. The analytical results used to develop the Piper Plots were obtained from groundwater samples collected in October 2018 and are provided in Table 2 and Table 3.

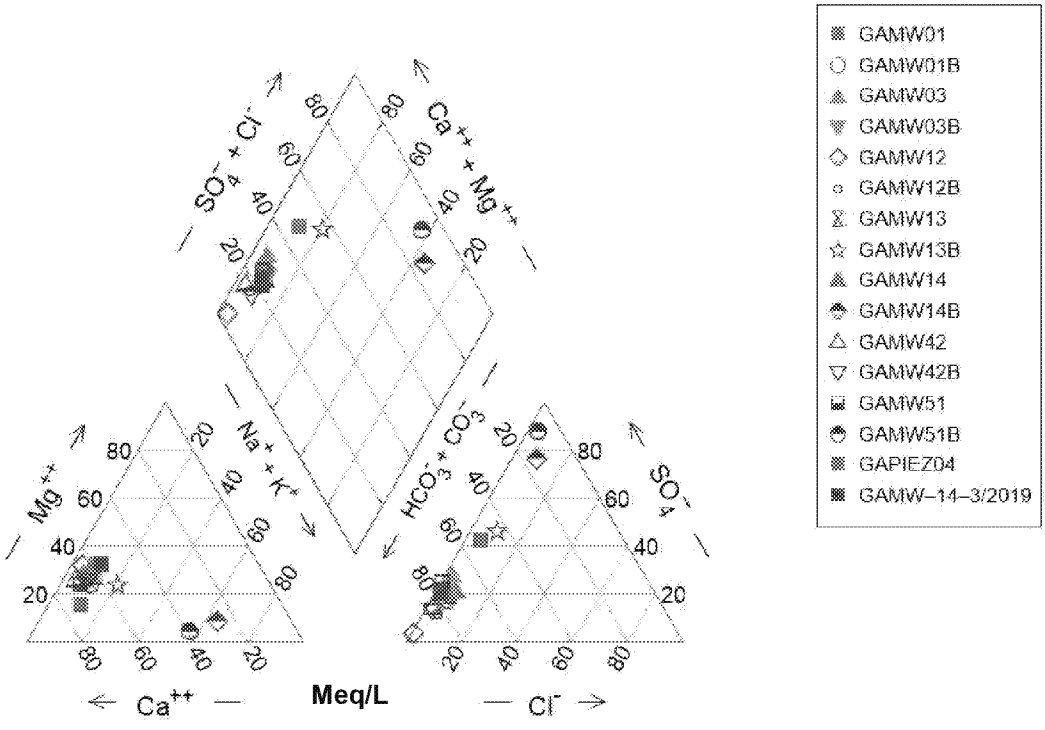


Figure 4-3(1): WDA Piper plot of relative ion abundance in groundwater samples

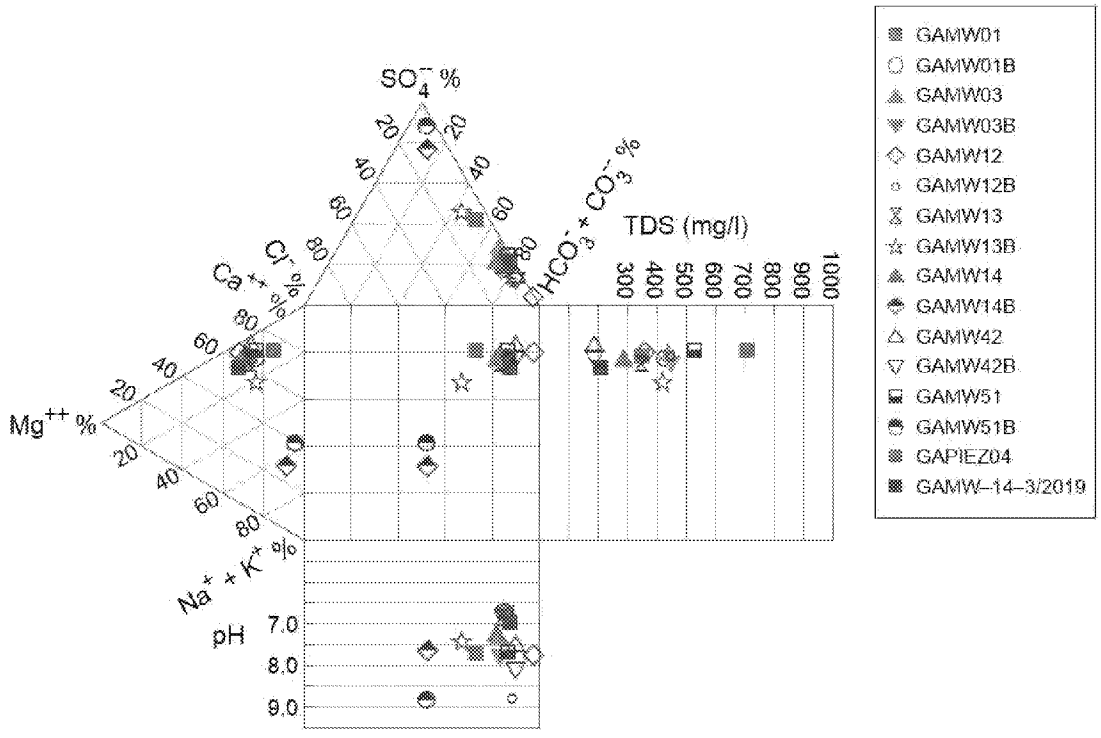


Figure 4-3(2): WDA Durov plot of relative ion abundance in groundwater and TDS (Note: TDS for GAMW-14B and GAMW-51B >1000mg/L not shown due to axis constraints)

4.3.2 Arsenic

Arsenic has been detected at concentrations above the MCL (0.01 mg/L) in groundwater samples collected from the shallow background monitoring well, shallow downgradient monitoring wells, and GAPIEZ-04 during the July 2016 to October 2018 monitoring events. The arsenic time-series plot (Figure 4-3(3)) shows seasonal impacts to the arsenic concentrations, with the lowest arsenic concentrations detected during the winter (December-March) and the highest concentrations detected during the late summer and fall (July-October). Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be detected in groundwater near the WDA. The fluctuations in arsenic concentration suggest seasonality effects and/or heterogeneity in the overburden based on the following findings:

- Arsenic concentrations found in groundwater samples collected from shallow background well GAMW-03 range from non-detect (<0.005 mg/L) to 0.018 mg/L.
- Total arsenic concentrations in the WDA porewater are similar to background concentrations (0.012 to 0.015 mg/L).
- Arsenic was observed at concentrations above the GWPS (0.015 mg/L) and/or the MCL in groundwater samples collected from shallow downgradient monitoring wells GAMW-01, GAMW-12, GAMW-13, GAMW-14. However, based on the statistical methodology applied, an SSL for arsenic has only been reported for GAMW-01. The arsenic concentrations in groundwater samples collected from monitoring well GAMW-01 range from 0.01 mg/L to 0.039 mg/L.

- Porewater arsenic concentrations measured in GAPIEZ-04 (groundwater in direct contact with CCR materials) are lower than the arsenic concentrations observed in the groundwater samples from downgradient monitoring well GAMW-01, suggesting that arsenic in groundwater samples collected from GAMW-01 is not due to a release from the CCR Unit.
- Monitoring well GAMW-01 is located at the waste boundary near the southwest corner of the WDA as shown in Figure 2. Previous bathymetric studies have indicated that there are few, if any, CCR materials in the southwest corner of the WDA. Therefore, groundwater quality at GAMW-01 should not be influenced by the contents of the WDA.

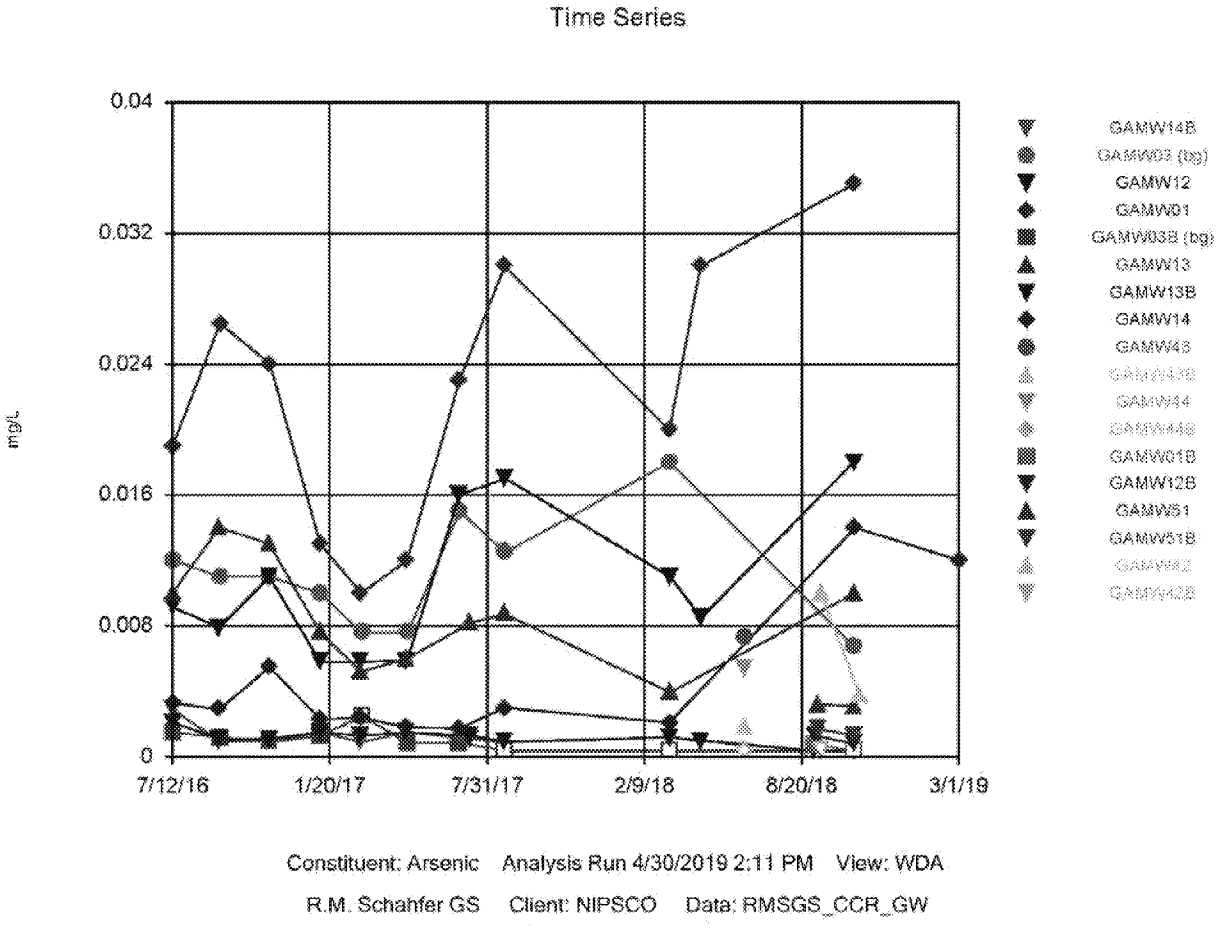


Figure 4-3(3): Arsenic Time-Series Plot

4.3.3 Cobalt

Cobalt has been detected at concentrations above the risk-based standard (0.006 mg/L) in groundwater samples collected from the shallow background monitoring well, shallow downgradient monitoring well GAMW-14, and upgradient well GAMW-03 during the July 2016 to October 2018 monitoring events. Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be detected in groundwater near the WDA. However, the cobalt time-series plot (Figure 4-3(4)) shows cobalt concentrations in GAMW-14 are fluctuating. Cobalt in all other monitoring wells is consistently observed at concentrations below the risk-based standard

(0.006 mg/L). The fluctuations in cobalt concentration suggest seasonality effects and/or heterogeneity in the overburden based on the following findings:

- Cobalt concentrations found in groundwater samples from shallow background well GAMW-03 range from non-detect (<0.001 mg/L) to 0.015 mg/L.
- Porewater cobalt concentrations observed in groundwater samples collected from GAPIEZ-04 (groundwater in direct contact with CCR materials) are not detected above the laboratory reporting limit (<0.001 mg/L).
- Cobalt was identified at a concentration above the risk-based standard and GWPS (0.015 mg/L) in groundwater samples collected from shallow downgradient monitoring well GAMW-14. Cobalt concentrations range from 0.0052 mg/L to 0.052 mg/L in groundwater samples collected from monitoring well GAMW-14 during the July 2016 to March 2019 monitoring events. The cobalt concentrations also show a statistically-significant increasing trend (see Figure 4-3(4) below) where the lower confidence interval is above the GWPS; therefore, an SSL for cobalt has been reported in GAMW-14. Golder collected a confirmation groundwater sample in March 2019. The cobalt result (0.0083 mg/L) obtained from the March 2019 monitoring event is lower than the cobalt concentration observed during the October 2018 (0.031 mg/L) monitoring event and lower than the GWPS (0.015 mg/L). While the cobalt level in GAMW-14 decreased substantially in March 2019, there was no substantial change in major relative ion abundance between the October 2018 and March 2019 samples (Figure 4-3(5)), indicating a consistent groundwater composition at this well.
- Porewater cobalt concentrations detected in GAPIEZ-04 (groundwater in direct contact with CCR materials) are lower than the cobalt concentrations found in downgradient monitoring well GAMW-14, suggesting that cobalt present in groundwater samples collected from GAMW-14 is not due to a release from the CCR Unit.

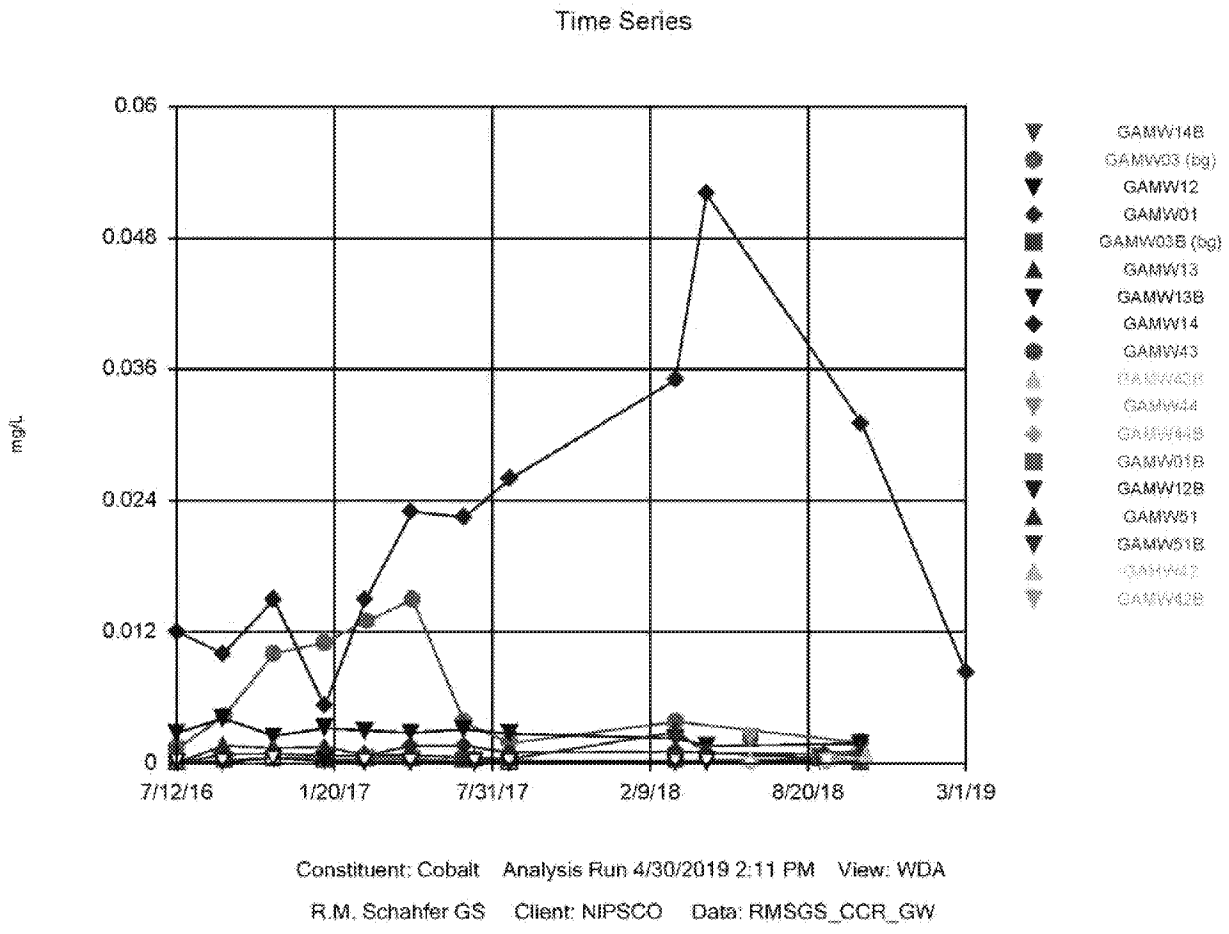


Figure 4-3(4): Cobalt Time-Series Plot

4.3.4 Indicator Parameters

The CCR Final Rule Appendix III parameters are common indicator parameters for CCR material and, depending upon site conditions, can be indicative of the presence of CCR material constituents in media of interest. Several of these indicator parameters, including boron, chloride, sulfate, and total dissolved solids, have been observed at higher concentrations in groundwater samples collected from downgradient deep monitoring well GAMW-14B (and to a lesser extent, GAMW-13B) than in the background monitoring wells. Boron, in particular, is a known CCR indicator parameter that has high mobility in groundwater and, as such, is expected to represent the furthest extent of groundwater impacts originating from CCR releases. A summary of groundwater boron concentrations is as follows:

- Boron concentrations found in groundwater samples collected from background monitoring wells GAMW-03 and GAMW-03B range from non-detect (<0.2 mg/L) to 0.32 mg/L.
- Porewater boron concentrations detected in groundwater samples collected from GAPIEZ-04 (groundwater in direct contact with CCR materials) range from 0.71 to 0.86 mg/L.
- The highest boron concentrations were observed in groundwater samples collected from the deep downgradient monitoring wells GAMW-14B (2.4 to 3.4 mg/L) and GAMW-13B (0.69 to 0.79 mg/L). These

boron concentrations are higher than background and porewater concentrations, indicating that they may be due to another source. Because boron is a groundwater tracer and the plume should be stable based on the disposal history of the WDA, Golder would expect that the highest concentrations of other CCR parameters would also be found in the same deep wells that contain elevated boron concentrations. However, this is not the case as the arsenic and cobalt SSLs occur in shallow wells. Boron concentrations in groundwater samples collected from GAMW-01 vary but are generally closer to background concentrations than porewater concentrations. Boron concentrations found in groundwater samples collected from GAMW-01 are below 0.3 mg/L in 2018. Boron concentrations detected in groundwater samples collected from GAMW-14 are similar to background concentrations and range from 0.23 to 0.36 mg/L (see Figure 4-3(5)).

Based on the lines of evidence provided above, it is considered unlikely that the WDA is the source of the arsenic and cobalt SSLs.

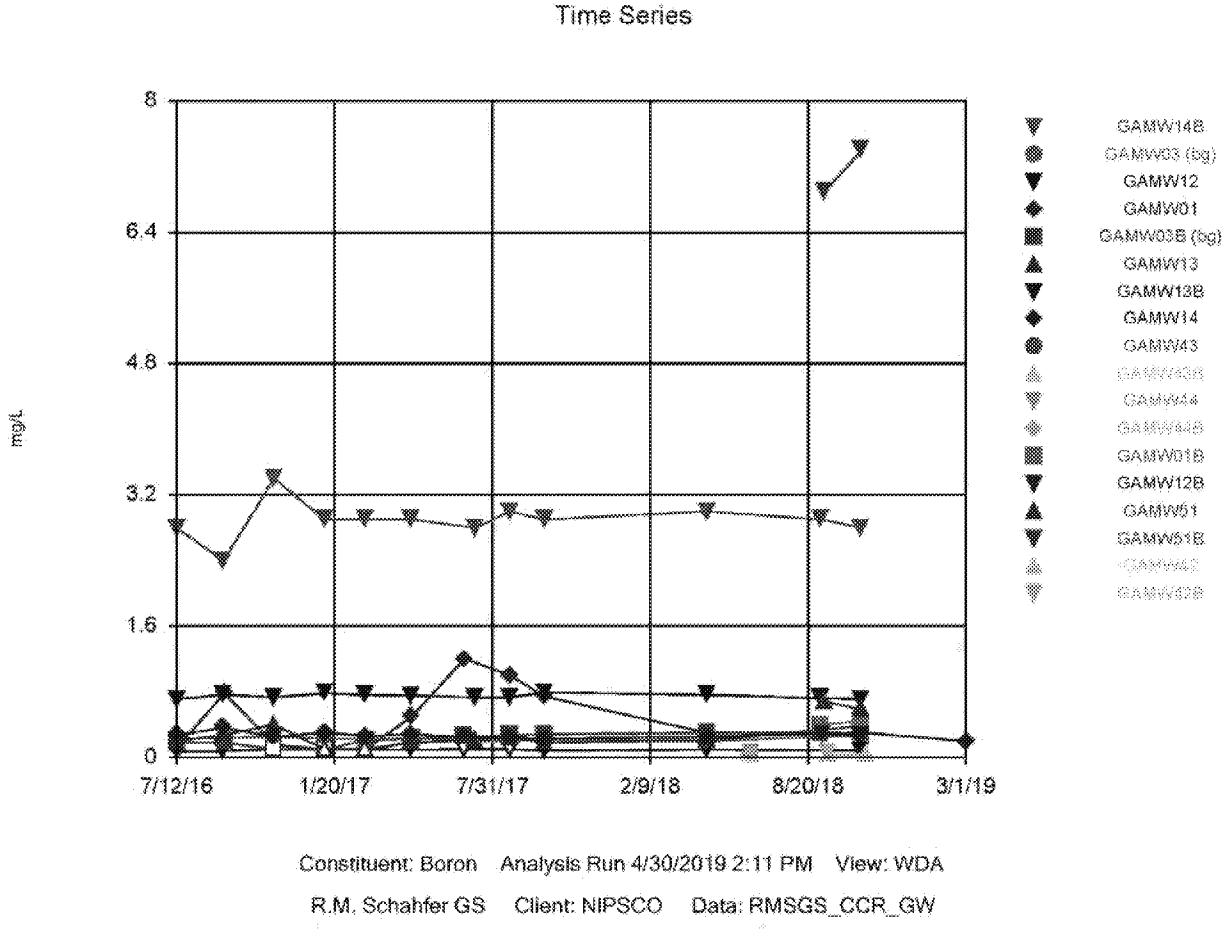


Figure 4-3(5): Boron Time-Series Plot

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on a literature review and the testing results presented above, it is Golder's opinion that the arsenic and cobalt SSLs encountered in groundwater near the WDA are linked to an alternative source rather than a release from the WDA. Golder concludes the arsenic and cobalt SSLs are caused by natural variation in the arsenic and cobalt contents of the overburden and bedrock.

Primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in Table 5-1.

Table 5-1: Primary Lines of Evidence and Supporting ASD Analysis

Key Line of Evidence	Supporting Evidence	Description
Source Material Characteristics	WDA source material and porewater concentrations	WDA source materials contain low levels of arsenic and cobalt but indicate low to no leaching potential for these compounds. Additionally, WDA porewater samples indicate lower levels of both arsenic and cobalt than in the downgradient wells. Therefore, another source must be present to account for the higher arsenic and cobalt concentrations observed in downgradient groundwater.
	Relative ion abundance differs from the WDA	As presented in the Piper and other ternary diagrams, major ion concentrations show distinct differences between the WDA porewater and downgradient groundwater samples. The geochemical properties of the downgradient groundwater samples cannot have been generated by a release from the WDA.
Natural Source	Natural Overburden and Bedrock Concentrations	Naturally occurring total arsenic and cobalt were detected in background soil boring (SB-42B). The concentrations varied across the three intervals (30-34 ft bgs, 34-36 ft bgs, 36-38 ft bgs), with concentrations up to 30 mg/kg and 41 mg/kg for arsenic and cobalt, respectively. The presence of this range in total arsenic and cobalt in the background soil boring demonstrates the heterogeneity in the natural geology of the site.
Hydrogeology	Groundwater Flow Direction	GAMW-01, a shallow well located farthest from the CCR source material, contains groundwater arsenic at concentrations above the GWPS. Arsenic has generally not been detected in samples from monitoring wells GAMW-12, GAMW-13, and GAMW-14, which are closer to and downgradient of the source material. This concentration pattern is inconsistent with the CCR Unit being the source of arsenic in this well.
	Indicator Parameters	Boron, because of its mobility, can be used to define the leading edge of the groundwater plume originating from a CCR source. The highest concentrations of boron in monitoring wells on the downgradient edge of the CCR Unit were found in GAMW-14B and GAMW-13B. Lower concentrations of boron were detected in GAMW-01 and GAMW-14. This concentration pattern is inconsistent with the CCR being the source for the cobalt and arsenic in these wells.
	Temporal trends and associations	In certain downgradient wells, seasonal variability is observed in arsenic groundwater concentrations. Cobalt concentrations were increasing between January 2017 and October 2018, but otherwise have been variable. This suggests the arsenic and cobalt is naturally occurring and not representative of a constant and consistent release from the WDA. Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be found in groundwater near the WDA. However, this is not the case, indicating the arsenic and cobalt do not originate from the WDA.

6.0 CONCLUSION

The preceding information serves as the ASD prepared for the WDA in accordance with 40 CFR 257.95(g)(3)(ii) and supports the finding that the SSLs determined on February 18, 2019 are not due to a release from the CCR Unit. The key supporting lines of evidence described above indicate that the arsenic and cobalt observed in monitoring wells downgradient of the WDA are due to natural variation and not the WDA. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the RMSGS WDA will remain in Assessment Monitoring.

7.0 REFERENCES

Dzombak, David A. Surface complexation modeling: hydrous ferric oxide. John Wiley & Sons, 1990.

EPA. 2014. National Functional Guidelines for Inorganic Data Review (EPA 540-R-013-001, August 2014).

Fenelon, J.M., K.E. Bombay, et al., 1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water Resources Investigations, Report 92-4142, 1994.

Fraser, G. S., Bleuer, N. K. Fraser, G.S., Bleuer, N.K., 1991, Geologic framework of the aquifers in the Kankakee River lowland: Indiana Geological Survey Occasional Paper 60, 10 p., 9 fig.

Hem, J. D., & Geological Survey (US). (1989). Study and interpretation of the chemical characteristics of natural water.

Lourigan, J., & Phelps, W. (2013). Caledonia Groundwater Molybdenum Investigation Southeast Wisconsin. *Wisconsin Department of Natural Resources*.

Schneider and Keller, 1970. Schneider, A.F. and Keller, S.J., Geologic Map of the Chicago Quadrangle, Indiana, Illinois, and Michigan; Indiana Geologic Survey, Bloomington. 1970.

USEPA, 1996, Test methods for evaluating solid waste, physical/chemical methods (SW-846): 3rd edition, Environmental Protection Agency, National Center for Environmental Publications, Cincinnati, Ohio, accessed at URL https://www.epa.gov/hw-sw846

US EPA (2017). Leaching Environmental Assessment Framework (LEAF) How-To Guide.

Golder Associates Inc.

Mark Haney
Program Leader

Rens Verburg
Principal Geochemist

MAH/RV/drb

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/nipscoccrgwmonitoring/shared documents/r.m. schahfer generating station/reports/wda asd spring 2019/final/wda_ask-051719.docx

TABLES

Table 1: Source Material and Background Overburden Soil and Bedrock Shale Analytical Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Sample Location	WDA-EAST	WDA-MID	WDA-WEST	SB-42B		
Start Depth (ft bgs)	0	0	0	30	34	36
End Depth (ft bgs)	1.5	1	1.5	34	36	38
Total Arsenic Result	5.2	3.4	5.1	2 J	30	30
SPLP Arsenic Result	0.015 U	0.015 U	0.0015 U	NM	NM	NM
Total Cobalt Result	19 J	5.4	6.9	3.7 J	41	37
SPLP Cobalt Result	0.0040 U	0.0040 U	0.0040 U	NM	NM	NM

Notes:

ft bgs: Feet below ground surface

All results displayed are in milligram per kilogram (mg/kg), except SPLP results which are in milligram per liter (mg/L).

SPLP: Synthetic Precipitation Leaching Procedure

J: Indicates the result is estimated.

U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

NM: Not measured

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

Table 2: Porewater Analytical Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Location	GAPIEZ04		
Sample Date	2018-08-09	2018-09-13	2018-10-30
Fraction	D	T	T
Analyte			
Alkalinity, Total	210 J	220	220
Arsenic	0.012	0.015	0.015
Boron	0.86	0.71	0.86
Calcium	140	160	170
Chloride	19	21	18
Cobalt	0.00026 J	0.001 U	0.001 U
Magnesium	20	20	20
pH	7.35	7.27	7.71
Potassium	4.8 J	5	4.8 J
Sodium	28	22	27
Sulfate	280	280	170
Total Dissolved Solids	670	660	710

Notes:

Table shows all results in milligram per liter (mg/L)

D: Dissolved

T: Total

J: Indicates result is estimated.

U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW01													GAMW01B	
		2016-07-12	2016-09-08	2016-09-08	2016-11-09	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-23	2018-09-06	2018-10-23
		N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters																
Boron	mg/L	0.11	1.2 J	0.36 J	0.15 J	0.2 U	0.2 U	0.5	1.2	1	0.74		0.3	0.29	0.4	0.44
Calcium	mg/L	65	240 J	83 J	74	71	83	110	110	81	81		87	77	110	100
Chloride	mg/L	4.3	28 J	12 J	5.3	5.6	8.3	18	18	12	16		10	8.1	21	19
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.17 J	0.14
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78	7.01	6.74
Sulfate	mg/L	54 J-	500 J	100 J	62	52	54	100	200	130	110		50	68	72	69
Total Dissolved Solids	mg/L	280	1100 J	380 J	320	280	340	480	580	420	420		360	350	450	430
Appendix IV Parameters																
Antimony	mg/L	0.00048 J	0.001 J	0.00068 J	0.001 J	0.0016 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.019	0.014 J	0.039 J	0.024	0.013	0.01	0.012	0.023	0.03		0.02	0.03	0.035	0.00077 J	0.005 U
Barium	mg/L	0.059	0.078 J	0.057 J	0.064	0.053	0.07	0.065	0.093	0.077		0.057	0.052	0.052	0.19	0.17
Beryllium	mg/L	0.00099 J	0.00068 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.00036 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J		0.001 U		0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00038 J	0.002 U	0.00037 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00053 J	0.0011	0.00087 J	0.00068 J	0.00074 J	0.0016	0.0016	0.001		0.0011	0.001	0.00075 J	0.00056 J	0.00027 J
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.17 J	0.14
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00065 J		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0031 J	0.008 U	0.008 U	0.008 U	0.0031 J	0.0015 J	0.003 J	0.0042 J	0.0037 J		0.0019 J		0.0028 J	0.0039 J	0.0046 J
Mercury	mg/L	0.0002 U	0.00035	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.011	0.025	0.022	0.011	0.01 U	0.01 U	0.017	0.033	0.045		0.014	0.016	0.015	0.0015 J	0.01 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00075 J	0.0018 J	0.001 J	0.0016 J	0.0031 J	0.0017 J		0.0016 J		0.001 J	0.001 J	0.005 U
Thallium	mg/L	0.00018 J	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00032 J		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L													250	290	320
Magnesium	mg/L													19	21	24
Potassium	mg/L													4.6 J	4.8 J	5.5
Sodium	mg/L													9.1	18	10
Field Parameters																
Dissolved Oxygen	mg/L	0.14		0.9	0.18	0.25	0.17	0.07	0.61	0.32	0.19	0.28	0.14	0.22	0.62	0.23
Oxidation-Reduction Potential	millivolts	-92.6		-21.4	-120.7	-110.5	-127.2	-102.8	98.3	-43.1	-48.2	-85.1	284.1	-130.2	-96.2	-111.7
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78	7.01	6.74
Specific Conductance	uS/cm	448		604	512	416	508	707	844	650	673	395	550	594	684	687
Temperature	deg C	13.9		17.8	16.2	11.2	9.73	10.8	13.8	17	17.2	9.2	9.4	16.9	13.9	13.9
Turbidity	NTU	1.25		2.12	3.92	4.79	3.86	3.69	4.22	2.22	2.8	4.61	4.05	4.81	4.16	2.41

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW03														
		2016-07-13	2016-09-08	2016-11-08	2017-01-09	2017-01-09	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-10-24	2018-10-24
		N	N	N	FD	N	N	N	N	FD	N	N	N	N	FD	N
Appendix III Parameters																
Boron	mg/L	0.23	0.24	0.25	0.24	0.22	0.22	0.23	0.21	0.2	0.2	0.22		0.2	0.28	0.26
Calcium	mg/L	83	87	100	110	94	100	110	87	75	77	87		93	97	94
Chloride	mg/L	7.7	8.6	10	9.1	9.1	8.1	6.8	10	8.2	8.3	9		4.9	22	7.7
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37
Sulfate	mg/L	100 J-	100	110	110	110	120	130	83	77	77	93		110	67	100
Total Dissolved Solids	mg/L	400	390	500	440	430	450	510	420	370	370	430		380	440	440
Appendix IV Parameters																
Antimony	mg/L	0.00023 J	0.00091 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Arsenic	mg/L	0.012	0.011	0.011	0.01	0.01	0.0076	0.0076	0.015	0.012	0.013		0.018		0.005 U	0.013
Barium	mg/L	0.087	0.096	0.11	0.11 J	0.081 J	0.087	0.091	0.071	0.079	0.079		0.074		0.11	0.1
Beryllium	mg/L	0.00055 J	0.00053 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	8.8E-05 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Cobalt	mg/L	0.0014	0.0043	0.01	0.011	0.011	0.013	0.015	0.0037	0.0018	0.0019		0.0038		0.001 U	0.0037
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15
Lead	mg/L	0.001 U	0.001 U	0.00016 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00052 J	0.00045 J	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.0064 J	0.008 U	0.008 U	0.0042 J	0.0044 J	0.0025 J	0.0045 J	0.0063 J	0.0067 J	0.0069 J		0.006 J		0.008 U	0.0074 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.0087 J	0.009 J	0.01 U	0.012 J+	0.01 U	0.01 U	0.0082 J	0.0084 J	0.0069 J	0.0076 J		0.0063 J		0.0065 J	0.0082 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00085 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L															260
Magnesium	mg/L															25
Potassium	mg/L															0.97 J
Sodium	mg/L															10
Field Parameters																
Dissolved Oxygen	mg/L	0.38	0.61	0.24		0.71	1.07	0.73	0.61		0.22	0.29	1.3	0.9		0.99
Oxidation-Reduction Potential	millivolts	186.5	7.4	-30.2		-34	-28.5	-21.7	-24.1		-28.5	-83.1	-76.4	-98.2		-283.8
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37
Specific Conductance	uS/cm	599	630	711		586	588	760	550		583	655	369	572		675
Temperature	deg C	13.4	16.2	15.5		10.8	9.02	10.4	12.7		15.2	16.1	8.6	7.9		16.2
Turbidity	NTU	2.72	4.41	2.92		4.58	4.68	4.42	4.5		2.51	4.18	4.66	4.96		3.55

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW03B													
		2016-07-13	2016-09-08	2016-11-08	2017-01-10	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-09-06	2018-09-06	2018-10-24
		N	N	N	N	N	N	N	N	N	N	N	FD	N	N
Appendix III Parameters															
Boron	mg/L	0.18	0.18	0.2 U	0.2 U	0.21	0.23	0.25	0.27	0.28		0.3	0.32	0.28	0.29
Calcium	mg/L	98	100	110	98	110	110	110	99	95		110	100	99	98
Chloride	mg/L	14	13	15	16	20	20	22	21	25		23	24	25	22
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77
Sulfate	mg/L	58 J-	59	58	77	67	67	66	68	84		66	64	64	67
Total Dissolved Solids	mg/L	420	410	420	440	450	480	510	450	460		420	470	450	450
Appendix IV Parameters															
Antimony	mg/L	0.00019 J	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0015 J	0.0012 J	0.0009 J	0.0013 J	0.005 U	0.00085 J	0.00087 J	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U
Barium	mg/L	0.11	0.1	0.11	0.096	0.11	0.11	0.11	0.12		0.13		0.12	0.12	0.12
Beryllium	mg/L	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00031 J	0.001 U	0.00017 J	0.001 U	0.00038 J	0.00021 J	0.001 U		0.00024 J		0.00034 J	0.00036 J	0.001 U
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21
Lead	mg/L	0.001 U	0.001 U	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0014 J	0.008 U	0.008 U	0.0011 J	0.0011 J	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0044 J	0.0043 J	0.01 U	0.01 U	0.01 U	0.0045 J	0.0052 J	0.0055 J		0.0066 J		0.0067 J	0.0067 J	0.0066 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00066 J	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.0014 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry															
Alkalinity, Total	mg/L													310	300
Magnesium	mg/L													27	25
Potassium	mg/L													1.4 J	1.2 J
Sodium	mg/L													20	18
Field Parameters															
Dissolved Oxygen	mg/L	0.42	1.11	0.32	0.48	0.41	0.15	0.38	0.31	0.17	0.4	0.19		1.12	0.5
Oxidation-Reduction Potential	millivolts	196.3	-26.8	-61.4	-98.9	-86.2	-77.9	-49.1	-34.5	-94.7	-85.2	-95.1		-66.2	-294.4
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77
Specific Conductance	uS/cm	676	680	6.84	678	631	737	656	730	728	515	778		669	719
Temperature	deg C	12.4	13.2	13.2	12.2	11.63	12.1	12.2	13	13.3	11.3	4.1		13	13.69
Turbidity	NTU	3.66	4.73	2.84	2.02	3.1	2.51	1.84	1.16	0.81	4.59	4.36		3.55	3.54

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW12													GAMW12B	
		2016-07-12	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-10-23	2018-09-07	2018-10-23
		FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters																
Boron	mg/L	0.07	0.073	0.075	0.2 U	0.2 U	0.2 U	0.092 J	0.2 U	0.2 U	0.079 J		0.095 J	0.081 J	0.28	0.26
Calcium	mg/L	88	93	91	97	90	97	97	100	89	87		87	94	100	110
Chloride	mg/L	2.3	3.8	6.1	9.6	11	10	10	7.6	5.2	3.2		3.3	2.5	22	19
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.12 J	0.096
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.15	8.83
Sulfate	mg/L	5.9 J-	7.5 J-	15	6.8	17	12	14	11	11	11		11	12	63	49
Total Dissolved Solids	mg/L	380	390	390	430	400	410	390	400	400	390		350	360	870 J+	450
Appendix IV Parameters																
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.00086 J		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0086	0.0097	0.0079	0.011	0.0058	0.0058	0.0059	0.016	0.017		0.011	0.0085	0.018	0.0013 J	0.00079 J
Barium	mg/L	0.14	0.14	0.15	0.14	0.11	0.14	0.12	0.14	0.13		0.11	0.1	0.12	0.11	0.12
Beryllium	mg/L	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.00032 J		0.00044 J	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.00024 J	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.00099 J
Cobalt	mg/L	0.0026	0.0029	0.0041	0.0025	0.0032	0.003	0.0028	0.0031	0.0027		0.0023	0.0016	0.0018	0.00039 J	0.00038 J
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.12 J	0.096
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0025 J	0.003 J	0.008 U	0.008 U	0.0029 J	0.0026 J	0.0032 J	0.0034 J	0.003 J		0.0023 J		0.0032 J	0.0042 J	0.0042 J
Mercury	mg/L	0.00019 J+	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.01 U	0.002 J	0.0037 J	0.01 U	0.01 U	0.01 U	0.004 J	0.003 J	0.0029 J		0.0035 J		0.0033 J	0.01 U	0.01 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00054 J	0.0007 J	0.005 U	0.005 U	0.005 U		0.00091 J		0.005 U	0.0024 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L													360	340	380
Magnesium	mg/L													25	27	28
Potassium	mg/L													2.2 J	2.8 J	3.2 J
Sodium	mg/L													5.5	13	14
Field Parameters																
Dissolved Oxygen	mg/L		0.57	2.06	0.25	0.31	0.25	0.1	0.4	0.32	0.46	0.33	0.25	0.93	0.6	0.52
Oxidation-Reduction Potential	millivolts		-47.5	-44.9	-71.8	-50.3	-74	-66.7	-75.8	-30.1	-101.1	-87.5	-239.8	-377.3	-98.9	-378.3
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.15	8.83
Specific Conductance	uS/cm		634	688	660	569	605	664	645	667	665	393	558	628	712	760
Temperature	deg C		14.7	19.5	16.2	10.6	9.38	10.8	14.3	17.2	17.5	8.2	8.7	16.99	14	14.11
Turbidity	NTU		2.97	3.11	4.9	4.44	4.61	4.46	3.78	3.33	3.41	3.55	4.12	2.91	3.33	1.39

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW13											
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20	2018-10-24
		N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters													
Boron	mg/L	0.2	0.27	0.4	0.2 U	0.2 U	0.18 J	0.21	0.24	0.18 J		0.21	0.38
Calcium	mg/L	85	86	86	80	94	100	87	88	86		110	74
Chloride	mg/L	13	15	18	4.6	7.4	8.2	10	10	11		9.7	14
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88
Sulfate	mg/L	14 J-	47	62	40	43	52	25	15	25		52	59
Total Dissolved Solids	mg/L	340	400	430	320	360	380	340	370	360		400 J	350
Appendix IV Parameters													
Antimony	mg/L	0.00016 J	0.00028 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U
Arsenic	mg/L	0.01	0.014	0.013	0.0076	0.0052	0.006	0.0082	0.0087		0.0039 J		0.01
Barium	mg/L	0.13	0.14	0.14	0.092	0.11	0.13	0.16	0.14		0.11	0.12	0.14
Beryllium	mg/L	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Chromium	mg/L	0.00097 J	0.002 U	0.002 U	0.002 U	0.00068 J	0.002 U	0.002 U	0.002 U		0.0012 J		0.002 U
Cobalt	mg/L	0.001 U	0.0016	0.0014	0.0015	0.00077 J	0.00074 J	0.0005 J	0.00042 J		0.0029	0.00096 J	0.00032 J
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Lithium	mg/L	0.0012 J	0.008 U	0.008 U	0.00047 J	0.008 U	0.008 U	0.0019 J	0.008 U		0.008 U		0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U
Molybdenum	mg/L	0.0021 J	0.0074 J	0.013	0.01 U	0.01 U	0.004 J	0.0033 J	0.0022 J		0.0053 J		0.0054 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.0011 J		0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
General Chemistry													
Alkalinity, Total	mg/L												240
Magnesium	mg/L												20
Potassium	mg/L												3.1 J
Sodium	mg/L												14
Field Parameters													
Dissolved Oxygen	mg/L	0.23	0.95	6.77	0.43	0.6	0.28	0.91	0.28	0.41	0.81	0.32	1.12
Oxidation-Reduction Potential	millivolts	-92.2	-70.8	-95.5	-66.2	-84.8	-96	-4.1	16.8	-34.8	-101.1	-112.4	-268.7
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88
Specific Conductance	uS/cm	6.14	717	694	538	593	664	630	661	655	446	723	614
Temperature	deg C	16.3	20.5	16.6	10.4	9.14	11.2	16	17.6	17.8	8.2	8.7	17.02
Turbidity	NTU	4.75	2.41	3.92	1.59	1.51	2.11	3.16	1.28	2.05	4.77	2.88	1.12

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW13B															
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-02-28	2017-04-25	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20	2018-04-20	2018-09-06	2018-10-24
		N	N	N	N	FD	N	FD	N	N	N	N	N	FD	N	N	N
Appendix III Parameters																	
Boron	mg/L	0.71	0.76	0.73	0.78	0.74	0.78	0.74	0.76	0.73	0.73	0.79			0.76	0.72	0.71
Calcium	mg/L	80	70	78	76	76	79	78	77	75	72	78			76	72	71
Chloride	mg/L	24	25	25	25	25	25	25	26	26	27	28			27	27	24
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45
Sulfate	mg/L	150 J-	150	150	150	150	150	150	150	150	160	170			150	150	150
Total Dissolved Solids	mg/L	440	410	410	390	420	420	400	390	390	430	440			370 J	410	420
Appendix IV Parameters																	
Antimony	mg/L	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U
Arsenic	mg/L	0.0021 J	0.0011 J	0.0011 J	0.0015 J	0.0013 J	0.0013 J	0.0016 J	0.0014 J	0.0013 J	0.00092 J		0.0012 J	0.00098 J		0.005 U	0.005 U
Barium	mg/L	0.093	0.08	0.084	0.084	0.093	0.097	0.091	0.093	0.089	0.086		0.1	0.091	0.094	0.087	0.082
Beryllium	mg/L	0.00063 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00036 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U		0.00019 J	0.001 U
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25
Lead	mg/L	0.001 U	0.001 U	0.00042 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Lithium	mg/L	0.0023 J	0.008 U	0.008 U	0.0019 J	0.0013 J	0.0016 J	0.0018 J	0.0017 J	0.0034 J	0.0021 J		0.008 U	0.008 U		0.008 U	0.0018 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U			0.0002 U	0.0002 U
Molybdenum	mg/L	0.023	0.021	0.022	0.019 J+	0.02	0.02	0.021	0.021	0.022	0.021		0.021	0.022	0.021	0.018	0.018
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U		0.001 J	0.005 U
Thallium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
General Chemistry																	
Alkalinity, Total	mg/L															150	150
Magnesium	mg/L															19	19
Potassium	mg/L															2.9 J	2.9 J
Sodium	mg/L															28	30
Field Parameters																	
Dissolved Oxygen	mg/L	0.65	1.05	0.44	0.226		0.69		0.22	0.56	0.63	0.34	0.53		0.14	0.38	1.24
Oxidation-Reduction Potential	millivolts	-86.5	-92.3	-110.1	-111.5		-114.4		-125.7	-72.6	1.1	-72.1	-98.1		-230.2	-118.7	-235.5
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45
Specific Conductance	uS/cm	634	634	624	575		611		604	613	652	681	464		607	631	639
Temperature	deg C	14.7	16.8	14.5	12.7		12.6		13.2	13.9	14.4	14.4	12		12.3	14.14	14.1
Turbidity	NTU	4.94	1.94	1.57	2.86		4.56		4.5	3.86	1.8	0.42	4.22		4.19	2.25	1.08

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW14													
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-25	2019-03-01
		N	N	N	N	N	N	FD	N	N	N	N	N	N	N
Appendix III Parameters															
Boron	mg/L	0.27	0.36	0.25	0.3	0.26	0.28	0.26	0.24	0.24	0.23		0.25	0.3	0.2
Calcium	mg/L	69	69	72	55	65	57	58	58	68	73		37	58	38
Chloride	mg/L	15	11	8.7	7.6	8.4	5.1	2	2.1	1.7 J	1.8		1.4	13	2.8
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21
pH	SU	6.32 O	6.88	6.59	5.99 O	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01
Sulfate	mg/L	100 J-	88	52	74	79	77	52	48	54	54		35	51	35
Total Dissolved Solids	mg/L	360	310	310	250 J+	310	260	270	260	300	340		220	290	210
Appendix IV Parameters															
Antimony	mg/L	0.00036 J	0.00032 J	0.002 U	0.00039 J	0.002 U	0.00091 J	0.002 U	0.002 U	0.002 U		0.0016 J		0.002 U	0.002 U
Arsenic	mg/L	0.0033 J	0.0029 J	0.0055	0.0023 J	0.0024 J	0.0018 J	0.0017 J	0.0018 J	0.003 J		0.0021 J		0.014	0.012
Barium	mg/L	0.065	0.068	0.065	0.059	0.07	0.071	0.065	0.066	0.069		0.061	0.049	0.058	0.041
Beryllium	mg/L	0.00013 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.00046 J	0.002 U	0.002 U	0.002 U	0.002 U		0.0011 J		0.002 U	0.002 U
Cobalt	mg/L	0.012	0.01	0.015	0.0052	0.015	0.023	0.022	0.023	0.026		0.035	0.052	0.031	0.0083
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.00046 J	0.008 U	0.008 U	0.00038 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.0088 J	0.011	0.01 U	0.013 J+	0.011	0.0098 J	0.008 J	0.0082 J	0.0078 J		0.011	0.0096 J	0.011	0.0074
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00058 J	0.0011 J	0.00095 J	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
General Chemistry															
Alkalinity, Total	mg/L													180	140
Magnesium	mg/L													18	13
Potassium	mg/L													2.6 J	1.9 J
Sodium	mg/L													7.1	7
Field Parameters															
Dissolved Oxygen	mg/L	0.39	1.24	0.78	1.68	3.38	0.6		3.1	1.19	0.46	1.33	1.02	1.8	0.32
Oxidation-Reduction Potential	millivolts	179.6	163.9	75.6	2303	225.8	82.1		268.3	110.1	89.5	-117	-243.1	-240.9	-11.5
pH	SU	6.32	6.88	6.59	5.99	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01
Specific Conductance	uS/cm	501	512	505	360	430	400		404	466	578	241	283	464	226
Temperature	deg C	14.7	18.6	15.5	11.2	9.85	10.9		13.5	16.2	16.7	8.99	9.4	16.3	8.79
Turbidity	NTU	2.33	1.33	0.57	0.91	4.14	2.71		3.23	3.71	2.61	4.41	4.89	1.81	4.43

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW14B												
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-09-06	2018-10-25
		N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters														
Boron	mg/L	2.8	2.4	3.4	2.9	2.9	2.9	2.8	3	2.9		3	2.9	2.8
Calcium	mg/L	150	130	140	84	95	110	120	120	120		150	150	150
Chloride	mg/L	100	100	120	94	100	100	83	100	110		110	110	97
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67
Sulfate	mg/L	1200 J-	950	1100	790	860	900	780	960	880		990	1100	1100
Total Dissolved Solids	mg/L	1900	2000	2000	1700	1700	1700	1500	1800	1800		2000	2000	1900
Appendix IV Parameters														
Antimony	mg/L	0.00016 J	0.002 U	0.00071 J	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Arsenic	mg/L	0.0029 J	0.00095 J	0.001 J	0.0015 J	0.00092 J	0.0015 J	0.0011 J	0.0009 J		0.0012 J		0.005 U	0.005 U
Barium	mg/L	0.13	0.12	0.12	0.081	0.089	0.096	0.11	0.1		0.11	0.11	0.12	0.12
Beryllium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.00094 J	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00023 J	0.001 U	0.00045 J	0.0002 J	0.001 U	0.00019 J	0.00028 J		0.00019 J		0.00039 J	0.00022 J
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31
Lead	mg/L	0.0012	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.005 J	0.008 U	0.008 U	0.0053 J	0.0046 J	0.0054 J	0.0065 J	0.0051 J		0.0043 J		0.0056 J	0.0057 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.035	0.035	0.023	0.031 J+	0.03	0.028	0.014	0.015		0.022	0.026	0.033	0.035
Selenium	mg/L	0.005 U	0.005 U	0.00087 J	0.00083 J	0.00061 J	0.005 U	0.005 U	0.00099 J		0.005 U		0.0021 J	0.001 J
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00025 J		0.001 U		0.001 U	0.001 U
General Chemistry														
Alkalinity, Total	mg/L												220	220
Magnesium	mg/L												31	28
Potassium	mg/L												13	12
Sodium	mg/L												430	410
Field Parameters														
Dissolved Oxygen	mg/L	0.3	1.28	0.44	0.35	0.27	0.11	1.02	0.76	0.31	0.37	0.17	0.44	1.3
Oxidation-Reduction Potential	millivolts	-60.6	29.7	-76.7	-79.8	-81.4	-112.8	31.4	58	-93.4	102.6	-286.8	-114.1	-211.9
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67
Specific Conductance	uS/cm	2425	2515	2557	2019	1990	2211	2156	2177	2295	1844	2171	2642	2542
Temperature	deg C	14.6	16.3	14	12.4	12.5	13.3	13.5	14	14.1	12.4	12.5	13.91	13.4
Turbidity	NTU	4.7	1.94	0.97	1.48	4.05	4.13	1.26	0.63	0.48	3.79	2.59	1.42	1.41

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW42		GAMW42B	GAMW43	GAMW43B	GAMW44	GAMW44B		GAMW51		GAMW51B	
		2018-09-13	2018-10-31	2018-09-13	2018-06-13	2018-06-13	2018-06-13	2018-06-13	2018-06-13	2018-09-10	2018-10-25	2018-09-10	2018-10-25
		N	N	N	N	N	N	FD	N	N	N	N	N
Appendix III Parameters													
Boron	mg/L	0.04 J	0.041 J	0.061 J	0.025 J	0.037 J	0.05 J	0.036 J	0.034 J	0.68	0.58	6.9	7.4
Calcium	mg/L	44	38	46	26	38	25	39	40	130	130	250	240
Chloride	mg/L	3.1	2.8	4	6	1.5	10	7.8	7.9	6.3	3.6	62	54
Fluoride	mg/L	0.25 J	0.2	0.25 J	0.15 J	0.16 J	0.096 J	0.1 J	0.11 J	0.44 J	0.41	0.79 J	0.8
pH	SU	7.54	7.15	8.08	6.63	7.11	6.77		7.29	8.08	7.69	8.72	8.86
Sulfate	mg/L	21	23	21	25	26	50	24	25	130	110	1300	1600
Total Dissolved Solids	mg/L	190	170	190	160	180	200	180	170	550	530	2200	2200
Appendix IV Parameters													
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0008 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	0.0037 J	0.005 U	0.0073	0.0018 J	0.0054	0.005 U	0.005 U	0.0032 J	0.0031 J	0.0017 J	0.0013 J
Barium	mg/L	0.034	0.046	0.016	0.028	0.015	0.024	0.013	0.013	0.16	0.17	0.07	0.063
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.0014 J	0.002 U	0.002 U	0.0011 J	0.0023	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00027 J	0.00053 J	0.001 U	0.0023	0.00033 J	0.0025	0.001 U	0.001 U	0.001	0.0011	0.00028 J	0.00022 J
Fluoride	mg/L	0.25 J	0.2	0.25 J	0.15 J	0.16 J	0.096 J	0.1 J	0.11 J	0.44 J	0.41	0.79 J	0.8
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.00092 J	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.0018 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0073 J	0.0052 J	0.05	0.048
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0035 J	0.0022 J	0.0048 J	0.004 J	0.0022 J	0.013	0.0021 J	0.0021 J	0.028	0.022	0.13	0.13
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.001 J	0.00089 J	0.0014 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
General Chemistry													
Alkalinity, Total	mg/L	130		140						350	350	160	160
Magnesium	mg/L	9.9		11						25	27	16	16
Potassium	mg/L	0.76 J		1.9 J						8.5	6.2	24	24
Sodium	mg/L	3 J		6.2						17	13	340	390
Field Parameters													
Dissolved Oxygen	mg/L	0.8	0.13	0.53	0.19	0.18	0.68		0.48	0.31	1.9	0.26	1.08
Oxidation-Reduction Potential	millivolts	-112.2	-147.1	-248.6	-12	-81.5	51.6		-55.9	-124.4	-247.2	-169.2	-258.6
pH	SU	7.54	7.15	8.08	6.63	7.11	6.77		7.29	8.08	7.69	8.72	8.86
Specific Conductance	uS/cm	288	274	297	269	245	272		248	1076	806	3438	2720
Temperature	deg C	14.8	13.9	12.8	13.1	12.1	12.8		11.6	15.79	15.08	14.43	13.63
Turbidity	NTU	3.92	4.11	4.9	4.35	2.01	4.38		3.22	0.94	1	2.98	1.49

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

FIGURES

LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	1/31/2019
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	1

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

LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Assessment Monitoring Well
- Porewater Sample Location
- CCR Source Material Sample Location
- Slurry Wall
- CCR Unit
- Approximate Extent of Inactive Retired Waste Disposal Area
- Generalized Groundwater Flow Directions
- Approximate Property Line

0 350 700

1 " = 350 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCES: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SAMPLE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	5/6/2019
DESIGNED	JSP
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	2

GOLDER

golder.com

APPENDIX B

Waste Disposal Area Alternative Source Demonstration November 2019

Northern Indiana Public Service Company (NIPSCO)

R. M. Schahfer Generating Station – Waste Disposal Area

Wheatfield, Indiana

Recertification of Alternative Source Demonstration

40 CFR §257.95

I have personally reviewed this recertification of the alternative source demonstration (ASD), the subject of which is the Waste Disposal Area (WDA) at the NIPSCO R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated November 2019. Based on an inquiry of those individuals immediately responsible and on supporting data that I understand to be true, accurate, and complete, I verify the information in this recertification of the ASD is accurate and meets the applicable requirements of the CCR Final Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the WDA meets the applicable requirements of 40 CFR §257.95.

JOSEPH BERNARD GORMLEY JR.
REGISTERED
No. PE11900213
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Joseph Bernard Gormley, Jr.
Indiana Professional Engineer
License #: PE11900213

11/26/2019
Date

GOLDER

TECHNICAL MEMORANDUM

DATE November 26, 2019 **Project No.** 19121567

TO Marc Okin, Dan Sullivan, NIPSCO LLC

CC Maggie Rice, Maureen Turman, Joe Kutch, Mark Haney, Jim Peace, Joe Gormley

FROM Danielle Sylvia **EMAIL dsylvia@golder.com**

RE: RECERTIFICATION OF R.M. SCHAHFER WASTE DISPOSAL AREA ALTERNATIVE SOURCE DEMONSTRATION

On behalf of Northern Indiana Public Service Company LLC (NIPSCO LLC), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the third (April 2019) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS) Waste Disposal Area (CCR Unit). This evaluation was conducted in accordance with 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (CCR Rule), as amended, and corresponding regulations under 329 Indiana Administrative Code (IAC) 10-9-1.

The statistical evaluation of the third Assessment Monitoring event was completed on August 28, 2019. The results of the statistical evaluation indicated the lower confidence level (LCL) exceeded the background concentration for arsenic in downgradient monitoring well GAMW-01, which is interpreted as apparent evidence of a statistically-significant level (SSL). Although determination of an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO LLC) to demonstrate that a source other than the CCR unit or another condition caused the apparent SSL. Golder identified the same SSL after the second (October 2018) Assessment Monitoring event at the RMSGS Waste Disposal Area (WDA) and submitted an Alternative Source Demonstration (ASD) on May 17, 2019. As described in the ASD, the source materials characteristics, naturally occurring concentrations, and site hydrogeology indicate that the source of the arsenic SSL observed in GAMW-01 is due to natural variation and not the WDA.

1.0 SUMMARY OF RESULTS

The results of the third Assessment Monitoring event will be included in the 2019 Annual Report and the results of the statistical analysis are summarized below. The arsenic results collected from GAMW-01 in April 2019 were 0.014 milligram per liter (mg/L) and 0.015 mg/L, for normal and field duplicate samples, respectively. These results are at or below the arsenic groundwater protection standard (GWPS) for the WDA of 0.015 mg/L, which is calculated based on the background arsenic concentrations. In addition, these results are within the historical range of values recorded from GAMW-01. As described above, when the LCL exceeds the GWPS, this is interpreted as an apparent SSL. Despite the most recent data points being below the GWPS, the LCL (0.0151 mg/L) exceeds the GWPS by 0.0001 mg/L.

As discussed in the ASD, a second SSL, cobalt was identified at well GAMW-14. Subsequent to the second Assessment Monitoring event, Golder collected two samples from this well and both results were below the cobalt

GWPS of 0.015 mg/L. Consequently, the LCL is no longer above the GWPS and there is no cobalt SSL in the third Assessment Monitoring event. The differences in results are likely due to normal or temporal fluctuations in groundwater quality, which supports the conclusion of the ASD that the source of the SSL is natural variation.

2.0 ALTERNATIVE SOURCE DEMONSTRATION

The information presented above indicates the results of the third Assessment Monitoring event are consistent with the previous Assessment Monitoring events, and the rationale presented in the May 17, 2019 ASD is still applicable. Golder prepared the current ASD in accordance with 40 CFR 257.95(g)(3) and it supports the finding that the SSLs determined in the August 28, 2019 statistical evaluation are not due to release from the CCR Unit. As described above and in the May 17, 2019 ASD, the source materials characteristics, naturally occurring concentrations, and site hydrogeology indicate that the source of the arsenic SSL observed in GAMW-01 is due to natural variation and not the WDA. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the WDA will remain in Assessment Monitoring.

3.0 REFERENCES

Golder Associates, "Northern Indiana Public Service Company R.M. Schahfer Generating Station Wheatfield, Indiana - Alternative Source Demonstration – Waste Disposal Area", May 17, 2019.

https://golderassociates.sharepoint.com/sites/nipscoccrgwmonitoring/shared documents/rmsgs/reports/wda asd fall 2019/wda recertification 112019_ final.docx

GOLDER

golder.com

APPENDIX H

Waste Disposal Area Alternative Source Demonstration- November 2018

GOLDER

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

WASTE DISPOSAL AREA

ALTERNATIVE SOURCE DEMONSTRATION

Prepared Pursuant to 40 CFR 40 CFR §257.94(e)(2) and Corresponding Regulations under 329 Indiana Administrative Code 10-9-1

November 2018

GOLDER

November 2018

Northern Indiana Public Service Company
R. M. Schahfer Generating Station
Wheatfield, Indiana
Waste Disposal Area

Certification of Alternative Source Demonstration

40 CFR §257.95(g)(3) & Corresponding Regulations under 329 Indiana Administrative Code 10-9-1

I have personally reviewed this alternative source demonstration (ASD), the subject of which is the Waste Disposal Area at the NIPSCO R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated November 2018. Based on an inquiry of those individuals immediately responsible, and on supporting data which I understand to be true, accurate and complete, I verify the information in this ASD is accurate and meets the applicable requirements of the CCR Final Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the Waste Disposal Area has been prepared and meets the applicable requirements of 40 CFR §257.95(g)(3) and corresponding State of Indiana requirements.

RICHARD A. WESENBERG
REGISTERED
No. 11500584
STATE OF
INDIANA
PROFESSIONAL ENGINEER

11-19-2018

Richard A. Wesenberg, P.E.
Program Leader and Principal
Licensed Professional Engineer
State of Indiana License Number: PE11500584

Golder Associates Inc.
670 North,Commercial Street, Suite 103, Manchester, NH 03101

T: +1 603 668-0880 F: +1 603 668-1199

Golder and the G logo are trademarks of Golder Associates Corporation

golder.com

Table of Contents

1.0 INTRODUCTION **1**

2.0 CONCEPTUAL SITE MODEL **1**

2.1 Description of Waste Disposal Area 1

2.2 Site Geology and Hydrogeology 2

2.3 Groundwater Monitoring Network 2

2.4 Groundwater Conditions 3

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS **4**

3.1 Overburden, Bedrock, and Source Material Assessment 4

3.1.1 Sample Collection 4

3.1.2 Geochemical Characterization 5

3.2 Groundwater and Porewater 7

3.2.1 Sample Collection 7

3.2.2 Geochemical Analysis 7

4.0 DATA EVALUATION AND FINDINGS **8**

4.1 Bedrock Mineralogical Composition 8

4.2 Potential Molybdenum Sources 9

4.3 Groundwater and Porewater Geochemistry 10

4.4 Data Usability 13

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE **13**

6.0 CONCLUSION **14**

7.0 REFERENCES **15**

TABLES

Table 2-3: Waste Disposal Area Monitoring Well Network 3

Table 3-1: Summary of Overburden, Shale, and WDA Source Material Samples 5

Table 4-1: Mineralogical Composition of Bedrock and Overburden Samples Collected Downgradient of the Waste Disposal Area 8

Table 5.1: Primary Lines of Evidence and Supporting ASD Analysis 13

FIGURES

Figure 1 Site Location Map
Figure 2 Sample Location Map

Figure 4-3(1): WDA Molybdenum Trend Chart (July 2016-September 2018)..... 11

Figure 4-3(2): WDA Piper Plot (left) and ternary plot (right) of certain ions (sulfate, sodium, and chloride) and TDS 12

APPENDICES

Appendix A Analytical Results

1.0 INTRODUCTION

On behalf of Northern Indiana Public Service Company (NIPSCO), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the first (April/May 2018) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS or Site) Waste Disposal Area (WDA, the CCR Unit), located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (see Figure 1). The statistical evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule" (CCR Final Rule), as amended, and corresponding regulations under 329 Indiana Administrative Code (IAC) 10-9-1.

Statistical analyses of the Appendix IV Assessment Monitoring data for molybdenum indicated the lower confidence interval (LCI) exceeded the background concentration for that parameter in three downgradient monitoring wells (GAMW-01, GAMW-13B, and GAMW-14B), which NIPSCO interpreted as apparent evidence of a statistically-significant level (SSL). Although an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO) 90 days from the date of determination (August 23, 2018) to demonstrate a source other than the CCR unit or another condition caused the molybdenum SSLs.

Golder's initial review of the Site history and geologic conditions indicated the potential for SSLs to have resulted from a source other than the CCR unit. To further assess potential sources and natural variability of groundwater concentrations, Golder collected and analyzed overburden, bedrock, porewater, CCR source materials, and groundwater samples. Based upon this assessment and in accordance with provisions of the 40 CFR §257.95(g)(3), Golder prepared this Alternative Source Demonstration (ASD) for the WDA. This ASD includes an evaluation of geological, hydrogeological, and chemical information obtained from borings and monitoring wells installed within and adjacent to the WDA.

The ASD provides the basis for concluding that the apparent SSLs are not a result of a release from the WDA. The following sections provide a summary of the RMSGS WDA Conceptual Site Model, sampling procedures and analytical methods, analytical and geochemical modeling results, and lines of evidence demonstrating an alternative source is responsible for the molybdenum SSLs.

2.0 CONCEPTUAL SITE MODEL

Golder developed this conceptual site model (CSM) to help frame and support the ASD assessment approach. The CSM presents WDA construction and operational history, a summary of geologic and hydrogeologic information, and a discussion of groundwater monitoring data, which together lays the groundwork for consideration in the development of the ASD. Additionally, related to the CSM, this section of the report introduces findings of literature research that suggest certain naturally-occurring groundwater conditions observed at Schahfer may be the cause of the apparent SSL.

2.1 Description of Waste Disposal Area

NIPSCO constructed the WDA in 1982, which is an approximately 80-acre impoundment located in the southwestern corner of RMSGS as shown in Figure 2. According to NIPSCO construction drawings, the WDA is unlined and is surrounded by berms which were constructed with an approximate two-foot wide slurry wall that extends from just below the top of the berms to the underlying shale located approximately 30 to 35 feet below

ground surface (ft bgs). NIPSCO's engineer, Sargent & Lundy, designed and constructed the slurry walls to provide a hydraulic barrier to reduce potential migration of the contents of the WDA.

The WDA receives primarily bottom ash/boiler slag that is sluiced from all four active boilers. Most of the ash/slag is deposited in the northern half of the WDA where the slurry lines discharge. Due to size of the unit and settling/depositional properties of the CCR materials, very little, if any, ash/slag is present in the southern half of the WDA.

2.2 Site Geology and Hydrogeology

The Site is directly underlain by unconsolidated, upper-Pleistocene (post-Wisconsin) fine-grained sand and silt and outwash deposits of the Atherton Formation, occasionally overlain by alluvial and lacustrine deposits of the Martinsville Formation (Schneider and Keller 1970). According to Fraser and Bleur (1991), during the late Pleistocene, the Site was occupied by a post-glacial lake followed by a broad, low-gradient outwash stream that deposited sand uniformly across the basin to form the Kankakee-Valparaiso Formation. Golder's interpretation of the Site geology is based on bedrock geology maps, prior reports and CCR-related well installation activities, and includes:

- Brown fine- to medium-grained sand from the ground surface to approximately 14 ft bgs
- Grayish-brown fine to medium sand from approximately 14 ft bgs to 30 -35 ft bgs (coarsens with depth)
- Bedrock: Black to dark gray shale with planar cleavage. Top of bedrock is approximately 30 to 35 ft bgs near the impoundments

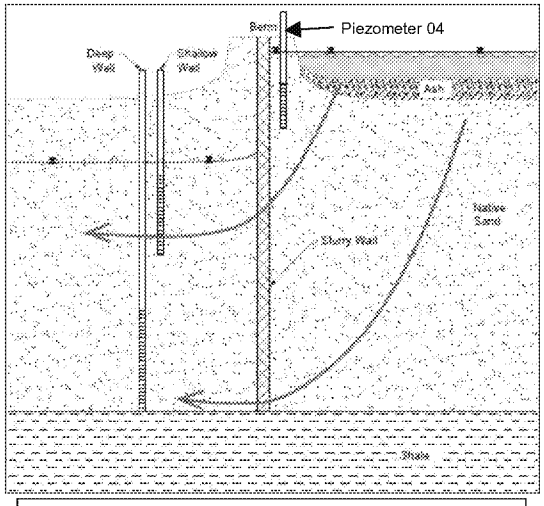
Regional bedrock consists of more than 4,000 feet of sedimentary rocks overly Precambrian granitic bedrock (Fenelon, Bobay, and others1994). This assemblage is part of the north side of the Kankakee Arch, the major structural feature in the Kankakee River Basin. The first 3,500 feet of sedimentary rocks overlying the granitic bedrock are Cambrian and Ordovician in age. The uppermost 300 feet of Ordovician rocks are composed of shale and minor limestones and are referred to as the Maquoketa Group. The Maquoketa Group underlies Silurian, Devonian and Mississippian rocks and consist of a wide variety of sedimentary layers ranging from shaley to coarse-grained carbonate rocks. This carbonate sequence is overlain by a series of shales including the Antrim Shale, a brownish-black, non-calcareous shale (Fenelon, Bobay, and others 1994).

Available groundwater elevation data indicate that groundwater in the uppermost aquifer near the WDA flows to the north and northwest (and possibly northeast). Localized groundwater flow direction is influenced by the slurry walls that surround the WDA and adjacent Recycle Settling Basin and inactive Retired Waste Disposal Area (RWDA - both of these are non-CCR regulated). Hydraulic heads measured inside the slurry walls that surround the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates that the slurry walls significantly impede the flow of water from the CCR unit to the uppermost aquifer.

2.3 Groundwater Monitoring Network

Design of the CCR Final Rule-compliant WDA monitoring program considered the size, disposal/operational history, hydraulic influence of the slurry walls, anticipated groundwater flow direction, and saturated thickness of

the uppermost aquifer. Based on the available hydrogeologic information for the WDA, groundwater mounding is occurring within the slurry walls. NIPSCO's monitoring approach for the CCR surface impoundments featured the installation of well pairs including shallow (approximately 15 ft bgs) and deep (approximately 35 ft bgs – to the top of shale [signified with a "B" in Figure 2]) couplets at each background and downgradient monitoring well location outside of the perimeter slurry walls as shown in Figure 2. As-built drawings of the slurry walls are not available; therefore, it is unknown if the slurry walls were keyed into the underlying shale. Depending upon the degree of contact between the slurry walls and shale, the higher hydraulic head observed within the slurry walls may result in the discharge of water beneath the slurry walls. Consequently, as illustrated in this graphic, Golder installed deep monitoring wells to supplement shallow wells and monitor potential flow paths beneath the slurry walls into the aquifer. Piezometer 04, constructed as a two-inch diameter, polyvinyl chloride (PVC) piezometer, screened approximately 21 to 26 ft bgs, is located within the slurry wall of the WDA (GAPIEZ04, see Figure 2) and is used to monitor the porewater within the WDA.



Conceptual Cross-Section

The WDA monitoring network includes two background and ten downgradient monitoring wells. The groundwater monitoring network is summarized in the following table:

Table 2-3: Waste Disposal Area Monitoring Well Network

Background Monitoring Wells	Downgradient Monitoring Wells	Downgradient Property Boundary Wells
GAMW-03 and GAMW-03B	GAMW-01, GAMW-01B*, GAMW-12, GAMW-12B*, GAMW-13, GAMW-13B, GAMW-14, and GAMW-14B	GAMW-42* and GAMW-42B*

*Monitoring well installed in 2018

2.4 Groundwater Conditions

Between July 2016 and August 2017, Golder collected eight independent background groundwater samples from each background and downgradient well, as required by 40 CFR §257.94. The results of the background monitoring phase were used to develop appropriate, statistically valid background values for each constituent/monitoring well. Following completion of the eight background monitoring events, Golder collected the first Detection Monitoring groundwater samples in October 2017 and compared the results to the calculated prediction limits to determine statistically significant increases (SSIs). Based on these results, NIPSCO established an Assessment Monitoring program in January 2018.

Golder performed the first Assessment Monitoring event in March 2018. Groundwater samples were collected at all background and downgradient monitoring well locations and analyzed for 40 CFR Part 257 Appendix IV constituents. Verification sampling was completed in April 2018 and groundwater samples were analyzed for Appendix III constituents and detected Appendix IV constituents per 40 CFR §257.95. Following receipt and validation of laboratory results, Golder evaluated the results of the first Assessment Monitoring sampling event to

determine the concentration of Appendix IV constituents relative to CCR Unit-specific calculated groundwater protection standards (GWPSs). The GWPS is the maximum contaminant level (MCL) (if an MCL exists) or the unit-specific background concentration for each analyte using a tolerance/prediction limit procedure.

Based on this statistical analysis, Golder concluded that the only constituent demonstrating an apparent SSL was molybdenum. The calculated GWPS (unit-specific background concentration) for molybdenum is 0.009 milligrams per liter (mg/L). Molybdenum concentrations in groundwater samples collected from downgradient monitoring wells GAMW-01, GAMW-13B, and GAMW-14B exceed this GWPS. However, the detected groundwater molybdenum concentrations do not exceed the new U. S. Environmental Protection Agency (USEPA) risk-based level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and became effective August 29, 2018 (CCR Final Rule Part 1 Phase 1 Addendum). While the new risk-based level was promulgated after the determination of the molybdenum SSLs, for purposes of this initial evaluation the GWPS is characterized as the standard in effect at the time of the analysis. The new risk-based molybdenum standard will apply to all subsequent samples.

A literature review of other locations underlain by similar shales revealed the documented occurrence of molybdenum at concentrations >0.1 milligram per liter (mg/L) in groundwater. Molybdenum is a naturally-occurring metal that can be found in similar black shales of up to 1,240 milligrams per kilogram (mg/kg) (Smedley and Kinniburgh, 2017). Additional literature suggests localized increases in groundwater sodium and sulfate concentrations were co-occurring with molybdenum. Using various geochemical techniques, including groundwater dating and isotopic methods, the authors determined that the release of molybdenum, sodium, and sulfate was due to the oxidative weathering of pyritic shale-rich bedrock (Harkness et al. 2017). The type of shale identified in the literature review is similar to the shale that is present at RMSGS.

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS

To further assess potential groundwater impacts downgradient of the WDA and collect data (i.e., overburden, bedrock, porewater, and groundwater) and support an ASD for molybdenum, Golder performed supplemental assesment activities between July 24 and September 25, 2018. Golder performed the supplemental assessment activities in accordance with the RMSGS Groundwater Monitoring Program Implementation Manual (Golder 2017). The following sections summarize the supplemental assessment activities.

3.1 Overburden, Bedrock, and Source Material Assessment

3.1.1 Sample Collection

Golder subcontracted a licensed well driller to advance overburden borings and install monitoring wells using sonic drilling methods. The drillers collected continous cores from all deep wells (i.e., "B" flagged wells). Golder collected a composite overburden sample (i.e., two-foot interval) from within the well screened intervals (i.e., 10-foot screened interval) of monitoring wells GAMW-01B, GAMW-12B, GAMW-42B, and from three overburden borings north of the WDA (i.e., not associated with the WDA well network but similar geology) identified as SB-52B, SB-54B, and SB-56B. The unique overburden sample description included the overburden boring name and approximate depth of the sample (e.g., SB-01B-25'-27').

Golder collected two shale samples from borings GAMW-01B and GAMW-42B, including one shale sample located just below the contact between the overburden/shale (i.e., considered as "weathered" shale) and one shale sample located approximately two feet into the shale (i.e., considered as "non-weathered" shale) for laboratory analysis.

Golder collected three WDA source material samples from the north side of the WDA using an excavator (see Figure 2 for sample locations). Golder's field engineer composited three sub-samples from each excavation into one sample per excavation area for submittal to the laboratory including:

- WDA-West Sample: Collected from approximately 1.5 ft bgs in a pile of recently dredged source material, which originated from the northwestern corner of the WDA.
- WDA-MID Sample: Collected from approximaterly 1.0 ft bgs from a recently dredged source material pile, which originated near the effluent discharge pipes in the north-central portion of the WDA
- WDA-East Sample: Collected from approxiamtely 1.5 ft bgs from a recently dredged source material pile, which originated from the northeastern portion of the WDA

The sample type and analytical testing requirements for each overburden, shale, and WDA source material samples are provided in the table below.

Table 3-1: Summary of Overburden, Shale, and WDA Source Material Samples

Sample Location	Sample Type	Number of Samples	Analysis	Notes
Downgradient boring (GAMW01B)	Shale	2	Total metals, 7-step sequential extraction, X-ray diffraction (XRD)	One weathered and one non-weathered sample
Side-gradient boring (GAMW42B)	Shale	2	Total metals, 7-step sequential extraction, XRD	One weathered and one non-weathered sample
Side-gradient boring (GAMW42B)	Overburden	1	Total metals, 7-step sequential extraction	Overburden from screened interval
Downgradient boring (GAMW01B)	Overburden	1	Total metals, 7-step sequential extraction	Overburden from screened interval
Downgradient boring (GAMW12B)	Overburden	1	Total metals, 7-step sequential extraction	Overburden from screened interval
Downgradient boring (SB-52B)	Overburden	1	Total metals, 7-step sequential extraction, XRD	Overburden from screened interval
Downgradient boring (SB-54B)	Overburden	1	Total metals, 7-step sequential extraction, XRD	Overburden from screened interval
Downgradient boring (SB-56B)	Overburden	1	Total metals, 7-step sequential extraction, XRD	Overburden from screened interval
WDA	CCR	3	Total metals, SPLP extraction	Composite samples

3.1.2 Geochemical Characterization

Golder used multiple geochemical analytical methods to assess the overburden, bedrock, and WDA source material samples including mineralogical testing, chemical composition (total metals) testing, leachability testing, and sequential extraction. The selected geochemical test methods are summarized in the following paragraphs.

Mineralogical Composition: The purpose of the mineralogical test was to identify and quantify the crystalline mineral phases in each sample. This information is needed for geochemical modeling as constituents of concern (COC) release or uptake is potentially influenced by the mineral phases present (Hem 1989). The laboratory (SGS Minerals Services) performed the mineralogical analysis using quantitative (Rietveld) X-ray diffraction (XRD) (ME-LR-MIN-MET-MN-DO5) and a Bruker AXS D8 Advance Diffractometer.

Total Metals: The purpose of this test was to assess the chemical composition of potential source and aquifer materials. The total mass of metals in combination with the results from leachability testing and sequential extraction can be used to determine the provenance of the COC metals and their relative leachability. The laboratory analyzed a target analyte list of metals following the USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000) and USEPA SW846 7471B Mercury in Solid or Semisolid Wastes (Manual Cold-Vapor Technique) Revision 2 (January 1998).

Leachability: The purpose of this test was to obtain an understanding of the fraction of total metals that is leachable, which is important to evaluating the long-term stability of potential source materials. The analysis simulates the interaction between a solid and meteoric water, and thus provides the leachability potential of a material. This analysis was only conducted on WDA source materials (i.e., samples collected from within the WDA). The laboratory used porewater collected by Golder from the WDA Piezometer 04 as the leaching medium to simulate natural conditions. The laboratory tested the leachability of the WDA source materials using USEPA SW846 1312 Modified Synthetic Precipitation Leaching Procedure (SPLP) (September 1994).

Sequential Extraction: This test consists of a seven-step metals extraction from solids to provide the provenance of the COCs (i.e., the operationally-defined fraction that contains the COC)[1]. This sequence of steps, provides valuable information on metal mobility. For instance, metals bound in the carbonate fraction or that are exchangeable are much more likely to become mobile with changes to pH and groundwater geochemistry, while metals bound within a sulfide or silicate fraction are not as likely to be released to groundwater under natural conditions. A metal present in the exchangeable fraction is more likely to be surface adsorbed and, therefore, more labile than a metal residing in the silicate fraction. The laboratory analyzed the samples using USEPA SW846 6020B Inductively Coupled Plasma- MS Revision 2 (July 2014) and USEPA SW846 7470A Mercury in Liquid Wastes (Manual Cold- Vapor Technique) Revision 1 (September 1994).

---

1 Sequential extraction of metals from overburden and bedrock samples consisted of seven discrete steps for this investigation:

Step 1 - Exchangeable Phase: This extraction includes trace elements that are reversibly adsorbed to overburden minerals, amorphous solids, and/or organic material by electrostatic forces.

Step 2 - Carbonate Phase: This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals.

Step 3 – Non-Crystalline Materials Phase: This extraction targets trace elements that are complexed by amorphous minerals (e.g., iron).

Step 4 - Metal Hydroxide Phase: Trace elements bound to hydroxides of iron, manganese, and/or aluminum.

Step 5 - Organic Phase: This extraction targets trace elements strongly bound via chemisorption to organic material.

Step 6 - Acid/Sulfide Fraction: The extraction is used to identify trace elements precipitated as sulfide minerals.

Step 7 - Residual Fraction: Trace elements remaining in the overburden after the previous extractions will be distributed between silicates, phosphates, and refractory oxides.

3.2 Groundwater and Porewater

3.2.1 Sample Collection

Golder field personnel collected porewater (i.e., water in direct contact with CCR materials) and groundwater samples in accordance with the RMSGS Groundwater Monitoring Program Implementation Manual (Golder 2017). Golder collected groundwater and porewater samples for analysis of Appendix III and IV metals and other groundwater quality parameters, as described below, from a subset of WDA monitoring wells including: GAMW-03B, GAMW-01B, GAMW-12B, GAMW-13B, GAMW-14B, GAMW-42, and GAMW-42B.

3.2.2 Geochemical Analysis

The geochemical analysis of the porewater and groundwater samples included total metals and major cations and anions. These selected analytical methods are summarized below.

Metals: Metals analyses (i.e., Appendix III and IV) are important to understand the geochemical properties of porewater and groundwater. In porewater, metal results can be used for geochemical modeling and provide an indication of the leachable fraction of the solids (ITRC, 2012). In groundwater, metals analysis allows for the delineation of a potential plume, and background contributions from natural sources or off-site locations.

Major Cations and Anions/Field Parameters: Geochemical modeling of mineral solubility, metal attenuation and background contributions requires analysis of major cations and anions because they affect and participate in sorption and mineral dissolution/precipitation reactions. Required field parameters include pH, dissolved oxygen, oxidation reduction potential (ORP), conductivity, and temperature, which are needed to support geochemical modeling and serve an important quality assurance/quality control (QA/QC) function.

The laboratory analyzed porewater and groundwater samples using the following methods:

- Total Hardness following Standard Method (SM) 2340B (1997)
- Chloride, Fluoride, and Sulfide following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- pH following USEPA SW846 9040C pH Electrometric Measurement (November 2004)
- Total Target Analyte List (TAL) Metals following USEPA SW846 6010C Inductively Coupled Plasma-Atomic Emission Spectrometry Revision 3 (November 2000), SW846 6020B Inductively Coupled Plasma-MS Revision 2 (July 2014), and SW846 6020A Inductively Coupled Plasma- MS Revision 1 (January 1998)
- Mercury following USEPA SW846 7470A Mercury in Liquid Wastes (Manual Cold- Vapor Technique) Revision 1 (September 1994)
- Total Dissolved Solids following SM 2540C Total Dissolved Solids Dried at 180°C (1993)
- Nitrate and nitrite following EPA 353.2 Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry, Revision 2.0 (August 1993)
- Alkalinity following SM 2320B Alkalinity by Titration (2005)
- Phosphorous following SM 4500-P E Phosphorous by Ascorbic Acid Method (2005)

4.0 DATA EVALUATION AND FINDINGS

4.1 Bedrock Mineralogical Composition

Quantitative X-ray diffraction (XRD) with Rietveld refinement was used to identify minerals in four bedrock and three overburden samples collected during the drilling activities (Table 4-1). Golder collected two bedrock samples per borehole: one bedrock sample just below the overburden/bedrock interface and the second bedrock sample from a deeper, more competent bedrock to identify the weathering potential at the overburden/bedrock interface. The overburden samples were collected to assess the relationship between overburden and bedrock parent materials. Understanding the mineralogy of the aquifer and bedrock system is important for identifying potential natural sources of molybdenum.

The mineralogical analysis identified sulfide minerals (pyrite and marcasite, which are iron sulfide minerals) in all four bedrock samples, at concentrations up to 6.8 % by weight (% wt.). These minerals can oxidize in the presence of even trace amounts of dissolved oxygen, which would lead to the mobilization of trace metals or metalloids known to associate with sulfide minerals (e.g., arsenic and molybdenum) into groundwater. As expected, the overburden samples are mineralogically different from the bedrock shale samples and have much lower sulfide mineral content (0.1 wt. % pyrite and marcasite). Potential shale weathering and/or shale pieces appear to have been present in overburden sample SB-52B-35'-37', which showed a closer relationship mineralogically to the bedrock samples, with the highest sulfide mineral abundance (0.6 wt. %) of the three overburden samples submitted for mineralogical testing.

The range of sulfide mineral contents in bedrock (4.9 to 6.8 % wt.) may be indicative of localized weathering of the shale-rich bedrock parent material and oxidation of sulfide minerals. Bedrock weathering also explains the localized differences in groundwater quality, such as at well GAMW-14B, where sodium and sulfate concentrations were approximately 15 and four times higher, respectively, than in WDA porewater. The higher sulfate and sodium groundwater concentrations are consistent with oxidation of sulfide minerals and weathering of shale-rich bedrock. The coincidental release of sulfate, sodium, and molybdenum from shales during weathering has been well documented in previous studies (Harkness et al. 2017; Lourigan and Phelps 2013).

Table 4-1: Mineralogical Composition of Bedrock and Overburden Samples Collected Downgradient of the Waste Disposal Area

	Bedrock Samples				Overburden Samples		
Mineral	SB-01B		SB-42B		SB-52B	SB-54B	SB-56B
% by weight	36-37' bgs	40-41' bgs	34-36' bgs	36-38' bgs	35-37' bgs	30-32' bgs	30-33' bgs
Quartz	35.8	28.9	45.0	42.9	53.4	61.4	72.1
Pyrite	3.9	3.5	3.0	3.3	0.4	0.1	0.1
Marcasite	1.2	1.4	3.2	3.5	0.2	-	-
Muscovite	24.2	23.1	23.8	25.7	7.8	1.7	1.3
Biotite	1.8	2.1	1.6	1.8	1.1	0.6	0.2
Chlorite	6.5	5.2	5.5	6.2	2.6	1.0	1.1

	Bedrock Samples				Overburden Samples		
Mineral	SB-01B		SB-42B		SB-52B	SB-54B	SB-56B
% by weight	36-37' bgs	40-41' bgs	34-36' bgs	36-38' bgs	35-37' bgs	30-32' bgs	30-33' bgs
Microcline	17.8	19.1	12.0	11.4	9.2	7.5	6.6
Orthoclase	2.8	2.3	2.1	2.4	2.2	0.7	0.6
Hematite	0.3	0.3	0.4	0.5	0.3	0.4	0.6
Dolomite	1.3	8.8	0.1	0.2	7.9	9.6	5.3
Calcite	0.7	0.6	0.7	0.6	4.7	5.8	3.9
Albite	2.2	1.1	1.8	1.0	7.3	9.1	6.4
Epidote	1.7	2.9	0.8	0.6	2.8	2.1	1.9
Anatase	-	0.7	-	-	-	-	-
TOTAL	100	100	100	100	100	100	100

4.2 Potential Molybdenum Sources

Golder utilized several lines of evidence to assess potential molybdenum sources that can contribute molybdenum to groundwater, including:

- Total Molybdenum Concentrations: This test is used to determine the total amount of molybdenum present in bedrock, overburden, and WDA source materials.
- Sequential Metal Extraction: This test is more comprehensive than the leachability test and provides information on the provenance of the molybdenum in overburdens and bedrock, i.e., the specific mineral phase(s) in which the molybdenum resides. This information helps identify under what geochemical conditions molybdenum may be released into groundwater.
- Leachability Test: This test is used to determine the amount of leachable molybdenum from WDA source materials to groundwater. The USEPA Modified SPLP Method was applied, which mimics natural conditions in groundwater.

The laboratory reported total molybdenum concentrations for three WDA source material samples, four bedrock (shale) samples, and four overburden samples collected within the screened intervals of the monitoring wells installed in 2018. Bedrock samples had the highest total molybdenum concentrations, ranging from 18 to 94 mg/kg, while overburden and WDA source material samples contained much lower levels, ranging from 0.91 to 2.9 mg/kg and 1.4 to 6.8 mg/kg, respectively, as shown in Appendix A. The range of molybdenum contents in bedrock may be a result of natural geological processes that occurred during deposition or, given the presence of sulfide minerals (Table 4-1), the result of bedrock weathering.

Bedrock sequential extraction test results confirmed an association between molybdenum and sulfide minerals in all bedrock samples, as shown in Appendix A. Molybdenum associated with sulfide minerals accounted for 57 to 72% of the total molybdenum present. Sulfide association with molybdenum would occur during geogenic deposition of chalcophile elements (i.e., elements that have an affinity for sulfur) during sedimentary rock (shale) formation. Weathering of shale and oxidation of sulfides would result in release of molybdenum to groundwater. In the absence of weathering, molybdenum is effectively retained in the sulfide mineral.

In the overburden samples, total molybdenum concentrations ranged from 0.91 to 2.9 mg/kg while molybdenum showed a stronger association with amorphous minerals (e.g., iron, manganese, or aluminum oxy(hydr)oxides) than with sulfide minerals. Molybdenum sorbed to such phases is much more sensitive to changes in groundwater geochemistry and can, thus, be more easily re-mobilized into groundwater. As a consequence, seasonal or other natural fluctuations in groundwater conditions can lead to fluctuating molybdenum concentrations.

The laboratory determined the leachability of three WDA source material samples using the USEPA Modified SPLP Method. Using interstitial porewater from the WDA (i.e., GAPIEZ-04), the molybdenum concentrations in the SPLP leachates ranged from 0.004 to 0.006 mg/L (lower than the WDA-specific GWPS of 0.009 mg/L). These data indicate that the WDA source material has a very low leaching potential for molybdenum. The leachability results are also in good agreement with the total molybdenum concentrations observed in WDA porewater of <0.003 mg/L (see Section 4.3).

4.3 Groundwater and Porewater Geochemistry

Molybdenum groundwater and porewater concentrations are provided in Appendix A. Molybdenum concentrations in groundwater samples collected from three monitoring wells (i.e., one shallow and two deep wells) downgradient of the WDA exceeded the WDA-specific GWPS (0.009 mg/L) and range from 0.01 to 0.045 mg/L (GAMW-01, GAMW-13B, GAMW-14B). However, these concentrations did not exceed the new USEPA risk-based background level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and which became effective August 29, 2018 (CCR Final Rule Part 1 Phase 1 Addendum). Molybdenum concentrations in groundwater samples collected from background wells GAMW-03 and GAMW-03B (0.0043 to 0.009 mg/L) were not detected above the laboratory reporting limit.

Molybdenum concentrations in porewater samples collected from piezometer GAPIEZ04, installed in the northwest corner of the WDA and in direct contact with CCR materials, were less than 0.003 mg/L during both monitoring events. These concentrations are lower than those in the downgradient samples, suggesting that the molybdenum present in the downgradient groundwater samples is not due to a release from the CCR.

The analytical data also suggest that groundwater in some wells (GAMW-01 and GAMW-14B) displays significant seasonal variability in molybdenum concentrations (Figure 4-3(1). The molybdenum concentrations in these two wells do not appear to follow any trend (i.e., upward, downward, or constant). This indicates that the molybdenum patterns in groundwater in these wells likely result from natural fluctuations in groundwater conditions and are not representative of a release from a constant and consistent source such as the CCR.

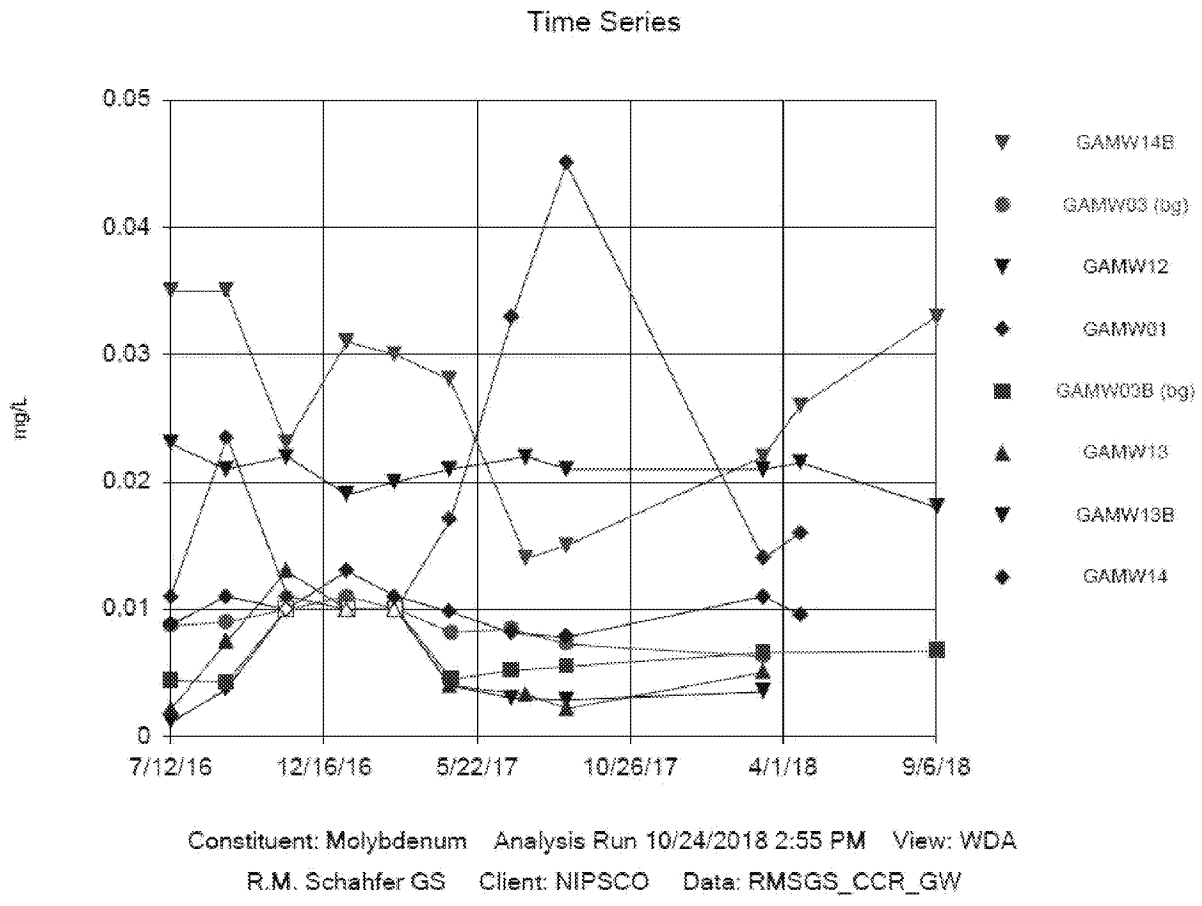


Figure 4-3(1): WDA Molybdenum Trend Chart (July 2016-September 2018)

Figure 4-3(1) also shows molybdenum concentrations are higher in groundwater samples collected from GAMW-01 than in GAMW-12, GAMW-13, and GAMW-14. If the WDA were the source of molybdenum, signs of a release would most likely be observed in those wells located closest to the source materials in the northern half of the WDA (i.e., GAMW-12, GAMW-13, and GAMW-14).

Groundwater and porewater geochemistry were also evaluated using the relative abundance of major cations and anions. Piper and other ternary plots, developed using Geochemist's Workbench, were generated to visually depict major ion chemistry abundance and elucidate relationships between background groundwater, downgradient groundwater and porewater. Additionally, they were used to evaluate the nature and cause(s) of groundwater quality impacts, if any.

The Spece8 package in Geochemist's Workbench was then used to evaluate mineral saturation in groundwater samples and to determine if mineral precipitation would impact relative ion abundance. Only those monitoring wells for which comprehensive analytical results (i.e., including all major ions) were available, were included in this evaluation, as this is a prerequiste for reliable geochemical modeling.

The evaluation of major ion composition indicates the samples fall into the following three discrete groups:

- Background and downgradient groundwater

- Bedrock influenced groundwater
- WDA porewater

All deep downgradient groundwater samples, except from monitoring wells GAMW-13B and GAMW-14B, showed a closer relationship to groundwater quality in background monitoring well GAMW-03B than the WDA porewater samples (see Figure 4-3(2) left). This similarity in major ion composition suggests that downgradient groundwater has the same source as background groundwater. In cases where groundwater is impacted by a potential large discrete source, such as the WDA, the groundwater would plot between the background and source groundwater, indicating mixing of the two waters.

Downgradient well GAMW-13B is an exception to the general trend and plots between the WDA and background well GAMW-03B. However, upon further evaluation using a ternary diagram for sulfate, chloride, and sodium (tracers commonly used to identify CCR-influenced waters), groundwater in well GAMW-13B is found to be more related to the other downgradient wells than the WDA due to its higher relative sodium content (Figure 4-3(2) right). This is further supported by the total dissolved solids (TDS) content measured in GAMW-13B (430 mg/L), which was lower than in both the WDA (670 mg/L) and groundwater from background well GAMW-03/03B (490 mg/L; Figure 4-3(2) right *only*). In the absence of attenuation reactions such as mineral precipitation (which would lower the TDS of a groundwater sample), the TDS of a mixture of two samples should range between the TDS values of both inputs. Based on geochemical modeling, mineral saturation is not achieved in GAMW-13B, so this groundwater does not represent a mixture of WDA porewater and groundwater from GAMW-03B. The analytical data used to develop the Piper Plots is provided in Appendix A.

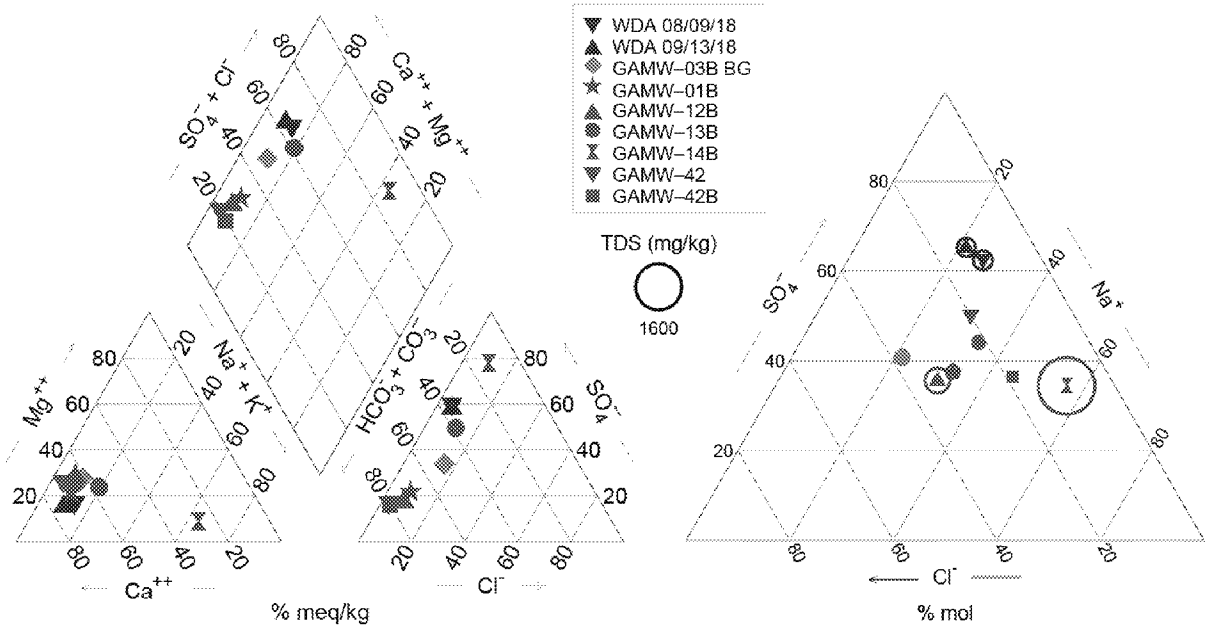


Figure 4-3(2): WDA Piper Plot (left) and ternary plot (right) of certain ions (sulfate, sodium, and chloride) and TDS

Groundwater in monitoring well GAMW-14B is also geochemically different from groundwater from the other monitoring wells and WDA porewater samples. Its' much higher TDS content (2,000 mg/L) is due to a greater

abundance of sodium and sulfate as compared to WDA porewater (660 to 670 mg/L) and the other groundwater samples (190 to 870 mg/L). Sodium concentrations were 15 times higher in the groundwater sample from GAMW-14B than in the WDA porewater, while the sulfate concentration was nearly four times higher than in the WDA porewater. Compared to average concentrations in background groundwater, sodium and sulfate concentrations in groundwater from GAMW-14B were 21 and 7 times higher, respectively.

Geochemical modeling has demonstrated that both sodium and sulfate can be considered conservative tracers (i.e., they are not attenuated through adsorption or mineral precipitation) in site groundwater. The sodium to sulfate ratio should, therefore, remain generally constant and indications of mixing or dilution would change this ratio in a predictable manner. The ratio of sodium to sulfate in GAMW-14B (3.9 to 10) is much higher than in the WDA porewater (0.8 to 1:10) and ambient groundwater (1.25 to 10). No possible combination of WDA porewater and ambient groundwater could achieve this ratio. Thus, groundwater in monitoring well GAMW-14B is considered not affected by WDA porewater but only influenced by direct interaction with bedrock, including release of molybdenum.

4.4 Data Usability

Golder validates 100% of the groundwater data generated as part of the CCR monitoring program in accordance with the National Functional Guidelines for Inorganic Superfund Data Review (EPA 540-R-013-001, August 2014). All data included in this report have been accepted or qualified on the basis of specific QC criteria as described in the Groundwater Monitoring Program Implementation Manual (Golder 2017).

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on a literature review and the testing results presented above, it is Golder's opinion that the molybdenum SSL detected in groundwater near the WDA is linked to an alternative source rather than a release from the WDA. Golder concludes the source of molybdenum is naturally-occuring molybdenum present in overburden and bedrock.

Primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in Table 5.1.

Table 5.1: Primary Lines of Evidence and Supporting ASD Analysis

Key Line of Evidence	Supporting Evidence	Description
Groundwater Geochemistry	Relative ion abundance differs from the WDA	As presented in the Piper and other ternary diagrams, major ion concentrations show distinct differences between the WDA porewater and downgradient groundwater samples. The geochemical properties of the downgradient groundwater samples cannot have been generated by a release from the WDA.
	Temporal trends and associations	In certain downgradient wells, significant seasonal variability is observed in molybdenum groundwater concentrations. In addition, molybdenum concentrations do not appear to follow any trend. This suggests the molybdenum is naturally occurring and not representative of a constant and consistent release from the WDA. Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be detected in groundwater near the WDA. However, this is not the case, indicating the molybdenum does not originate from the WDA.

Key Line of Evidence	Supporting Evidence	Description
	Sodium and sulfate ion ratios	Groundwater in monitoring well GAMW-14B shows increased sulfate, sodium, and molybdenum concentrations, consistent with oxidation of sulfide minerals present in shale-rich bedrock. Sodium and sulfate concentrations and sodium to sulfate ratios in groundwater samples from well GAMW-14B are much higher than in the WDA porewater and downgradient groundwater, supporting the hypothesis that molybdenum in GAMW-14B is not derived from the WDA but from bedrock.
	Total dissolved solids	The TDS content in downgradient well GAMW-13B is lower than in both ambient groundwater and WDA porewater. GAMW-14B has a higher TDS content than even WDA porewater. Neither GAMW-13B nor GAMW-14B, therefore, contain a mixture of WDA porewater and ambient groundwater.
	Non-detect molybdenum concentrations in WDA porewater	WDA porewater samples had the lowest measured molybdenum concentrations (<0.003 mg/L) of all groundwater samples analyzed as part of this ASD, including background groundwater samples. Leach test results further indicate WDA source materials have a similarly low potential to leach molybdenum. Therefore, another molybdenum source must be present to account for the higher molybdenum concentrations observed in downgradient groundwater.
Source of Molybdenum	Molybdenum content of overburdens, bedrock, and WDA source materials	Bedrock had the highest molybdenum concentrations. Molybdenum is present at lower concentrations in the overburden and WDA source materials. An adequate amount of naturally-occurring molybdenum, therefore, is present in overburden and bedrock to cause the observed molybdenum concentrations in groundwater.
	Molybdenum association in bedrock	Molybdenum in bedrock was found to be primarily associated with sulfide minerals. During bedrock weathering and associated sulfide oxidation, this molybdenum is released.
	Mineralogy	Results from the mineralogical analysis indicate sulfide minerals are present in bedrock, representing a potential source for the molybdenum and sulfate observed in groundwater. The presence of molybdenum, sodium, and sulfate is consistent with a literature review of similar shales in the region.
	Hydrogeology	GAMW-01, a shallow well located farthest from the WDA source material and the other shallow monitoring wells (GAMW-12, GAMW-13, and GAMW-14), contains molybdenum in concentrations above the GWPS. Molybdenum has generally not been detected in samples from monitoring wells GAMW-12, GAMW-13, and GAMW-14, which are closer to and downgradient of the source material. This concentration pattern is inconsistent with the CCR being the source of molybdenum.

6.0 CONCLUSION

The preceding information serves as the ASD prepared for the WDA in accordance with 40 CFR 257.95(g)(3)(ii) and supports the finding that the SSLs determined on August 23, 2018 are not due to a release from the CCR Unit. The key supporting lines of evidence described above indicate that the molybdenum detected in monitoring wells downgradient of the WDA is due to a natural source and not due to the WDA. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the RMSGS WDA will remain in Assessment Monitoring.

7.0 REFERENCES

Fenelon, J.M., K.E. Bobay, T.K. Greeman, M.E. Hoover, D.A. Cohen, K.K. Fowler, M.C. Woodfield, and J. M. Durbin., 1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water Resources Investigations, Report 92-4142.

Fraser, G.S., and Bleuer, N.K., 1991. Geologic framework of the aquifers in the Kankakee River lowland: Indiana Geological Survey Occasional Paper 60.

Golder Associates Inc., 2017. Rollin M. Schahfer Generating Station Groundwater Monitoring Program Implementation Manual

Harkness, J. S., Darrah, T. H., Moore, M. T., Whyte, C. J., Mathewson, P. D., Cook, T., and Vengosh, A., 2017. Naturally occurring versus anthropogenic sources of elevated molybdenum in groundwater: Evidence for Geogenic contamination from Southeast Wisconsin, United States. *Environmental Science & Technology*, *51*(21), 12190-12199.

Hem, J. D., U.S Geological Survey Water Supply Paper 2254 1989. Study and interpretation of the chemical characteristics of natural water.

Lourigan, J., and Phelps, W., 2013. Caledonia Groundwater Molybdenum Investigation Southeast Wisconsin. Wisconsin Department of Natural Resources.

Schneider, A.F. and Keller, S.J., 1970. Geologic Map of the Chicago Quadrangle, Indiana, Illinois, and Michigan; Indiana Geologic Survey, Bloomington.

Smedley, P. L. and Kinniburgh, D. G., 2017. Molybdenum in natural waters: A review of occurrence, distributions and controls. Applied Geochemistry, 84, 387-432.

USEPA, 1996. Test methods for evaluating solid waste, physical/chemical methods (SW-846): 3rd edition, Environmental Protection Agency, National Center for Environmental Publications, Cincinnati, Ohio, accessed at URL https://www.epa.gov/hw-sw846.

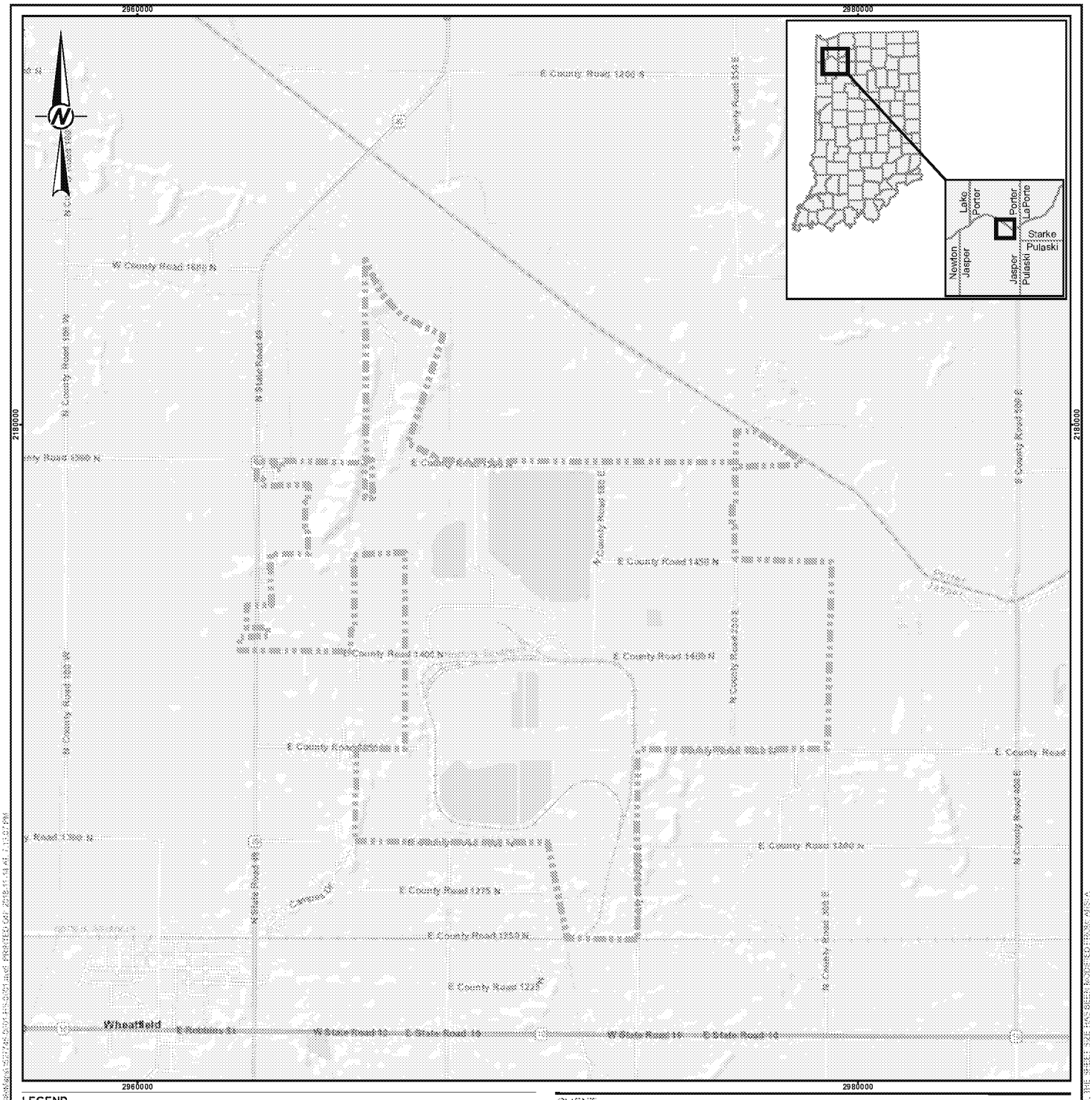
USEPA, 2014. National Functional Guidelines for Inorganic Superfund Data Review (EPA 540-R-013-001).

Sincerely,
GOLDER ASSOCIATES INC.

Mark A. Haney
Program Leader and Principal

Rens Verburg
Principal Geochemist

FIGURES



LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

NOTE(S)

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	11/14/2018
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
1527745	A	0	1

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

LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Assessment Monitoring Well
- Porewater Sample Location
- Soil Boring Location
- CCR Source Material Sample Location
- Slurry Wall
- CCR Unit
- Approximate Extent of Inactive Retired Waste Disposal Area
- Generalized Groundwater Flow Directions
- Approximate Property Line

0 650 1,300

1 " = 650 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SAMPLE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	11/14/2018
DESIGNED	JSP
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	2

APPENDIX A

Analytical Results

Table A.1: Soil and CCR Material Molybdenum Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Sample Location	SB-01B	SB-01B	SB-01B	SB-12B	SB-42B	SB-42B	SB-42B	SB-52B	SB-54B	SB-56B	WDA-EAST	WDA-MID	WDA-WEST
Start Depth	25	36	40	32	30	34	36	35	30	30	0	0	0
End Depth	27	37	41	34	34	36	38	37	32	32	1.5	1	1.5
Source Material	Overburden	Bedrock	Bedrock	Overburden	Overburden	Bedrock	Bedrock	Overburden	Overburden	Overburden	CCR	CCR	CCR
SEP Step 1	9.3 U (0%)	1.4 J (3%)	1.3 J (6%)	9.6 U (0%)	9.7 U (0%)	4.2 J (4%)	2.2 J (2%)	8.9 U (0%)	9.8 U (0%)	2.2 J (2%)			
SEP Step 2	6.9 U (0%)	0.4 J (1%)	7.3 U (0%)	7.2 U (0%)	7.3 U (0%)	1.5 J (1%)	0.58 J (0%)	6.7 U (0%)	7.3 U (0%)	0.58 J (0%)			
SEP Step 3	0.67 J (73%)	4 (8%)	3.4 (15%)	0.15 J (19%)	0.18 J (100%)	14 (12%)	11 (9%)	0.51 J (46%)	0.59 J (45%)	11 (9%)			
SEP Step 4	0.25 J (27%)	1.9 J (4%)	2.2 J (10%)	0.14 J (18%)	2.4 U (0%)	5.8 (5%)	4.3 (4%)	0.39 J (35%)	0.53 J (41%)	4.3 (4%)			
SEP Step 5	35 U (0%)	1.5 J (3%)	36 U (0%)	36 U (0%)	36 U (0%)	2.4 J (2%)	5.1 J (4%)	33 U (0%)	37 U (0%)	5.1 J (4%)			
SEP Step 6	2.3 U (0%)	38 (72%)	13 (59%)	0.49 J (63%)	2.4 U (0%)	71 (59%)	68 (57%)	0.21 J (19%)	0.18 J (14%)	68 (57%)			
SEP Step 7	2.3 U (0%)	5.1 (10%)	1.8 J (8%)	2.4 U (0%)	2.4 U (0%)	23 (19%)	26 (22%)	2.2 U (0%)	2.4 U (0%)	26 (22%)			
SEP SUM	0.92 J (100%)	53 (100%)	22 (100%)	0.78 J (100%)	0.18 J (100%)	120 (100%)	120 (100%)	1.1 J (100%)	1.3 J (100%)	120 (100%)			
Total Result	2.9 J	41	18	0.91 J	4.6 U	94	83	3.8 J	0.88 J	83	1.4 J	6.4	6.8
SPLP Result											0.005 J	0.0043 J	0.0061 J

Notes:
All results displayed are molybdenum results in milligram per kilogram (mg/kg), except SPLP results which are in milligram per liter (mg/L).
Percent (%) displayed is the amount of molybdenum detected in the given step compared to the calculated total molybdenum "SEP SUM".
SEP: Sequential Extraction Procedure
Step 1 - Exchangeable Phase: This extraction includes trace elements that are reversibly adsorbed to soil minerals, amorphous solids, and/or organic material by electrostatic forces.
Step 2 - Carbonate Phase: This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals.
Step 3 - Non-Crystalline Materials Phase: This extraction targets trace elements that are complexed by amorphous minerals (e.g. iron).
Step 4 - Metal Hydroxide Phase: This extraction targets trace elements bound to hydroxides of iron, manganese, and/or aluminum.
Step 5 - Organic Phase: This extraction targets trace elements strongly bound via chemisorption to organic material.
Step 6 - Acid/Sulfide Fraction: The extraction is used to identify trace elements precipitated as sulfide minerals.
Step 7 - Residual Fraction: Trace elements remaining in the soil after the previous extractions will be distributed between silicates, phosphates, and refractory oxides.
SPLP: Synthetic Precipitation Leaching Procedure
J: Indicates result was detected above the laboratory method detection limit, but below the laboratory reporting limit, the estimated result is provided.
U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

Prepared by: DFS
Checked by: KMC
Reviewed by: JSP

Table A.2: Groundwater and Porewater Molybdenum Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Location		GAMW01		GAMW01B	GAMW03		GAMW03B		GAMW12		GAMW12B	GAMW13	GAMW13B		GAMW14		GAMW14B	GAMW42	GAMW42B	GAPIEZ04
Sample Type		FD	N	N	FD	N	FD	N	FD	N	N	N	FD	N	FD	N	N	N	N	N
Date	Fraction																			
2016-07	Total		0.011			0.0087 J		0.0044 J	0.01 U	0.002 J		0.0021 J		0.023		0.0088 J	0.035			
2016-09	Total	0.025	0.022			0.009 J		0.0043 J		0.0037 J		0.0074 J		0.021		0.011	0.035			
2016-11	Total		0.011			0.01 U		0.01 U		0.01 U		0.013		0.022		0.01 U	0.023			
2017-01	Total		0.01 U		0.012 J+	0.01 U		0.01 U		0.01 U		0.01 U		0.019 J+		0.013 J+	0.031 J+			
2017-02	Total		0.01 U			0.01 U		0.01 U		0.01 U		0.01 U	0.02	0.02		0.011	0.03			
2017-04	Total		0.017			0.0082 J		0.0045 J		0.004 J		0.004 J	0.021	0.021		0.0098 J	0.028			
2017-06	Total		0.033			0.0084 J		0.0052 J		0.003 J		0.0033 J		0.022	0.008 J	0.0082 J	0.014			
2017-08	Total		0.045		0.0069 J	0.0076 J		0.0055 J		0.0029 J		0.0022 J		0.021		0.0078 J	0.015			
2018-03	Total		0.014			0.0063 J		0.0066 J		0.0035 J		0.0053 J		0.021		0.011	0.022			
2018-04	Total		0.016										0.022	0.021		0.0096 J	0.026			
2018-08	Dissolved																			0.0028 J
2018-09	Dissolved			0.0014 J				0.0066 J			0.0012 J			0.019			0.034			
2018-09	Total			0.0015 J			0.0067 J	0.0067 J			0.01 U			0.018			0.033	0.0035 J	0.0048 J	0.0028 J

Notes:
Table shows all Molybdenum results in milligram per liter (mg/L)
J: Indicates result was detected above the laboratory method detection limit, but below the laboratory reporting limit, the estimated result is provided.
J+: Indicates result was qualified as estimated, biased high during data validation.
U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.
FD: Field duplicate
N: Normal sample

Prepared by: DFS
Checked by: KMC
Reviewed by: JSP

Table A.3: Groundwater and Porewater Chemistry Data
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Parameter	Unit	GAPIEZ04 (8/9/2018)	GAPIEZ04 (9/13/2018)	GAMW-03B	GAMW-01B	GAMW-12B	GAMW-13B	GAMW-14B	GAMW-42	GAMW-42B
Calcium	mg/L	140	160	100	110	100	77	160	44	46
Magnesium	mg/L	20	20	27	21	27	19	31	9.9	11
Sodium	mg/L	28	22	20	15	13	28	430	3 J	6.2
Potassium	mg/L	4.8 J	5	1.4 J	5.1	2.8	2.9 J	13	0.76 J	1.9 J
Alkalinity	mg/L	210 J	220	310	290	340	150	220	130	140
Sulfate	mg/L	280	280	160	72	63	150	1100	21	21
Chloride	mg/L	19	21	55	21	22	27	110	3.1	4
Total Dissolved Solids	mg/L	670	660	490	450	870	430	2000	190	200
pH		7.35	7.27	7.1	7.01	7.15	7.37	7.29	7.54	8.08

Notes:
Table shows maximum result collected in September 2018 unless otherwise indicated, results are in milligram per liter (mg/L)
J: Indicates the result is estimated.
U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

Prepared by: PJN
Checked by: DFS
Reviewed by: JSP

GOLDER

golder.com

APPENDIX I

Waste Disposal Area Alternative Source Demonstration- May 2019

GOLDER

ALTERNATIVE SOURCE DEMONSTRATION - WASTE DISPOSAL AREA

Northern Indiana Public Service Company

Rollin M. Schahfer Generating Station

Wheatfield, Indiana

Submitted to:

Northern Indiana Public Service Company
801 East 86th Avenue
Merrillville, Indiana 46410

Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101
+1 603 668-0880

164817101.03

May 2019

Northern Indiana Public Service Company (NIPSCO)

R. M. Schahfer Generating Station – Waste Disposal Area

Wheatfield, Indiana

Certification of Alternative Source Demonstration

40 CFR §257.95

I have personally reviewed this alternative source demonstration (ASD), the subject of which is the Waste Disposal Area (WDA) at the NIPSCO R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated May 2019. Based on an inquiry of those individuals immediately responsible and on supporting data that I understand to be true, accurate, and complete, I verify the information in this ASD is accurate and meets the applicable requirements of the CCR Final Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the WDA meets the applicable requirements of 40 CFR §257.95.

JOSEPH BERNARD GORMLEY JR.
REGISTERED
No. PE 11900213
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Joseph Bernard Gormley, Jr.
Indiana Professional Engineer
License #: PE11900213

5/17/2019
Date

Table of Contents

1.0 INTRODUCTION 1

2.0 CONCEPTUAL SITE MODEL 1

2.1 Description of Waste Disposal Area 1

2.2 Site Geology and Hydrogeology 2

2.3 Groundwater Monitoring Network 2

2.4 Groundwater Conditions 3

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS 4

3.1 Source Material Assessment 4

3.1.1 Sample Collection 4

3.1.2 Geochemical Characterization 5

3.2 Overburden Soil and Bedrock Shale Samples 5

3.3 Groundwater and Porewater Assessment 5

3.3.1 Sample Collection 5

3.3.2 Geochemical Characterization 6

4.0 DATA EVALUATION AND FINDINGS 6

4.1 Source Material Results 6

4.2 Overburden Soil and Bedrock Shale Results 7

4.3 Groundwater and Porewater Results 7

4.3.1 Geochemistry 7

4.3.2 Arsenic 9

4.3.3 Cobalt 10

4.3.4 Indicator Parameters 12

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE 13

6.0 CONCLUSION 15

7.0 REFERENCES 15

TABLES

Table 1 Source Material and Background Overburden Soil and Bedrock Shale Analytical Results
Table 2 Porewater Analytical Results
Table 3 Groundwater Analytical Results

FIGURES

Figure 1 Site Location Map
Figure 2 Sample Location Map

1.0 INTRODUCTION

On behalf of Northern Indiana Public Service Company (NIPSCO), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the second (October 2018) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS or Site) Waste Disposal Area (WDA, the CCR Unit), located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (see Figure 1). This evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule" (CCR Final Rule), as amended.

Statistical analyses of the Appendix IV Assessment Monitoring data for arsenic and cobalt indicated the lower confidence interval (LCI) exceeded the background concentration for those parameters in downgradient monitoring wells GAMW-01 and GAMW-14, respectively, which NIPSCO interpreted as apparent evidence of a statistically-significant level (SSL). Although determination of an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO) 90 days from the date of determination (February 18, 2019) to demonstrate a source other than the CCR Unit or another condition caused the SSLs.

Golder's initial review of the Site history and geologic conditions indicates the potential for SSLs to have resulted from a source other than the CCR Unit. To assess potential sources and natural variability of groundwater concentrations, Golder collected and analyzed porewater, CCR source materials, overburden, bedrock, and groundwater samples. Based upon this assessment and in accordance with provisions of the CCR Final Rule, Golder prepared this Alternative Source Demonstration (ASD) for the WDA. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding porewater and groundwater obtained from monitoring wells installed within and adjacent to the WDA.

The ASD conforms to the requirements of 40 CFR §257.95(g)(3) and provides the basis for concluding that the apparent SSLs are not a result of a release from the WDA. The following sections provide a summary of the RMSGS WDA Conceptual Site Model (CSM), sampling procedures and analytical methods, analytical and geochemical modeling results, and lines of evidence demonstrating an alternative source is responsible for the SSLs.

2.0 CONCEPTUAL SITE MODEL

Golder developed this CSM to help frame and support the ASD assessment approach. The CSM presents WDA construction and operational history, a summary of geologic and hydrogeologic information, and a discussion of groundwater monitoring data, which together lay the groundwork for consideration and development of the ASD.

2.1 Description of Waste Disposal Area

The WDA is an approximately 80-acre impoundment located in the southwestern corner of RMSGS as shown in Figure 2. According to NIPSCO construction drawings, the WDA is unlined and is surrounded by berms that were constructed with an approximate two-foot wide slurry wall that extends from just below the top of the berms to the underlying shale located approximately 30 to 35 feet below ground surface (ft bgs). NIPSCO designed and constructed the slurry walls to reduce potential migration of the CCR constituents out of the WDA.

The WDA receives primarily bottom ash/boiler slag that is slurried from all four active boilers. Most of the ash/slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to size of the

unit and settling/depositional properties of the CCR materials, preliminary studies have shown little, if any, ash/slag is present in the southern half of the WDA.

2.2 Site Geology and Hydrogeology

The Site is directly underlain by unconsolidated, upper-Pleistocene (post-Wisconsin) fine-grained sand and silt and outwash deposits of the Atherton Formation, occasionally overlain by alluvial and lacustrine deposits of the Martinsville Formation (Schneider and Keller, 1970). According to Fraser and Bleur (1991), during the late Pleistocene, the Site was occupied by a post-glacial lake followed by a broad, low-gradient outwash stream that deposited sand uniformly across the basin to form the Kankakee-Valparaiso Formation. Golder's interpretation of the Site geology is based on bedrock geology maps, prior reports, and CCR Final Rule-related well installation activities, and includes the following stratigraphy:

Overburden

- Brown fine- to medium-grained sand from the ground surface to approximately 14 ft bgs
- Grayish-brown fine to medium sand from approximately 14 ft bgs to 30-35 ft bgs (coarsens with depth)

Bedrock

- Black to dark gray shale with planar cleavage (Antrim Shale). Top of bedrock is approximately 30 to 35 ft bgs near the impoundments

Regional bedrock consists of more than 4,000 feet of sedimentary rocks that overly Precambrian granitic bedrock (Fennelon 1994). This assemblage is part of the north side of the Kankakee Arch, which is the major structural feature in the Kankakee River Basin. The first 3,500 feet of sedimentary rocks overlying the granitic bedrock are Cambrian and Ordovician in age. The uppermost 300 feet of Ordovician rocks are composed of shale and minor limestones and are referred to as the Maquoketa Group. The Maquoketa Group underlies Silurian, Devonian and Mississippian rocks and consist of a wide variety of sedimentary layers ranging from shaley to coarse-grained carbonate rocks. This carbonate sequence is overlain by a series of shales including the Antrim Shale, a brownish-black, non-calcareous shale (Fennelon, 1994).

Available groundwater elevation data indicate that groundwater in the uppermost aquifer near the WDA flows to the north and northwest (and possibly northeast, immediately adjacent to the WDA). Groundwater flow direction is influenced by the slurry walls that surround the WDA and adjacent Recycle Settling Basin and Inactive Retired Waste Disposal Basin (IRWDB - both of these latter impoundments are non-CCR Final Rule regulated). Hydraulic heads measured inside the slurry walls that surround the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates that the slurry walls significantly impede the flow of water from the CCR Unit to the uppermost aquifer.

2.3 Groundwater Monitoring Network

Design of the CCR Final Rule-compliant WDA monitoring program considered the size, disposal/operational history, hydraulic influence of the slurry walls, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer. Based on the available hydrogeologic information for the WDA, groundwater mounding is occurring within the slurry walls. NIPSCO's monitoring approach for the CCR surface impoundment featured the installation of well pairs including shallow (approximately 15 ft bgs) and deep (approximately 35 ft bgs – to the top of shale [signified with a "B" in Figure 2]) couplets at each background and downgradient monitoring well location outside of the perimeter slurry walls as shown in Figure 2. As-built drawings of the slurry walls are not available;

therefore, it is unknown if the slurry walls were keyed into the underlying shale. Depending upon the degree of contact between the slurry walls and shale, the higher hydraulic head observed within the slurry walls may result in the discharge of water beneath the slurry walls. Consequently, as illustrated in Figure 2-3, Golder installed deep monitoring wells to supplement shallow wells and monitor potential flow paths beneath the slurry walls into the aquifer.

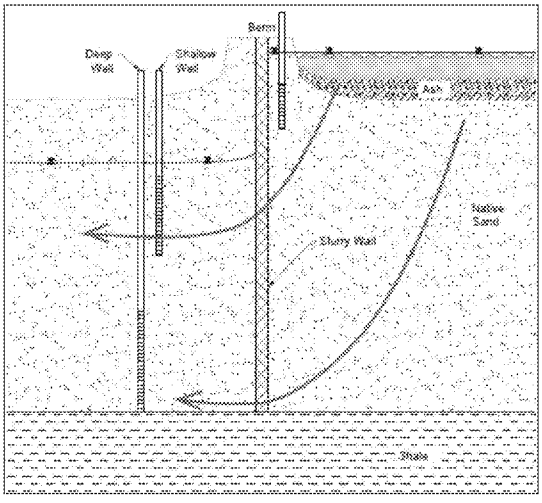


Figure 2-3: Conceptual Site Model

NIPSCO modified the groundwater monitoring well network to include two new deep wells (GAMW-01B, GAMW-12B) and four assessment monitoring well pairs (GAMW-42/42B, GAMW-43/43B, GAMW-44/44B, and GAMW-51/51B) in May and July 2018 at the locations shown in Figure 2. Golder installed the two new deep wells to monitor groundwater at the bedrock/overburden interface co-located with existing shallow wells (GAMW-01 and GAMW-12) near the waste boundary and four new well pairs further downgradient of the WDA to assess the extent of potential groundwater impacts detected during Assessment Monitoring (see Figure 2). The WDA monitoring network includes two background and eight downgradient monitoring wells. The groundwater monitoring network is summarized in Table 2-3.

Table 2-3: Waste Disposal Area Monitoring Well Network

Background Monitoring Wells	Downgradient Monitoring Wells	Assessment Monitoring Wells
GAMW-03 and GAMW-03B	GAMW-01, GAMW-01B*, GAMW-12, GAMW-12B*, GAMW-13, GAMW-13B, GAMW-14, and GAMW-14B	GAMW-42*, GAMW-42B*, GAMW-43*, GAMW-43B*, GAMW-44*, GAMW-44B*, GAMW-51*, and GAMW-51B*

*Monitoring well installed in 2018

Golder installed piezometer GAPIEZ04 in the northwest corner of the WDA within the slurry wall to assess groundwater elevations in the WDA. GAPIEZ04 is screened within the CCR materials.

2.4 Groundwater Conditions

Between July 2016 and August 2017, Golder collected eight independent background groundwater samples from each background and downgradient well, as required by 40 CFR §257.94. The results of the background

monitoring phase were used to develop appropriate, statistically-valid background values for each constituent/monitoring well. Following completion of the eight background monitoring events, Golder collected the first Detection Monitoring groundwater samples in October 2017 and compared the results to the calculated prediction limits to determine statistically significant increases (SSIs). Based on these results, NIPSCO established an Assessment Monitoring program in January 2018.

Golder performed the first Assessment Monitoring event in March 2018 (with verification sampling in April 2018). Following receipt and validation of laboratory results, Golder evaluated the results of the first Assessment Monitoring sampling event to determine the concentration of Appendix IV constituents relative to CCR Unit-specific calculated groundwater protection standards (GWPSs). The GWPS is the maximum contaminant level (MCL), if an MCL exists, or the unit-specific background concentration for each analyte using a tolerance/prediction limit procedure. Based on this statistical analysis, Golder concluded that the only constituent demonstrating an apparent SSL was molybdenum. The calculated GWPS (unit-specific background concentration) for molybdenum was 0.009 milligrams per liter (mg/L). However, the detected groundwater molybdenum concentrations did not exceed the new U. S. Environmental Protection Agency (USEPA) risk-based level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and became effective August 29, 2018 (CCR Final Rule Part 1 Phase 1 Addendum). Golder completed an ASD in November 2018 concluding that the molybdenum SSLs determined in August 2018 are not due to a release from the CCR Unit. The key supporting lines of evidence described in the ASD indicate that the molybdenum detected in monitoring wells downgradient of the WDA is due to a natural source and not the WDA.

Golder performed the second Assessment Monitoring event in October 2018 by collecting groundwater samples from each background and downgradient monitoring well, including the new Assessment Monitoring wells per 40 CFR §257.95. Golder performed the statistical evaluation in February 2019 and concluded that the only constituents demonstrating apparent SSLs were arsenic, in GAMW-14, and cobalt, in GAMW-01. A summary of the GWPSs for these compounds are provided in Table 2-4.

Table 2-4: Waste Disposal Area Groundwater Protection Standards

Analyte	USEPA MCL or risk-based level	GWPS
Arsenic	0.01 mg/L	0.015 mg/L
Cobalt	0.006 mg/L	0.015 mg/L

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS

To further assess potential groundwater impacts downgradient of the WDA, Golder performed supplemental assessment activities between July 24 and October 31, 2018. Golder conducted the supplemental assessment activities in accordance with the RMSGS Groundwater Monitoring Program Implementation Manual (GMPIM, Golder 2017). The following sections summarize the supplemental assessment activities.

3.1 Source Material Assessment

3.1.1 Sample Collection

Golder collected three WDA source material samples from the north side of the WDA (see Figure 2 for sample locations). Golder's field engineer composited three sub-samples into one sample per excavation area for submittal to the laboratory. The three WDA source material samples are described as follows:

- WDA-West Sample: Collected from approximately 1.5 ft below the top of a pile of recently dredged source material that originated from the northwestern corner of the WDA
- WDA-MID Sample: Collected from approximaterly one ft below the top of a pile from a recently dredged source material pile that originated near the effluent discharge pipes in the north-central portion of the WDA
- WDA-East Sample: Collected from approximately 1.5 ft below the top of a pile from a recently dredged source material pile that originated from the northeastern portion of the WDA

3.1.2 Geochemical Characterization

Golder used two geochemical analytical methods to characterize the source material samples: total metals analysis and leachability testing. The selected geochemical test methods are summarized in the following paragraphs. The analytical results for the WDA source material are provided in Table 1.

Total Metals: The purpose of this test was to assess the chemical composition of potential source and aquifer materials. The total mass of metals in combination with the results from leachability testing can be used to determine the provenance of the COC metals and their relative leachability. The laboratory analyzed a target analyte list (TAL) of metals following the USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000) and USEPA SW846 7471B Mercury in Solid or Semisolid Wastes (Manual Cold-Vapor Technique) Revision 2 (January 1998).

Leachability: The purpose of this test was to obtain an understanding of the fraction of total metals that is leachable, which is important for evaluating the long-term environmental stability of potential source materials. The analysis simulates the interaction between a solid and meteoric water, and thus provides the leachability potential of a material. This analysis was only conducted on source materials (i.e., samples collected from within the WDA, see Section 3.1.1). The laboratory used porewater collected by Golder from the WDA (piezometer GAPIEZ04) as the leaching medium to simulate natural conditions. The laboratory tested the leachability of the source materials using USEPA SW846 1312 Modified Synthetic Precipitation Leaching Procedure (SPLP) (September 1994).

3.2 Overburden Soil and Bedrock Shale Samples

Golder subcontracted a union-licensed well driller to advance borings and install monitoring wells using sonic drilling methods. Golder collected a composite overburden sample (i.e., two-foot interval) from within the well screen interval (i.e., 10-foot screened interval) of monitoring well GAMW-42B. Golder also collected two shale samples from boring GAMW-42B, including one shale sample located just below the contact between the overburden/shale (i.e., considered as "weathered" shale) and one shale sample located approximately two feet into the shale (i.e., "non-weathered" shale). Golder submitted the overburden and shale samples to a certified laboratory under chain-of-custody procedures for analysis of total metals (see Section 3.1.12 for analytical method). The overburden and bedrock analytical results are provided in Table 1.

3.3 Groundwater and Porewater Assessment

3.3.1 Sample Collection

Golder field personnel collected groundwater and porewater (i.e., water in direct contact with CCR materials) samples in accordance with the RMSGS GMPIM. Porewater samples were collected in August, September, and October 2018. Porewater analytical results are provided in Table 2 and groundwater analytical results are

provided in Table 3. Groundwater and porewater samples were analyzed for Appendix III and IV metals and other groundwater quality parameters, as described below.

3.3.2 Geochemical Characterization

The geochemical analytical methods Golder used to characterize the porewater and groundwater samples included total metals analyses and major cations and anions analyses. These selected analytical methods are summarized below.

Metals: Metals analyses (i.e., Appendix III and IV) are important to understand the geochemical properties of porewater and groundwater. In porewater, metal results can be used for geochemical modeling and provide an indication of the leachable fraction of the solids (ITRC, 2012). In groundwater, metals analysis allows for the delineation of a potential plume, and identification of background contributions from natural sources or off-site locations.

Major Cations and Anions/Field Parameters: Geochemical modeling of mineral solubility, metal attenuation and background contributions requires analysis of major cations and anions because they affect and participate in sorption and mineral dissolution/precipitation reactions. Required field parameters include pH, dissolved oxygen, oxidation reduction potential (ORP), conductivity, and temperature, which are needed to support geochemical modeling and serve an important quality assurance/quality control (QA/QC) function.

The laboratory analyzed porewater and groundwater samples using the following methods:

- Chloride, Fluoride, and Sulfide following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- pH following USEPA SW846 9040C pH Electrometric Measurement (November 2004)
- Total Target Analyte List (TAL) Metals following USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000), SW846 6020B Inductively Coupled Plasma- MS Revision 2 (July 2014), SW846 6020A Inductively Coupled Plasma- MS Revision 1 (January 1998), and SW846 7470A Mercury in Liquid Wastes (Manual Cold- Vapor Technique) Revision 1 (September 1994)
- Total Dissolved Solids following SM 2540C Total Dissolved Solids Dried at 180°C (1993)
- Alkalinity following SM 2320B Alkalinity by Titration (2005)

4.0 DATA EVALUATION AND FINDINGS

4.1 Source Material Results

Golder collected three WDA source material samples to assess the potential contribution of source materials to groundwater. The laboratory reported results as both total and leachable arsenic and cobalt concentrations. Total arsenic and cobalt concentrations were low, ranging from 3.4 to 5.2 milligram per kilogram (mg/kg) and 5.4 to 19 mg/kg, respectively. These WDA source material concentrations are less than the range of concentrations observed in the on-Site unimpacted soil and bedrock samples (described below in Section 4.2). In addition, the laboratory measured the leachability potential of the WDA source material samples using interstitial porewater collected from the WDA (i.e., GAPIEZ-04) following U.S. EPA Modified SPLP Method protocols (see Section 3.1.2). The arsenic and cobalt leachability levels were non-detect (<0.015 mg/L and <0.004 mg/L for arsenic and cobalt, respectively), indicating that the WDA source material has negligible to no leaching potential for either arsenic or cobalt. Therefore, constituents of the WDA source materials, if they have been released from the CCR

Unit, do not appear to be contributing to the downgradient groundwater arsenic and cobalt concentrations. The WDA CCR source material results are provided in Table 1.

4.2 Overburden Soil and Bedrock Shale Results

Golder collected soil and bedrock samples from boring/monitoring well GAMW-42B to assess the presence of naturally-occurring arsenic and cobalt. Boring/monitoring well GAMW-42B is located west of and in an area unimpacted by the WDA. Total arsenic and total cobalt concentrations ranged from 2 to 30 mg/kg and 3.7 to 41 mg/kg, respectively, across the three intervals samples (30-34 ft bgs, 34-36 ft bgs, and 36-38 ft bgs). The range of total arsenic and cobalt concentrations in the samples demonstrates the heterogeneity in the natural geology of the Site. Groundwater reaches equilibrium with the naturally-occurring metals as it flows through the media, which accounts for natural variability in the arsenic and cobalt groundwater concentrations. Both arsenic and cobalt are sensitive to changes in groundwater chemistry (e.g., pH or redox potential) and can be easily remobilized into groundwater (Hem 1989). As a consequence, seasonal or other natural fluctuations in groundwater chemistry will also lead to fluctuating arsenic and cobalt concentrations.

4.3 Groundwater and Porewater Results

As stated in the CSM (see Section 2.1), most of the bottom ash/boiler slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to size of the unit and settling/depositional properties of the CCR materials, very little, if any, ash/slag is present in the southern half of the WDA. Overall, Golder expects that if there was a release from the WDA, the highest concentrations would be expected in the groundwater samples collected from monitoring wells installed near the northwest corner of the WDA (e.g.,GAMW-14/14B), as compared to concentrations detected in monitoring wells installed near the southwest corner of the WDA (e.g., GAMW-01/01B). This expectation helps explain the groundwater findings and frames the porewater results as compared to groundwater quality. The porewater and groundwater analytical results are provided in Table 2 and Table 3, respectively, and described in the following sections.

4.3.1 Geochemistry

Golder evaluated groundwater and porewater data using the relative abundance of major cations and anions to differentiate between groundwater compositions. Golder generated Piper and Durov plots using Geochemist's Workbench software to visually depict major ion chemistry abundance and elucidate relationships between background groundwater, downgradient groundwater, and porewater.

Golder used the Spece8 package in Geochemist's Workbench to assess mineral saturation in groundwater samples and determine if mineral precipitation would impact relative ion abundance. The Spece8 analysis only used data from monitoring wells with a full suite of groundwater analytical results (i.e., all major ions), which is a prerequiste for reliable and defensible geochemical modeling. The evaluation of major ion composition indicates that there are three discrete groundwater groups:

- Background and downgradient groundwater
- Groundwater influenced by an alternative source
- WDA porewater

Groundwater quality observed in samples collected from downgradient GAMW-01B and GAMW-12B showed a closer relationship to groundwater quality in background monitoring wells GAMW-03 and GAMW-03B than the WDA porewater samples (see Figure 4-3(1)). This similarity in major ion composition suggests that downgradient

groundwater has the same source as background groundwater. As a comparison, in cases where groundwater is impacted by a potential large discrete source (e.g., unlined fly ash landfill), the major groundwater ions would plot between the background and source groundwater, indicating mixing of the two waters. Wells GAMW-13B, GAMW-14B, and GAMW-51B are deeper wells installed to the top of bedrock and their groundwater compositions are different with respect to relative ion abundance from those of other downgradient wells, suggesting a potential alternative source. Neither GAMW-13B, GAMW-14B, or GAMW-51B show exceedances of arsenic or cobalt. Based on the Piper plot, the composition of groundwater in GAMW-13B is the most closely related to that of WDA porewater, and if the WDA was the source of arsenic and cobalt in groundwater, it would most likely be present in GAMW-13B.

The WDA not being the source of arsenic and cobalt in wells GAMW-01 and GAMW-14 is also supported by the total dissolved solids (TDS) content measured in these wells. The TDS contents measured in GAMW-01 and GAMW-14 in October 2018 were 350 mg/L and 290 mg/L, respectively, which was lower than in both the WDA (710 mg/L) and groundwater from background well GAMW-03/03B (440 mg/L to 450 mg/L; Figure 4-3(2)). In the absence of attenuation reactions such as mineral precipitation (which would lower the TDS of a groundwater sample), the TDS of a mixture of two samples should range between the TDS values of both inputs. Based on geochemical modeling, mineral saturation is not achieved in GAMW-01 or GAMW-14, so the groundwater does not represent a mixture of WDA porewater and groundwater from GAMW-03/03B. The TDS content measured in monitoring wells GAMW-14B and GAMW-51B is much higher than in other monitoring wells and WDA porewater samples. The TDS concentrations from these wells group independently on both the Piper and Durov diagrams compared to TDS concentrations in other wells and are likely influenced by an alternative source affecting their groundwater chemistry while demonstrating no influences from the WDA. The analytical results used to develop the Piper Plots were obtained from groundwater samples collected in October 2018 and are provided in Table 2 and Table 3.

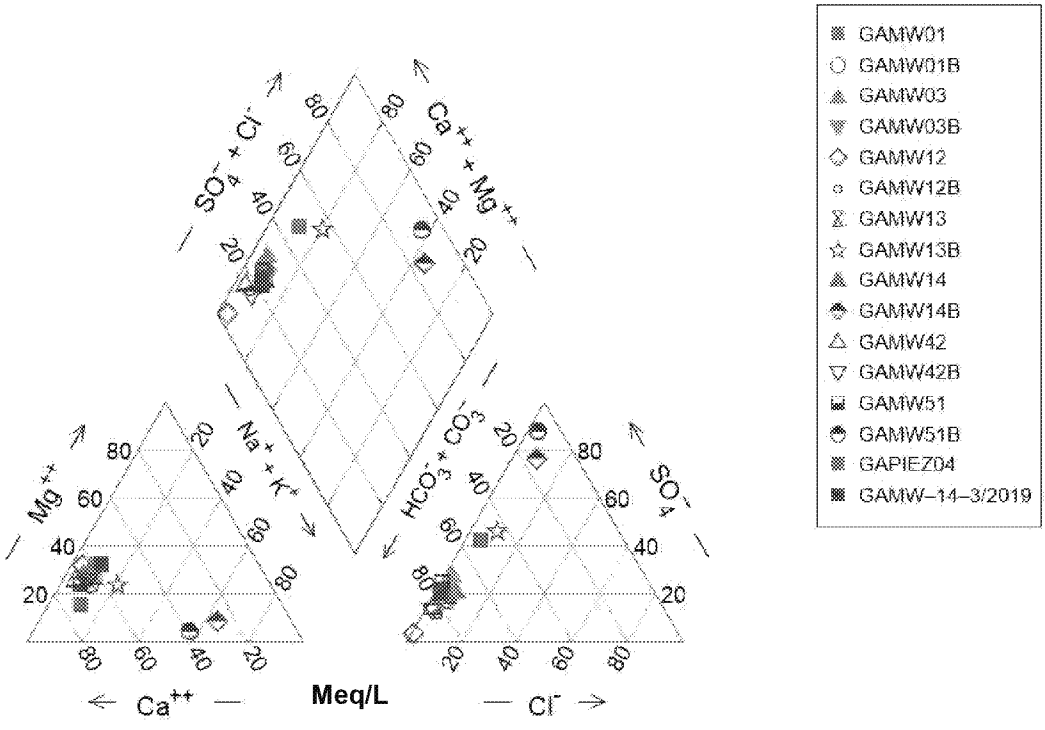


Figure 4-3(1): WDA Piper plot of relative ion abundance in groundwater samples

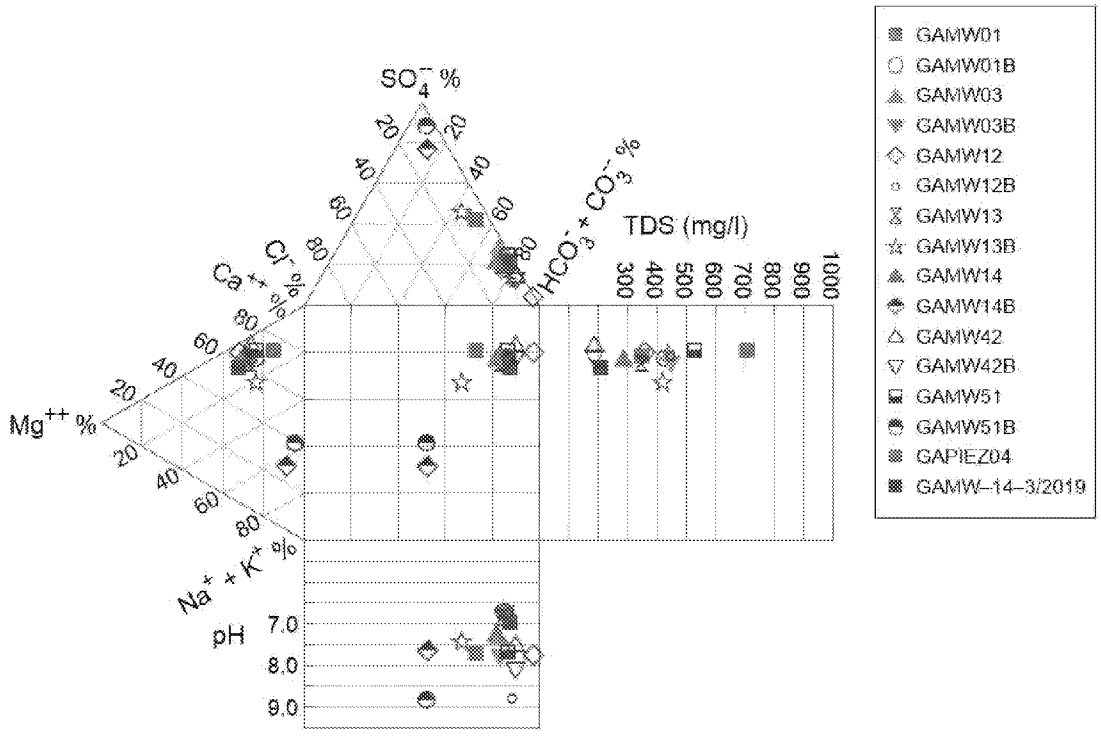


Figure 4-3(2): WDA Durov plot of relative ion abundance in groundwater and TDS (Note: TDS for GAMW-14B and GAMW-51B >1000mg/L not shown due to axis constraints)

4.3.2 Arsenic

Arsenic has been detected at concentrations above the MCL (0.01 mg/L) in groundwater samples collected from the shallow background monitoring well, shallow downgradient monitoring wells, and GAPIEZ-04 during the July 2016 to October 2018 monitoring events. The arsenic time-series plot (Figure 4-3(3)) shows seasonal impacts to the arsenic concentrations, with the lowest arsenic concentrations detected during the winter (December-March) and the highest concentrations detected during the late summer and fall (July-October). Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be detected in groundwater near the WDA. The fluctuations in arsenic concentration suggest seasonality effects and/or heterogeneity in the overburden based on the following findings:

- Arsenic concentrations found in groundwater samples collected from shallow background well GAMW-03 range from non-detect (<0.005 mg/L) to 0.018 mg/L.
- Total arsenic concentrations in the WDA porewater are similar to background concentrations (0.012 to 0.015 mg/L).
- Arsenic was observed at concentrations above the GWPS (0.015 mg/L) and/or the MCL in groundwater samples collected from shallow downgradient monitoring wells GAMW-01, GAMW-12, GAMW-13, GAMW-14. However, based on the statistical methodology applied, an SSL for arsenic has only been reported for GAMW-01. The arsenic concentrations in groundwater samples collected from monitoring well GAMW-01 range from 0.01 mg/L to 0.039 mg/L.

- Porewater arsenic concentrations measured in GAPIEZ-04 (groundwater in direct contact with CCR materials) are lower than the arsenic concentrations observed in the groundwater samples from downgradient monitoring well GAMW-01, suggesting that arsenic in groundwater samples collected from GAMW-01 is not due to a release from the CCR Unit.
- Monitoring well GAMW-01 is located at the waste boundary near the southwest corner of the WDA as shown in Figure 2. Previous bathymetric studies have indicated that there are few, if any, CCR materials in the southwest corner of the WDA. Therefore, groundwater quality at GAMW-01 should not be influenced by the contents of the WDA.

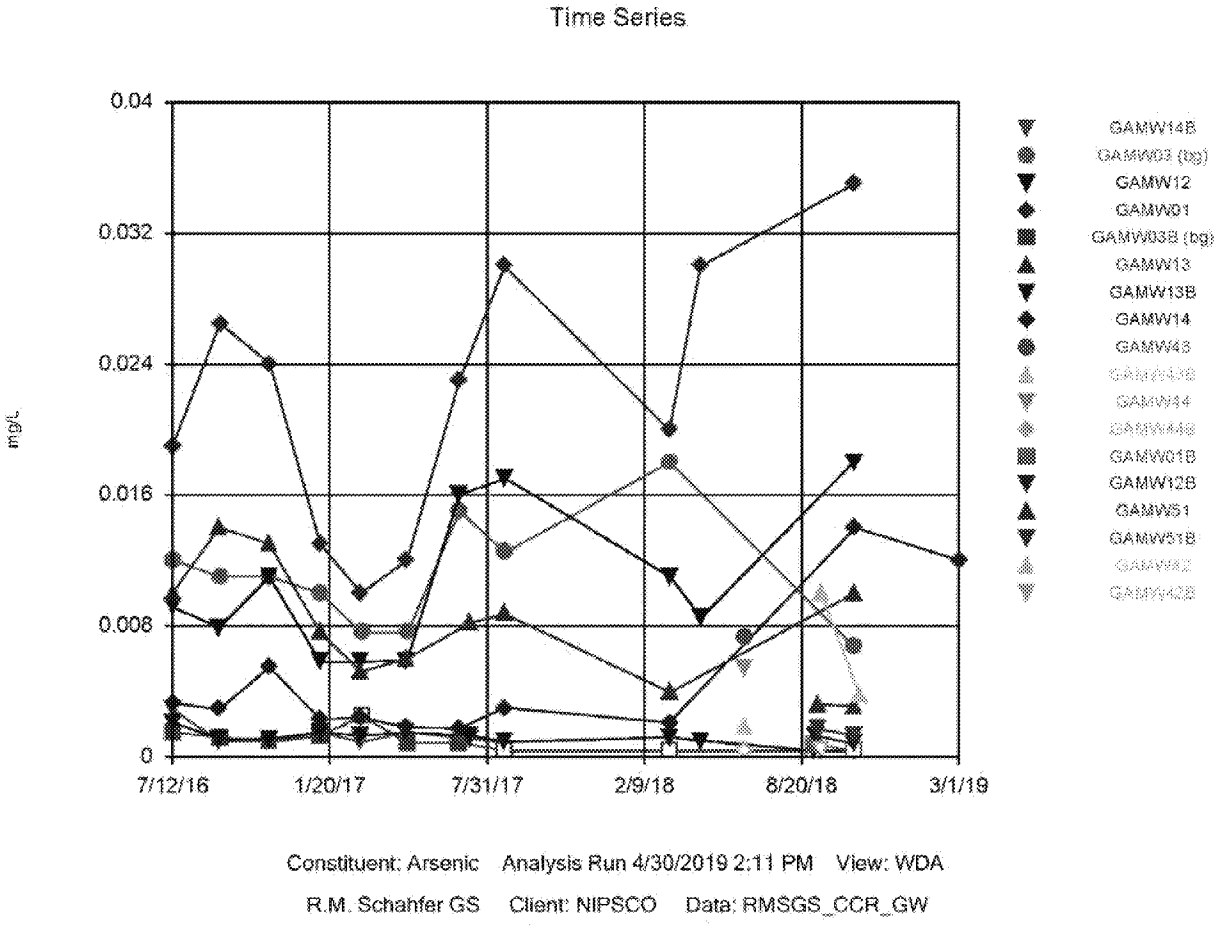


Figure 4-3(3): Arsenic Time-Series Plot

4.3.3 Cobalt

Cobalt has been detected at concentrations above the risk-based standard (0.006 mg/L) in groundwater samples collected from the shallow background monitoring well, shallow downgradient monitoring well GAMW-14, and upgradient well GAMW-03 during the July 2016 to October 2018 monitoring events. Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be detected in groundwater near the WDA. However, the cobalt time-series plot (Figure 4-3(4)) shows cobalt concentrations in GAMW-14 are fluctuating. Cobalt in all other monitoring wells is consistently observed at concentrations below the risk-based standard

(0.006 mg/L). The fluctuations in cobalt concentration suggest seasonality effects and/or heterogeneity in the overburden based on the following findings:

- Cobalt concentrations found in groundwater samples from shallow background well GAMW-03 range from non-detect (<0.001 mg/L) to 0.015 mg/L.
- Porewater cobalt concentrations observed in groundwater samples collected from GAPIEZ-04 (groundwater in direct contact with CCR materials) are not detected above the laboratory reporting limit (<0.001 mg/L).
- Cobalt was identified at a concentration above the risk-based standard and GWPS (0.015 mg/L) in groundwater samples collected from shallow downgradient monitoring well GAMW-14. Cobalt concentrations range from 0.0052 mg/L to 0.052 mg/L in groundwater samples collected from monitoring well GAMW-14 during the July 2016 to March 2019 monitoring events. The cobalt concentrations also show a statistically-significant increasing trend (see Figure 4-3(4) below) where the lower confidence interval is above the GWPS; therefore, an SSL for cobalt has been reported in GAMW-14. Golder collected a confirmation groundwater sample in March 2019. The cobalt result (0.0083 mg/L) obtained from the March 2019 monitoring event is lower than the cobalt concentration observed during the October 2018 (0.031 mg/L) monitoring event and lower than the GWPS (0.015 mg/L). While the cobalt level in GAMW-14 decreased substantially in March 2019, there was no substantial change in major relative ion abundance between the October 2018 and March 2019 samples (Figure 4-3(5)), indicating a consistent groundwater composition at this well.
- Porewater cobalt concentrations detected in GAPIEZ-04 (groundwater in direct contact with CCR materials) are lower than the cobalt concentrations found in downgradient monitoring well GAMW-14, suggesting that cobalt present in groundwater samples collected from GAMW-14 is not due to a release from the CCR Unit.

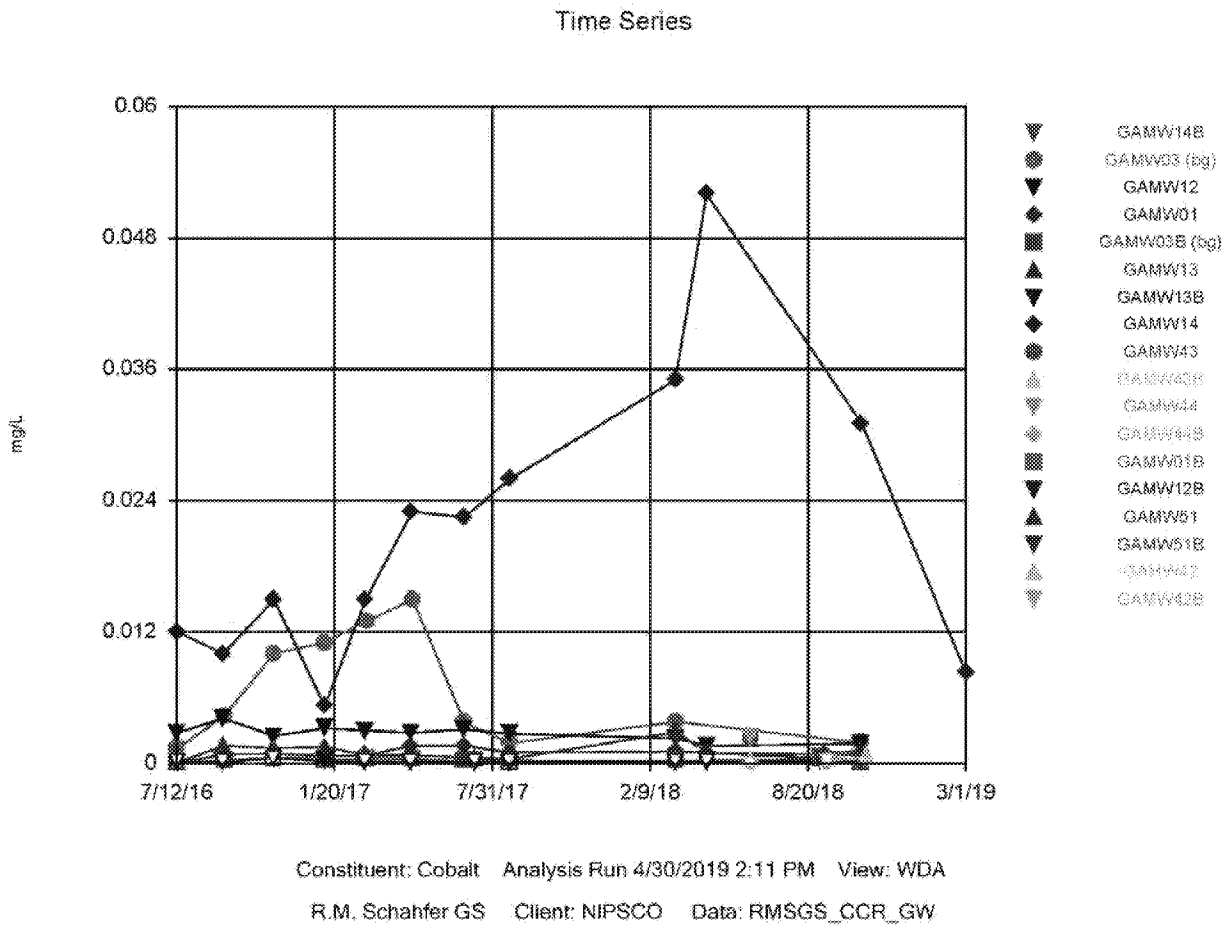


Figure 4-3(4): Cobalt Time-Series Plot

4.3.4 Indicator Parameters

The CCR Final Rule Appendix III parameters are common indicator parameters for CCR material and, depending upon site conditions, can be indicative of the presence of CCR material constituents in media of interest. Several of these indicator parameters, including boron, chloride, sulfate, and total dissolved solids, have been observed at higher concentrations in groundwater samples collected from downgradient deep monitoring well GAMW-14B (and to a lesser extent, GAMW-13B) than in the background monitoring wells. Boron, in particular, is a known CCR indicator parameter that has high mobility in groundwater and, as such, is expected to represent the furthest extent of groundwater impacts originating from CCR releases. A summary of groundwater boron concentrations is as follows:

- Boron concentrations found in groundwater samples collected from background monitoring wells GAMW-03 and GAMW-03B range from non-detect (<0.2 mg/L) to 0.32 mg/L.
- Porewater boron concentrations detected in groundwater samples collected from GAPIEZ-04 (groundwater in direct contact with CCR materials) range from 0.71 to 0.86 mg/L.
- The highest boron concentrations were observed in groundwater samples collected from the deep downgradient monitoring wells GAMW-14B (2.4 to 3.4 mg/L) and GAMW-13B (0.69 to 0.79 mg/L). These

boron concentrations are higher than background and porewater concentrations, indicating that they may be due to another source. Because boron is a groundwater tracer and the plume should be stable based on the disposal history of the WDA, Golder would expect that the highest concentrations of other CCR parameters would also be found in the same deep wells that contain elevated boron concentrations. However, this is not the case as the arsenic and cobalt SSLs occur in shallow wells. Boron concentrations in groundwater samples collected from GAMW-01 vary but are generally closer to background concentrations than porewater concentrations. Boron concentrations found in groundwater samples collected from GAMW-01 are below 0.3 mg/L in 2018. Boron concentrations detected in groundwater samples collected from GAMW-14 are similar to background concentrations and range from 0.23 to 0.36 mg/L (see Figure 4-3(5)).

Based on the lines of evidence provided above, it is considered unlikely that the WDA is the source of the arsenic and cobalt SSLs.

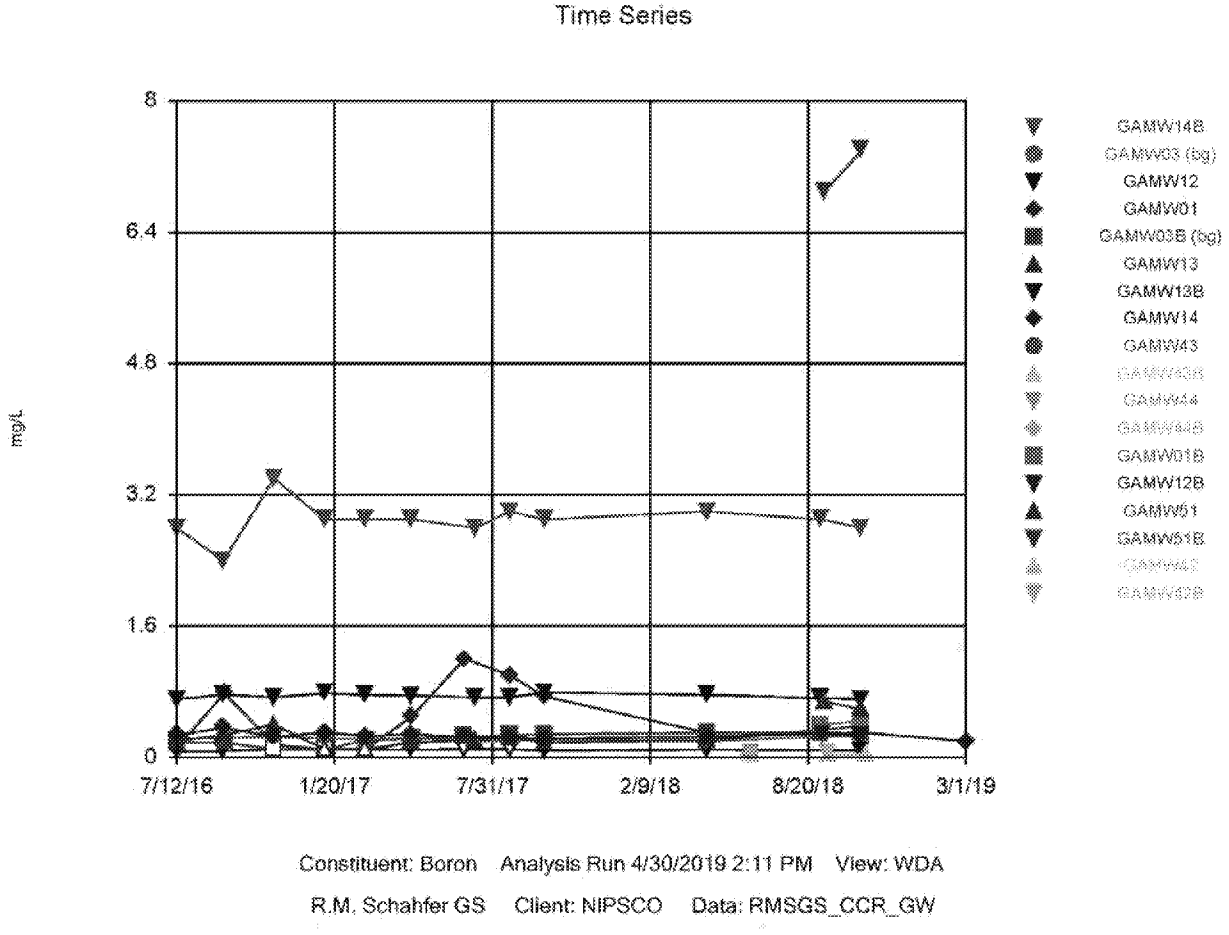


Figure 4-3(5): Boron Time-Series Plot

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on a literature review and the testing results presented above, it is Golder's opinion that the arsenic and cobalt SSLs encountered in groundwater near the WDA are linked to an alternative source rather than a release from the WDA. Golder concludes the arsenic and cobalt SSLs are caused by natural variation in the arsenic and cobalt contents of the overburden and bedrock.

Primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in Table 5-1.

Table 5-1: Primary Lines of Evidence and Supporting ASD Analysis

Key Line of Evidence	Supporting Evidence	Description
Source Material Characteristics	WDA source material and porewater concentrations	WDA source materials contain low levels of arsenic and cobalt but indicate low to no leaching potential for these compounds. Additionally, WDA porewater samples indicate lower levels of both arsenic and cobalt than in the downgradient wells. Therefore, another source must be present to account for the higher arsenic and cobalt concentrations observed in downgradient groundwater.
	Relative ion abundance differs from the WDA	As presented in the Piper and other ternary diagrams, major ion concentrations show distinct differences between the WDA porewater and downgradient groundwater samples. The geochemical properties of the downgradient groundwater samples cannot have been generated by a release from the WDA.
Natural Source	Natural Overburden and Bedrock Concentrations	Naturally occurring total arsenic and cobalt were detected in background soil boring (SB-42B). The concentrations varied across the three intervals (30-34 ft bgs, 34-36 ft bgs, 36-38 ft bgs), with concentrations up to 30 mg/kg and 41 mg/kg for arsenic and cobalt, respectively. The presence of this range in total arsenic and cobalt in the background soil boring demonstrates the heterogeneity in the natural geology of the site.
Hydrogeology	Groundwater Flow Direction	GAMW-01, a shallow well located farthest from the CCR source material, contains groundwater arsenic at concentrations above the GWPS. Arsenic has generally not been detected in samples from monitoring wells GAMW-12, GAMW-13, and GAMW-14, which are closer to and downgradient of the source material. This concentration pattern is inconsistent with the CCR Unit being the source of arsenic in this well.
	Indicator Parameters	Boron, because of its mobility, can be used to define the leading edge of the groundwater plume originating from a CCR source. The highest concentrations of boron in monitoring wells on the downgradient edge of the CCR Unit were found in GAMW-14B and GAMW-13B. Lower concentrations of boron were detected in GAMW-01 and GAMW-14. This concentration pattern is inconsistent with the CCR being the source for the cobalt and arsenic in these wells.
	Temporal trends and associations	In certain downgradient wells, seasonal variability is observed in arsenic groundwater concentrations. Cobalt concentrations were increasing between January 2017 and October 2018, but otherwise have been variable. This suggests the arsenic and cobalt is naturally occurring and not representative of a constant and consistent release from the WDA. Given the WDA disposal history, types of CCR materials placed in the WDA, and decades since CCR was first placed in the WDA, Golder anticipates that a mature plume (i.e., steady-state or consistent concentration levels), if any, would be found in groundwater near the WDA. However, this is not the case, indicating the arsenic and cobalt do not originate from the WDA.

6.0 CONCLUSION

The preceding information serves as the ASD prepared for the WDA in accordance with 40 CFR 257.95(g)(3)(ii) and supports the finding that the SSLs determined on February 18, 2019 are not due to a release from the CCR Unit. The key supporting lines of evidence described above indicate that the arsenic and cobalt observed in monitoring wells downgradient of the WDA are due to natural variation and not the WDA. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the RMSGS WDA will remain in Assessment Monitoring.

7.0 REFERENCES

Dzombak, David A. Surface complexation modeling: hydrous ferric oxide. John Wiley & Sons, 1990.

EPA. 2014. National Functional Guidelines for Inorganic Data Review (EPA 540-R-013-001, August 2014).

Fenelon, J.M., K.E. Bombay, et al., 1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water Resources Investigations, Report 92-4142, 1994.

Fraser, G. S., Bleuer, N. K. Fraser, G.S., Bleuer, N.K., 1991, Geologic framework of the aquifers in the Kankakee River lowland: Indiana Geological Survey Occasional Paper 60, 10 p., 9 fig.

Hem, J. D., & Geological Survey (US). (1989). Study and interpretation of the chemical characteristics of natural water.

Lourigan, J., & Phelps, W. (2013). Caledonia Groundwater Molybdenum Investigation Southeast Wisconsin. *Wisconsin Department of Natural Resources*.

Schneider and Keller, 1970. Schneider, A.F. and Keller, S.J., Geologic Map of the Chicago Quadrangle, Indiana, Illinois, and Michigan; Indiana Geologic Survey, Bloomington. 1970.

USEPA, 1996, Test methods for evaluating solid waste, physical/chemical methods (SW-846): 3rd edition, Environmental Protection Agency, National Center for Environmental Publications, Cincinnati, Ohio, accessed at URL https://www.epa.gov/hw-sw846

US EPA (2017). Leaching Environmental Assessment Framework (LEAF) How-To Guide.

Golder Associates Inc.

Mark Haney
Program Leader

Rens Verburg
Principal Geochemist

MAH/RV/drb

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/nipscoccrgwmonitoring/shared documents/r.m. schahfer generating station/reports/wda asd spring 2019/final/wda_ask-051719.docx

TABLES

Table 1: Source Material and Background Overburden Soil and Bedrock Shale Analytical Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Sample Location	WDA-EAST	WDA-MID	WDA-WEST	SB-42B		
Start Depth (ft bgs)	0	0	0	30	34	36
End Depth (ft bgs)	1.5	1	1.5	34	36	38
Total Arsenic Result	5.2	3.4	5.1	2 J	30	30
SPLP Arsenic Result	0.015 U	0.015 U	0.0015 U	NM	NM	NM
Total Cobalt Result	19 J	5.4	6.9	3.7 J	41	37
SPLP Cobalt Result	0.0040 U	0.0040 U	0.0040 U	NM	NM	NM

Notes:

ft bgs: Feet below ground surface

All results displayed are in milligram per kilogram (mg/kg), except SPLP results which are in milligram per liter (mg/L).

SPLP: Synthetic Precipitation Leaching Procedure

J: Indicates the result is estimated.

U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

NM: Not measured

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

Table 2: Porewater Analytical Results
Waste Disposal Area
R. M. Schahfer Generating Station
Wheatfield, Indiana

Location	GAPIEZ04		
Sample Date	2018-08-09	2018-09-13	2018-10-30
Fraction	D	T	T
Analyte			
Alkalinity, Total	210 J	220	220
Arsenic	0.012	0.015	0.015
Boron	0.86	0.71	0.86
Calcium	140	160	170
Chloride	19	21	18
Cobalt	0.00026 J	0.001 U	0.001 U
Magnesium	20	20	20
pH	7.35	7.27	7.71
Potassium	4.8 J	5	4.8 J
Sodium	28	22	27
Sulfate	280	280	170
Total Dissolved Solids	670	660	710

Notes:

Table shows all results in milligram per liter (mg/L)

D: Dissolved

T: Total

J: Indicates result is estimated.

U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW01													GAMW01B	
		2016-07-12	2016-09-08	2016-09-08	2016-11-09	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-23	2018-09-06	2018-10-23
		N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters																
Boron	mg/L	0.11	1.2 J	0.36 J	0.15 J	0.2 U	0.2 U	0.5	1.2	1	0.74		0.3	0.29	0.4	0.44
Calcium	mg/L	65	240 J	83 J	74	71	83	110	110	81	81		87	77	110	100
Chloride	mg/L	4.3	28 J	12 J	5.3	5.6	8.3	18	18	12	16		10	8.1	21	19
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.17 J	0.14
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78	7.01	6.74
Sulfate	mg/L	54 J-	500 J	100 J	62	52	54	100	200	130	110		50	68	72	69
Total Dissolved Solids	mg/L	280	1100 J	380 J	320	280	340	480	580	420	420		360	350	450	430
Appendix IV Parameters																
Antimony	mg/L	0.00048 J	0.001 J	0.00068 J	0.001 J	0.0016 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.019	0.014 J	0.039 J	0.024	0.013	0.01	0.012	0.023	0.03		0.02	0.03	0.035	0.00077 J	0.005 U
Barium	mg/L	0.059	0.078 J	0.057 J	0.064	0.053	0.07	0.065	0.093	0.077		0.057	0.052	0.052	0.19	0.17
Beryllium	mg/L	0.00099 J	0.00068 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.00036 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J		0.001 U		0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00038 J	0.002 U	0.00037 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00053 J	0.0011	0.00087 J	0.00068 J	0.00074 J	0.0016	0.0016	0.001		0.0011	0.001	0.00075 J	0.00056 J	0.00027 J
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.17 J	0.14
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00065 J		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0031 J	0.008 U	0.008 U	0.008 U	0.0031 J	0.0015 J	0.003 J	0.0042 J	0.0037 J		0.0019 J		0.0028 J	0.0039 J	0.0046 J
Mercury	mg/L	0.0002 U	0.00035	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.011	0.025	0.022	0.011	0.01 U	0.01 U	0.017	0.033	0.045		0.014	0.016	0.015	0.0015 J	0.01 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00075 J	0.0018 J	0.001 J	0.0016 J	0.0031 J	0.0017 J		0.0016 J		0.001 J	0.001 J	0.005 U
Thallium	mg/L	0.00018 J	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00032 J		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L													250	290	320
Magnesium	mg/L													19	21	24
Potassium	mg/L													4.6 J	4.8 J	5.5
Sodium	mg/L													9.1	18	10
Field Parameters																
Dissolved Oxygen	mg/L	0.14		0.9	0.18	0.25	0.17	0.07	0.61	0.32	0.19	0.28	0.14	0.22	0.62	0.23
Oxidation-Reduction Potential	millivolts	-92.6		-21.4	-120.7	-110.5	-127.2	-102.8	98.3	-43.1	-48.2	-85.1	284.1	-130.2	-96.2	-111.7
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78	7.01	6.74
Specific Conductance	uS/cm	448		604	512	416	508	707	844	650	673	395	550	594	684	687
Temperature	deg C	13.9		17.8	16.2	11.2	9.73	10.8	13.8	17	17.2	9.2	9.4	16.9	13.9	13.9
Turbidity	NTU	1.25		2.12	3.92	4.79	3.86	3.69	4.22	2.22	2.8	4.61	4.05	4.81	4.16	2.41

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW03														
		2016-07-13	2016-09-08	2016-11-08	2017-01-09	2017-01-09	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-10-24	2018-10-24
		N	N	N	FD	N	N	N	N	FD	N	N	N	N	FD	N
Appendix III Parameters																
Boron	mg/L	0.23	0.24	0.25	0.24	0.22	0.22	0.23	0.21	0.2	0.2	0.22		0.2	0.28	0.26
Calcium	mg/L	83	87	100	110	94	100	110	87	75	77	87		93	97	94
Chloride	mg/L	7.7	8.6	10	9.1	9.1	8.1	6.8	10	8.2	8.3	9		4.9	22	7.7
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37
Sulfate	mg/L	100 J-	100	110	110	110	120	130	83	77	77	93		110	67	100
Total Dissolved Solids	mg/L	400	390	500	440	430	450	510	420	370	370	430		380	440	440
Appendix IV Parameters																
Antimony	mg/L	0.00023 J	0.00091 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Arsenic	mg/L	0.012	0.011	0.011	0.01	0.01	0.0076	0.0076	0.015	0.012	0.013		0.018		0.005 U	0.013
Barium	mg/L	0.087	0.096	0.11	0.11 J	0.081 J	0.087	0.091	0.071	0.079	0.079		0.074		0.11	0.1
Beryllium	mg/L	0.00055 J	0.00053 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	8.8E-05 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Cobalt	mg/L	0.0014	0.0043	0.01	0.011	0.011	0.013	0.015	0.0037	0.0018	0.0019		0.0038		0.001 U	0.0037
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15
Lead	mg/L	0.001 U	0.001 U	0.00016 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00052 J	0.00045 J	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.0064 J	0.008 U	0.008 U	0.0042 J	0.0044 J	0.0025 J	0.0045 J	0.0063 J	0.0067 J	0.0069 J		0.006 J		0.008 U	0.0074 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.0087 J	0.009 J	0.01 U	0.012 J+	0.01 U	0.01 U	0.0082 J	0.0084 J	0.0069 J	0.0076 J		0.0063 J		0.0065 J	0.0082 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00085 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L															260
Magnesium	mg/L															25
Potassium	mg/L															0.97 J
Sodium	mg/L															10
Field Parameters																
Dissolved Oxygen	mg/L	0.38	0.61	0.24		0.71	1.07	0.73	0.61		0.22	0.29	1.3	0.9		0.99
Oxidation-Reduction Potential	millivolts	186.5	7.4	-30.2		-34	-28.5	-21.7	-24.1		-28.5	-83.1	-76.4	-98.2		-283.8
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37
Specific Conductance	uS/cm	599	630	711		586	588	760	550		583	655	369	572		675
Temperature	deg C	13.4	16.2	15.5		10.8	9.02	10.4	12.7		15.2	16.1	8.6	7.9		16.2
Turbidity	NTU	2.72	4.41	2.92		4.58	4.68	4.42	4.5		2.51	4.18	4.66	4.96		3.55

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW03B													
		2016-07-13	2016-09-08	2016-11-08	2017-01-10	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-09-06	2018-09-06	2018-10-24
		N	N	N	N	N	N	N	N	N	N	N	FD	N	N
Appendix III Parameters															
Boron	mg/L	0.18	0.18	0.2 U	0.2 U	0.21	0.23	0.25	0.27	0.28		0.3	0.32	0.28	0.29
Calcium	mg/L	98	100	110	98	110	110	110	99	95		110	100	99	98
Chloride	mg/L	14	13	15	16	20	20	22	21	25		23	24	25	22
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77
Sulfate	mg/L	58 J-	59	58	77	67	67	66	68	84		66	64	64	67
Total Dissolved Solids	mg/L	420	410	420	440	450	480	510	450	460		420	470	450	450
Appendix IV Parameters															
Antimony	mg/L	0.00019 J	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0015 J	0.0012 J	0.0009 J	0.0013 J	0.005 U	0.00085 J	0.00087 J	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U
Barium	mg/L	0.11	0.1	0.11	0.096	0.11	0.11	0.11	0.12		0.13		0.12	0.12	0.12
Beryllium	mg/L	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00031 J	0.001 U	0.00017 J	0.001 U	0.00038 J	0.00021 J	0.001 U		0.00024 J		0.00034 J	0.00036 J	0.001 U
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21
Lead	mg/L	0.001 U	0.001 U	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0014 J	0.008 U	0.008 U	0.0011 J	0.0011 J	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0044 J	0.0043 J	0.01 U	0.01 U	0.01 U	0.0045 J	0.0052 J	0.0055 J		0.0066 J		0.0067 J	0.0067 J	0.0066 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00066 J	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.0014 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry															
Alkalinity, Total	mg/L													310	300
Magnesium	mg/L													27	25
Potassium	mg/L													1.4 J	1.2 J
Sodium	mg/L													20	18
Field Parameters															
Dissolved Oxygen	mg/L	0.42	1.11	0.32	0.48	0.41	0.15	0.38	0.31	0.17	0.4	0.19		1.12	0.5
Oxidation-Reduction Potential	millivolts	196.3	-26.8	-61.4	-98.9	-86.2	-77.9	-49.1	-34.5	-94.7	-85.2	-95.1		-66.2	-294.4
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77
Specific Conductance	uS/cm	676	680	6.84	678	631	737	656	730	728	515	778		669	719
Temperature	deg C	12.4	13.2	13.2	12.2	11.63	12.1	12.2	13	13.3	11.3	4.1		13	13.69
Turbidity	NTU	3.66	4.73	2.84	2.02	3.1	2.51	1.84	1.16	0.81	4.59	4.36		3.55	3.54

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW12													GAMW12B	
		2016-07-12	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-20	2018-10-23	2018-09-07	2018-10-23
		FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters																
Boron	mg/L	0.07	0.073	0.075	0.2 U	0.2 U	0.2 U	0.092 J	0.2 U	0.2 U	0.079 J		0.095 J	0.081 J	0.28	0.26
Calcium	mg/L	88	93	91	97	90	97	97	100	89	87		87	94	100	110
Chloride	mg/L	2.3	3.8	6.1	9.6	11	10	10	7.6	5.2	3.2		3.3	2.5	22	19
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.12 J	0.096
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.15	8.83
Sulfate	mg/L	5.9 J-	7.5 J-	15	6.8	17	12	14	11	11	11		11	12	63	49
Total Dissolved Solids	mg/L	380	390	390	430	400	410	390	400	400	390		350	360	870 J+	450
Appendix IV Parameters																
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.00086 J		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0086	0.0097	0.0079	0.011	0.0058	0.0058	0.0059	0.016	0.017		0.011	0.0085	0.018	0.0013 J	0.00079 J
Barium	mg/L	0.14	0.14	0.15	0.14	0.11	0.14	0.12	0.14	0.13		0.11	0.1	0.12	0.11	0.12
Beryllium	mg/L	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.00032 J		0.00044 J	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.00024 J	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.00099 J
Cobalt	mg/L	0.0026	0.0029	0.0041	0.0025	0.0032	0.003	0.0028	0.0031	0.0027		0.0023	0.0016	0.0018	0.00039 J	0.00038 J
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.12 J	0.096
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0025 J	0.003 J	0.008 U	0.008 U	0.0029 J	0.0026 J	0.0032 J	0.0034 J	0.003 J		0.0023 J		0.0032 J	0.0042 J	0.0042 J
Mercury	mg/L	0.00019 J+	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.01 U	0.002 J	0.0037 J	0.01 U	0.01 U	0.01 U	0.004 J	0.003 J	0.0029 J		0.0035 J		0.0033 J	0.01 U	0.01 U
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00054 J	0.0007 J	0.005 U	0.005 U	0.005 U		0.00091 J		0.005 U	0.0024 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
General Chemistry																
Alkalinity, Total	mg/L													360	340	380
Magnesium	mg/L													25	27	28
Potassium	mg/L													2.2 J	2.8 J	3.2 J
Sodium	mg/L													5.5	13	14
Field Parameters																
Dissolved Oxygen	mg/L		0.57	2.06	0.25	0.31	0.25	0.1	0.4	0.32	0.46	0.33	0.25	0.93	0.6	0.52
Oxidation-Reduction Potential	millivolts		-47.5	-44.9	-71.8	-50.3	-74	-66.7	-75.8	-30.1	-101.1	-87.5	-239.8	-377.3	-98.9	-378.3
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.15	8.83
Specific Conductance	uS/cm		634	688	660	569	605	664	645	667	665	393	558	628	712	760
Temperature	deg C		14.7	19.5	16.2	10.6	9.38	10.8	14.3	17.2	17.5	8.2	8.7	16.99	14	14.11
Turbidity	NTU		2.97	3.11	4.9	4.44	4.61	4.46	3.78	3.33	3.41	3.55	4.12	2.91	3.33	1.39

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW13											
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20	2018-10-24
		N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters													
Boron	mg/L	0.2	0.27	0.4	0.2 U	0.2 U	0.18 J	0.21	0.24	0.18 J		0.21	0.38
Calcium	mg/L	85	86	86	80	94	100	87	88	86		110	74
Chloride	mg/L	13	15	18	4.6	7.4	8.2	10	10	11		9.7	14
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88
Sulfate	mg/L	14 J-	47	62	40	43	52	25	15	25		52	59
Total Dissolved Solids	mg/L	340	400	430	320	360	380	340	370	360		400 J	350
Appendix IV Parameters													
Antimony	mg/L	0.00016 J	0.00028 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U
Arsenic	mg/L	0.01	0.014	0.013	0.0076	0.0052	0.006	0.0082	0.0087		0.0039 J		0.01
Barium	mg/L	0.13	0.14	0.14	0.092	0.11	0.13	0.16	0.14		0.11	0.12	0.14
Beryllium	mg/L	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Chromium	mg/L	0.00097 J	0.002 U	0.002 U	0.002 U	0.00068 J	0.002 U	0.002 U	0.002 U		0.0012 J		0.002 U
Cobalt	mg/L	0.001 U	0.0016	0.0014	0.0015	0.00077 J	0.00074 J	0.0005 J	0.00042 J		0.0029	0.00096 J	0.00032 J
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
Lithium	mg/L	0.0012 J	0.008 U	0.008 U	0.00047 J	0.008 U	0.008 U	0.0019 J	0.008 U		0.008 U		0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U
Molybdenum	mg/L	0.0021 J	0.0074 J	0.013	0.01 U	0.01 U	0.004 J	0.0033 J	0.0022 J		0.0053 J		0.0054 J
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.0011 J		0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U
General Chemistry													
Alkalinity, Total	mg/L												240
Magnesium	mg/L												20
Potassium	mg/L												3.1 J
Sodium	mg/L												14
Field Parameters													
Dissolved Oxygen	mg/L	0.23	0.95	6.77	0.43	0.6	0.28	0.91	0.28	0.41	0.81	0.32	1.12
Oxidation-Reduction Potential	millivolts	-92.2	-70.8	-95.5	-66.2	-84.8	-96	-4.1	16.8	-34.8	-101.1	-112.4	-268.7
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88
Specific Conductance	uS/cm	6.14	717	694	538	593	664	630	661	655	446	723	614
Temperature	deg C	16.3	20.5	16.6	10.4	9.14	11.2	16	17.6	17.8	8.2	8.7	17.02
Turbidity	NTU	4.75	2.41	3.92	1.59	1.51	2.11	3.16	1.28	2.05	4.77	2.88	1.12

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW13B															
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-02-28	2017-04-25	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-20	2018-04-20	2018-09-06	2018-10-24
		N	N	N	N	FD	N	FD	N	N	N	N	N	FD	N	N	N
Appendix III Parameters																	
Boron	mg/L	0.71	0.76	0.73	0.78	0.74	0.78	0.74	0.76	0.73	0.73	0.79			0.76	0.72	0.71
Calcium	mg/L	80	70	78	76	76	79	78	77	75	72	78			76	72	71
Chloride	mg/L	24	25	25	25	25	25	25	26	26	27	28			27	27	24
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45
Sulfate	mg/L	150 J-	150	150	150	150	150	150	150	150	160	170			150	150	150
Total Dissolved Solids	mg/L	440	410	410	390	420	420	400	390	390	430	440			370 J	410	420
Appendix IV Parameters																	
Antimony	mg/L	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U
Arsenic	mg/L	0.0021 J	0.0011 J	0.0011 J	0.0015 J	0.0013 J	0.0013 J	0.0016 J	0.0014 J	0.0013 J	0.00092 J		0.0012 J	0.00098 J		0.005 U	0.005 U
Barium	mg/L	0.093	0.08	0.084	0.084	0.093	0.097	0.091	0.093	0.089	0.086		0.1	0.091	0.094	0.087	0.082
Beryllium	mg/L	0.00063 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00036 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U		0.00019 J	0.001 U
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25
Lead	mg/L	0.001 U	0.001 U	0.00042 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
Lithium	mg/L	0.0023 J	0.008 U	0.008 U	0.0019 J	0.0013 J	0.0016 J	0.0018 J	0.0017 J	0.0034 J	0.0021 J		0.008 U	0.008 U		0.008 U	0.0018 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U			0.0002 U	0.0002 U
Molybdenum	mg/L	0.023	0.021	0.022	0.019 J+	0.02	0.02	0.021	0.021	0.022	0.021		0.021	0.022	0.021	0.018	0.018
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U		0.001 J	0.005 U
Thallium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U
General Chemistry																	
Alkalinity, Total	mg/L															150	150
Magnesium	mg/L															19	19
Potassium	mg/L															2.9 J	2.9 J
Sodium	mg/L															28	30
Field Parameters																	
Dissolved Oxygen	mg/L	0.65	1.05	0.44	0.226		0.69		0.22	0.56	0.63	0.34	0.53		0.14	0.38	1.24
Oxidation-Reduction Potential	millivolts	-86.5	-92.3	-110.1	-111.5		-114.4		-125.7	-72.6	1.1	-72.1	-98.1		-230.2	-118.7	-235.5
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45
Specific Conductance	uS/cm	634	634	624	575		611		604	613	652	681	464		607	631	639
Temperature	deg C	14.7	16.8	14.5	12.7		12.6		13.2	13.9	14.4	14.4	12		12.3	14.14	14.1
Turbidity	NTU	4.94	1.94	1.57	2.86		4.56		4.5	3.86	1.8	0.42	4.22		4.19	2.25	1.08

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW14													
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-25	2019-03-01
		N	N	N	N	N	N	FD	N	N	N	N	N	N	N
Appendix III Parameters															
Boron	mg/L	0.27	0.36	0.25	0.3	0.26	0.28	0.26	0.24	0.24	0.23		0.25	0.3	0.2
Calcium	mg/L	69	69	72	55	65	57	58	58	68	73		37	58	38
Chloride	mg/L	15	11	8.7	7.6	8.4	5.1	2	2.1	1.7 J	1.8		1.4	13	2.8
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21
pH	SU	6.32 O	6.88	6.59	5.99 O	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01
Sulfate	mg/L	100 J-	88	52	74	79	77	52	48	54	54		35	51	35
Total Dissolved Solids	mg/L	360	310	310	250 J+	310	260	270	260	300	340		220	290	210
Appendix IV Parameters															
Antimony	mg/L	0.00036 J	0.00032 J	0.002 U	0.00039 J	0.002 U	0.00091 J	0.002 U	0.002 U	0.002 U		0.0016 J		0.002 U	0.002 U
Arsenic	mg/L	0.0033 J	0.0029 J	0.0055	0.0023 J	0.0024 J	0.0018 J	0.0017 J	0.0018 J	0.003 J		0.0021 J		0.014	0.012
Barium	mg/L	0.065	0.068	0.065	0.059	0.07	0.071	0.065	0.066	0.069		0.061	0.049	0.058	0.041
Beryllium	mg/L	0.00013 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.00046 J	0.002 U	0.002 U	0.002 U	0.002 U		0.0011 J		0.002 U	0.002 U
Cobalt	mg/L	0.012	0.01	0.015	0.0052	0.015	0.023	0.022	0.023	0.026		0.035	0.052	0.031	0.0083
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.00046 J	0.008 U	0.008 U	0.00038 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.0088 J	0.011	0.01 U	0.013 J+	0.011	0.0098 J	0.008 J	0.0082 J	0.0078 J		0.011	0.0096 J	0.011	0.0074
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00058 J	0.0011 J	0.00095 J	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
General Chemistry															
Alkalinity, Total	mg/L													180	140
Magnesium	mg/L													18	13
Potassium	mg/L													2.6 J	1.9 J
Sodium	mg/L													7.1	7
Field Parameters															
Dissolved Oxygen	mg/L	0.39	1.24	0.78	1.68	3.38	0.6		3.1	1.19	0.46	1.33	1.02	1.8	0.32
Oxidation-Reduction Potential	millivolts	179.6	163.9	75.6	2303	225.8	82.1		268.3	110.1	89.5	-117	-243.1	-240.9	-11.5
pH	SU	6.32	6.88	6.59	5.99	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01
Specific Conductance	uS/cm	501	512	505	360	430	400		404	466	578	241	283	464	226
Temperature	deg C	14.7	18.6	15.5	11.2	9.85	10.9		13.5	16.2	16.7	8.99	9.4	16.3	8.79
Turbidity	NTU	2.33	1.33	0.57	0.91	4.14	2.71		3.23	3.71	2.61	4.41	4.89	1.81	4.43

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW14B												
		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-07-12	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-09-06	2018-10-25
		N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters														
Boron	mg/L	2.8	2.4	3.4	2.9	2.9	2.9	2.8	3	2.9		3	2.9	2.8
Calcium	mg/L	150	130	140	84	95	110	120	120	120		150	150	150
Chloride	mg/L	100	100	120	94	100	100	83	100	110		110	110	97
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67
Sulfate	mg/L	1200 J-	950	1100	790	860	900	780	960	880		990	1100	1100
Total Dissolved Solids	mg/L	1900	2000	2000	1700	1700	1700	1500	1800	1800		2000	2000	1900
Appendix IV Parameters														
Antimony	mg/L	0.00016 J	0.002 U	0.00071 J	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Arsenic	mg/L	0.0029 J	0.00095 J	0.001 J	0.0015 J	0.00092 J	0.0015 J	0.0011 J	0.0009 J		0.0012 J		0.005 U	0.005 U
Barium	mg/L	0.13	0.12	0.12	0.081	0.089	0.096	0.11	0.1		0.11	0.11	0.12	0.12
Beryllium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Chromium	mg/L	0.00094 J	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00023 J	0.001 U	0.00045 J	0.0002 J	0.001 U	0.00019 J	0.00028 J		0.00019 J		0.00039 J	0.00022 J
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31
Lead	mg/L	0.0012	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U
Lithium	mg/L	0.005 J	0.008 U	0.008 U	0.0053 J	0.0046 J	0.0054 J	0.0065 J	0.0051 J		0.0043 J		0.0056 J	0.0057 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U
Molybdenum	mg/L	0.035	0.035	0.023	0.031 J+	0.03	0.028	0.014	0.015		0.022	0.026	0.033	0.035
Selenium	mg/L	0.005 U	0.005 U	0.00087 J	0.00083 J	0.00061 J	0.005 U	0.005 U	0.00099 J		0.005 U		0.0021 J	0.001 J
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00025 J		0.001 U		0.001 U	0.001 U
General Chemistry														
Alkalinity, Total	mg/L												220	220
Magnesium	mg/L												31	28
Potassium	mg/L												13	12
Sodium	mg/L												430	410
Field Parameters														
Dissolved Oxygen	mg/L	0.3	1.28	0.44	0.35	0.27	0.11	1.02	0.76	0.31	0.37	0.17	0.44	1.3
Oxidation-Reduction Potential	millivolts	-60.6	29.7	-76.7	-79.8	-81.4	-112.8	31.4	58	-93.4	102.6	-286.8	-114.1	-211.9
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67
Specific Conductance	uS/cm	2425	2515	2557	2019	1990	2211	2156	2177	2295	1844	2171	2642	2542
Temperature	deg C	14.6	16.3	14	12.4	12.5	13.3	13.5	14	14.1	12.4	12.5	13.91	13.4
Turbidity	NTU	4.7	1.94	0.97	1.48	4.05	4.13	1.26	0.63	0.48	3.79	2.59	1.42	1.41

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Groundwater Analytical Results
Waste Disposal Area
NIPSCO Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Analyte	Unit	GAMW42		GAMW42B	GAMW43	GAMW43B	GAMW44	GAMW44B		GAMW51		GAMW51B	
		2018-09-13	2018-10-31	2018-09-13	2018-06-13	2018-06-13	2018-06-13	2018-06-13	2018-06-13	2018-09-10	2018-10-25	2018-09-10	2018-10-25
		N	N	N	N	N	N	FD	N	N	N	N	N
Appendix III Parameters													
Boron	mg/L	0.04 J	0.041 J	0.061 J	0.025 J	0.037 J	0.05 J	0.036 J	0.034 J	0.68	0.58	6.9	7.4
Calcium	mg/L	44	38	46	26	38	25	39	40	130	130	250	240
Chloride	mg/L	3.1	2.8	4	6	1.5	10	7.8	7.9	6.3	3.6	62	54
Fluoride	mg/L	0.25 J	0.2	0.25 J	0.15 J	0.16 J	0.096 J	0.1 J	0.11 J	0.44 J	0.41	0.79 J	0.8
pH	SU	7.54	7.15	8.08	6.63	7.11	6.77		7.29	8.08	7.69	8.72	8.86
Sulfate	mg/L	21	23	21	25	26	50	24	25	130	110	1300	1600
Total Dissolved Solids	mg/L	190	170	190	160	180	200	180	170	550	530	2200	2200
Appendix IV Parameters													
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0008 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	0.0037 J	0.005 U	0.0073	0.0018 J	0.0054	0.005 U	0.005 U	0.0032 J	0.0031 J	0.0017 J	0.0013 J
Barium	mg/L	0.034	0.046	0.016	0.028	0.015	0.024	0.013	0.013	0.16	0.17	0.07	0.063
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.0014 J	0.002 U	0.002 U	0.0011 J	0.0023	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00027 J	0.00053 J	0.001 U	0.0023	0.00033 J	0.0025	0.001 U	0.001 U	0.001	0.0011	0.00028 J	0.00022 J
Fluoride	mg/L	0.25 J	0.2	0.25 J	0.15 J	0.16 J	0.096 J	0.1 J	0.11 J	0.44 J	0.41	0.79 J	0.8
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.00092 J	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.0018 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0073 J	0.0052 J	0.05	0.048
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0035 J	0.0022 J	0.0048 J	0.004 J	0.0022 J	0.013	0.0021 J	0.0021 J	0.028	0.022	0.13	0.13
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.001 J	0.00089 J	0.0014 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
General Chemistry													
Alkalinity, Total	mg/L	130		140						350	350	160	160
Magnesium	mg/L	9.9		11						25	27	16	16
Potassium	mg/L	0.76 J		1.9 J						8.5	6.2	24	24
Sodium	mg/L	3 J		6.2						17	13	340	390
Field Parameters													
Dissolved Oxygen	mg/L	0.8	0.13	0.53	0.19	0.18	0.68		0.48	0.31	1.9	0.26	1.08
Oxidation-Reduction Potential	millivolts	-112.2	-147.1	-248.6	-12	-81.5	51.6		-55.9	-124.4	-247.2	-169.2	-258.6
pH	SU	7.54	7.15	8.08	6.63	7.11	6.77		7.29	8.08	7.69	8.72	8.86
Specific Conductance	uS/cm	288	274	297	269	245	272		248	1076	806	3438	2720
Temperature	deg C	14.8	13.9	12.8	13.1	12.1	12.8		11.6	15.79	15.08	14.43	13.63
Turbidity	NTU	3.92	4.11	4.9	4.35	2.01	4.38		3.22	0.94	1	2.98	1.49

Note:
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pci/L = picocuries per liter

"U" = Indicates the result is not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result was estimated below the RL but above the MDL by the analytical laboratory; the estimated value is provided.

"J+" = Indicates the result was estimated below the RL but above the MDL and may be biased high; the estimated value is provided.

"J-" = Indicates the result was estimated below the RL but above the MDL and may be biased low; the estimated value is provided.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.

"O" = Indicates the result was identified as an outlier and removed from the background data set.

Prepared by: DFS
Checked by: ERW
Reviewed by: MAH

FIGURES

LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	1/31/2019
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	1

1 in

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

LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Assessment Monitoring Well
- Porewater Sample Location
- CCR Source Material Sample Location
- Slurry Wall
- CCR Unit
- Approximate Extent of Inactive Retired Waste Disposal Area
- Generalized Groundwater Flow Directions
- Approximate Property Line

0 350 700

1 " = 350 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCES: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SAMPLE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	5/6/2019
DESIGNED	JSP
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	2

GOLDER

golder.com

APPENDIX J

Waste Disposal Area Alternative Source Demonstration Recertification- November 2019

Northern Indiana Public Service Company (NIPSCO)

R. M. Schahfer Generating Station – Waste Disposal Area

Wheatfield, Indiana

Recertification of Alternative Source Demonstration

40 CFR §257.95

I have personally reviewed this recertification of the alternative source demonstration (ASD), the subject of which is the Waste Disposal Area (WDA) at the NIPSCO R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated November 2019. Based on an inquiry of those individuals immediately responsible and on supporting data that I understand to be true, accurate, and complete, I verify the information in this recertification of the ASD is accurate and meets the applicable requirements of the CCR Final Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the WDA meets the applicable requirements of 40 CFR §257.95.

JOSEPH BERNARD GORMLEY JR.
REGISTERED
No. PE11900213
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Joseph Bernard Gormley, Jr.
Indiana Professional Engineer
License #: PE11900213

11/26/2019
Date

GOLDER

TECHNICAL MEMORANDUM

DATE November 26, 2019 **Project No.** 19121567

TO Marc Okin, Dan Sullivan, NIPSCO LLC

CC Maggie Rice, Maureen Turman, Joe Kutch, Mark Haney, Jim Peace, Joe Gormley

FROM Danielle Sylvia **EMAIL dsylvia@golder.com**

RE: RECERTIFICATION OF R.M. SCHAHFER WASTE DISPOSAL AREA ALTERNATIVE SOURCE DEMONSTRATION

On behalf of Northern Indiana Public Service Company LLC (NIPSCO LLC), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the third (April 2019) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS) Waste Disposal Area (CCR Unit). This evaluation was conducted in accordance with 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (CCR Rule), as amended, and corresponding regulations under 329 Indiana Administrative Code (IAC) 10-9-1.

The statistical evaluation of the third Assessment Monitoring event was completed on August 28, 2019. The results of the statistical evaluation indicated the lower confidence level (LCL) exceeded the background concentration for arsenic in downgradient monitoring well GAMW-01, which is interpreted as apparent evidence of a statistically-significant level (SSL). Although determination of an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO LLC) to demonstrate that a source other than the CCR unit or another condition caused the apparent SSL. Golder identified the same SSL after the second (October 2018) Assessment Monitoring event at the RMSGS Waste Disposal Area (WDA) and submitted an Alternative Source Demonstration (ASD) on May 17, 2019. As described in the ASD, the source materials characteristics, naturally occurring concentrations, and site hydrogeology indicate that the source of the arsenic SSL observed in GAMW-01 is due to natural variation and not the WDA.

1.0 SUMMARY OF RESULTS

The results of the third Assessment Monitoring event will be included in the 2019 Annual Report and the results of the statistical analysis are summarized below. The arsenic results collected from GAMW-01 in April 2019 were 0.014 milligram per liter (mg/L) and 0.015 mg/L, for normal and field duplicate samples, respectively. These results are at or below the arsenic groundwater protection standard (GWPS) for the WDA of 0.015 mg/L, which is calculated based on the background arsenic concentrations. In addition, these results are within the historical range of values recorded from GAMW-01. As described above, when the LCL exceeds the GWPS, this is interpreted as an apparent SSL. Despite the most recent data points being below the GWPS, the LCL (0.0151 mg/L) exceeds the GWPS by 0.0001 mg/L.

As discussed in the ASD, a second SSL, cobalt was identified at well GAMW-14. Subsequent to the second Assessment Monitoring event, Golder collected two samples from this well and both results were below the cobalt

GWPS of 0.015 mg/L. Consequently, the LCL is no longer above the GWPS and there is no cobalt SSL in the third Assessment Monitoring event. The differences in results are likely due to normal or temporal fluctuations in groundwater quality, which supports the conclusion of the ASD that the source of the SSL is natural variation.

2.0 ALTERNATIVE SOURCE DEMONSTRATION

The information presented above indicates the results of the third Assessment Monitoring event are consistent with the previous Assessment Monitoring events, and the rationale presented in the May 17, 2019 ASD is still applicable. Golder prepared the current ASD in accordance with 40 CFR 257.95(g)(3) and it supports the finding that the SSLs determined in the August 28, 2019 statistical evaluation are not due to release from the CCR Unit. As described above and in the May 17, 2019 ASD, the source materials characteristics, naturally occurring concentrations, and site hydrogeology indicate that the source of the arsenic SSL observed in GAMW-01 is due to natural variation and not the WDA. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the WDA will remain in Assessment Monitoring.

3.0 REFERENCES

Golder Associates, "Northern Indiana Public Service Company R.M. Schahfer Generating Station Wheatfield, Indiana - Alternative Source Demonstration – Waste Disposal Area", May 17, 2019.

https://golderassociates.sharepoint.com/sites/nipscoccrgwmonitoring/shared documents/rmsgs/reports/wda asd fall 2019/wda recertification 112019_ final.docx

APPENDIX K

Waste Disposal Area Alternative Source Demonstration- June 2020

GOLDER

ALTERNATIVE SOURCE DEMONSTRATION - WASTE DISPOSAL AREA

Northern Indiana Public Service Company

Rollin M. Schahfer Generating Station

Wheatfield, Indiana

Submitted to:

Northern Indiana Public Service Company
801 East 86th Avenue
Merrillville, Indiana 46410

Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101
+1 603 668-0880

19121567

June 2020

Northern Indiana Public Service Company LLC (NIPSCO LLC)

R. M. Schahfer Generating Station – Waste Disposal Area

Wheatfield, Indiana

Certification of Alternative Source Demonstration

40 CFR §257.95(g)(3)(ii)

I have personally reviewed this alternative source demonstration (ASD), the subject of which is the Waste Disposal Area (WDA) at the NIPSCO LLC R. M. Schahfer Generating Station, prepared by Golder Associates Inc. and dated June 2020. Based on an inquiry of those individuals immediately responsible and on supporting data that I understand to be true, accurate, and complete, I verify the information in this ASD is accurate and meets the applicable requirements of the CCR Rule. In consideration of the above, I certify to the best of my knowledge, information, and belief, that the ASD for the regulated CCR management unit referred to as the WDA meets the applicable requirements of 40 CFR §257.95(g)(3)(ii).

JOSEPH BERNARD GORMLEY JR.
REGISTERED
No. PE11900213
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Joseph Bernard Gormley, Jr.
Indiana Professional Engineer
License #: PE11900213

6/9/2020
Date

Table of Contents

1.0 INTRODUCTION **3**

2.0 CONCEPTUAL SITE MODEL **3**

2.1 Description of Waste Disposal Area 3

2.2 Site Geology and Hydrogeology 4

2.3 Groundwater Monitoring Network 4

2.4 Groundwater Conditions 6

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS **7**

3.1 Source Material Assessment 7

3.2 Groundwater and Porewater Assessment 8

4.0 DATA EVALUATION AND FINDINGS **9**

4.1 Source Material Results 9

4.2 Groundwater and Porewater Results 9

4.2.1 Geochemistry 10

4.2.2 Molybdenum 12

4.2.3 Lithium 13

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE OR OTHER CONDITION **15**

6.0 CONCLUSION **15**

7.0 REFERENCES **16**

TABLES

Table 1 Source Material Analytical Results
Table 2 Groundwater Analytical Results
Table 3 Porewater Analytical Results

FIGURES

Figure 1 Site Location Map
Figure 2 Sample Location Map

1.0 INTRODUCTION

On behalf of Northern Indiana Public Service Company LLC (NIPSCO LLC), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater analytical results from the fourth (October 2019) groundwater Assessment Monitoring event at the Rollin M. Schahfer Generating Station (RMSGS or Site) Waste Disposal Area (WDA, the CCR Unit), located at 2723 E 1500 N Road, Wheatfield, Jasper County, Indiana (see Figure 1). This evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule" (CCR Rule), as amended.

Statistical analyses of the Appendix IV Assessment Monitoring data for molybdenum indicated the lower confidence interval (LCI) exceeded the background concentration for downgradient monitoring well GAMW51B, which NIPSCO LLC interpreted as apparent evidence of a statistically significant level (SSL). Although determination of an SSL generally indicates that the groundwater monitoring program should transition from Assessment Monitoring to Assessment of Corrective Measures, 40 CFR §257.95(g)(3) allows the owner or operator (i.e., NIPSCO LLC) 90 days from the date of determination (March 15, 2020) to demonstrate a source other than the CCR Unit or another condition caused the SSL.

Golder's initial review of the Site history, geologic conditions, and data from porewater, CCR source materials, overburden, bedrock, and groundwater samples indicated the potential for the SSL to be a result of another condition or a source other than the CCR Unit. Based upon this preliminary assessment, Golder performed further analysis of geological and hydrogeological information from the vicinity of the CCR Unit, evaluated chemical information for porewater and groundwater samples obtained from monitoring wells installed within and adjacent to the WDA, and in accordance with provisions of the CCR Rule, prepared this Alternative Source Demonstration (ASD).

The ASD conforms to the requirements of 40 CFR §257.95(g)(3) and provides the basis for concluding that the apparent SSLs are not a result of a release from the WDA. The following sections provide a summary of the RMSGS WDA Conceptual Site Model (CSM), sampling procedures and analytical methods, analytical results, and lines of evidence supporting the ASD conclusion.

2.0 CONCEPTUAL SITE MODEL

Golder developed and refined a CSM to design a CCR Rule compliant monitoring system, to review and evaluate the monitoring system's performance, and to support the ASD assessment approach. The CSM presents WDA construction and operational history, a summary of geologic and hydrogeologic information in the vicinity of the CCR Unit, and a discussion of groundwater monitoring data, which together lay the groundwork for consideration of potential causes of the SSL and development of the ASD.

2.1 Description of Waste Disposal Area

The WDA is an approximately 80-acre impoundment located in the southwestern corner of RMSGS as shown in Figure 2. According to NIPSCO LLC construction drawings, the WDA is unlined but is surrounded by perimeter berms that were constructed with a minimum one-foot wide slurry wall component that extends from just below the top of the berms to the underlying shale bedrock located approximately 30 to 35 feet below ground surface (ft bgs). The slurry wall was designed and constructed to create a barrier to groundwater flow.

The WDA received primarily bottom ash/boiler slag that was slurried from all four active boilers. Most of the ash/slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to the

expanse of the impoundment and settling/depositional properties of the CCR materials it receives, preliminary studies have shown that little ash/slag is present in the southern half of the WDA.

2.2 Site Geology and Hydrogeology

The Site is directly underlain by unconsolidated, upper-Pleistocene (post-Wisconsin Glacier) fine-grained sand and silt and outwash deposits of the Atherton Formation, occasionally overlain by alluvial and lacustrine deposits of the Martinsville Formation (Schneider and Keller 1970). According to Fraser and Bleur (1991), during the late Pleistocene, the Site was occupied by a post-glacial lake followed by a broad, low-gradient outwash stream that deposited sand uniformly across the basin to form the Kankakee-Valparaiso Formation. Golder's interpretation of the Site geology is based on bedrock geology maps, prior reports, and CCR Rule-related well installation activities, and includes the following stratigraphy:

Overburden

- Brown fine- to medium-grained sand from the ground surface to approximately 14 ft bgs.
- Grayish-brown fine to medium sand from approximately 14 ft bgs to 30-35 ft bgs (coarsens with depth).

Bedrock

- Black to dark gray shale with planar cleavage (Antrim Shale). Top of bedrock is approximately 30 to 35 ft bgs near the impoundment.

Regional bedrock consists of more than 4,000 feet of sedimentary rocks that overly Precambrian granitic bedrock (Fennelon 1994). This assemblage is part of the north side of the Kankakee Arch, which is the major structural feature in the Kankakee River Basin. The first 3,500 feet of sedimentary rocks overlying the granitic bedrock are Cambrian and Ordovician in age. The uppermost 300 feet of Ordovician rocks are composed of shale and minor limestones and are referred to as the Maquoketa Group. The Maquoketa Group underlies Silurian, Devonian and Mississippian rocks and consist of a wide variety of sedimentary layers ranging from shaley to coarse-grained carbonate rocks. This carbonate sequence is overlain by a series of shales including the Antrim Shale, a brownish-black, non-calcareous shale (Fennelon 1994).

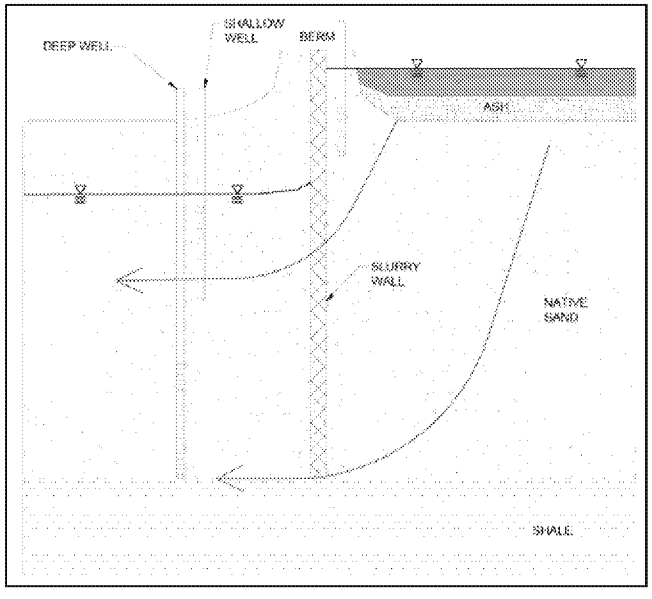
Groundwater elevation data collected to-date indicate that groundwater in the uppermost aquifer near the WDA generally flows to the north and northwest (with a possible northeast component, immediately adjacent to the WDA). Groundwater flow direction is influenced by the presence of slurry walls surrounding the WDA and adjacent non-CCR Rule regulated Recycle Settling Basin and Inactive Retired Waste Disposal Basin (IRWDB). Hydraulic heads measured inside the slurry walls surrounding the WDA are significantly higher (i.e., up to 15 feet or more) than those measured beyond the slurry wall. This contrast in potentiometric levels indicates the slurry walls significantly impede lateral flow of impounded water from the CCR Unit to the uppermost aquifer.

2.3 Groundwater Monitoring Network

Design of the CCR Rule-compliant WDA monitoring system considered the size and configuration of the impoundment, operational history, hydraulic influence of the slurry walls on the groundwater flow regime, likelihood and anticipated location of potential impacts to groundwater, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer.

In 2015, Golder installed piezometer GAPIEZ04 inside the northwest corner of the WDA. The piezometer, which is screened within the CCR materials, was installed inside the slurry wall to assess groundwater elevations in the

WDA; monitoring determined groundwater mounding is occurring within the slurry walls. As-built drawings of the slurry walls are not available. Depending upon the degree of contact between the bottom surface of the slurry walls and the shale, the higher hydraulic head observed within the slurry walls may result in the discharge of impounded water beneath the slurry walls. Based upon the above information, NIPSCO LLC's monitoring approach for the CCR surface impoundment featured the installation of well pairs including shallow (approximately 15 ft bgs) and deep (approximately 35 ft bgs – to the top of shale [signified with a "B" in Figure 2]) couplets at each background and downgradient monitoring well location outside of the perimeter slurry walls as shown in Figure 2. As illustrated in the embedded figure below, deep monitoring wells supplement shallow wells and monitor potential flow beneath the slurry walls into the aquifer.



Conceptual Site Model

NIPSCO LLC modified the groundwater monitoring well network to include two additional deep wells (GAMW01B, GAMW12B) and four assessment monitoring well pairs (GAMW42/42B, GAMW43/43B, GAMW44/44B, and GAMW51/51B) in May and July 2018 at the locations shown in Figure 2. Golder installed the additional deep wells to monitor groundwater at the bedrock/overburden interface co-located with existing shallow wells (GAMW01 and GAMW12) near the waste boundary and four well pairs further downgradient of the WDA to assess the extent of potential groundwater impacts detected during Assessment Monitoring (see Figure 2).

In 2019, NIPSCO LLC installed nine additional assessment monitoring wells to further assess the nature and extent and overall groundwater quality downgradient of the WDA, including two well pairs designated GAMW59/59B and GAMW60/60B downgradient of existing assessment monitoring well pair GAMW51/51B; a deep monitoring well screened in shale, designated GAMW42C, and installed adjacent to existing well pair GAMW42/42B; and two well pairs designated GAMW57/57B and GAMW58/58B to the north of the existing property boundary wells. The current groundwater monitoring network is summarized in the embedded table below.

Waste Disposal Area Monitoring Well Network

Background Monitoring Wells	Downgradient Monitoring Wells	Assessment Monitoring Wells
GAMW03 and GAMW03B	GAMW01, GAMW01B, GAMW12, GAMW12B, GAMW13, GAMW13B, GAMW14, and GAMW14B	GAMW42, GAMW42B, GAMW42C, GAMW43, GAMW43B, GAMW44, GAMW44B, GAMW51, GAMW51B, GAMW57, GAMW57B, GAMW58, GAMW58B, GAMW59, GAMW59B, GAMW60, and GAMW60B

2.4 Groundwater Conditions

Between July 2016 and August 2017, Golder collected eight independent background groundwater samples from each background and downgradient well, as required by 40 CFR §257.94. The results of the background monitoring phase were used to develop appropriate, statistically-valid background values for each constituent/monitoring well. Following completion of the eight background monitoring events, Golder collected the first Detection Monitoring groundwater samples in October 2017 and compared the results to the calculated prediction limits to determine statistically significant increases (SSIs). Based on these results, NIPSCO LLC established an Assessment Monitoring program in January 2018.

Golder performed the first Assessment Monitoring event in March 2018 (with verification sampling in April 2018). Following receipt and validation of laboratory results, Golder evaluated the results of the first Assessment Monitoring sampling event to determine the concentration of Appendix IV constituents relative to CCR Unit-specific calculated groundwater protection standards (GWPSs). The GWPS is the maximum contaminant level (MCL), if an MCL exists, or the unit-specific background concentration for each analyte using a tolerance/prediction limit procedure. Based on this statistical analysis, Golder concluded that the only constituent demonstrating an apparent SSL was molybdenum. The calculated GWPS (unit-specific background concentration) for molybdenum was 0.009 milligrams per liter (mg/L). However, the detected groundwater molybdenum concentrations did not exceed the new U. S. Environmental Protection Agency (USEPA) risk-based level for molybdenum of 0.1 mg/L, which USEPA published in the Federal Register on July 30, 2018 and which became effective August 29, 2018 (CCR Rule, Part 1 Phase 1 Addendum). Golder completed an ASD in November 2018 concluding that the molybdenum SSLs identified in August 2018 are not due to a release from the WDA. The key supporting lines of evidence described in the ASD indicate that the molybdenum detected in monitoring wells downgradient of the WDA is naturally-occurring, and not due to a release from the WDA.

Golder performed the second Assessment Monitoring event in October 2018 by collecting groundwater samples from each background and downgradient monitoring well, including the additional Assessment Monitoring wells, per 40 CFR §257.95. Golder performed the statistical evaluation in February 2019 and concluded that the only constituents demonstrating apparent SSLs were arsenic, in GAMW01, and cobalt, in GAMW14. Golder completed an ASD in May 2019 in which the key supporting lines of evidence indicated that the source of the arsenic and cobalt is natural variation, not the WDA.

Golder performed the third Assessment Monitoring event in April 2019 and the statistical evaluation in August 2019 and concluded that the only constituent demonstrating an apparent SSL was arsenic in well GAMW01. Golder recertified the previously submitted ASD in November 2019 indicating that this SSL is due to natural variation.

Golder performed the fourth Assessment Monitoring event in October/November 2019 and the statistical evaluation in March 2020. SSLs were evaluated according to the RMSGS Groundwater Monitoring Program Implementation Manual (GMPIM) which indicates that confidence intervals are used to evaluate for potential SSLs and confidence intervals are required to be calculated based on a minimum of four independent observations. As such, the statistical evaluation completed in March 2020 is the first to include the monitoring wells installed in May/June 2018 (see Section 2.3) including Assessment Monitoring wells GAMW51 and GAMW51B (Golder 2017). Applying the risk-based standards of 0.1 mg/L and 0.04 mg/L for molybdenum and lithium, respectively, as the GWPSs, the results of the statistical evaluation indicate an apparent SSL for molybdenum in well GAMW51B. Three of the four samples collected from GAMW51B also include detections of lithium above the GWPS; however, the results of the statistical evaluation do not indicate an apparent SSL for lithium (i.e., the upper confidence interval exceeds the GWPS, but the lower confidence interval does not). Therefore, a discussion of the potential sources of lithium is also included in this ASD.

3.0 SAMPLING PROCEDURES AND ANALYTICAL METHODS

To further assess potential groundwater impacts downgradient of the WDA, Golder performed supplemental assessment activities in both 2018 and 2019. Golder conducted the supplemental assessment activities in accordance with the RMSGS GMPIM (Golder 2017). The following sections summarize the supplemental assessment activities.

3.1 Source Material Assessment

In 2018, Golder collected three WDA source material samples from the north side of the WDA (see Figure 2 for sample locations). Golder's field engineer composited three sub-samples into one sample per excavation area for submittal to the laboratory. The three WDA source material samples are described as follows:

- WDA-West Sample: Collected from approximately 1.5 ft below the top of a pile of recently dredged source material that originated from the northwestern corner of the WDA
- WDA-MID Sample: Collected from approximately one ft below the top of a pile of recently dredged source material that originated near the effluent discharge pipes in the north-central portion of the WDA
- WDA-East Sample: Collected from approximately 1.5 ft below the top of a pile of recently dredged source material pile that originated from the northeastern portion of the WDA

In 2019, Golder subcontracted Mid-Atlantic Drilling Company (Mid-Atlantic) to advance 16 soil borings within the WDA as shown on Figure 2. Golder observed 0.5 to 20 feet of CCR material in these borings. CCR material is thickest to the north (8-20 feet) and shallowest to the south (less than 3.6 feet). From the 16 soil borings, Golder collected 28 samples within the CCR material and 34 samples within the underlying native material.

As described below, Golder used two analytical methods to characterize the source material samples: total metal analysis and leachability testing.

Total Metals: The purpose of this analysis was to assess the chemical composition of potential source and aquifer materials. The total mass of metals in combination with the results from leachability testing can be used to determine the provenance of the constituent of concern (COC) metals and their related leachability. The laboratory analyzed a target analyte list (TAL) of metals following the USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000) and USEPA SW846 7471 Mercury in Solid or Semisolid Wastes (Manual Cold-Vapor Technique) Revision 2 (January 1998).

Leachability: The purpose of this analysis was to obtain an understanding of the fraction of total metals that is leachable, which is important for evaluating the long-term environmental stability of potential source materials. The analysis simulates the interaction between a solid and meteoric water, and thus provides the leachability potential of a material. The leachability testing was only conducted on the three source samples WDA-West, WDA-MID, and WDA-East. The laboratory used porewater collected by Golder from the WDA (piezometer GAPIEZ04) as the leaching medium to simulate natural conditions. The laboratory tested the leachability of the source materials using USEPA SW846 1312 Modified Synthetic Precipitation Leaching Procedure (SPLP) (September 1994).

3.2 Groundwater and Porewater Assessment

Golder field personnel collected groundwater and porewater (i.e., water in direct contact with CCR materials) samples in accordance with the RMSGS GMPIM. Groundwater samples were collected on at least a semi-annual basis for each well in the monitoring system since their respective installation. The most recent groundwater samples were collected in October and November of 2019. Porewater samples were collected in August, September, and October 2018. Groundwater and porewater samples were analyzed for CCR Rule Appendix III and IV metals and other groundwater quality parameters, as described below.

The geochemical analytical methods Golder used to characterize the groundwater and porewater samples included analyses for total metals and major cations and anions. These selected analytical methods are summarized below.

Metals: Metals analyses (i.e., Appendix III and IV) are important to understand the geochemical properties of groundwater and porewater. In groundwater, metals analysis allows for the identification and delineation of a potential plume, and identification of background contributions from natural sources or off-site locations. In porewater, metal results can be used for geochemical modeling and provide an indication of the leachable fraction of the solids (ITRC, 2012).

Major Cations and Anions/Field Parameters: Geochemical modeling of mineral solubility, metal attenuation and background contributions requires analysis of major cations and anions because they affect and participate in sorption and mineral dissolution/precipitation reactions. Required field parameters include pH, dissolved oxygen, oxidation reduction potential (ORP), conductivity, and temperature, which are needed to support geochemical modeling and serve an important quality assurance/quality control (QA/QC) function.

The laboratory analyzed groundwater and porewater samples using the following methods:

- Chloride, Fluoride, and Sulfide following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- pH following USEPA SW846 9040C pH Electrometric Measurement (November 2004)
- Total Target Analyte List (TAL) Metals following USEPA SW846 6010C Inductively Coupled Plasma- Atomic Emission Spectrometry Revision 3 (November 2000), SW846 6020B Inductively Coupled Plasma- MS Revision 2 (July 2014), SW846 6020A Inductively Coupled Plasma- MS Revision 1 (January 1998), and SW846 7470A Mercury in Liquid Wastes (Manual Cold- Vapor Technique) Revision 1 (September 1994)
- Total Dissolved Solids following SM 2540C Total Dissolved Solids Dried at 180°C (1993)
- Alkalinity following SM 2320B Alkalinity by Titration (2005)

4.0 DATA EVALUATION AND FINDINGS

4.1 Source Material Results

Golder collected three source material samples from recently dredged WDA ash material to assess the potential contribution of molybdenum and lithium from the WDA to groundwater. The laboratory reported results as both total and leachable molybdenum and lithium concentrations. Total molybdenum concentrations were just above the laboratory reporting limit, ranging from 1.4 to 6.8 milligram per kilogram (mg/kg). The lithium results have a range of 9.5 J+ to 49 J+ mg/kg. Generally, the WDA source material concentrations are similar to the concentrations observed in the on-Site background soil and bedrock samples. Additionally, these results are within the range of naturally occurring metal concentrations reported by Shachklette and Beorngen (1984) of <3 mg/kg to 15 mg/kg and <5 mg/kg to 150 mg/kg, for molybdenum and lithium, respectively. In addition to total metal concentrations, the laboratory determined the leachability potential of the WDA source material samples. The concentrations of leachable molybdenum and lithium were less than the laboratory reporting limits (0.0043 J to 0.0061 J mg/L and <0.03 mg/L for molybdenum and lithium, respectively), indicating that the WDA source material has negligible to no leaching potential for either constituent. Given the low leachability of these constituents, the WDA source materials do not appear to be contributing to downgradient groundwater molybdenum and lithium concentrations.

In 2019, Golder completed 16 soil borings within the WDA as shown on Figure 2. From the 16 soil borings, Golder collected 28 samples within the CCR material and 34 samples within the underlying native material. The average, median, and range of molybdenum and lithium results are summarized in the embedded table below. Overall, the molybdenum and lithium results are low (e.g., just above the reporting limit) even within the CCR material. Molybdenum was detected in 21 of 28 CCR material samples and two of 34 native material samples. To calculate the average and median, non-detect result were replaced with the laboratory reporting limit. Complete results of the WDA CCR source material analyses are provided in Table 1.

Summary of WDA Source Material Analytical Results

Matrix	CCR			Native		
No. of Samples	28			34		
	Average	Median	Range	Average	Median	Range
Lithium (mg/kg)	7.9	5.2	1.1 - 25	2.7	2.3	1.1 – 8.1
Molybdenum (mg/kg)	3.3	2.7	Non-detect (<1.0 U) - 11	1.2	1.1	Non-Detect (<1.0 U)– 1.7

4.2 Groundwater and Porewater Results

As stated in the CSM (see Section 2.1), most of the bottom ash/boiler slag is deposited in the northern half of the WDA, closest to the discharge points of the slurry lines. Due to the expanse and configuration of the CCR Unit and settling/depositional properties of the CCR materials, very little ash/slag is present in the southern half of the WDA. Overall, Golder expects that if there was a release from the WDA, the highest concentrations would be indicated by the results of groundwater samples collected from monitoring wells installed near the northwest corner of the WDA, where most of the CCR is located (e.g.,GAMW14/14B), as compared to concentrations detected in monitoring wells installed near the southwest corner of the WDA (e.g., GAMW01/01B). This aspect of

the CSM in combination with known operational conditions and potential release mechanisms helps explain the groundwater findings and frame the porewater results as compared to groundwater quality. The groundwater and porewater analytical results are provided in Table 2 and Table 3, respectively, and described in the following sections.

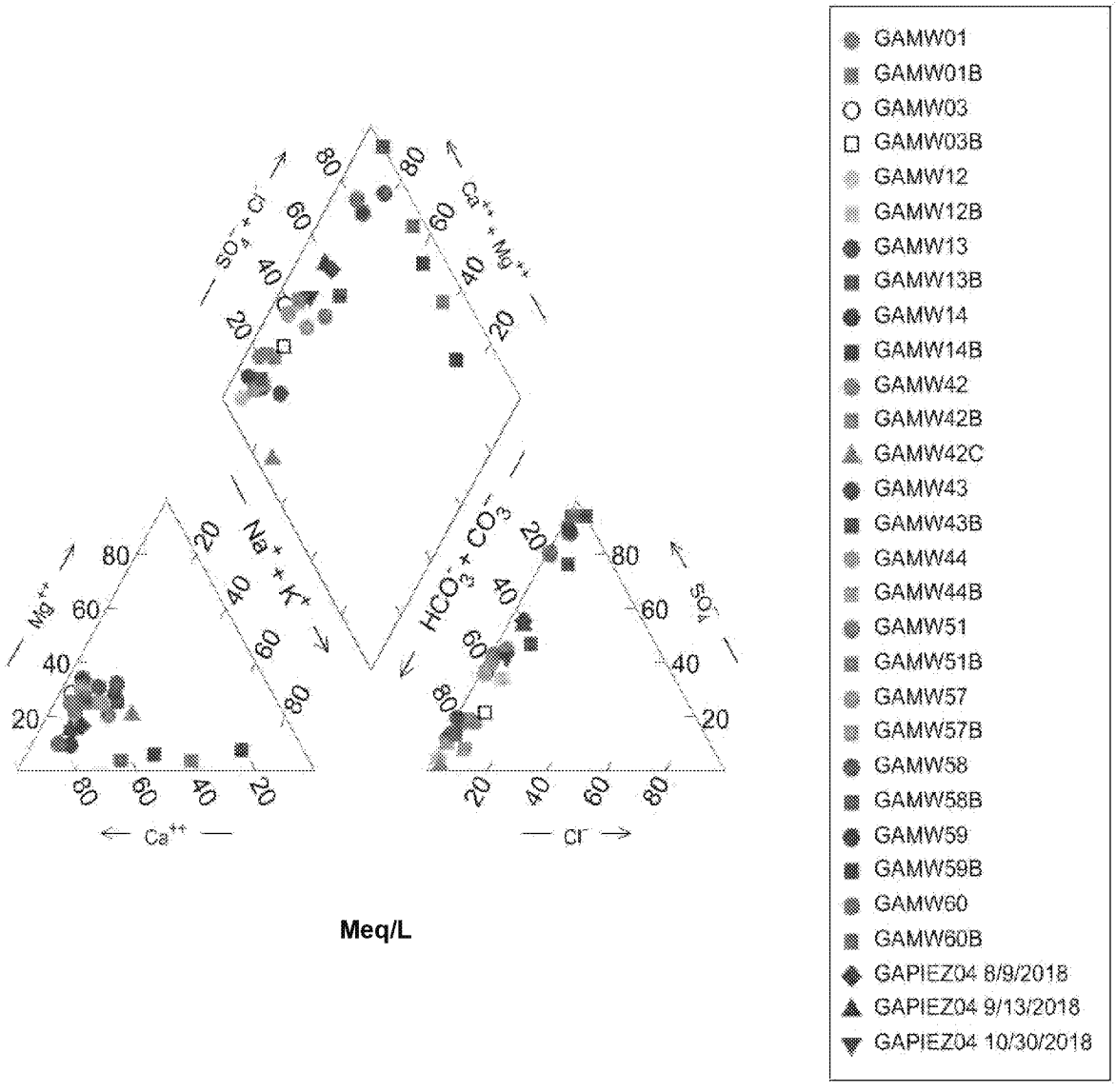
4.2.1 Geochemistry

Golder evaluated groundwater and porewater data using the relative abundance of major cations and anions to differentiate between water compositions. Golder generated Piper and Durov plots using Geochemist's Workbench software to visually depict major ion chemistry abundance and elucidate relationships between background groundwater, downgradient groundwater, and porewater (Bethke 2015). The analytical results used to develop the Piper Plots were obtained from groundwater samples collected in November 2019 (except the GAPIEZ04 sample which was collected in October 2018) and are provided in Table 2 and Table 3.

Golder used Geochemist's Workbench to assess mineral saturation in groundwater samples, determine if mineral precipitation would impact relative ion abundance, and evaluate the overall water type classifcation of each sample. The evaluation of major ion composition indicates that there are three discrete water groups:

- Background and downgradient groundwater
- Groundwater reflecting influence by an alternative source or another condition
- WDA porewater

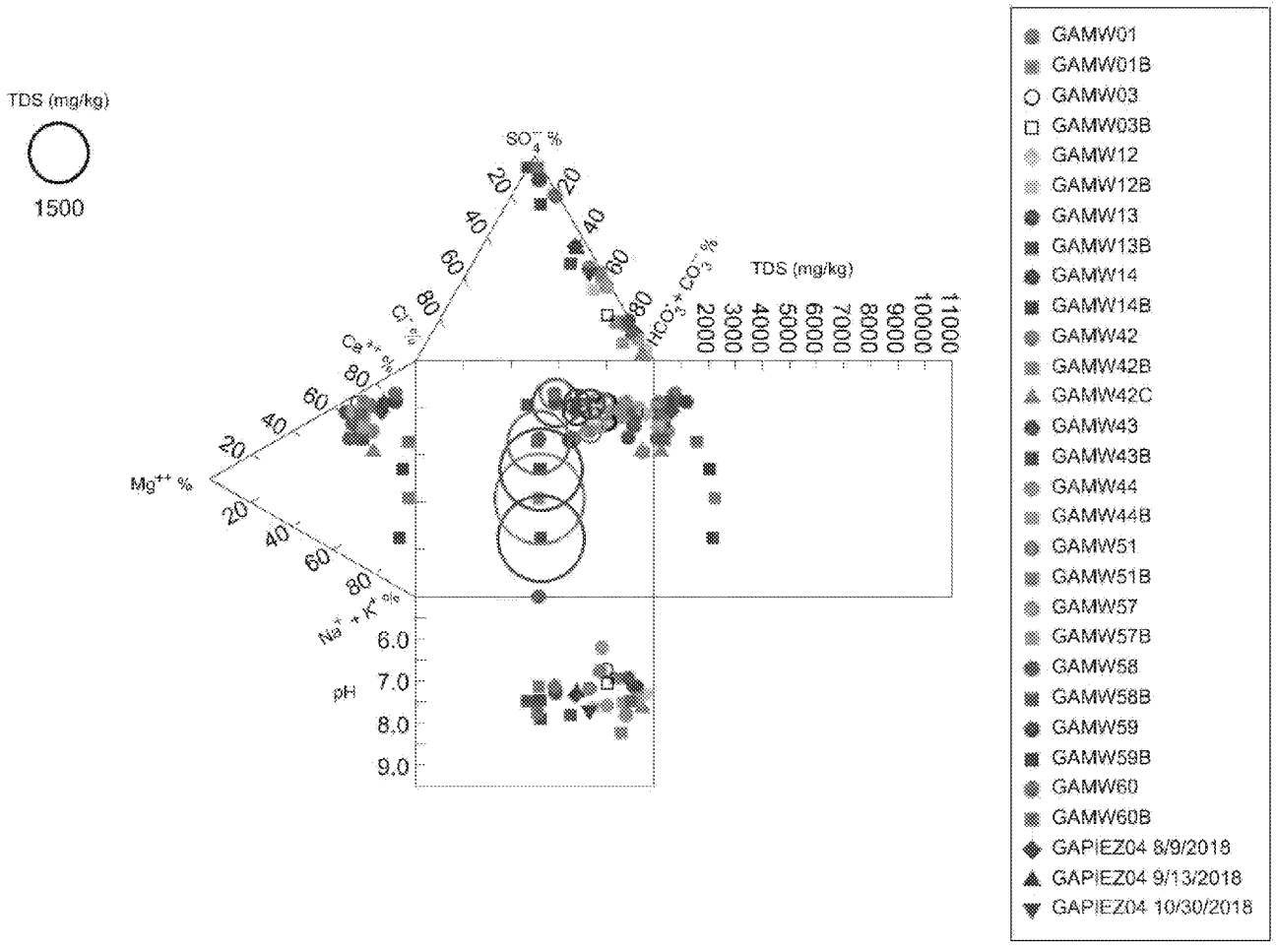
Groundwater quality observed in samples collected from monitoring well GAMW51B showed a closer relationship to the groundwater quality in monitoring wells GAMW14B, GAMW59/59B, and GAMW60/60B than the other wells directly downgradient of the WDA (i.e., GAMW14, GAMW13/13B, GAMW12/12B, and GAMW01/01B, see the embedded figure below). The wells that are directly downgradient of the WDA are closely related to the groundwater quality observed in the background monitoring wells GAMW03 and GAMW03B. The similarity in major ion composition suggests that downgradient groundwater is similar in quality to the background groundwater. In cases where groundwater is impacted by a potential large discrete source (e.g., unlined fly ash landfill), the major groundwater ions would plot between the background and source groundwater, indicating a mixing of the two waters. Groundwater at wells GAMW14B, GAMW-51B, GAMW59/59B, and GAMW60/60B is different with respect to relative ion abundance than that of groundwater at other downgradient wells, suggesting a potential alternative source or another condition affecting groundwater chemistry. Based on the Piper plot, the composition of groundwater in GAMW13B is the most closely related to that of WDA porewater. If the WDA was the source of molybdenum and lithium in the groundwater, it would most likely be present in this well, however, molybdenum and lithium were consistently detected below the GWPS in this well.



WDA Piper plot of relative ion abundance in groundwater samples

A condition other than a release from the WDA as the source of molybdenum and lithium detected in groundwater at GAMW51B is also supported by the total dissolved solids (TDS) content. The TDS value measured in GAMW51B in November 2019 was 2300 mg/L, which is much higher than in both the WDA (710 mg/L) and groundwater from background wells GAMW03/03B (440 mg/L to 450 mg/L; see embedded figure below). In the absence of relevant mineral precipitation as indicated by geochemical modeling (which would lower the TDS of a groundwater sample), the TDS of a mixture of two samples (i.e. source and upgradient groundwater) should range between the TDS of those samples. The TDS values measured in monitoring wells GAMW14B, GAMW51B, GAMW59, GAMW59B, GAMW60, and GAMW60B are up to an order of magnitude higher than that of other monitoring wells and to WDA porewater. These wells also group independently on both the Piper and Durov diagrams further confirming different groundwater signatures. Thus, water quality as measured by TDS

content is likely influenced by another condition affecting groundwater chemistry, not as a result of a release from the WDA.



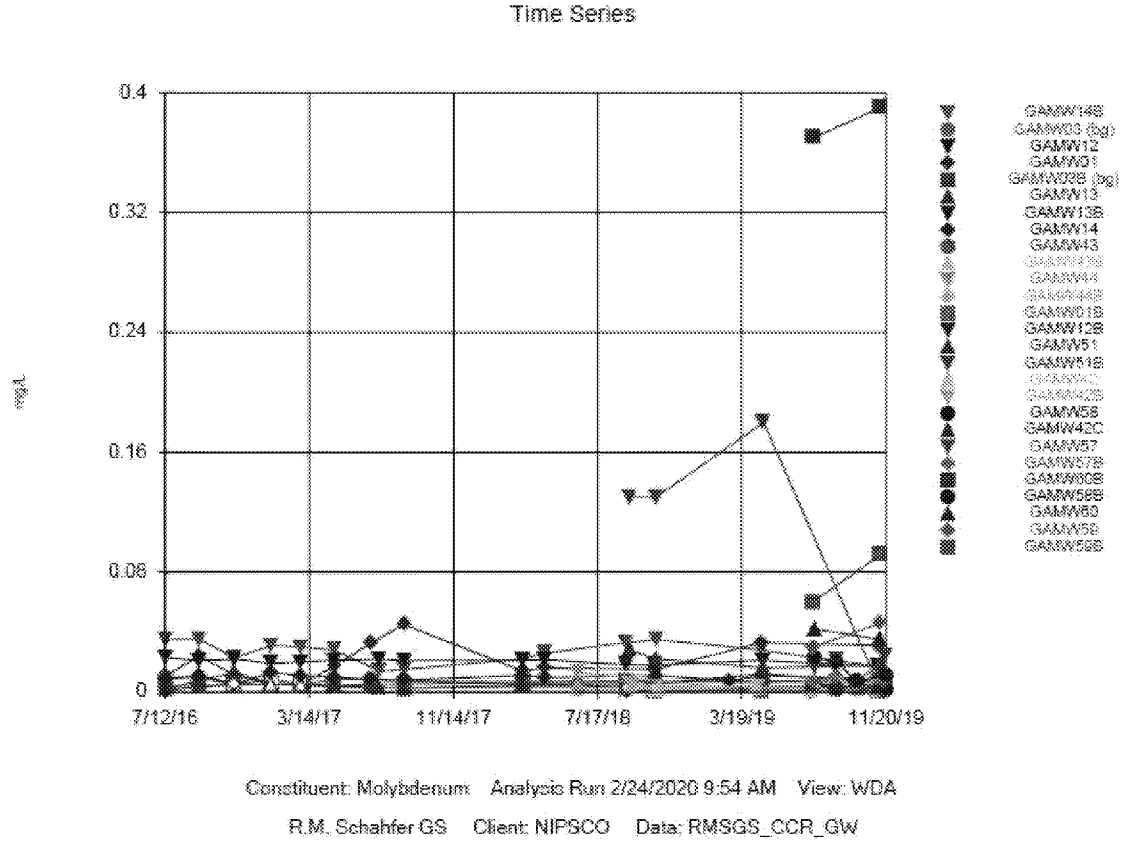
WDA Durov plot of relative ion abundance in groundwater and TDS

4.2.2 Molybdenum

Molybdenum is detected at concentrations above the health-based standard and GWPS (both 0.1 mg/L) in groundwater samples collected from deep monitoring wells GAMW59B and GAMW60B (located downgradient of GAMW51B). The molybdenum time-series plot (embedded figure below) indicates that molybdenum concentrations are below 0.05 mg/L in 22 of 27 wells in the proximity of the WDA. The following summarizes the molybdenum sample results:

- Molybdenum was not detected above the laboratory reporting limit (<0.01 mg/L) in the groundwater samples collected from the background wells GAMW03 and GAMW03B.
- Porewater molybdenum concentrations observed in samples collected from GAPIEZ04 (water in direct contact with CCR materials) were not detected above the laboratory reporting limit (<0.01 mg/L).

- Historically, Molybdenum has been detected inconsistently in groundwater samples from across the Site; however, molybdenum detections are low (<0.05 mg/L) in all monitoring wells except GAMW51B, GAMW59B, and GAMW60B.
- Porewater molybdenum concentrations measured in GAPIEZ04 (water in direct contact with CCR materials) are non-detect at a laboratory reporting limit an order of magnitude lower than the concentrations detected in GAMW51B, suggesting that molybdenum in groundwater samples collected from GAMW51B are not associated with a release from the CCR Unit.
- Monitoring wells GAMW14 and GAMW14B are located at the waste boundary near the northwest corner of the WDA as shown in Figure 2. If the WDA was the source of molybdenum in the groundwater, according to the CSM it would be expected that these wells should also have detections of molybdenum above the GWPS, which they do not.

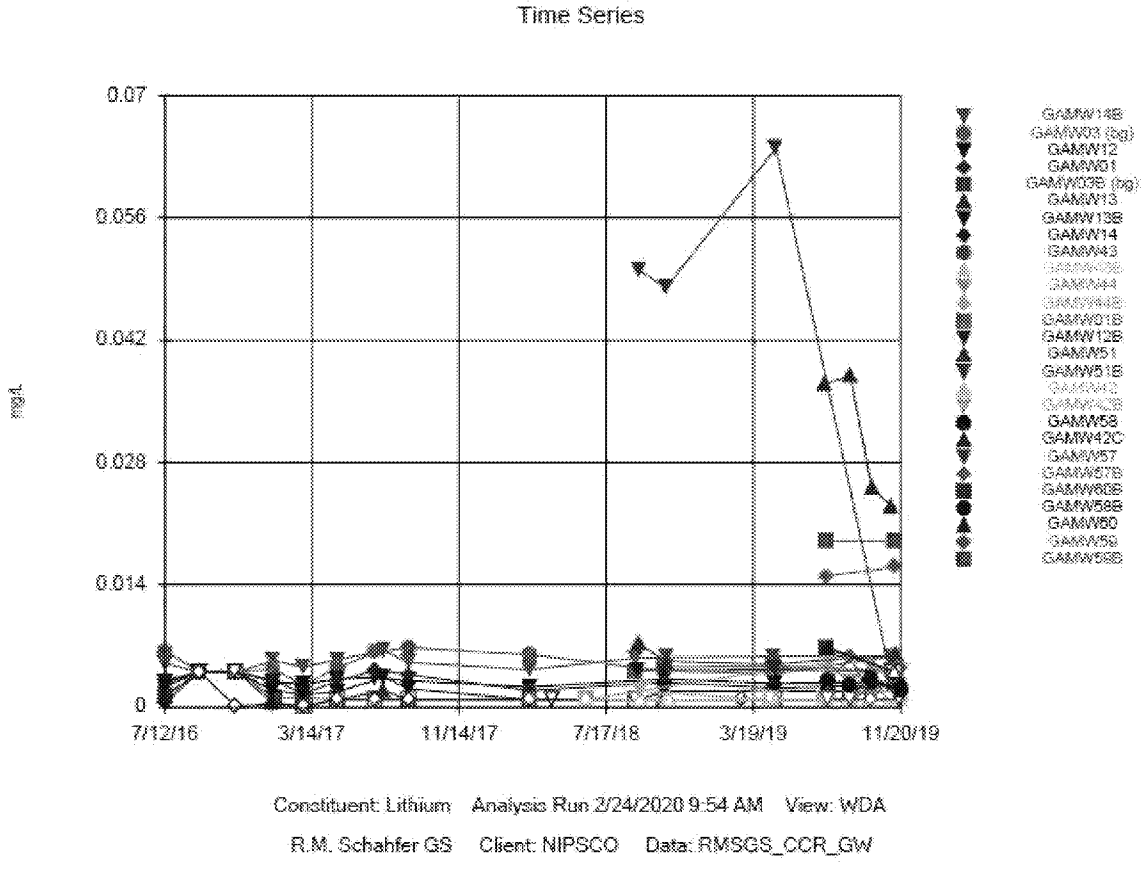


Molybdenum Time-Series Plot

4.2.3 Lithium

Lithium is detected at concentrations above the health-based standard and GWPS (both 0.04 mg/L) in groundwater samples collected from deep monitoring well GAMW51B. The lithium time-series plot (embedded figure below) shows that lithium concentrations are below 0.01 mg/L in most wells in the proximity of the WDA. The following summarizes the lithium sample results:

- Lithium was not detected above the laboratory reporting limit (0.008 mg/L) in the groundwater samples collected from the background wells GAMW03 and GAMW03B.
- Porewater lithium concentrations in samples collected from GAPIEZ04 (water in direct contact with CCR materials) were not detected above the laboratory reporting limit (<0.008 mg/L).
- In addition to detections in the groundwater samples collected from GAMW51B, lithium was detected in monitoring wells GAMW42C (screened in the shale) and monitoring well pair GAMW59/59B located downgradient of GAMW51B.
- Porewater lithium concentrations measured in GAPIEZ04 (water in direct contact with CCR materials) were non-detect at a laboratory reporting limit, an order of magnitude lower than the concentrations detected in GAMW51B, suggesting that lithium in groundwater samples collected from GAMW51B are not associated with a release from the CCR Unit.
- Monitoring wells GAMW14 and GAMW14B are located at the waste boundary near the northwest corner of the WDA as shown in Figure 2. If the WDA was the source of lithium in the groundwater, according to the CSM it would be expected that these wells should also have detections of lithium, which they do not.



Lithium Time-Series Plot

5.0 EVIDENCE OF AN ALTERNATIVE SOURCE OR OTHER CONDITION

In accordance with the RMSGS CSM and the procedural requirements of 40 CFR §257.95(g)(3)(ii), Golder performed a review of geological and hydrogeological information from the vicinity of the CCR Unit, evaluated chemical information for porewater and groundwater samples obtained from monitoring wells installed within and adjacent to the WDA, and identified and analyzed possible causes of molybdenum and lithium detections. Based upon the analyses performed and presented above, it is Golder's opinion that the molybdenum and lithium identified in groundwater samples from GAMW51B are associated with another condition rather than a release from the CCR Unit. Primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in the embedded table below.

Primary Lines of Evidence and Supporting ASD Analysis

Key Line of Evidence	Description
WDA source material and porewater concentrations	Although WDA source materials contain low levels of molybdenum and lithium, leachability testing indicates low to no leaching potential for these constituents. Additionally, WDA porewater samples indicate lower levels of both molybdenum and lithium than that of groundwater at well GAMW51B. Therefore, another condition or source must be present to account for the relatively higher molybdenum and lithium concentrations observed in downgradient groundwater.
Relative ion abundance differs from the WDA	As presented in the Piper and other ternary diagrams, the relative major ion abundance in groundwater demonstrates a distinct difference between the WDA porewater and downgradient groundwater samples with no indications of a mixing condition. Therefore, the chemical characteristics of the downgradient groundwater cannot have been caused by a release from the WDA mixing with ambient groundwater. Additionally, the chemical characteristics of groundwater from wells GAMW51B, GAMW59B, and GAMW60B are similar, suggesting that these wells are all affected by the same condition or alternate source, rather than a release from the WDA.
Groundwater Flow Direction	Monitoring wells GAMW14 and GAMW14B are located at the waste boundary near the northwest corner of the WDA, as shown in Figure 2. If the WDA was the source of molybdenum and lithium in the groundwater, according to the CSM it would be expected that these wells should also have detections of these constituents. This apparent lack of detections in monitoring wells at the waste management boundary is inconsistent with the CCR Unit being the source of molybdenum and lithium in groundwater at GAMW51B, which is located farther downgradient in the direction of groundwater flow.

6.0 CONCLUSION

The preceding information serves as the ASD prepared for the WDA in accordance with 40 CFR 257.95(g)(3)(ii) and supports the finding that the SSL determined on March 15, 2020 is not due to a release from the CCR Unit. The key supporting lines of evidence described above indicate that the molybdenum and lithium concentrations observed in GAMW51B downgradient of the WDA are due to another condition. Therefore, no further action (i.e., Assessment of Corrective Measures) is warranted, and the RMSGS WDA will remain in Assessment Monitoring.

7.0 REFERENCES

Bethke, C., 2015. Geochemist's Workbench: Release 12.0 - Aqueous Solutions, LLC. EPA. 2014. National Functional Guidelines for Inorganic Data Review (EPA 540-R-013-001, August 2014).

Fenelon, J.M., K.E. Bombay, et al., 1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water Resources Investigations, Report 92-4142, 1994.

Fraser, G. S., Bleuer, N. K. Fraser, G.S., Bleuer, N.K., 1991, Geologic framework of the aquifers in the Kankakee River lowland: Indiana Geological Survey Occasional Paper 60, 10 p., 9 fig.

Lourigan, J., & Phelps, W. (2013). Caledonia Groundwater Molybdenum Investigation Southeast Wisconsin. *Wisconsin Department of Natural Resources*.

Schneider and Keller, 1970. Schneider, A.F. and Keller, S.J., Geologic Map of the Chicago Quadrangle, Indiana, Illinois, and Michigan; Indiana Geologic Survey, Bloomington. 1970.

Shacklette, H. T and Boerngen, J. G., 1984 Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States: U.S. Geological Survey Professional Paper 1270, 1984.

USEPA, 1996, Test methods for evaluating solid waste, physical/chemical methods (SW-846): 3rd edition, Environmental Protection Agency, National Center for Environmental Publications, Cincinnati, Ohio, accessed at URL https://www.epa.gov/hw-sw846

US EPA (2017). Leaching Environmental Assessment Framework (LEAF) How-To Guide.

Golder and the G logo are trademarks of Golder Associates Corporation

Tables

Table 1: Source Material Analytical Results
Waste Disposal Area Alternative Source Demonstration
NIPSCO LLC R. M. Schahfer Generating Station

Sample ID[1]	Material	Chemical Name Units Sample Date	Total Lithium mg/kg	Lithium SPLP mg/L	Total Molybdenum mg/kg	Molybdenum SPLP mg/L
WDA-EAST	CCR	7/31/2018	49 J+	< 0.03 U	1.4 J	0.005 J
WDA-MID	CCR	7/31/2018	9.5 J+	< 0.03 U	6.4	0.0043 J
WDA-WEST	CCR	7/31/2018	13 J+	< 0.03 U	6.8	0.0061 J
WDA-2-2-4ft	CCR (bottom ash)	10/23/2019	8.2	NA	5.3	NA
WDA-2-6-8ft	CCR (bottom ash)	10/23/2019	6.3 J	NA	2.7	NA
WDA-2-13-14ft	Native	10/23/2019	2.0 J	NA	< 1.2 U	NA
WDA-2-16-18ft	Native	10/23/2019	2.3 J	NA	< 1.2 U	NA
WDA-2-40-42ft	Native	10/23/2019	3.7 J	NA	< 1.1 U	NA
WDA-5-8-10ft	CCR (bottom ash)	10/23/2019	5.5 J	NA	11	NA
WDA-5-12-14ft	CCR (bottom ash)	10/23/2019	7.5	NA	2.5	NA
WDA-5-16-18ft	Native	10/23/2019	2.2 J	NA	< 1.2 U	NA
WDA-5-40-42ft	Native	10/23/2019	3.2 J	NA	< 1.1 U	NA
WDA-8-2-4ft	CCR (boiler slag)	10/24/2019	18	NA	1.6	NA
WDA-8-6-8ft	CCR (boiler slag)	10/24/2019	25	NA	1.8	NA
WDA-8-16-18ft	Native	10/24/2019	2.8 J	NA	< 1.2 U	NA
WDA-8-40-42ft	Native	10/24/2019	4.7 J	NA	< 1.2 U	NA
WDA-11-2-4ft	CCR (boiler slag)	10/22/2019	8.3 J	NA	10	NA
WDA-11-6-8ft	CCR (boiler slag)	10/22/2019	11	NA	3.9	NA
WDA-11-16-18ft	Native	10/22/2019	2.1 J	NA	< 1.1 U	NA
WDA-11-25-27ft	Native	10/22/2019	2.8 J	NA	< 1.2 U	NA
WDA-11-43.5-45.5ft	Native	10/22/2019	2.0 J	NA	< 1.2 U	NA
WDA-13-0-2ft	CCR (bottom ash)	8/13/2019	4.9 J	NA	4.8	NA
WDA-13-4-6ft	CCR (boiler slag)	8/13/2019	7.6	NA	3.6	NA
WDA-13-6-8ft	Native	8/13/2019	2.1 J	NA	< 1.1 U	NA
WDA-13-16-20ft	Native	8/13/2019	1.1 J	NA	< 1.1 U	NA
WDA-13-28-30ft	Native	8/13/2019	3.8 J	NA	1.7	NA
WDA-17-0-4ft	CCR (boiler slag)	8/1/2019	7.1 J	NA	6.4	NA
WDA-17-10-12ft	CCR (boiler slag)	8/1/2019	1.4 J	NA	< 1.2 U	NA
WDA-17-14-16ft	CCR (bottom ash)	8/1/2019	2.2 J	NA	< 1.1 U	NA
WDA-17-24-26ft	Native	8/2/2019	3.5 J	NA	< 1.1 U	NA
WDA-30-2-4ft	CCR (boiler slag)	10/23/2019	24	NA	2.3	NA
WDA-30-4-6ft	CCR (boiler slag)	10/24/2019	21	NA	3.4	NA
WDA-30-10-12ft	CCR (boiler slag)	10/24/2019	17	NA	< 1.2 U	NA
WDA-30-16-18ft	Native	10/24/2019	1.9 J	NA	< 1.2 U	NA
WDA-30-26-28ft	Native	10/24/2019	2.2 J	NA	< 1.2 U	NA
WDA-34-10-12ft	CCR (bottom ash)	10/22/2019	3.9 J	NA	< 1.2 U	NA
WDA-34-14-16ft	CCR (bottom ash)/ Native	10/22/2019	1.9 J	NA	1.7	NA
WDA-47-0-2ft	CCR (bottom ash)	8/5/2019	3.1 J	NA	< 1.3	NA
WDA-47-2-4ft	CCR (bottom ash)/ Native	8/5/2019	1.6 J	NA	< 1.2 U	NA
WDA-47-16-18ft	Native	8/4/2019	1.8 J	NA	< 1.1 U	NA
WDA-47-30-32ft	Native	8/5/2019	4.3 J	NA	< 1.2 U	NA
WDA-53-0-2ft	CCR (bottom ash)	8/4/2019	4.1 J	NA	2.7	NA
WDA-53-8-10ft	Native	8/4/2019	2.1 J	NA	< 1.0 U	NA
WDA-53-28-30ft	Native	8/4/2019	3.7 J	NA	< 1.1 U	NA
WDA-54-0-2ft	CCR (bottom ash)	8/2/2019	5.3 J	NA	2.7	NA
WDA-54-18-20ft	Native	8/3/2019	2.2 J	NA	< 1.1 U	NA
WDA-54-28-30ft	Native	8/3/2019	3.2 J	NA	< 1.1 U	NA
WDA-55-0-2ft	CCR (bottom ash)	8/3/2019	5.0 J	NA	2.9	NA
WDA-55-12.5-14.5ft	Native	8/3/2019	1.5 J	NA	< 1.2 U	NA
WDA-55-27.5-29.5ft	Native	8/3/2019	3.0 J	NA	< 1.1 U	NA
WDA-56-0-0.5ft	CCR (bottom ash)	8/4/2019	4.9 J	NA	3.8	NA
WDA-56-5-7ft	Native	8/4/2019	2.0 J	NA	< 1.2 U	NA
WDA-56-30-32ft	Native	8/4/2019	3.3 J	NA	< 1.1 U	NA
WDA-57-0-2ft	CCR (bottom ash)	8/6/2019	3.1 J	NA	2.6	NA
WDA-57-2-4ft	CCR (bottom ash)	8/6/2019	2.6 J	NA	< 1.1 U	NA
WDA-57-13-15ft	Native	8/6/2019	1.6 J	NA	< 1.1 U	NA
WDA-57-30-32ft	Native	8/6/2019	3.1 J	NA	< 1.2 U	NA
WDA-58-0-2ft	CCR (bottom ash)	8/13/2019	5.0 J	NA	3.1	NA
WDA-58-2-4ft	Native	8/13/2019	1.9 J	NA	< 1.1 U	NA
WDA-58-14-16ft	Native	8/13/2019	1.3 J	NA	< 1.1 U	NA
WDA-58-30-32ft	Native	8/13/2019	2.5 J	NA	< 1.1 U	NA
WDA-59-0-2ft	CCR (bottom ash)	8/13/2019	5.1 J	NA	4.8	NA
WDA-59-2-4ft	Native	8/13/2019	1.6 J	NA	< 1.0 U	NA
WDA-59-15-17ft	Native	8/13/2019	8.1	NA	< 1.1 U	NA
WDA-59-30-32ft	Native	8/13/2019	3.8 J	NA	1.1	NA

Notes:
1. The sample ID includes the location (see Figure 2) and the approximate depth from which the sample was collected (if applicable).
mg/kg = milligram per kilogram
mg/L = milligram per liter
U= The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J= The analyte was positively identified. The associated numerical value is the approximate concentration.
J+= The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample and biased high.
NA= not analyzed
CCR= coal combustion residual
SPLP = Synthetic Precipitation Leaching Procedure

Prepared by: DFSC
Checked by: KMC
Reviewed by: JBG

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative Source Demonstration
NIPSCO LLC R. M. Schahfer Generating Station

Location		GAMW01																GAMW01B			
Sample Date		2016-07-12	2016-09-08		2016-11-09	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-10-23	2019-04-23		2019-11-05	2018-09-06	2018-10-23	2019-04-23	2019-11-05
Sample Type		N	FD	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N
Chemical Name	Unit																				
CCR Appendix III																					
Boron	mg/L	0.11	1.2 J	0.36 J	0.15 J	0.2 U	0.2 U	0.5	1.2	1	0.74		0.3	0.29	1.1	1.1	1.6	0.4	0.44	0.35	0.38
Calcium	mg/L	65	240 J	83 J	74	71	83	110	110	81	81		87	77	110	110	94 J-	110	100	110	94 J-
Chloride	mg/L	4.3	28 J	12 J	5.3	5.6	8.3	18	18	12	16		10	8.1	20	20	13	21	19	21	19
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.31 J+	0.31 J+	0.41	0.17 J	0.14	0.14 J+	0.15
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78		6.89	7.2	7.01	6.74	6.98	6.94
Sulfate	mg/L	54 J-	500 J	100 J	62	52	54	100	200	130	110		50	68	220	230	180	72	69	73	67
Total Dissolved Solids	mg/L	280	1100 J	380 J	320	280	340	480	580	420	420		360	350	600	630	520	450	430	490	440
CCR Appendix IV																					
Antimony	mg/L	0.00048 J	0.001 J	0.00068 J	0.001 J	0.0016 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.019	0.014 J	0.039 J	0.024	0.013	0.01	0.012	0.023	0.03		0.02	0.03	0.035	0.015	0.014	0.013	0.00077 J	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.059	0.078 J	0.057 J	0.064	0.053	0.07	0.065	0.093	0.077		0.057	0.052	0.052	0.088	0.087	0.069	0.19	0.17	0.19	0.15
Beryllium	mg/L	0.00099 J	0.00068 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.0014	0.001 U	0.00036 J	0.001 U	0.00086 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00038 J	0.002 U	0.00037 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00053 J	0.0011	0.00087 J	0.00068 J	0.00074 J	0.0016	0.0016	0.001		0.0011	0.001	0.00075 J	0.0016	0.0017	0.001	0.00056 J	0.00027 J	0.00033 J	0.00019 J
Fluoride	mg/L	0.34 J+	0.25 J	0.38 J	0.34 J	0.34 J	0.3 J	0.26 J	0.35 J	0.41 J	0.38 J	0.28 J	0.32 J	0.3	0.31 J+	0.31 J+	0.41	0.17 J	0.14	0.14 J+	0.15
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00065 J		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0031 J	0.008 U	0.008 U	0.008 U	0.0031 J	0.0015 J	0.003 J	0.0042 J	0.0037 J		0.0019 J		0.0028 J	0.0021 J	0.0023 J	0.0025 J	0.0039 J	0.0046 J	0.0047 J	0.0042 J
Mercury	mg/L	0.0002 U	0.00035	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.011	0.025	0.022	0.011	0.01 U	0.01 U	0.017	0.033	0.045		0.014	0.016	0.015	0.033	0.033	0.031	0.0015 J	0.01 U	0.0011 J	0.01 U
Radium, Total	pci/L	5 U	0.399 U	0.771	0.403	0.501 U	0.446 U	0.551	0.692	0.835		0.741 J+	0.475	1.45 J+	1.21	0.781		2.16	2.62 J+	2.11	
Radium-226	pci/L	1 U	0.118	0.328	0.341 U	0.247	0.148	0.304	0.658 J+	0.46		0.284	0.292	0.614 J+	0.693	0.474		1.56	1.47 J+	1.13	
Radium-228	pci/L	1 U	0.399 U	0.512 U	0.359 U	0.501 U	0.446 U	0.314 U	0.341 U	0.435 U		0.457 J+	0.183	0.832 J+	0.517	0.388 U		0.6	1.15 J+	0.982	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00075 J	0.0018 J	0.001 J	0.0016 J	0.0031 J	0.0017 J		0.0016 J		0.001 J	0.0075	0.0077	0.0057	0.001 J	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.00018 J	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00032 J		0.001 U		0.001 U	0.001 U	0.00021 J	0.00046 J	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																					
DO	mg/L	0.14		0.9	0.18	0.25	0.17	0.07	0.61	0.32	0.19	0.28	0.14	0.22		1.97	0.31	0.62	0.23	1.06	0.32
ORP	millivolts	-92.6		-21.4	-120.7	-110.5	-127.2	-102.8	98.3	-43.1	-48.2	-85.1	284.1	-130.2		27.1	-217.5	-96.2	-111.7	-23.6	-196.7
pH	SU	7.18		6.5	6.93	7.33	7.26	7.16	6.5	7.24	7.18	7.24	7	6.78		6.89	7.2	7.01	6.74	6.98	6.94
SC	uS/cm	448		604	512	416	508	707	844	650	673	395	550	594		624	547	684	687	563	468
TEMP	deg C	13.9		17.8	16.2	11.2	9.73	10.8	13.8	17	17.2	9.2	9.4	16.9		2.4	15.9	13.9	13.9	9.88	13.8
TURB	NTU	1.25		2.12	3.92	4.79	3.86	3.69	4.22	2.22	2.8	4.61	4.05	4.81		4.48	3.8	4.16	2.41	3.15	1.2

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Prepared by: DFSC
Checked by: KMC
Reviewed by: JBG

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GABW03																
	Sample Date	2016-07-15	2016-09-08	2016-11-08	2017-01-09		2017-03-01	2017-04-26	2017-06-28	2017-08-22		2017-10-04	2018-03-19	2018-04-20	2018-10-24		2019-04-25	2019-11-06
	Sample Type	N	N	N	FD	N	N	N	N	FD	N	N	N	N	FD	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.23	0.24	0.25	0.24	0.22	0.22	0.23	0.21	0.2	0.2	0.22		0.2	0.28	0.26	0.16	0.35
Calcium	mg/L	83	87	100	110	94	100	110	87	75	77	87		93	97	94	84	110 J-
Chloride	mg/L	7.7	8.6	10	9.1	9.1	8.1	6.8	10	8.2	8.3	9		4.9	22	7.7	2.4	6.5
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15	0.2	0.17
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37	6.94	6.74
Sulfate	mg/L	100 J-	100	110	110	110	120	130	83	77	77	93		110	67	100	86	150
Total Dissolved Solids	mg/L	400	390	500	440	430	450	510	420	370	370	430		380	440	440	350	490
CCR Appendix IV																		
Antimony	mg/L	0.00023 J	0.00091 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.012	0.011	0.011	0.01	0.01	0.0076	0.0076	0.015	0.012	0.013		0.018		0.005 U	0.013	0.0035 J	0.016
Barium	mg/L	0.087	0.096	0.11	0.11 J	0.081 J	0.087	0.091	0.071	0.079	0.079		0.074		0.11	0.1	0.071	0.11
Beryllium	mg/L	0.00055 J	0.00053 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	8.8E-05 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.0014	0.0043	0.01	0.011	0.011	0.013	0.015	0.0037	0.0018	0.0019		0.0038		0.001 U	0.0037	0.0099	0.0048
Fluoride	mg/L	0.15 J+	0.19 J	5 U	0.12 J	0.12 J	0.14 J	0.13 J	0.2 J	0.17 J	0.18 J	0.12 J	0.16 J	0.2 J	0.21	0.15	0.2	0.17
Lead	mg/L	0.001 U	0.001 U	0.00016 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00052 J	0.00045 J	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0064 J	0.008 U	0.008 U	0.0042 J	0.0044 J	0.0025 J	0.0045 J	0.0063 J	0.0067 J	0.0069 J		0.006 J		0.008 U	0.0074 J	0.0038 J	0.0058 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0087 J	0.009 J	0.01 U	0.012 J+	0.01 U	0.01 U	0.0082 J	0.0084 J	0.0069 J	0.0076 J		0.0063 J		0.0065 J	0.0082 J	0.0071 J	0.0063 J
Radium, Total	pci/L	5 U	0.696	0.873 J+	0.53 U	0.765	0.385 U	0.399	0.302 U	0.346 U	0.427 U		0.49 J+		1.11 J+	1.38 J+	0.373 U	
Radium-226	pci/L	1 U	0.276	0.408 U	0.287 U	0.277	0.115	0.157	0.114 J+	0.117	0.126		0.165		0.567 J+	0.342 J+	0.314 U	
Radium-228	pci/L	1 U	0.539 U	0.728 J+	0.53 U	0.513 U	0.385 U	0.338 U	0.302 U	0.346 U	0.427 U		0.42 U		0.547	1.04	0.373 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00085 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																		
DO	mg/L	0.38	0.61	0.24		0.71	1.07	0.73	0.61		0.22	0.29	1.3	0.9		0.99	1.1	0.43
ORP	millivolts	186.5	7.4	-30.2		-34	-28.5	-21.7	-24.1		-28.5	-83.1	-76.4	-98.2		-283.8	40.1	-182.6
pH	SU	6.85	6.62	6.53		6.69	6.66	6.64	6.76		7.1	6.9	6.61	7.13		7.37	6.94	6.74
SC	uS/cm	599	630	711		586	588	760	550		583	655	369	572		675	352	510
TEMP	deg C	13.4	16.2	15.5		10.8	9.02	10.4	12.7		15.2	16.1	8.6	7.9		16.2	3.28	15
TURB	NTU	2.72	4.41	2.92		4.58	4.68	4.42	4.5		2.51	4.18	4.66	4.96		3.55	3.49	4.41

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GMW03B															
	Sample Date	2016-07-13	2016-09-08	2016-11-08	2017-01-10	2017-03-01	2017-04-26	2017-06-28	2017-08-23	2017-10-04	2018-03-13	2018-04-30	2018-09-06		2018-10-24	2018-04-26	2019-11-06
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N
Chemical Name	Unit																
CCR Appendix III																	
Boron	mg/L	0.18	0.18	0.2 U	0.2 U	0.21	0.23	0.25	0.27	0.28		0.3	0.32	0.28	0.29	0.25	0.31
Calcium	mg/L	98	100	110	98	110	110	110	99	95		110	100	99	98	90	89 J-
Chloride	mg/L	14	13	15	16	20	20	22	21	25		23	24	25	22	24	24
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21	0.22	0.26
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77	7.15	7.08
Sulfate	mg/L	58 J-	59	58	77	67	67	66	68	84		66	64	64	67	74	80
Total Dissolved Solids	mg/L	420	410	420	440	450	480	510	450	460		420	470	450	450	460	410
CCR Appendix IV																	
Antimony	mg/L	0.00019 J	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0015 J	0.0012 J	0.0009 J	0.0013 J	0.005 U	0.00085 J	0.00087 J	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.11	0.1	0.11	0.096	0.11	0.11	0.11	0.12		0.13		0.12	0.12	0.12	0.1	0.11
Beryllium	mg/L	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00031 J	0.001 U	0.00017 J	0.001 U	0.00038 J	0.00021 J	0.001 U		0.00024 J		0.00034 J	0.00036 J	0.001 U	0.0005 J	0.001 U
Fluoride	mg/L	0.25 J+	0.23 J	5 U	0.24 J	0.23 J	0.2 J	0.24 J	0.24 J	0.21 J	0.2 J	0.22 J	0.23 J	0.23 J	0.21	0.22	0.26
Lead	mg/L	0.001 U	0.001 U	0.00035 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0014 J	0.008 U	0.008 U	0.0011 J	0.0011 J	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0044 J	0.0043 J	0.01 U	0.01 U	0.01 U	0.0045 J	0.0052 J	0.0055 J		0.0066 J		0.0067 J	0.0067 J	0.0066 J	0.0068 J	0.0074 J
Radium, Total	pci/L	0.943	1.15	1.36 J+	1.03	0.62	0.449	1	0.643		1.99 J+		1.14	1.06	1.26 J+	0.596	
Radium-226	pci/L	0.642 J+	0.52	0.537	0.513	0.29	0.456	0.447 J+	0.414		0.458		0.671	0.574	0.478 J+	0.38 U	
Radium-228	pci/L	1 U	0.629	0.823 J+	0.513	0.39 U	0.338 U	0.556	0.354 U		1.53 J+		0.47	0.49	0.783	0.442	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00066 J	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.0014 J	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																	
DO	mg/L	0.42	1.11	0.32	0.48	0.41	0.15	0.38	0.31	0.17	0.4	0.19		1.12	0.5	1.7	0.58
ORP	millivolts	196.3	-26.8	-61.4	-98.9	-86.2	-77.9	-49.1	-34.5	-94.7	-85.2	-95.1		-66.2	-294.4	7.6	-181.9
pH	SU	7.01	6.74	6.53	7.08	7.04	6.97	6.81	7.29	7.07	6.83	7.12		7.1	7.77	7.15	7.08
SC	uS/cm	676	680	6.84	678	631	737	656	730	728	515	778		669	719	527	443
TEMP	deg C	12.4	13.2	13.2	12.2	11.63	12.1	12.2	13	13.3	11.3	4.1		13	13.69	9.03	13.1
TURB	NTU	3.66	4.73	2.84	2.02	3.1	2.51	1.84	1.16	0.81	4.59	4.36		3.55	3.54	3.56	1.92

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GAMW12																GAMW12B				
Sample Date		2016-07-12		2016-09-07	2016-11-09	2017-01-09	2017-02-28	2017-04-25	2017-06-28	2017-08-22	2017-10-04	2018-03-13	2018-04-20	2018-10-23	2019-04-24	2019-11-07		2018-09-07	2018-10-23	2019-04-25		2019-11-07
Sample Type		FD	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	FD	N	N
Chemical Name	Unit																					
CCR Appendix III																						
Boron	mg/L	0.07	0.073	0.075	0.2 U	0.2 U	0.2 U	0.092 J	0.2 U	0.2 U	0.079 J		0.095 J	0.081 J	0.073 J	0.071 J	0.069 J	0.28	0.26	0.31	0.3	0.33
Calcium	mg/L	88	93	91	97	90	97	97	100	89	87		87	94	88	76	76	100	110	100	100	88
Chloride	mg/L	2.3	3.8	6.1	9.6	11	10	10	7.6	5.2	3.2		3.3	2.5	2.9	2.8	2.8	22	19	23	23	24
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.21	0.23	0.24	0.12 J	0.096	0.11	0.11	0.11
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.06		7.32	7.15	8.83		7	7.63
Sulfate	mg/L	5.9 J-	7.5 J-	15	6.8	17	12	14	11	11	11		11	12	22	14	16	63	49	120	120	130
Total Dissolved Solids	mg/L	380	390	390	430	400	410	390	400	400	390		350	360	390	360	330	870 J+	450	480	500	470
CCR Appendix IV																						
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.00086 J		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0086	0.0097	0.0079	0.011	0.0058	0.0058	0.0059	0.016	0.017		0.011	0.0085	0.018	0.014	0.0077	0.008	0.0013 J	0.00079 J	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.14	0.14	0.15	0.14	0.11	0.14	0.12	0.14	0.13		0.11	0.1	0.12	0.087	0.079	0.079	0.11	0.12	0.12	0.11	0.1
Beryllium	mg/L	0.001 U	0.00021 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.00032 J		0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.00024 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00099 J	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.0026	0.0029	0.0041	0.0025	0.0032	0.003	0.0028	0.0031	0.0027		0.0023	0.0016	0.0018	0.0031	0.0027	0.0028	0.00039 J	0.00038 J	0.001 U	0.001 U	0.00044 J
Fluoride	mg/L	0.11 J+	0.24 J+	0.23 J	5 UO	0.23 J	0.19 J	0.17 J	0.21 J	0.23 J	0.21 J	0.19 J	0.24 J	0.19	0.21	0.23	0.24	0.12 J	0.096	0.11	0.11	0.11
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J
Lithium	mg/L	0.0025 J	0.003 J	0.008 U	0.008 U	0.0029 J	0.0026 J	0.0032 J	0.0034 J	0.003 J		0.0023 J		0.0032 J	0.0027 J	0.0028 J	0.003 J	0.0042 J	0.0042 J	0.0043 J	0.0043 J	0.004 J
Mercury	mg/L	0.00019 J+	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.01 U	0.002 J	0.0037 J	0.01 U	0.01 U	0.01 U	0.004 J	0.003 J	0.0029 J		0.0035 J		0.0033 J	0.0034 J	0.0032 J	0.0036 J	0.01 U	0.01 U	0.0014 J	0.0013 J	0.0015 J
Radium, Total	pci/L	0.921	0.735	0.823	2.14 J+	0.721	0.79	0.441	0.6	1.42		0.962 J+	0.67	1.3 J+	0.474 U			1.66 J+	1.61 J+	1.03 J	0.544 J	
Radium-226	pci/L	0.591 J+	0.476 J+	0.472	1.12	0.3	0.38	0.262	0.426 J+	0.529		0.322	0.321	0.57 J+	0.307 U			0.886 J+	0.916 J+	0.439	0.426 U	
Radium-228	pci/L	1 U	1 U	0.423 U	1.02 J+	0.423 U	0.409	0.354 U	0.305 U	0.893		0.64 J+	0.35	0.734 J+	0.474 U			0.774	0.695 J+	0.592	0.373 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00054 J	0.0007 J	0.005 U	0.005 U	0.005 U		0.00091 J		0.005 U	0.005 U	0.005 U	0.005 U	0.0024 J	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.00039 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																						
DO	mg/L		0.57	2.06	0.25	0.31	0.25	0.1	0.4	0.32	0.46	0.33	0.25	0.93	1.07		2.61	0.6	0.52		0.76	4.86
ORP	millivolts		-47.5	-44.9	-71.8	-50.3	-74	-66.7	-75.8	-30.1	-101.1	-87.5	-239.8	-377.3	-12.7		-4.1	-98.9	-378.3		-10.2	-34.9
pH	SU		6.75	6.85	6.81	6.87	6.89	6.87	6.67	6.69	6.91	6.62	7.17	7.79	7.06		7.32	7.15	8.83		7	7.63
SC	uS/cm		634	688	660	569	605	664	645	667	665	393	558	628	381		421	712	760		560	482
TEMP	deg C		14.7	19.5	16.2	10.6	9.38	10.8	14.3	17.2	17.5	8.2	8.7	16.99	0.8		12.97	14	14.11		11.5	1.39
TURB	NTU		2.97	3.11	4.9	4.44	4.61	4.46	3.78	3.33	3.41	3.55	4.12	2.91	12.6		3.1	3.33	1.39		3.56	4.02

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GMW13													
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-26	2017-04-25	2017-07-12	2017-08-23	2017-10-03	2018-03-15	2018-04-20	2018-10-24	2019-04-24	2019-11-06
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit														
CCR Appendix III															
Boron	mg/L	0.2	0.27	0.4	0.2 U	0.2 U	0.18 J	0.21	0.24	0.18 J		0.21	0.38	0.18	0.13
Calcium	mg/L	85	86	86	80	94	100	87	88	86		110	74	75	71 J-
Chloride	mg/L	13	15	18	4.6	7.4	8.2	10	10	11		9.7	14	7.9	3.9
Fluoride	mg/L	0.32 J+	0.35 J	5 UO	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28	0.24	0.31
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88	6.79	7.15
Sulfate	mg/L	14 J-	47	62	40	43	52	25	15	25		52	59	52	40
Total Dissolved Solids	mg/L	340	400	430	320	360	380	340	370	360		400 J	350	360	330
CCR Appendix IV															
Antimony	mg/L	0.00016 J	0.00028 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	0.014	0.013	0.0076	0.0052	0.006	0.0082	0.0087		0.0039 J		0.01	0.005	0.006
Barium	mg/L	0.13	0.14	0.14	0.092	0.11	0.13	0.16	0.14		0.11	0.12	0.14	0.081	0.063
Beryllium	mg/L	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.00089 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.00097 J	0.002 U	0.002 U	0.002 U	0.00068 J	0.002 U	0.002 U	0.002 U		0.0012 J		0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.0016	0.0014	0.0015	0.00077 J	0.00074 J	0.0005 J	0.00042 J		0.0029	0.00096 J	0.00032 J	0.0012	0.00057 J
Fluoride	mg/L	0.32 J+	0.35 J	5 O	0.19 J	0.19 J	0.22 J	0.27 J	0.31 J	0.28 J	5 U	0.27 J	0.28	0.24	0.31
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0012 J	0.008 U	0.008 U	0.00047 J	0.008 U	0.008 U	0.0019 J	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0021 J	0.0074 J	0.013	0.01 U	0.01 U	0.004 J	0.0033 J	0.0022 J		0.0053 J		0.0054 J	0.012	0.0068 J
Radium, Total	pci/L	1.45	1.02	1.54 J+	0.382 U	0.644	0.807	0.502	0.713		0.667 J+	0.401	1.84 J+	0.473 U	
Radium-226	pci/L	1.04 J+	0.588	0.455	0.302 U	0.208	0.23	0.461 J+	0.34		0.193	0.224	0.671 J+	0.241 U	
Radium-228	pci/L	1 U	0.435	1.09 J+	0.382 U	0.436	0.577	0.375 U	0.373		0.474 J+	0.177	1.17	0.473 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.0011 J		0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U
Sample Parameters															
DO	mg/L	0.23	0.95	6.77	0.43	0.6	0.28	0.91	0.28	0.41	0.81	0.32	1.12	1.35	2.26
ORP	millivolts	-92.2	-70.8	-95.5	-66.2	-84.8	-96	-4.1	16.8	-34.8	-101.1	-112.4	-268.7	94.8	42
pH	SU	6.71	6.76	6.78	6.72	6.76	6.74	6.81	6.46	6.8	6.4	6.94	6.88	6.79	7.15
SC	uS/cm	6.14	717	694	538	593	664	630	661	655	446	723	614	304	433
TEMP	deg C	16.3	20.5	16.6	10.4	9.14	11.2	16	17.6	17.8	8.2	8.7	17.02	1.7	9.2
TURB	NTU	4.75	2.41	3.92	1.59	1.51	2.11	3.16	1.28	2.05	4.77	2.88	1.12	4.63	1.38

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GAMW13B																	
	Sample Date	2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28		2017-04-25		2017-07-12	2017-08-23	2017-10-03	2018-03-13	2018-04-26		2018-09-06	2018-10-24	2019-04-24	2019-11-06
	Sample Type	N	N	N	N	FD	N	FD	N	N	N	N	N	FD	N	N	N	N	N
Chemical Name	Unit																		
CCR Appendix III																			
Boron	mg/L	0.71	0.76	0.73	0.78	0.74	0.78	0.74	0.76	0.73	0.73	0.79			0.76	0.72	0.71	0.71	0.7
Calcium	mg/L	80	70	78	76	76	79	78	77	75	72	78			76	72	71	72	66 J-
Chloride	mg/L	24	25	25	25	25	25	25	26	26	27	28			27	27	24	27	27
Fluoride	mg/L	0.28 J+	0.29 J	5 UO	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25	0.35	0.34
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45	7.3	7.81
Sulfate	mg/L	150 J-	150	150	150	150	150	150	150	150	160	170			150	150	150	150	150
Total Dissolved Solids	mg/L	440	410	410	390	420	420	400	390	390	430	440			370 J	410	420	430	400
CCR Appendix IV																			
Antimony	mg/L	0.00033 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0021 J	0.0011 J	0.0011 J	0.0015 J	0.0013 J	0.0013 J	0.0016 J	0.0014 J	0.0013 J	0.00092 J		0.0012 J	0.00098 J		0.005 U	0.005 U	0.0014 J	0.00091 J
Barium	mg/L	0.093	0.08	0.084	0.084	0.093	0.097	0.091	0.093	0.089	0.086		0.1	0.091	0.094	0.087	0.082	0.093	0.078
Beryllium	mg/L	0.00063 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.0013	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00036 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U			0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.00018 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U		0.00019 J	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.28 J+	0.29 J	5 O	0.3 J	0.29 J	0.29 J	0.32 J	0.28 J	0.23 J	0.27 J	0.26 J	0.27 J		0.31 J	0.28 J	0.25	0.35	0.34
Lead	mg/L	0.001 U	0.001 U	0.00042 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.0023 J	0.008 U	0.008 U	0.0019 J	0.0013 J	0.0016 J	0.0018 J	0.0017 J	0.0034 J	0.0021 J		0.008 U	0.008 U		0.008 U	0.0018 J	0.0019 J	0.0017 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U			0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.023	0.021	0.022	0.019 J+	0.02	0.02	0.021	0.021	0.022	0.021		0.021	0.022	0.021	0.018	0.018	0.021	0.017
Radium, Total	pci/L	5 U	0.66 U	1.16 J+	0.946	0.571 U	0.902	0.911 J	0.515 J	0.595	1.06		0.783 J+	0.571	0.863	0.885	1.76 J+	0.529	
Radium-226	pci/L	0.438 J+	0.511	0.665	0.64	0.387	0.404	0.603 J	0.316 J	0.41 J+	0.573		0.423	0.293	0.311	0.567	0.646 J+	0.436	
Radium-228	pci/L	1 U	0.66 U	0.495 J+	0.416 U	0.571 U	0.497	0.353 U	0.36 U	0.308 U	0.489		0.36 J+	0.278	0.552	0.386 U	1.11	0.435 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U		0.001 J	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U			0.001 U	0.001 U	0.00021 J	0.001 U
Sample Parameters																			
DO	mg/L	0.65	1.05	0.44	0.226		0.69		0.22	0.56	0.63	0.34	0.53		0.14	0.38	1.24	1.16	2.1
ORP	millivolts	-86.5	-92.3	-110.1	-111.5		-114.4		-125.7	-72.6	1.1	-72.1	-98.1		-230.2	-118.7	-235.5	17.8	-45.2
pH	SU	7.31	7.48	7.17	7.45		7.47		7.42	7.31	7.06	7.5	7.27		7.64	7.37	7.45	7.3	7.81
SC	uS/cm	634	634	624	575		611		604	613	652	681	464		607	631	639	394	440
TEMP	deg C	14.7	16.8	14.5	12.7		12.6		13.2	13.9	14.4	14.4	12		12.3	14.14	14.1	3.39	11.67
TURB	NTU	4.94	1.94	1.57	2.86		4.56		4.5	3.86	1.8	0.42	4.22		4.19	2.25	1.08	4.07	2.03

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GMW14															
Sample Date		2016-07-12	2016-09-07	2016-11-08	2017-01-09	2017-02-28	2017-04-25	2017-06-28		2017-08-22	2017-10-02	2018-03-12	2018-04-19	2018-10-25	2019-03-01	2019-04-22	2019-11-06
Sample Type		N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																
CCR Appendix III																	
Boron	mg/L	0.27	0.36	0.25	0.3	0.26	0.28	0.26	0.24	0.24	0.23		0.25	0.3	0.2	0.22	0.16
Calcium	mg/L	69	69	72	55	65	57	58	58	68	73		37	58	38	38	59 J-
Chloride	mg/L	15	11	8.7	7.6	8.4	5.1	2	2.1	1.7 J	1.8		1.4	13	2.8	2.7	2.1
Fluoride	mg/L	0.27 J+	0.24 J	2 UO	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21	0.18	0.23
pH	SU	6.32 O	6.88	6.59	5.99 O	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01	7.27	7.14
Sulfate	mg/L	100 J-	88	52	74	79	77	52	48	54	54		35	51	35	37	27
Total Dissolved Solids	mg/L	360	310	310	250 J+	310	260	270	260	300	340		220	290	210	360	260
CCR Appendix IV																	
Antimony	mg/L	0.00036 J	0.00032 J	0.002 U	0.00039 J	0.002 U	0.00091 J	0.002 U	0.002 U	0.002 U		0.0016 J		0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0033 J	0.0029 J	0.0055	0.0023 J	0.0024 J	0.0018 J	0.0017 J	0.0018 J	0.003 J		0.0021 J		0.014	0.012	0.0028 J	0.026
Barium	mg/L	0.065	0.068	0.065	0.059	0.07	0.071	0.065	0.066	0.069		0.061	0.049	0.058	0.041	0.049	0.055
Beryllium	mg/L	0.00013 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.00046 J	0.002 U	0.002 U	0.002 U	0.002 U		0.0011 J		0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.012	0.01	0.015	0.0052	0.015	0.023	0.022	0.023	0.026		0.035	0.052	0.031	0.0083	0.0026	0.014
Fluoride	mg/L	0.27 J+	0.24 J	2 O	0.23 J	0.19 J	0.2 J	0.2 J	0.22 J	0.21 J	0.21 J	0.25 J	0.29 J	0.2	0.21	0.18	0.23
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.00046 J	0.008 U	0.008 U	0.00038 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U		0.008 U		0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0088 J	0.011	0.01 U	0.013 J+	0.011	0.0098 J	0.008 J	0.0082 J	0.0078 J		0.011	0.0096 J	0.011	0.0074 J	0.011	0.0084 J
Radium, Total	pci/L	5 U	0.553	1.03 J+	0.375 U	0.413 U	0.447 U	0.72	0.287 U	0.4 U		0.366 U	0.399	0.671		0.345	
Radium-226	pci/L	0.282 J+	0.16 U	0.486	0.24 U	0.114 U	0.12	0.13 J+	0.11 J+	0.151		0.0752 U	0.0656	0.239		0.318 U	
Radium-228	pci/L	1 U	0.426	0.598 U	0.375 U	0.413 U	0.447 U	0.59	0.287 U	0.4 U		0.366 U	0.333	0.432		0.328 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.00058 J	0.0011 J	0.00095 J	0.005 U	0.005 U	0.005 U		0.005 U		0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																	
DO	mg/L	0.39	1.24	0.78	1.68	3.38	0.6		3.1	1.19	0.46	1.33	1.02	1.8	0.32	3.21	1.49
ORP	millivolts	179.6	163.9	75.6	230.3	225.8	82.1		268.3	110.1	89.5	-117	-243.1	-240.9	-11.5	61.3	38.2
pH	SU	6.32	6.88	6.59	5.99	6.77	6.85		6.93	6.77	6.77	6.75	6.99	7.26	7.01	7.27	7.14
SC	uS/cm	501	512	505	360	430	400		404	466	578	241	283	464	226	223	325
TEMP	deg C	14.7	18.6	15.5	11.2	9.85	10.9		13.5	16.2	16.7	8.99	9.4	16.3	8.79	10.3	14.71
TURB	NTU	2.33	1.33	0.57	0.91	4.14	2.71		3.23	3.71	2.61	4.41	4.89	1.81	4.43	4.68	2.51

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GAINYLIB															
	Sample Date	2016-07-12	2016-09-07	2016-11-09	2017-01-05	2017-02-28	2017-04-25	2017-07-12	2017-08-22	2017-10-03	2018-03-12	2018-04-19	2018-08-06	2018-10-25	2019-04-22	2019-11-06	
	Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N
Chemical Name	Unit																
CCR Appendix III																	
Boron	mg/L	2.8	2.4	3.4	2.9	2.9	2.9	2.8	3	2.9		3	2.9	2.8	2.9	3.4	3.3
Calcium	mg/L	150	130	140	84	95	110	120	120	120		150	150	150	140	130 J-	130 J-
Chloride	mg/L	100	100	120	94	100	100	83	100	110		110	110	97	99	120	120
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31	0.31	0.4	0.39
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67	7.75		7.93
Sulfate	mg/L	1200 J-	950	1100	790	860	900	780	960	880		990	1100	1100	1200	1300	1300
Total Dissolved Solids	mg/L	1900	2000	2000	1700	1700	1700	1500	1800	1800		2000	2000	1900	1900	1800	2200
CCR Appendix IV																	
Antimony	mg/L	0.00016 J	0.002 U	0.00071 J	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0029 J	0.00095 J	0.001 J	0.0015 J	0.00092 J	0.0015 J	0.0011 J	0.0009 J		0.0012 J		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.13	0.12	0.12	0.081	0.089	0.096	0.11	0.1		0.11	0.11	0.12	0.12	0.11	0.11	0.11
Beryllium	mg/L	0.00015 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.00083 J	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.00094 J	0.002 U	0.002 U	0.002 U	0.0007 J	0.002 U	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.0044	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.00023 J	0.001 U	0.00045 J	0.0002 J	0.001 U	0.00019 J	0.00028 J		0.00019 J		0.00039 J	0.00022 J	0.00058 J	0.001 U	0.001 U
Fluoride	mg/L	0.29 J+	0.27 J	20 U	0.39 J	10 U	0.3 J	10 U	0.35 J	0.25 J	10 U	0.43 J-	0.33 J	0.31	0.31	0.4	0.39
Lead	mg/L	0.0012	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.005 J	0.008 U	0.008 U	0.0053 J	0.0046 J	0.0054 J	0.0065 J	0.0051 J		0.0043 J		0.0056 J	0.0057 J	0.0058 J	0.0057 J	0.0059 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ		0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.035	0.035	0.023	0.031 J+	0.03	0.028	0.014	0.015		0.022	0.026	0.033	0.035	0.028	0.017	0.017
Radium, Total	pci/L	3.26	2.47	3.11 J+	1.45	2.17	1.65	1.17	1.73		1.87 J+	1.68	2.55	2.73	2.05		
Radium-226	pci/L	2.06 J+	1.32	1.69	1.04	0.861	0.795	0.715 J+	0.967		1.01	0.823	1.24	1.66	0.802		
Radium-228	pci/L	1.2	1.15	1.42 J+	0.402	1.31	0.856	0.452	0.759		0.86 J+	0.861	1.31	1.07	1.25		
Selenium	mg/L	0.005 U	0.005 U	0.00087 J	0.00083 J	0.00061 J	0.005 U	0.005 U	0.00099 J		0.005 U		0.0021 J	0.001 J	0.00093 J	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00025 J		0.001 U		0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U
Sample Parameters																	
DO	mg/L	0.3	1.28	0.44	0.35	0.27	0.11	1.02	0.76	0.31	0.37	0.17	0.44	1.3	1.07		2.16
ORP	millivolts	-60.6	29.7	-76.7	-79.8	-81.4	-112.8	31.4	58	-93.4	102.6	-286.8	-114.1	-211.9	28.8		-21.4
pH	SU	7.26	7.38	7.11	7.48	7.41	7.39	6.96	7.44	7.47	7.59	7.55	7.29	7.67	7.75		7.93
SC	uS/cm	2425	2515	2557	2019	1990	2211	2156	2177	2295	1844	2171	2642	2542	1887		2124
TEMP	deg C	14.6	16.3	14	12.4	12.5	13.3	13.5	14	14.1	12.4	12.5	13.91	13.4	12.8		13.37
TURB	NTU	4.7	1.94	0.97	1.48	4.05	4.13	1.26	0.63	0.48	3.79	2.59	1.42	1.41	2.79		0.71

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GAMW42											GAMW43B							
Sample Date		2018-09-13	2018-10-31	2019-03-04		2019-04-18	2019-06-05	2019-07-17	2019-08-26	2019-10-02	2019-11-05		2018-09-13	2019-03-04	2019-04-18	2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-05
Sample Type		N	N	FD	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																			
CCR Appendix III																				
Boron	mg/L	0.04 J	0.041 J	0.033 J	0.031 J	0.044 J	0.033 J	0.037 J	0.043 J	0.1 U	0.034 J	0.033 J	0.061 J	0.039 J	0.033 J	0.035 J	0.038 J	0.026 J	0.22	0.031 J
Calcium	mg/L	44	38	44	43	36	39	40	47	41	42	43	46	52	47	50	48	52	52	53
Chloride	mg/L	3.1	2.8	2.9	2.8	2.8		2.5	3.1	3.3	3.1	3.2	4	5	4.3		4	4.3	5.6	6.4
Fluoride	mg/L	0.25 J	0.2	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.25 J	0.18	0.18		0.19	0.18	0.18	0.18
pH	SU	7.54	7.15		6.93	7.1	6.85	7.58	7.54	7.41		7.83	8.08	7.23	7.7	7.12	8.25	7.57	7.67	8.25
Sulfate	mg/L	21	23	25	25	30		23	27	26	25	25	21	30	26		26	27	31	35
Total Dissolved Solids	mg/L	190	170	180	200	640		180	210	190	190	190	190	220	84		220	230	230	250
CCR Appendix IV																				
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00059 J	0.002 U
Arsenic	mg/L	0.01	0.0037 J	0.0026 J	0.0025 J	0.0023 J	0.0019 J	0.0016 J	0.0018 J	0.0022 J	0.0019 J	0.0021 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.034	0.046	0.023	0.022	0.024	0.018	0.019	0.021	0.02	0.021	0.022	0.016	0.011	0.0093	0.012	0.012	0.014	0.013	0.013
Beryllium	mg/L	0.001 U	0.001 U	0.0004 J	0.001 U	0.001 U	0.00056 J	0.001 U	0.001 U	0.00057 J	0.001 U	0.00072 J	0.001 U	0.001 U	0.001 U	0.0014	0.001 U	0.001 U	0.00074 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.0014 J	0.0012 J	0.0012 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0013 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0024
Cobalt	mg/L	0.00027 J	0.00053 J	0.001 U	0.001 U	0.00044 J	0.0002 J	0.001 U	0.001 U	0.001 U	0.001 U	0.00023 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Fluoride	mg/L	0.25 J	0.2	0.2	0.2	0.19		0.22	0.2	0.22	0.23	0.21	0.25 J	0.18	0.18		0.19	0.18	0.18	0.18
Lead	mg/L	0.001 U	0.001 U	0.00045 J	0.001 U	0.00064 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0018 J	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0035 J	0.0022 J	0.0024 J	0.0022 J	0.003 J	0.0023 J	0.0019 J	0.002 J	0.0029 J	0.0023 J	0.003 J	0.0048 J	0.0031 J	0.0026 J	0.0031 J	0.0025 J	0.0035 J	0.0039 J	0.0033 J
Radium, Total	pci/L	0.476		0.536	0.437 U	0.346 U		0.393 U	0.48 U	0.539			0.661	0.396 U	0.384 U		0.46	0.73	0.972	
Radium-226	pci/L	0.26		0.165	0.0922 U	0.0867 U		0.36 UJ	0.1 UJ	0.244 J+			0.419	0.233	0.139		0.278 UJ	0.165	0.428 J+	
Radium-228	pci/L	0.335 U		0.436 U	0.437 U	0.346 U		0.393 UJ	0.48 UJ	0.408 U			0.356 U	0.396 U	0.384 U		0.413 UJ	0.462 U	0.544	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00022 J	0.001 U	0.001 U	0.00062 J	0.001 U	0.0007 J	0.001 U	0.001 U	0.001 U	0.00062 J	0.001 U	0.0005 J	0.0008 J	0.00023 J
Sample Parameters																				
DO	mg/L	0.8	0.13		0.06	0.79	0.29	2.19	1.95	0.22		1.25	0.53	0.07	0.65	0.27	1.46	0.9	0.18	0.8
ORP	millivolts	-112.2	-147.1		113.7	-38.9	-82.3	13.9	-94.6	75.7		108	-248.6	-157.6	-133.1	-139.2	-132	-137.7	44.8	-60.2
pH	SU	7.54	7.15		6.93	7.1	6.85	7.58	7.54	7.41		7.83	8.08	7.23	7.7	7.12	8.25	7.57	7.67	8.25
SC	uS/cm	288	274		184	192	198	211	229	220		208	297	244	245	245	246	262	254	255
TEMP	deg C	14.8	13.9		8.2	8.8	11.5	13.7	14.8	14.9		13.06	12.8	10.9	10.8	12.2	12.7	12.8	13.4	11.81
TURB	NTU	3.92	4.11		3.16	8.18	2.47	2.4	1.4	1.6		2.81	4.9	3.15	4.05	0.6	1.09	0.58	0.96	0.36

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GAMW42C				GAMW42								
Sample Date		2019-07-18	2019-08-28	2019-10-02	2019-11-05	2018-06-13	2019-03-05	2019-04-19		2019-06-05	2019-07-17	2019-08-27	2019-10-02	2019-11-18
Sample Type		N	N	N	N	N	N	FD	N	N	N	N	N	N
Chemical Name	Unit													
CCR Appendix III														
Boron	mg/L	1	1	0.79	0.75	0.025 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.19	0.024 J
Calcium	mg/L	45	50	45	45	26	24	21	22	22	25	28	28	34
Chloride	mg/L	6.4	6.5	5.8	5.8	6	1.4	1.1	0.92 J		0.78 J	0.89 J	1.2	1.1
Fluoride	mg/L	0.3	0.25	0.25	0.26	0.15 J	0.11	0.11	0.1		0.14	0.13	0.14	0.14
pH	SU	7.81	7.28	7.48	7.64	6.63	6.8		7.07	6.62	7.35	7.1	6.98	6.94
Sulfate	mg/L	13	4.3	5.6	4.5	25	29	31	31		22	22	30	30
Total Dissolved Solids	mg/L	220	290	270	280	160	150	130	140		140	140	180	180
CCR Appendix IV														
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00061 J	0.00077 J	0.00063 J	0.002 U	0.002 U	0.002 U	0.00077 J
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.0073	0.0036 J	0.0024 J	0.0024 J	0.0027 J	0.0025 J	0.0037 J	0.0033 J	0.0035 J
Barium	mg/L	0.015	0.015	0.01	0.01	0.028	0.021	0.016	0.016	0.015	0.019	0.018	0.026	0.06
Beryllium	mg/L	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.00097 J	0.001 U	0.00075 J	0.0019	0.001 U	0.001 U	0.001 U	0.0014
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.001 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.0004 J	0.001 U	0.0003 J	0.0023	0.02	0.013	0.014	0.0067	0.0034	0.0036	0.0045	0.0037
Fluoride	mg/L	0.3	0.25	0.25	0.26	0.15 J	0.11	0.11	0.1		0.14	0.13	0.14	0.14
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.037	0.038	0.025	0.023	0.008 U	0.008 U	0.008 U	0.008 U	0.0023 J	0.008 U	0.008 U	0.0022 J	0.0026 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0053 J	0.0049 J	0.0027 J	0.0031 J	0.004 J	0.0016 J	0.0015 J	0.0017 J	0.0017 J	0.01 U	0.0015 J	0.0035 J	0.0048 J
Radium, Total	pci/L	0.723	1.14	0.972		0.323 U	0.371 U	0.405 U	0.369 U		0.362 U		0.411 U	
Radium-226	pci/L	0.668 J-	0.701	0.752		0.285 U	0.0944 U	0.125	0.0973 U		0.268 UJ		0.151 U	
Radium-228	pci/L	0.42 U	0.437	0.433 U		0.323 U	0.371 U	0.405 U	0.369 U		0.362 UJ		0.411 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.001 J	0.005 U	0.005 U	0.005 U	0.001 J	0.005 U	0.005 U	0.005 U	0.0012 J
Thallium	mg/L	0.00039 J	0.00061 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00073 J	0.001 U	0.001 U	0.00024 J	0.00091 J
Sample Parameters														
DO	mg/L	0.83	0.29	0.04	0.22	0.19	0.1		0.99	0.17	0.88	0.63	0.31	0.32
ORP	millivolts	-127.9	-205.2	-64.7	293.9	-12	42.7		119.6	47.7	18.7	-18.6	87.7	-220.2
pH	SU	7.81	7.28	7.48	7.64	6.63	6.8		7.07	6.62	7.35	7.1	6.98	6.94
SC	uS/cm	360	350	292	259	269	148		141	150	171	203	235	197
TEMP	deg C	13.3	12.3	11.9	11.5	13.1	7.48		8.2	12	15.7	16.3	16.4	12.6
TURB	NTU	4.43	4.5	4.69	9.33	4.35	3.99		4.6	4.2	2.98	1.95	4.2	4.05

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GMW-43B									GMW-44									
Sample Date		2018-06-13	2019-03-05	2019-04-19	2019-06-05		2019-07-17	2019-08-27	2019-10-02	2019-11-19	2018-06-13	2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-08-27		2019-10-01		2019-11-20
Sample Type		N	N	N	FD	N	N	N	N	N	N	N	N	N	N	FD	N	FD	N	N
Chemical Name	Unit																			
CCR Appendix III																				
Boron	mg/L	0.037 J	0.029 J	0.036 J	0.1 U	0.1 U	0.035 J	0.024 J	0.16	0.035 J	0.05 J	0.025 J	0.032 J	0.1 U	0.036 J	0.1 U	0.032 J	0.026 J	0.03 J	0.034 J
Calcium	mg/L	38	42	43	38 J-	39 J-	37	38	36	38	25	24	24	20 J-	20	37	23	32	34	27
Chloride	mg/L	1.5	1.5	1.6			1.5	1.5	1.6	1.5	10	2.4	3.1		1.8	1.5	1.6	1.9 J+	1.9 J+	1.7
Fluoride	mg/L	0.16 J	0.17	0.17			0.18	0.18	0.19	0.18	0.096 J	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096
pH	SU	7.11	7.62	7.76		7.47	8.09	7.49	7.41	7.5	6.77	6.23	6.41	5.99	6.6		6.31		6.91	6.22
Sulfate	mg/L	26	31	35			28	24	22	29	50	57	68		42	24	42	51 J+	51 J+	44
Total Dissolved Solids	mg/L	180	140	170			160	160	160	170	200	170	200		170	170	160	190	200	170
CCR Appendix IV																				
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0008 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 J	0.00072 J
Arsenic	mg/L	0.0018 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0054	0.0019 J	0.0019 J	0.0045 J	0.0087	0.005 U	0.01	0.0095	0.0091	0.054
Barium	mg/L	0.015	0.012	0.014	0.012	0.012	0.011	0.011	0.011	0.011	0.024	0.024	0.028	0.032	0.025	0.011	0.024	0.031	0.032	0.034
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.00075 J	0.0011	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00073 J	0.00083 J	0.00099 J	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 J	0.00041 J
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0023	0.0028	0.0029	0.0031	0.0028	0.002 U	0.0017 J	0.0012 J	0.0016 J	0.0023
Cobalt	mg/L	0.00033 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0025	0.0017	0.0019	0.0025	0.0025	0.001 U	0.0028	0.0039	0.0039	0.0079
Fluoride	mg/L	0.16 J	0.17	0.17			0.18	0.18	0.19	0.18	0.096 J	0.13	0.16		0.1	0.19	0.11	0.099 J+	0.11 J+	0.096
Lead	mg/L	0.00092 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.00045 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0006 J	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0038 J	0.0043 J	0.0042 J	0.005 J	0.008 U	0.0047 J	0.0042 J	0.0052 J	0.0042 J
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0022 J	0.0018 J	0.0018 J	0.0022 J	0.0025 J	0.0019 J	0.002 J	0.0022 J	0.0021 J	0.013	0.01 U	0.01 U	0.0013 J	0.0012 J	0.0019 J	0.002 J	0.0037 J	0.0049 J	0.0058 J
Radium, Total	pci/L	0.408	0.373 U	0.375 U			0.393 U	0.442 U	0.479 U		0.649	0.362 U	0.543		0.435 U	0.496 U	0.973	0.622 U	0.445 U	
Radium-226	pci/L	0.252 U	0.0977 U	0.105 U			0.317 UJ	0.124 U	0.144 U		0.268	0.193	0.12		0.196 U	0.153 U	0.138 U	0.255	0.155 U	
Radium-228	pci/L	0.303 U	0.373 U	0.375 U			0.393 UJ	0.442 U	0.479 U		0.381	0.362 U	0.423		0.435 U	0.496 U	0.518 U	0.622 U	0.445 U	
Selenium	mg/L	0.00089 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0014 J	0.00096 J	0.00092 J	0.00093 J	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.00042 J	0.00058 J	0.001 U	0.001 U	0.001 U	0.00028 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00094 J	0.00046 J
Sample Parameters																				
DO	mg/L	0.18	0.05	0.99		0.22	0.77	0.67	0.82	0.27	0.68	0.05	3.85	1.95	3.04		1.06		0.96	0.39
ORP	millivolts	-81.5	-85.9	-92.1		-114.5	-119.2	-87.8	78.7	-208.4	51.6	101.4	134.8	166.1	75.1		28.7		83.1	-148.8
pH	SU	7.11	7.62	7.76		7.47	8.09	7.49	7.41	7.5	6.77	6.23	6.41	5.99	6.6		6.31		6.91	6.22
SC	uS/cm	245	187	197		193	186	190	175	154	272	140	170	140	151		189		279	156
TEMP	deg C	12.1	10.3	10		11.9	13	13.3	13.3	12	12.8	6.02	9.1	12.1	14.3		15.7		16.1	11.7
TURB	NTU	2.01	1.56	2.44		3.16	0.9	0.66	0.87	1.43	4.38	3.09	4.96	5.75	4.69		4.78		3.65	4.4

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

Location		GAMW14B									GAMW51				GAMW51B			
Sample Date		2018-06-13		2019-03-05	2019-04-22	2019-06-06	2019-07-24	2019-09-27	2019-10-02	2019-11-20	2018-09-10	2018-10-25	2019-04-26	2019-11-12	2018-09-10	2018-10-25	2019-04-26	2019-11-12
Sample Type		FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.036 J	0.034 J	0.024 J	0.03 J	0.1 U	0.024 J	0.1 U	0.12	0.1 U	0.68	0.58	0.5	0.61	6.9	7.4	7.6	0.028 J
Calcium	mg/L	39	40	32	31	30	31	32	31	30	130	130	140	150	250	240	290	1 U
Chloride	mg/L	7.8	7.9	1.6	1.5		1.3	1.3	1.5	1.3	6.3	3.6	3.6	5.4	62	54	57	57
Fluoride	mg/L	0.1 J	0.11 J	0.13	0.13		0.14	0.13	0.15	0.15	0.44 J	0.41	0.39	0.4	0.79 J	0.8	0.81	0.83
pH	SU		7.29	7.79	7.62	7.52	8.28	7.64	7.16	7.44	8.08	7.69	7.14	6.78	8.72	8.86	7.48	7.15
Sulfate	mg/L	24	25	14	16		11	7.8	7.6	10	130	110	190	240	1300	1600	1400	1500
Total Dissolved Solids	mg/L	180	170	120	160		150	130	120	130	550	530	620	680	2200	2200	2400	2300
CCR Appendix IV																		
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0032 J	0.0031 J	0.0016 J	0.0015 J	0.0017 J	0.0013 J	0.0034 J	0.005 U
Barium	mg/L	0.013	0.013	0.0098	0.0091	0.0084	0.0087	0.0087	0.0093	0.0081	0.16	0.17	0.096	0.1	0.07	0.063	0.085	0.005 U
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.00031 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.0011 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001	0.0011	0.0031	0.003	0.00028 J	0.00022 J	0.001 U	0.001 U
Fluoride	mg/L	0.1 J	0.11 J	0.13	0.13		0.14	0.13	0.15	0.15	0.44 J	0.41	0.39	0.4	0.79 J	0.8	0.81	0.83
Lead	mg/L	0.00048 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.0073 J	0.0052 J	0.0049 J	0.006 J	0.05	0.048	0.064	0.008 U
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.0021 J	0.0021 J	0.0025 J	0.0026 J	0.0026 J	0.0021 J	0.0019 J	0.002 J	0.0022 J	0.028	0.022	0.016	0.018	0.13	0.13	0.18	0.01 U
Radium, Total	pci/L	0.306 U	0.368 U	0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		1.43	0.961	0.536		2.01	2.75	2.74	
Radium-226	pci/L	0.221 U	0.256 U	0.0972 U	0.105 U		0.175 U	0.162 U	0.147 U		0.681 J+	0.635	0.323		1.27 J+	1.46	1.37	
Radium-228	pci/L	0.306 U	0.368 U	0.35 U	0.312 U		0.438 U	0.465 U	0.446 U		0.745	0.354 U	0.381 U		0.741	1.29	1.38	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0011 J	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters																		
DO	mg/L		0.48	0.04	1.53	1.19	1.75	0.65	0.28	0.14	0.31	1.9	1.12	0.09	0.26	1.08	1.69	0.1
ORP	millivolts		-55.9	-124	9.7	-126.1	-33.3	-122.7	115.3	-171.5	-124.4	-247.2	17.2	-191.3	-169.2	-258.6	25.8	-222.3
pH	SU		7.29	7.79	7.62	7.52	8.28	7.64	7.16	7.44	8.08	7.69	7.14	6.78	8.72	8.86	7.48	7.15
SC	uS/cm		248	148	150	144	143	154	153	122	1076	806	661	640	3438	2720	2139	1796
TEMP	deg C		11.6	10.49	11.5	11.7	11.7	12.8	12.6	11.4	15.79	15.08	9.1	14.1	14.43	13.63	10	12.9
TURB	NTU		3.22	1.99	1.11	0.54	0.78	0.37	0.24	1.14	0.94	1	2.91	4.58	2.98	1.49	1.89	3.16

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GAMW57				GAMW57B				GAMW58					GAMW58B			
	Sample Date	2019-07-23	2019-08-29	2019-10-01	2019-11-19	2019-07-23	2019-08-29	2019-10-01	2019-11-19	2019-07-22		2019-08-29	2019-10-01	2019-11-20	2019-07-22	2019-08-29	2019-10-01	2019-11-20
	Sample Type	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N
Chemical Name	Unit																	
CCR Appendix III																		
Boron	mg/L	0.037 J	0.042 J	0.023 J	0.038 J	0.095 J	0.19	0.031 J	0.16	0.043 J	0.046 J	0.047 J	0.028 J	0.037 J	0.047 J	0.043 J	0.029 J	0.026 J
Calcium	mg/L	22	25	23	24	46	48	39	46	10	10	13	38	8.8	38	39	39	36
Chloride	mg/L	1.5	1.2	1 J+	1.3	9.4	12	8.9 J+	11	1.2	1.3	1.1	3.9 J+	1.5	4	3.8	3.9 J+	3.7
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.14	0.13	0.14 J+	0.14	0.32	0.31	0.31	0.16 J+	0.29	0.17	0.17	0.17 J+	0.16
pH	SU	7.42	7.7	7.58	7.61	8.21	7.4	7.67	7.53		5.42	5.82	6.18	5.02	8.74	8.33	7.57	7.49
Sulfate	mg/L	33	35	31 J+	34	23	18	17 J+	14	43	43	41	25 J+	40	24	21	26 J+	25
Total Dissolved Solids	mg/L	150	120	120	130	210	220	190	190	95 J+	100 J+	110	190	100	180	200	180	160
CCR Appendix IV																		
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00063 J	0.002 U
Arsenic	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.00075 J	0.00076 J	0.005 U	0.005 U	0.005 U	0.005 U	0.00098 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	0.012	0.008	0.006	0.0088	0.024	0.029	0.018	0.025	0.055	0.055	0.047	0.017	0.058	0.018	0.02	0.017	0.017
Beryllium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0011	0.0013	0.00097 J	0.001 U	0.0015	0.00035 J	0.001 U	0.00055 J	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00031 J	0.00035 J	0.001 U	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.0014 J	0.002 U	0.002 U	0.002 U	0.0021	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.00074 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.011	0.011	0.01	0.001 U	0.0096	0.00021 J	0.00019 J	0.001 U	0.001 U
Fluoride	mg/L	0.031 J	0.034 J	0.033 J+	0.031 J	0.14	0.13	0.14 J+	0.14	0.32	0.31	0.31	0.16 J+	0.29	0.17	0.17	0.17 J+	0.16
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0011	0.001	0.0011	0.001 U	0.0012	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.008 U	0.008 U	0.008 U	0.008 U	0.0029 J	0.0058 J	0.008 U	0.0044 J	0.0018 J	0.002 J	0.0017 J	0.0028 J	0.0021 J	0.0031 J	0.0025 J	0.0032 J	0.0019 J
Mercury	mg/L	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	0.016	0.022	0.0055 J	0.024	0.0061 J	0.011	0.0028 J	0.0073 J	0.01 U	0.01 U	0.0016 J	0.0059 J	0.0017 J	0.023	0.02	0.0069 J	0.011
Radium, Total	pci/L	0.419 U	0.453 U	0.548 U		0.502	0.435 U	0.543 U		0.54 U	0.599 U	0.457 U	1.2		0.504 U	0.506 U	0.603 U	
Radium-226	pci/L	0.161 U	0.118 U	0.193		0.213 U	0.233	0.295		0.286 U	0.282 U	0.243	0.307		0.232 U	0.118 U	0.174	
Radium-228	pci/L	0.419 U	0.453 U	0.548 U		0.492 U	0.435 U	0.543 U		0.54 U	0.599 U	0.457 U	0.895		0.504 U	0.506 U	0.603 U	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.001 U	0.0003 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00038 J	0.001 U	0.001 U	0.00064 J	0.0005 J	0.001 U	0.00067 J	0.001 U
Sample Parameters																		
DO	mg/L	5.56	3.89	3.94	2.67	1.12	0.78	0.35	0.22		4.29	1.88	0.63	3.38	1.21	8.56	0.43	0.19
ORP	millivolts	54.6	43.1	126.2	-127	-98.1	-109.6	94.6	-211.9		114.8	95.4	102.8	-53.6	-165	-248.6	90	-179.2
pH	SU	7.42	7.7	7.58	7.61	8.21	7.4	7.67	7.53		5.42	5.82	6.18	5.02	8.74	8.33	7.57	7.49
SC	uS/cm	127	152	133	124	237	277	213	190		8.6	99	105	67	204	214	204	168
TEMP	deg C	12.4	12.3	13.3	11.6	11.8	11.8	12.5	10.8		13.1	13.8	14.5	12	11	12.2	12.8	11.1
TURB	NTU	4.81	2.82	2.9	3.06	4.9	4.39	0.82	1.28		4.02	1.8	0.61	1.98	4.35	2.75	0.49	1.02

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.

"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 2: Groundwater Analytical Data
Waste Disposal Area Alternative
NIPSCO LLC R. M. Schahfer Ger

	Location	GAR|W59		GAR|W59B		GAR|W60			GAR|W60B	
	Sample Date	2019-07-19	2019-11-11	2019-07-19	2019-11-11	2019-07-22	2019-11-11		2019-07-19	2019-11-11
	Sample Type	N	N	N	N	N	FD	N	N	N
Chemical Name	Unit									
CCR Appendix III										
Boron	mg/L	1.2	1.4	4.8	5.4	2.1	1.4	1.5	8.1	7.2
Calcium	mg/L	250	280	310	330	330	350	350	280	300
Chloride	mg/L	6.5	9.8	38	44	7.8	11	11	19	18
Fluoride	mg/L	0.65	0.63	0.46	0.46	0.65	0.64	0.66	0.37	0.39
pH	SU	7.51	7.29	7.83	7.47	7.34		7.15	8.41	7.78
Sulfate	mg/L	580	770 J-	1400	1600 J-	890	880 J-	890 J-	1200	1200 J-
Total Dissolved Solids	mg/L	1100	1200	2100	2100	1400	1500 J	780 J	1700	1600
CCR Appendix IV										
Antimony	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.0033 J	0.0024 J	0.0015 J	0.00081 J	0.005 U	0.0009 J	0.00086 J	0.00088 J	0.005 U
Barium	mg/L	0.1	0.088	0.065	0.058	0.044	0.036	0.036	0.06	0.063
Beryllium	mg/L	0.001 U	0.00044 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cobalt	mg/L	0.0005 J	0.00081 J	0.0003 J	0.00023 J	0.0011	0.0019	0.002	0.00021 J	0.00024 J
Fluoride	mg/L	0.65	0.63	0.46	0.46	0.65	0.64	0.66	0.37	0.39
Lead	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Lithium	mg/L	0.015	0.016	0.019	0.019	0.0068 J	0.008 U	0.008 U	0.0067 J	0.008 U
Mercury	mg/L	0.0002 U	0.0002 UJ	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 UJ
Molybdenum	mg/L	0.03	0.046	0.06	0.092	0.042	0.035	0.035	0.37	0.39
Radium, Total	pci/L	1.11		2.3		0.504 U			2.25	
Radium-226	pci/L	0.607		0.981		0.298 U			1.63	
Radium-228	pci/L	0.499		1.32		0.504 U			0.622	
Selenium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Thallium	mg/L	0.001 U	0.00049 J	0.001 U	0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Sample Parameters										
DO	mg/L	0.77	0.21	0.55	0.11	1.06		0.32	0.67	0.14
ORP	millivolts	-94.6	154.8	-117.3	-214.4	23.5		-152.8	-160.7	-202.1
pH	SU	7.51	7.29	7.83	7.47	7.34		7.15	8.41	7.78
SC	uS/cm	1264	1132	2082	1837	1437		1182	1643	1320
TEMP	deg C	20.9	18	16	14.3	17.6		15.3	15.8	12.8
TURB	NTU	1.5	2.41	4.84	2.55	2.46		2.11	4.1	3.83

Note:
N = normal
FD = field duplicate
mg/L = milligrams per liter
uS/cm = micro Siemens per centimeter
deg C = degrees Celsius
NTU = Nephelometric Turbidity Units
SU = Standard Units
pCi/L = picocuries per liter

"U" = Indicates the result was not detected above the method detection limit (MDL) for the sample; the quantitation limit (RL) is provided.

"J" = Indicates the result is estimated.
"J+" = Indicates the result is estimated may be biased high.
"J-" = Indicates the result is estimated and may be biased low.

"UJ" = Indicates the result was not detected above the MDL, the estimated RL is provided.
"O" = Indicates the result was identified as an outlier and removed from the background data set.

Table 3: Porewater Analytical Results
Waste Disposal Area Alternative Source Demonstration
NIPSCO LLC R. M. Schahfer Generating Station

Location	GAPIEZ04		
Sample Date	2018-08-09	2018-09-13	2018-10-30
Fraction	D	T	T
Analyte			
Alkalinity, Total	210 J	220	220
Boron	0.86	0.71	0.86
Calcium	140	160	170
Chloride	19	21	18
Lithium	0.008 U	0.008 U	0.008 U
Magnesium	20	20	20
Molybdenum	0.0028 J	0.0028 J	0.0031 J
pH	7.35	7.27	7.71
Potassium	4.8 J	5	4.8 J
Sodium	28	22	27
Sulfate	280	280	170
Total Dissolved Solids	670	660	710

Notes:
Results (except pH) reported in milligrams per liter (mg/L)
pH results reported in standard units (SU)
D: Dissolved
T: Total
J: Indicates result is estimated.
U: Indicates result was not detected above the laboratory method detection limit, the laboratory reporting limit is provided.

Prepared by: DFSC
Checked by: KMC
Reviewed by: JBG

Figures

LEGEND

Approximate Property Line

0 0.75 1.5

1 " = 0.75 miles Miles

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT

NORTHERN INDIANA PUBLIC SERVICE COMPANY
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SITE LOCATION MAP

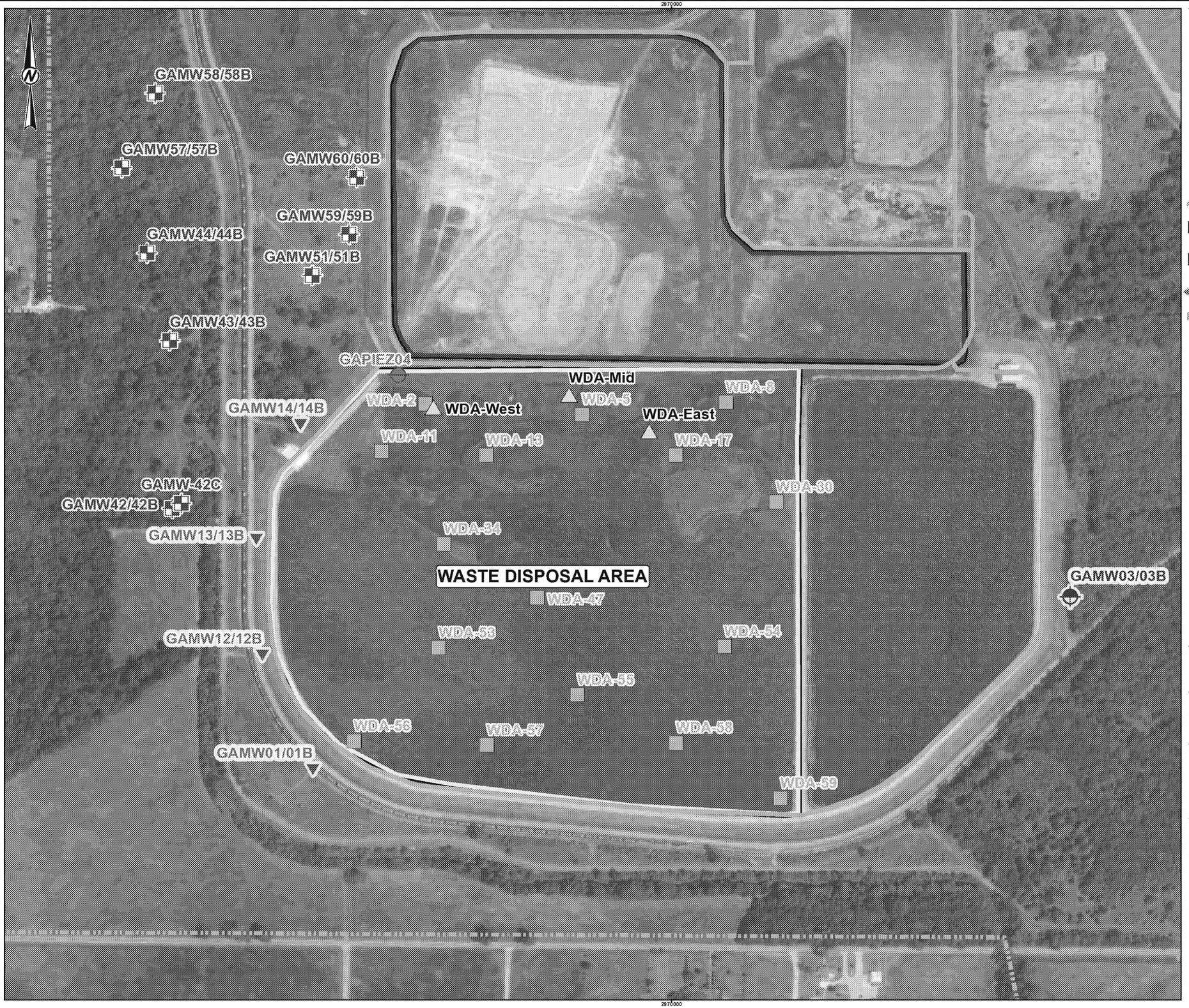
CONSULTANT

GOLDER

YYYY-MM-DD	1/31/2019
DESIGNED	DFS
PREPARED	SHL
REVIEWED	JSP
APPROVED	MAH

PROJECT NO.	CONTROL	REV.	FIGURE
164817101	A	0	1

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



LEGEND

- Background Monitoring Well
- Downgradient Monitoring Well
- Assessment Monitoring Well
- Porewater Sample Location
- SPT Boring Location
- CCR Source Material Sample Location
- Slurry Wall
- CCR Unit
- Approximate Extent of Inactive Retired Waste Disposal Area
- Generalized Groundwater Flow Directions
- Approximate Property Line

0 800

1 " = 400 feet Feet

NOTE(S)

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT

NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC

PROJECT

ALTERNATIVE SOURCE DEMONSTRATION REPORT
R.M. SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

TITLE

SAMPLE LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	5/5/2020
DESIGNED	DFS
PREPARED	SHL
REVIEWED	DFS
APPROVED	JBG

PROJECT NO.	CONTROL	REV.	FIGURE
19121567	A	0	2

GOLDER

golder.com

APPENDIX L

Structural Stability and Safety Factor Assessment Waste Disposal Area 40 CFR Part §257.73(d) and (e), dated October 5, 2016

NIPSCO R.M. SCHAHFER GENERATING FACILITY

WASTE DISPOSAL AREA (WDA)

STRUCTURAL STABILITY AND SAFETY FACTOR ASSESSMENT

Wheatfield, Indiana

Pursuant to 40 CFR 257.73(d) & 257.73(e)

Submitted To: Northern Indiana Public Service Company
2723 East 1500 North
Wheatfield, IN 46392

Submitted By: Golder Associates Inc.
15851 South US 27, Suite 50
Lansing, MI 48906 USA

October 5, 2016

Project No. 1651599

A world of capabilities delivered locally

Golder Associates

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.73(d)(3) & 257.73(e)(2)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations Section 257.73 (40 CFR Part 257.73), I attest that this Structural Stability and Safety Factor Assessment Report is accurate has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.73(d) periodic structural stability assessments and 40 CFR Part 257.73(e) periodic safety factor assessments.

Golder Associates Inc.

Signature

October 5, 2016

Date of Report Certification

Tiffany Johnson, PE

Name

PE 11500730

Indiana Professional Engineer License Number

TIFFANY D. JOHNSON
REGISTERED
No. PE11500730
STATE OF
INDIANA
PROFESSIONAL ENGINEER

10/5/16

Table of Contents

Professional Engineer Certification Statement [40 CFR 257.73(d)(3) & 257.73(e)(2)] C
1. INTRODUCTION 1
1.1 Purpose 1
1.2 WDA Background 1
1.3 Previous Evaluations 2
2. SITE DESCRIPTION 4
2.1 SUBSURFACE CONDITIONS 4
2.2 Physical Properties of Foundation Materials 4
2.3 Engineering Properties of Foundation Materials 4
2.4 Waste Disposal Area Design and Construction Details 6
3. STRUCTURAL STABILITY ASSESSMENT - § 257.73(D)(1)(I)-(VII) 8
3.1 Foundations and Abutments - §257.73(d)(1)(i) 8
3.2 Slope Protection - §257.73(d)(1)(ii) 8
3.3 Dikes (Embankment) - §257.73(d)(1)(iii) 9
3.4 Vegetated Slopes - §257.73(d)(1)(iv) 9
3.5 Spillways - §257.73(d)(1)(v) 9
3.6 Hydraulic Structures - §257.73(d)(1)(vi) 11
3.7 Downstream Slopes Adjacent to Water Body - §257.73(d)(1)(vii) 11
3.8 Structural Stability Deficiencies - §257.73(d)(2) 11
4. SAFETY FACTOR ASSESSMENT - § 257.73(E) 12
4.1 Slope Stability Analysis 12
4.1.1 Cross-Section Analyzed 13
4.1.2 Geotechnical Material Properties 13
4.1.3 Seismic analysis 13
4.1.4 Factor of Safety Results 13
4.2 Liquefaction Potential Assessment 14
5. CONCLUSIONS AND RECOMMENDATIONS 15
6. CLOSING 16
7. REFERENCES 17

List of Tables

Table 1 Previous Evaluations Related to Structural Stability Assessment
Table 2 Geotechnical Model Material Properties
Table 3 Slope Stability Analysis Results Summary
Table 4 Hydrology and Hydraulics Analysis Results
Table 5 Slope Stability Analysis Results Summary

List of Figures

Figure 1 Site Location Map
Figure 2 Site Plan (with CPT Borehole Locations Noted)
Figure 3 Waste Disposal Area
Figure 4 Typical Cross Section
Figure 5 Typical Geotechnical Model at the Waste Disposal Area Embankment

List of Appendices

Appendix A Slope Stability Analysis Results
Appendix B Liquefaction Potential Analysis Results

1. INTRODUCTION

1.1 Purpose

The United States Environmental Protection Agency (EPA) published 40 CFR Part 257 – Coal Combustion Residuals (CCR) Final Rule (CCR RCRA Rule) in April 2015 to regulate the solid waste management of CCR generated at electric utilities. The CCR RCRA Rule requires that existing CCR surface impoundments meeting the requirements of Section 257.73(b) conduct initial and periodic structural stability assessments in accordance with Section 257.73(d), and safety factor assessments in accordance with Section 257.73(e). Per rule 257.73(b), this initial stability assessment and factor of safety is required for all CCR units with either (1), a height of five feet or more and a storage volume of 20 acre-feet or more; or (2) a height of 20 feet or more. At the Northern Indiana Public Service Company (NIPSCO), R.M. Schahfer Generating Station (RMSGS), the only CCR unit which meets this criteria is the Waste Disposal Area (WDA).

This report provides the initial structural stability assessment and the safety factor assessment for the WDA surface impoundment at the NIPSCO RMSGS, located in Wheatfield, Indiana, see Figures 1 and 2. A hazard potential classification was conducted for the WDA pursuant to Section 257.73(a)(2), which resulted in a high hazard classification thereby requiring the probable maximum flood (PMF) elevation to be used in structural assessment.

1.2 WDA Background

The WDA was designed by Sargent & Lundy Engineers of Chicago, Illinois in 1982. The WDA is formed by a ring earth-fill dike with slurry trench core that is approximately 17 feet high and 7,540 feet long (including the common embankment) with a crest elevation of 681 feet above mean sea level (Marbach, 2011). The WDA was constructed for NIPSCO, put in service in 1982, and has been continuously owned and operated by NIPSCO.

The WDA accepts sluiced bottom ash and boiler slag CCR and various sump discharges from the generating station. The sluiced CCR enters the WDA via elevated pipes at the north side and also via buried pipes located at the northwest corner, the pipes do not penetrate the slurry wall core. Water exits the WDA via an overflow weir, to the Recycle Basin, or through the auxiliary spillway located at the northwest side. The overflow weir is located at the southern end of the east side of the WDA. The auxiliary spillway consisting of two, 24 inch diameter corrugated steel pipes with a concrete down-slope channel transitioning to a rip-rap lined downstream channel, is located near the northwest corner of the WDA. The east side of the WDA is common with the west side of the adjacent Recycle Basin. A survey of the WDA was performed by Marbach, Brady and Weaver, Inc. in December 2011 (Marbach, 2011), see Figure 3.

1.3 Previous Evaluations

A list of reviewed documents pertinent to the structural stability assessment is provided in Table 1.

Table 1: Previous Evaluations Related to Structural Stability Assessment

Document	Date	Author
Various construction drawings	1982	Sargent & Lundy Engineers
Assessment of Dam Safety of Coal Combustion Surface Impoundments, NIPSCO, RM Schahfer Generating Station	July 2010	CDM for the EPA
Report on Inspection of The Waste Disposal Area	January 2011	Golder Associates Inc.
Final Hazard Classification Review Report – NIPSCO Schahfer Generating Station	January 2011	Golder Associates Inc.
Embankment Elevation Survey, Waste Disposal Area and Recycle Pond, NIPSCO Schahfer Generating Station	December 2011	Marbach, Brady and Weaver, Inc.
Schahfer Spillway Hydrologic and Hydraulic Evaluation	December 2011	Golder Associates Inc.
Final Geotechnical Investigation and Embankment Stability Analyses	June 2012	Golder Associates Inc.
Report on Inspection of The Waste Disposal Area	September 2012	Golder Associates Inc.
Construction in a Floodway Permit Application, NIPSCO R.M. Schahfer Generating Station	November 2012	Golder Associates Inc.
Waste Disposal and Recycle Ponds Hydrographic Survey. NIPSCO R.M. Schahfer Generating Station	December 2012	DLZ Industrial, LLC (DLZ)
Basin Operation, Maintenance and Inspection Plan, NIPSCO R. M. Schahfer Generating Station	February 2013	Golder Associates Inc.
Emergency Action Plan, Final Settling Basin (FSB), Intake Settling Basin (ISB), Waste Disposal Area (WDA), Recycle Basin (RB), Northern Indiana Public Service Company (NIPSCO), R.M. Schahfer Generating Station	February 2013	Golder Associates Inc.

State of Indiana Department of Natural Resources (DNR), Certificate of Approval, After-the-Fact, Construction in a Floodway	April 23, 2013	State of Indiana DNR
Report on Inspection of The Waste Disposal Area	April 2014	Golder Associates Inc.
Construction Observation Documentation Report, Surface Water Basin Erosion Repairs, NIPSCO R.M. Schahfer Generating Station	October 2014	Golder Associates Inc.
First Annual RCRA CCR Unit Inspection Report – NIPSCO Schahfer Generating Station	January 2016	Golder Associates Inc.
Hazard Potential Classification Assessment and Visual Inspection Report – RCRA CCR Units, Waste Disposal Area, Drying Area, Material Storage Runoff Basin, & Metal Cleaning Waste Basin – Surface Impoundments, NIPSCO, R.M. Schahfer Generating Station	September 2016	Golder Associates Inc.

.

2. SITE DESCRIPTION

2.1 SUBSURFACE CONDITIONS

Soil borings and laboratory testing programs were completed in 2010, 2011 and 2012 around the WDA to develop site specific stratigraphy and engineering material properties. Golder performed a geotechnical investigation of the WDA in 2011 and prepared the *2012 Geotechnical Investigation and Embankment Stability Analyses* report, dated August 27, 2012. Topographically, the area is generally flat to gently rolling with isolated hills. In the northern and northeastern portions of Jasper County where the WDA is located, the soil is sandy, and is interspersed with sandy knolls and ridges. The northern part of the county is covered by Pleistocene aged, alluvial sand overlying shale of Carboniferous age.

The WDA is located in a rural area and is surrounded by farmland, forested areas, and isolated farm buildings to the south, and by the generating station and other infrastructure to the north. The Recycle Basin is contiguous to the east. The Drying Area is contiguous to the north.

2.2 Physical Properties of Foundation Materials

Based on the site specific available boring logs (Golder, 2012), the site is underlain by a relatively uniform deposit of coarse to fine sand with traces of gravel and silt overlying shale bedrock. Locally, there is a clayey or fine-grained deposit just above the shale bedrock, but this stratum is not evident at all boring locations.

Based on the available construction drawings (Sargent and Lundy, 1982), the WDA embankment is constructed of the native sand materials obtained from on-site borrow areas. The embankment footprint was stripped to a depth of approximately 1 foot below natural grade prior to embankment construction. The embankment fill placement and compaction was completed prior to construction of the slurry trench, which is located along the embankment centerline. The slurry trench is approximately 1.5 feet wide, and extends from 2 feet below the embankment crest down to the shale bedrock. The interior of the WDA is at approximately original ground surface elevation less the approximate 1 foot strip depth. The WDA's inlet and outlet pipes are located above the top of the slurry trench and do not penetrate it.

2.3 Engineering Properties of Foundation Materials

Historic construction drawings and technical specifications suggest that the WDA was constructed with reasonable and sound construction practices. Select drawings (Sargent and Lundy, 1982) can be attributed to the WDA, and these drawings indicate reasonable construction configurations, e.g. 3 horizontal to 1 vertical (3H:1V) upstream and downstream side slopes; embankment constructed of controlled compacted fill; central slurry trench extending down to shale bedrock at depth; inlet and outlet pipes that do not penetrate the slurry trench; rip-rap with bedding on the upstream slope; reinforced concrete structures at

the primary and auxiliary spillway, and inlet and outlet pipes; and detailed surface water control around the structure.

The available historic construction drawings also contain some geotechnical data indicating relatively uniform embankment foundation conditions at the WDA consisting of coarse to fine sand with traces of gravel and silt down to shale bedrock at a depth of approximately 40 feet.

The *Final 2012 Geotechnical Investigation and Embankment Stability Analyses*, prepared by Golder, was referenced during the file review for the WDA. Based on the *2012 Geotechnical Investigation and Embankment Stability Analyses (Golder, 2012),* cone penetration soundings were conducted in June 2011 at the WDA. Six cone penetration test (CPT) probes (noted at CPT-39 though CPT-44 on Figure 2) were advanced in and around the WDA. One CPT probe (CPT-38) was advanced in the adjacent Recycle Basin, which was built at the same time and has the same construction. CPT-38 was deeper than the 6 CPT probed advanced in the WDA, so CPT-38 was included in this analysis for the WDA. The subsurface conditions encountered during the June 2011 investigation are reasonably consistent with those encountered during the previous CPT probing performed at the site, and also with information available from previous historic geotechnical information at the site. The exploration indicated subsurface conditions are dense to very dense sand to silty sand from ground surface to the full depth of the exploration.

Laboratory testing was also performed on samples collected during the geotechnical investigation. The test results indicate a relatively uniform deposit of poorly graded, fine sand with typically less than 10 percent medium sand and less than 10 percent fines. The material is variously classified as a poorly graded sand with little or no fines (SP); a silty sand or sand silt mixture (SM); or a "SP-SM" which is a borderline classification used for materials with between 5 percent and 12 percent fines. The measured water contents ranged from approximately 10 percent to 20 percent. The distribution of water content with depth indicates with reasonable certainty where the water table is in the field. Laboratory samples consistently showed lower water contents in the upper portions of holes, and higher water contents in the lower portions.

The geotechnical model for the WDA is dense silty sand (embankment fill) overlying dense silty sand (subgrade). Figure 4, attached, shows the typical designed cross section of the WDA. Figure 5, attached, shows the geotechnical model for the WDA to be used for the factor of safety analysis. It should be noted that for the purposes of the factor of safety analysis prepared for the WDA and described in Section 4 of this report, the designed crest elevation (681 feet above mean sea level (ft MSL)) was used as the highest elevation found on the WDA, which is a worst case scenario. The surveyed lowest crest elevation (680 ft MSL, Marbach, 2011) was used in the spillway capacity calculations, because that is a worst case scenario for the spillway capacity calculations.

Material properties of each of the modeled layers are included in Table 2 below. These properties are based on the geotechnical investigation and associated laboratory testing that was performed by Golder (Golder, 2012).

Table 2: Geotechnical Model Material Properties

Material	Internal Friction Angle (deg.)	Peak Cohesion (psf)	Dry Unit Weight (pcf)	Saturated Unit Weight (pcf)	Undrained Shear Strength (psf)	Layer Thick-ness (ft)
Embank-ment Fill	42	0	125	135	NA	Varies
Topsoil	35	0	120	120	NA	0.5
Existing Subgrade	39	0	110	125	NA	Varies
Slurry Wall	NA	300	120	NA	NA	Varies
Riprap	45	0	140	145	NA	1
Crushed Stone	45	0	140	145	NA	Varies
Loose Silty Sand Subgrade	37	0	125	132	NA	Varies
Shale	45	0	145	150	0	Varies

Notes: deg. = degrees, psf = pounds per square foot, pcf = pounds per cubic foot, ft = feet, and cm/s = centimeters per second.

2.4 Waste Disposal Area Design and Construction Details

Available applicable Sargent & Lundy (1982) construction drawings provided by NIPSCO were reviewed and utilized during the preparation of this report.

A crest survey was performed the week of December 19, 2011 by Marbach, Brady & Weaver, Inc. (Marbach 2011). Survey data was obtained at 50 foot intervals along the crest centerline and embankment cross-section data was obtained on 500 foot intervals. Note that the 2011 survey reference vertical datum is North American Vertical Datum (NAVD) 88, while the original Sargent & Lundy construction drawing reference is U.S. Geological Survey (USGS) 1929 vertical datum adjustment.

The WDA was constructed for NIPSCO, put in service in 1982, and has been continuously owned and operated by NIPSCO. The WDA was designed by Sargent & Lundy Engineers of Chicago, Illinois. The WDA is formed by a ring dike approximately 7,540 feet long (including the common embankment). The constructor of the WDA is not known. Salisbury Engineering of Griffiths, Indiana performed at least some of the historical geotechnical soil borings and geotechnical laboratory testing associated with the WDA

geotechnical investigation and subsurface characterization. An additional geotechnical investigation was performed by Golder in 2011/2012.

A general description of the WDA is presented in Section 1.2. The location of the WDA relative to the generating station and surrounding structures is shown on Figures 1 and 2, attached.

SIZE AND PHYSICAL DATA

Designed Crest Elevation:	681 ft MSL (USGS 29) based on construction drawings
Current Lowest Crest Elevation:	680 ft MSL based on the December 2011 (Marbach, 2011) crest survey (NAVD 88)
Surrounding Ground Elevation:	Approximately 664 ft MSL
High Water Level:	678.9 ft MSL based on invert elevations of spillway pipes
Height:	17 feet
Surface Area:	75.5 acres
Reservoir Volume:	1,530 acre-feet

3. STRUCTURAL STABILITY ASSESSMENT - § 257.73(D)(1)(I)-(VII)

The CCR Rule requires an initial and periodic structural stability assessments be conducted by a qualified professional engineer (QPE) to document whether the design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater that can be impounded therein. The following sections provide documentation on the initial structural stability assessment and rely mainly on the recent and historic annual inspections performed at the site. The most recent inspection was completed by Golder on June 2, 2016 for the initial structural stability assessment (Golder, September 2016).

3.1 Foundations and Abutments - §257.73(d)(1)(i)

Based on the available construction drawings (Sargent and Lundy, 1982), the WDA embankment is constructed of the native sand materials obtained from on-site borrow areas. The embankment footprint was stripped to a depth of approximately 1 foot below natural grade prior to embankment construction. The embankment fill placement and compaction was completed prior to construction of the slurry trench, which is located along the embankment centerline. The slurry trench is approximately 1.5 feet wide, and extends from 2 feet below the embankment crest down to the shale bedrock. The interior of the WDA is at approximately original ground surface elevation less the approximate 1 foot strip depth. The WDA's inlet and outlet pipes are located above the top of the slurry trench and do not penetrate it.

There has been no indication of foundational or abutment instability or movement in recent or historic site inspections and; therefore, the foundation soils and abutments are considered stable.

3.2 Slope Protection - §257.73(d)(1)(ii)

The downstream slope of the WDA embankment is protected from erosion and deterioration by the establishment of a vegetative cover. The vegetative cover is inspected by NIPSCO personnel weekly for signs of erosion, seepage, animal burrows, sloughing, and plants that could negatively impact the embankment. The June 2016 inspection did not identify items relating to slope protection that required investigation or repair and the downstream slopes of the WDA are not subjected to wave or sudden drawdown effects. To reduce the possible impact of rising water surface elevations, waves, or ice sheets, upstream shoreline rip-rap protection has been installed along the upstream slope of the dike. Additionally, the downstream and upstream slopes are inspected weekly for erosion, signs of seepage, animal burrows, sloughing, and vegetation that could negatively impact the embankment. The 2016 annual inspection report did not identify any items relating to slope protection that required investigation or repair. The existing slope protection measures are considered adequate to provide against surface erosion, wave action, and adverse effects of sudden drawdown.

3.3 Dikes (Embankment) - §257.73(d)(1)(iii)

Based on the available construction drawings (Sargent and Lundy, 1982), the WDA embankment is constructed of the native sand materials obtained from on-site borrow areas. The embankment footprint was stripped to a depth of approximately 1 foot below natural grade prior to embankment construction. The embankment fill placement and compaction was completed prior to construction of the slurry trench, which is located along the embankment centerline. The slurry trench is approximately 1.5 feet wide, and extends from 2 feet below the embankment crest down to the shale bedrock. The interior of the WDA is at approximately original ground surface elevation less the approximate 1 foot strip depth. The WDA's inlet and outlet pipes are located above the top of the slurry trench and do not penetrate it. Based on the relative density of the material encountered during the investigations, historic inspections, recent observations, and results of the stability analysis; the embankment dikes are considered sufficient to withstand the range of loading conditions in the WDA.

3.4 Vegetated Slopes - §257.73(d)(1)(iv)

The EPA has vacated the requirement that vegetative cover on surface impoundment dikes be maintained at no more than six inches. At the time of the June inspection, the WDA's downstream slopes were adequately covered with appropriate vegetation that was well maintained. A new rule establishing requirements relating to the use of vegetation as slope protection for CCR surface impoundments is still pending.

3.5 Spillways - §257.73(d)(1)(v)

The principal spillway of the WDA is considered the overflow weir which is hydraulically linked to the adjacent Recycle Basin. The overflow weir was visually inspected during the June 2016 inspection, and is generally in good condition where visible. The overflow weir is located at the southeast side of the WDA where it connects to the Recycle Basin and is constructed of reinforced concrete (based on historical construction drawing review). Available drawings indicate the outlet conduit is a 36 inch diameter steel pipe with an energy dissipating reinforced concrete structure at the outlet end. Much of this structure is buried or was submerged and could not be inspected.

The auxiliary spillway is considered the two 24 inch diameter corrugated metals pipes (CMPs) located at the northwest side of the WDA, and were observed to be in acceptable condition. The 24 inch diameter CMPs are located side by side and at the outlet end there is a concrete downslope channel. Below the concrete downslope channel is a rip-rap lined channel leading to a perimeter ditch. At the time of the June 2016 inspection, the water level in the WDA was observed at approximately 2 feet below the invert of the inlet ends of the pipes.

A hydrologic and hydraulic analysis was completed for the WDA as part of the requirements for CCR Rule 257.73(d)(1)(v)(B) and 257.82. Per the CCR Rule, the combined capacity of all spillways must adequately manage flow during and following peak discharge from a:

- Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or
- 1000-year flood for a significant hazard potential CCR surface impoundment; or
- 100-year flood for a low hazard potential CCR surface impoundment.

Since the WDA has been classified as having a high hazard potential (Golder, September 2016), it is required to manage the flow during and following the peak discharge from a PMF event. A HEC-HMS (USACE, 2015) analysis and wave analysis was performed for the WDA. Since the principal spillway is an interconnecting pipe to the Recycle Basin, from which water is pumped as a discharge, the only applicable spillway for the WDA is the auxiliary spillway. Therefore, the analysis was performed using the auxiliary spillway, which includes the two 24 inch diameter CMP's with the invert elevation 678.9 ft MSL, as the only spillway available to manage the PMF event.

Results of the hydrology and hydraulics analysis of the WDA are summarized below in Table 4. These include the results of HEC-HMS (USACE, 2015) modelling analysis and the results of the wave action analysis.

Table 4: Hydrology and Hydraulics Analysis Results

Depth of Precipitation (in) for a PMF Event	31.9
WDA Catchment Area (acres)	83.5
WDA Lowest Crest Elevation (ft MSL, Marbach, 2011)	680
Invert Elevation of Auxiliary Spillway (ft MSL)	678.9
Maximum Inflow from Direct Precipitation (cubic feet per second (cfs))	3,668
Maximum Combined Inflow (cfs) [1]	3,708
Maximum WDA Outflow through Spillway (cfs)	37.9
Maximum Water Surface Elevation (ft MSL) [2]	682.2
Height of Wave Action (feet)	1.28
Net Freeboard during Design Storm Event (feet) [3, 7]	-3.4

Notes:
[1] Includes direct precipitation and 40 cfs from overflow weir.
[2] Assumes extra storage capacity is available above embankment crest (e.g. there is no outflow from the impoundment due to overtopping)

[3] Negative freeboard indicates that the embankment will overtop.
[5] All spillway configurations assume 2% longitudinal slope at embankment crest.
[6] All spillway cross-sections are trapezoidal.
[7] Net freeboard = minimum freeboard required for storm event plus the height of wave action.

As shown in Table 4, the current configuration of the WDA's auxiliary spillway is not compliant with 40 CFR 257.73(d)(1)(v). It is Golder's recommendation that NIPSCO explore options to improve the WDA emergency spillway to satisfy those requirements.

3.6 Hydraulic Structures - §257.73(d)(1)(vi)

Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

3.7 Downstream Slopes Adjacent to Water Body - §257.73(d)(1)(vii)

The downstream slopes of the WDA are not adjacent to water bodies and therefore rapid-drawdown was not considered a potential mechanism for structural instability in the exterior slope.

3.8 Structural Stability Deficiencies - §257.73(d)(2)

In accordance with the CCR Rule 257.73(d)(2), the periodic assessment must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

Based on structural stability assessment contained herein, one structural stability deficiency was identified as follows:

- The auxiliary spillway is not sized to manage the flow produced by a PMF event.

As a result, it is recommended that NIPSCO remedy this deficiency by improving the size of the auxiliary spillway, operationally controlling the water level in the WDA, or implementing an equivalent engineering or operational control.

4. SAFETY FACTOR ASSESSMENT - § 257.73(E)

According to Section 257.73(e)(1) of the CCR RCRA Rule, periodic safety factor assessments must be conducted for each CCR unit. The safety factor assessment must document the calculated factor of safety for the dike slopes under the following scenarios:

- Maximum Pool Storage - Section 257.73(e)(1)(i) – Defined as the long-term, maximum storage pool (or operating) elevation and equal to the outlet elevation (elevation = 678.9 ft MSL) for this facility; static factor of safety must equal or exceed 1.5
- Maximum Pool Surcharge - Section 257.73(e)(1)(ii) – Defined as the temporary raised pond level above the maximum pool storage elevation due to an inflow design flood (681 ft MSL); static factor of safety must equal or exceed 1.4
- Seismic Loading Conditions - Section 257.73(e)(1)(iii) – Seismic factor of safety must equal or exceed 1.0
- Liquefaction Potential - Section 257.73(e)(1)(iv) – Only necessary for dikes constructed of soils that have susceptibility to liquefaction; factor of safety must equal or exceed 1.2

The following sections provide details on the factor of safety assessment and methods used to calculate the slope factor of safety and results of the analysis.

4.1 Slope Stability Analysis

Slope stability analyses were performed to evaluate the slope factor of safety for each of the maximum pool storage, maximum pool surcharge, and seismic loading scenarios. In the Preamble to Sections 257 and 261 of the CCR RCRA Rule *General Safety Factor Assessment Considerations* [VI (E)(3)(b)(ii)(a)], limit equilibrium methods are identified as conventional analysis procedures for calculating the factor of safety and specific common methods are identified, including the Spencer and Janbu method of slices (Abramson et al. 2002), which was used for this stability analysis.

The specific analysis types are:

- Steady state seepage, Maximum Pool Storage (257.73 (e)(1)(i)), downstream slope
- Steady state seepage, Maximum Pool Surcharge (257.73 (e)(1)(ii)), downstream slope
- Seismic (pseudo-static) with Maximum Pool Storage, steady state seepage, (257.73(e)(1)(iii)), downstream slope

The steady state analyses were performed with the fully developed phreatic surface as indicated by the site geotechnical investigation and as extrapolated based on inferred subsurface conditions. This phreatic surface begins at the upstream water level, extends horizontally to the upstream side of the slurry wall, then extends downward at a steep angle through the slurry wall to near the elevation where the groundwater level was encountered in exploratory holes in the downstream side of the embankment. The inferred

piezometric levels in each model are illustrated in Appendix A. Drained shear strength parameters were used in all of the slope stability analyses for all of the material types except the slurry wall.

4.1.1 Cross-Section Analyzed

The critical section of the exterior dike was determined by using the existing topography (2011), and considering the interpreted soil profile from the subsurface investigations, and phreatic surface. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions.

The critical section used for the slope stability analysis is shown on Figure 4.

4.1.2 Geotechnical Material Properties

Based on the subsurface investigations and laboratory testing, representative material properties were selected for use in the stability analysis. These properties are included in Table 2 - Geotechnical Model Material Properties.

4.1.3 Seismic analysis

A pseudo static seismic analysis was performed on the downstream slope of the WDA. The analyses were performed with the same steady state, fully developed phreatic surface in the embankments as was used in the initial two cases analyzed for the WDA. The ground acceleration used in the seismic analysis was 0.1472g, which is the Maximum Considered Earthquake (MCE) ground motion of 0.2 second spectral response, or the 2 percent exceedance in 50 years. The value of the acceleration was obtained from the United States Geologic Survey (USGS) online seismic hazard tool, which provides such information for any location in the United States. The zip code for the RMSGS was used as the location of the site. Contour intervals of this same seismic acceleration are included in Appendix D of the US Army Corps of Engineers (USCOE) publication number: ER 1110-2-1806 titled *Engineering and Design – Earthquake Design and Evaluation for Civil Works Projects*. This contour map, which illustrates the seismic acceleration contours for the 0.2 sec spectral response and 2 percent probability of exceedance in 50 years is also included in Appendix A of this report. This map shows how the area of northwest Indiana is a relatively low hazard area from the view point of seismic risk. The RMSGS is in Risk Zone 1 in the ASCE seismic risk categorization which is also illustrated in the USACOE publication referenced above. This is the second lowest category in a five category system. This ASCE seismic risk map is also included in Appendix A.

4.1.4 Factor of Safety Results

As previously indicated, analyses were performed for the loading cases on the representative cross section for the WDA. Analyses were performed with both circular and planar (block) analyses. The search method of analysis was used, and several thousand trial surfaces for each case and each model were evaluated by the program.

The results of the analyses indicate the embankment for the WDA has adequate factors of safety given the strength parameters used and the conditions analyzed.

A summary of the lowest factors of safety for each case analyzed for the WDA is included in Table 5 below.

Table 5: Slope Stability Analysis Results Summary

Waste Disposal Area		
Case	**Pool Elevation**	**Factor of Safety**
1 - Steady Sate, Maximum **Storage** Pool Block - 257.73(e)(1)(i)	679 ft MSL	2.6
2 - Steady Sate, Maximum **Storage** Pool Block Seismic - 257.73(e)(1)(iii)	679 ft MSL	1.8
3 - Steady Sate, Maximum **Storage** Pool Rotational - 257.73(e)(1)(i)	679 ft MSL	2.7
4 - Steady Sate, Maximum **Storage** Pool Rotational Seismic - 257.73(e)(1)(iii)	679 ft MSL	1.8
5 - Steady State, Maximum **Surcharge** Pool Block - 257.73(e)(1)(ii)	681 ft MSL	2.6
6 - Steady State, Maximum **Surcharge** Pool Block Seismic - 257.73(e)(1)(iii)	681 ft MSL	1.7
7 - Steady State, Maximum **Surcharge** Pool Rotational - 257.73(e)(1)(ii)	681 ft MSL	2.8
8 - Steady State, Maximum **Surcharge** Pool Rotational Seismic - 257.73(e)(1)(iii)	681 ft MSL	1.8

Models from the slope stability analyses are included in Appendix A.

4.2 Liquefaction Potential Assessment

Embankment and foundation soils were screened for seismically-induced liquefaction susceptibility using methods recommended by the National Center for Earthquake Research (NCEER), which uses CPT data (Youd et al. 2001; Robertson and Wride 1998). The calculated factor of safety against seismically-induced liquefaction is shown in Appendix B and was calculated to be greater than 1.2 throughout the depth of the embankments and underlying foundation in the evaluated CPT soundings (Golder, 2012) for the considered earthquake loading, see Figure 2. These screening-level results indicate that the embankments and foundation soils for the WDA are not susceptible to seismically-induced liquefaction for the seismic loading considered.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the information provided by NIPSCO, onsite observations, and the results of the structural stability assessment, one structural stability deficiency was identified in the WDA surface impoundment during this assessment. As a result, it is recommended that NIPSCO remedy the deficiency by improving the size of the auxiliary spillway, operationally controlling the water level in the WDA, or implementing an equivalent engineering or operational control.

Based on this same information and on our analyses, the calculated factor of safety through the critical cross section in the WDA surface impoundment meets or exceeds the minimum values listed in §257.73(e)(1)(i)-(iv).

6. CLOSING

This report is intended to summarize the results of the structural stability and factor of safety assessment to fulfill the provisions of Title 40 of the Code of Federal Regulations Section 257.73(d) and (e) (40 CFR Part 257.73(d) and (e)) for the WDA at the R.M. Schahfer Generating Station.

GOLDER ASSOCIATES INC.

Tiffany Johnson, P.E.
Senior Consultant

David M. List, P.E.
Principal

7. REFERENCES

AASHTO, 2012. American Association of State Highway and Transportation Officials, Load Resistant Factor Design (LFRD) Bridge Design Specifications, 2012.

Abramson, L.W., T.S. Lee, S. Sharma, and G.M. Boyce (2002), Slope Stability and Stabilization Methods, 2nd edition, John Wiley & Sons, New York.

Chow, Ven T., 1959. *Open-Channel Hydraulics*. McGraw-Hill Publishing Company. New York.

DLZ Industrial, LLC (DLZ), 2012. *Waste Disposal and Recycle Ponds Hydrographic Survey. NIPSCO R.M. Schahfer generating Station*. December.

Federal highway Administration (FHWA), 2016. HY-8 Software, version 7.50. July, 2016.

Indiana State Department of Natural Resources (DNR), 2001. *General Guidelines for New Dams and Improvements to Existing Dams in Indiana*. January.

Marbach, Brady & Weaver, Inc (Marbach), 2011. *Embankment Elevation Survey Waste Disposal Area & Recycle Pond; NIPSCO Schahfer Generating Station*. December.

Natural Resource Conservation Service (NRCS), 2016. Type II Temporal Rainfall Distribution, accessed from http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprdb1044959 on September 2, 2016.

Robertson, R. and Wride, C. 1998. Evaluating Cyclic Liquefaction Potential Using the Cone Penetration Test, Canadian Geotechnical Journal, vol. 35, pp. 442-459.

Sargent and Lundy Engineers of Chicago (Sargent and Lundy), 1982. *Construction Drawings for the Rollin M. Schahfer Gen. Sta. Units 17&19; No. Indiana Public Service Co., Wheatfield, Indiana*. January.

U.S. Army Corps of Engineers (USACE), 1997. *EM 1110-2-1420, Hydrologic Engineering Requirements for Reservoirs*. October.

U.S. Army Corps of Engineers (USACE), 2003. *ERDC/CHL CHETN-III-68, Estimating Irregular Wave Run-up on Smooth, Impermeable Slopes.* September.

U.S. Army Corps of Engineers (USACE), 2005. *ERDC/CHL CHETN-III-70, Estimating Irregular Wave Run-up on Rough, Impermeable Slopes*. July.

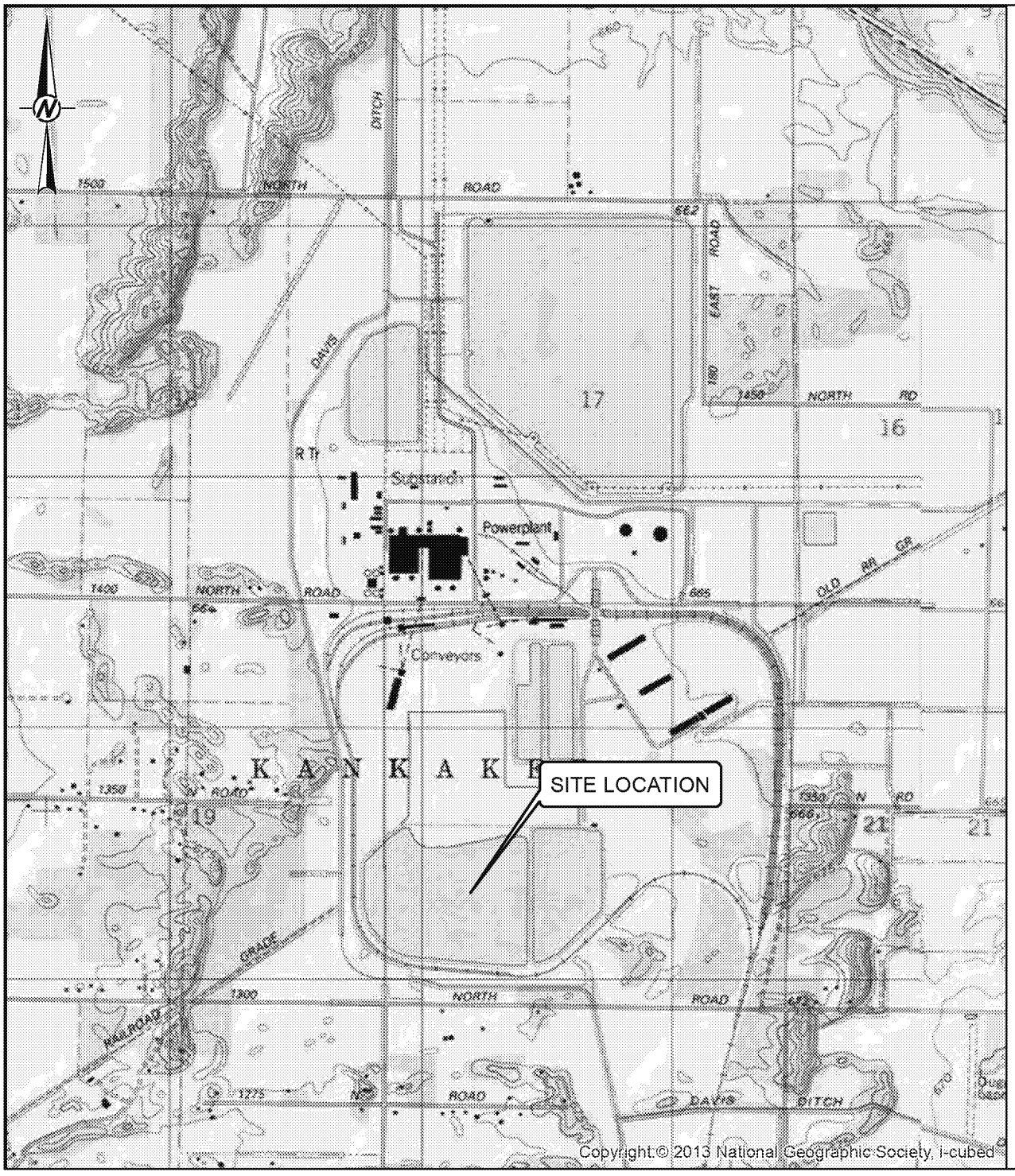
U.S. Army Corps of Engineers (USACE), 2008. *EM 1110-2-1100, Coastal Engineering Manual*. April.

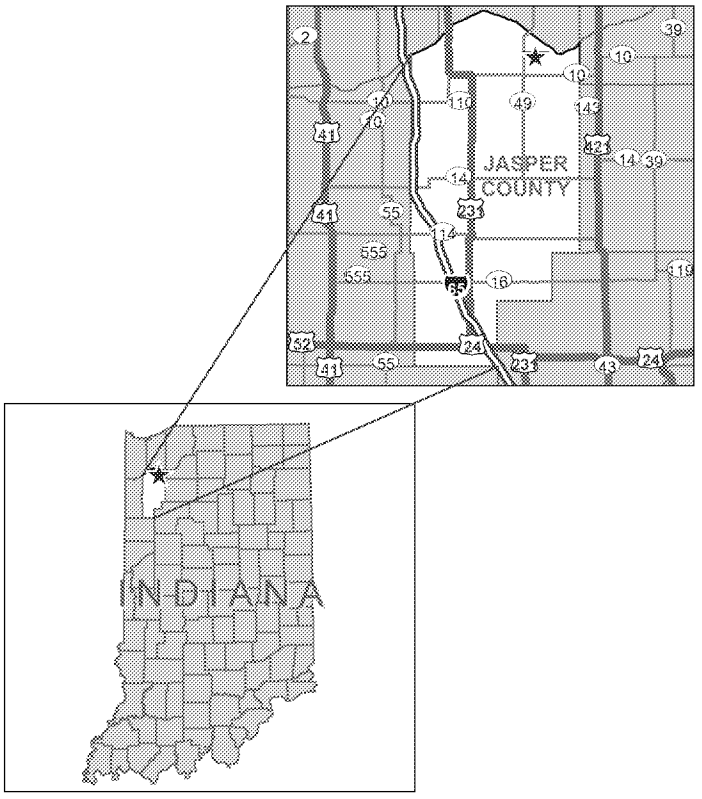
U.S. Army Corps of Engineers (USACE), 2015. *Hydrologic Modeling System (HEC-HMS), Version 4.1.* Institute For Water Resources, Hydrologic Engineering Center. July.

Youd, T., and Idriss, I., 2001. Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, April 2001, pp. 297-313.

FIGURES

Path: R:\Projects\1651599-NIPSCO SM Schahfer Generating Station\Figures\A-1651599A000-GIS.mxd





0 1000 2000 Feet

CLIENT
NIPSCO
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

PROJECT
STRUCTURAL STABILITY ASSESSMENT

TITLE
SITE LOCATION MAP

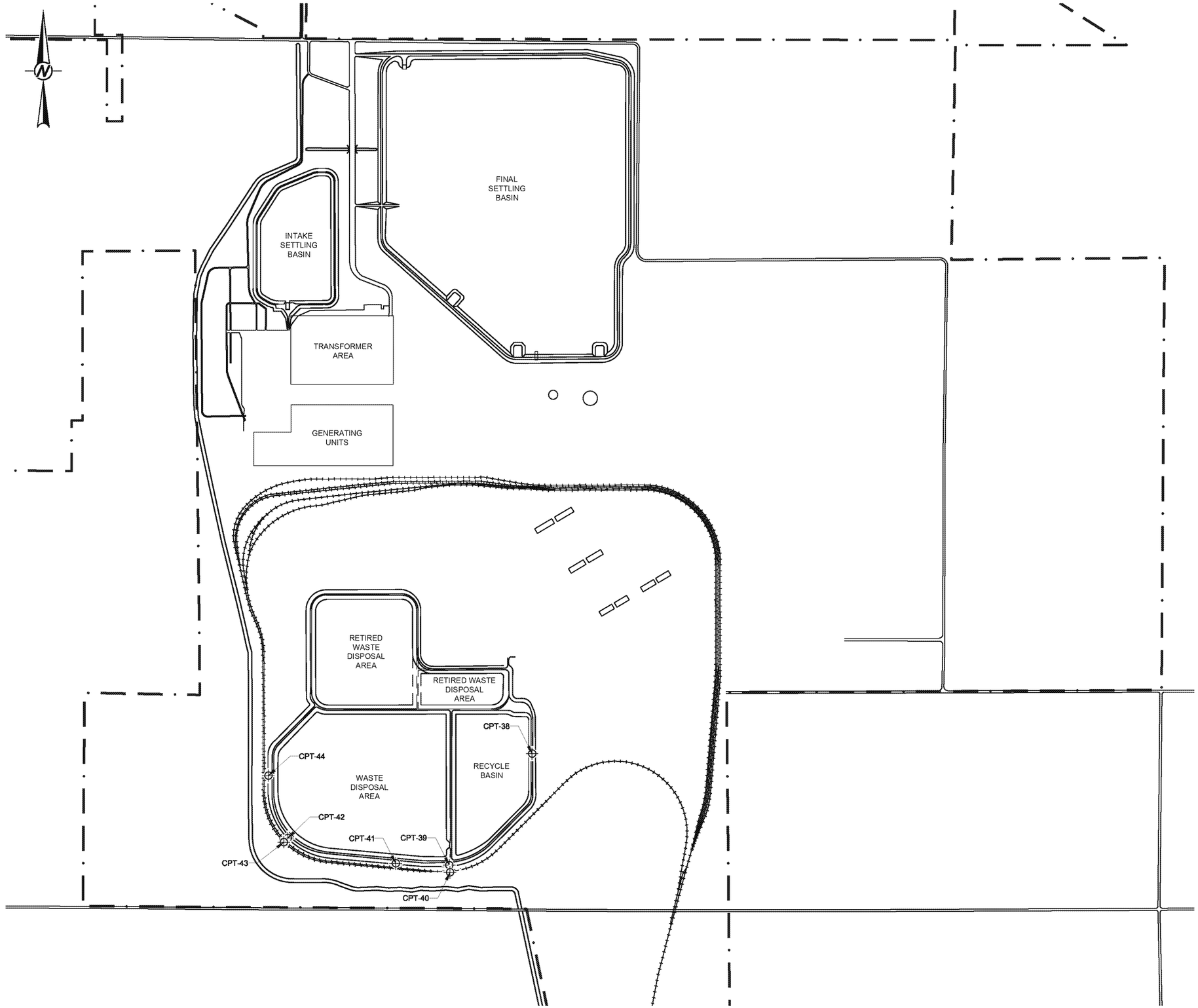
CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-07
PREPARED	DJC
DESIGN	TDJ
REVIEW	TDJ
APPROVED	DML

PROJECT No.	CONTROL	Rev.	FIGURE
1651599	1651599A000-GIS.mxd	0	1

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



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- RAILROAD TRACKS
- CPT-XX 2011 / 2012 GEOTECHNICAL INVESTIGATION CPT BOREHOLE LOCATION

REFERENCE

BASE MAP TAKEN FROM MARBACH, BRADY & WEAVER ENGINEERING & SURVEYING; EMBANKMENT ELEVATION SURVEY; DRAWING NO. A-31565; FILE NO. 0221-2011.DWG; DATED 2011-12-30; DELIVERED IN .DWG FORMAT

0 100 200
1" = 200' FEET

CLIENT
NIPSCO
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

PROJECT
STRUCTURAL STABILITY ASSESSMENT

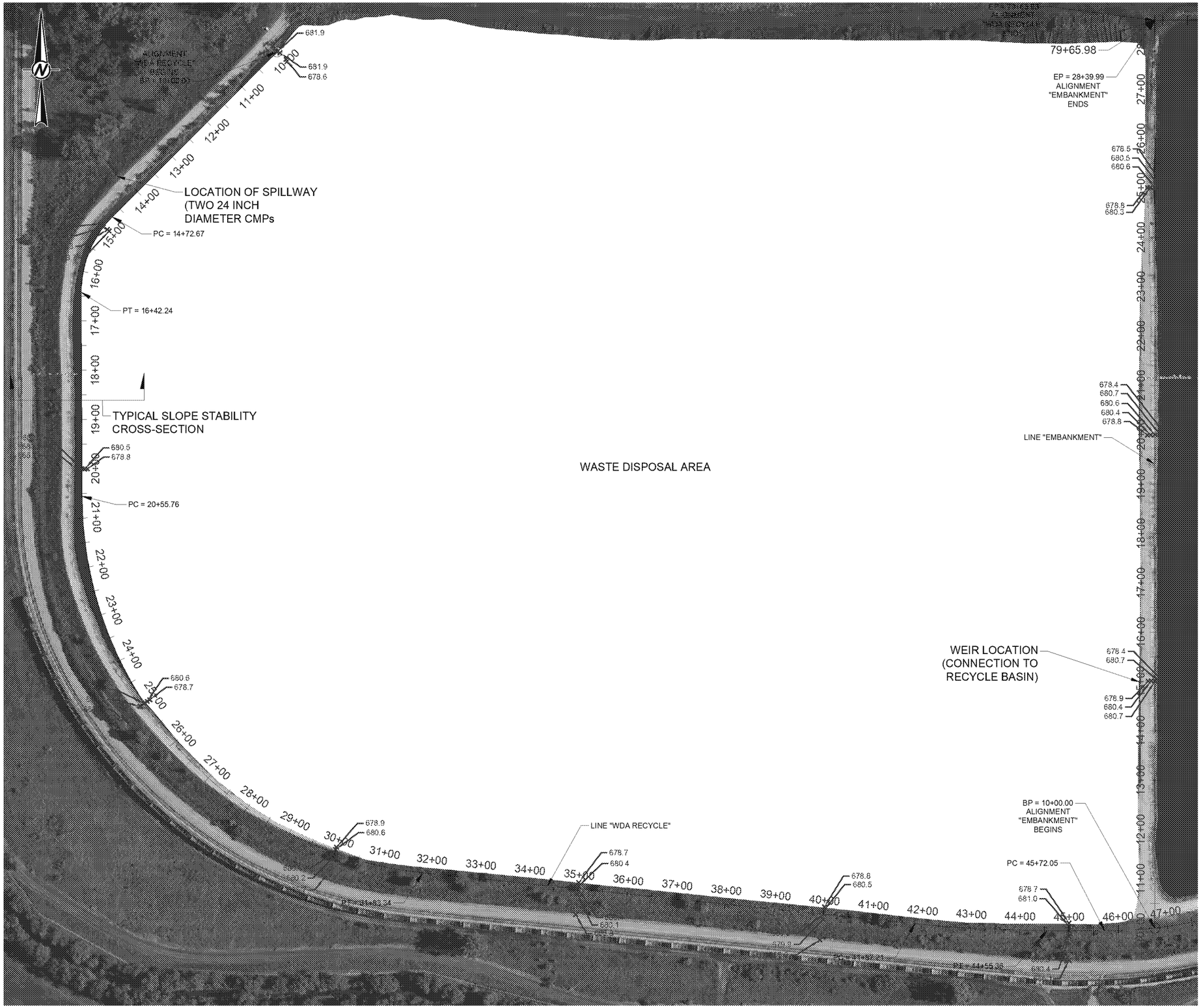
TITLE
SITE PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-07
DESIGNED	TDJ
PREPARED	DJC
REVIEWED	TDJ
APPROVED	DML

PROJECT NO	CONTROL	REV	FIGURE
1651599	1651599A001.dwg	0	2



REFERENCE(S)

BASE MAP TAKEN FROM MARBACH, BRADY & WEAVER ENGINEERING & SURVEYING; EMBANKMENT ELEVATION SURVEY; DRAWING NO. A-31565; FILE NO. 0221-2011.DWG; DATED 2011-12-30; DELIVERED IN .DWG FORMAT

0 100 200
1" = 200' FEET

CLIENT
NIPSCO
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

PROJECT
STRUCTURAL STABILITY ASSESSMENT

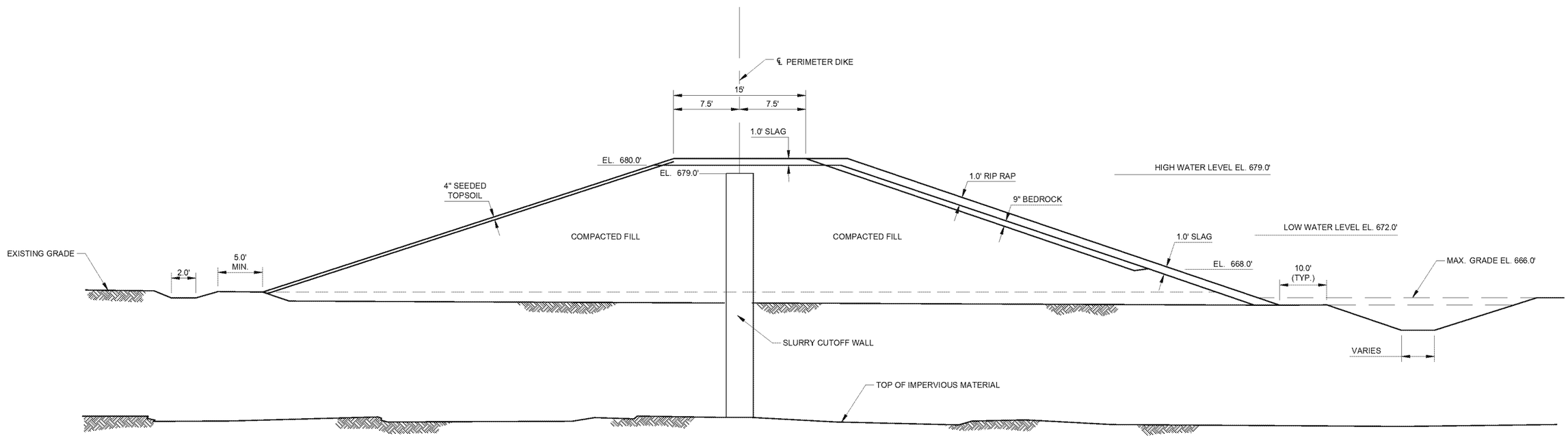
TITLE
WASTE DISPOSAL AREA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-07
DESIGNED	TDJ
PREPARED	DJC
REVIEWED	TDJ
APPROVED	DML

PROJECT NO	CONTROL	REV	FIGURE
1651599	1651599A002.dwg	0	3



REFERENCE
FROM SARGENT & LUNDY CONSTRUCTION; DRAWING C-19; SETTLING BASINS DIKEWORK SECTIONS AND DETAILS; SHEET - 1; REV. F; 1982-07-13.

CLIENT
NIPSCO
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

PROJECT
STRUCTURAL STABILITY ASSESSMENT

TITLE
TYPICAL CROSS SECTION

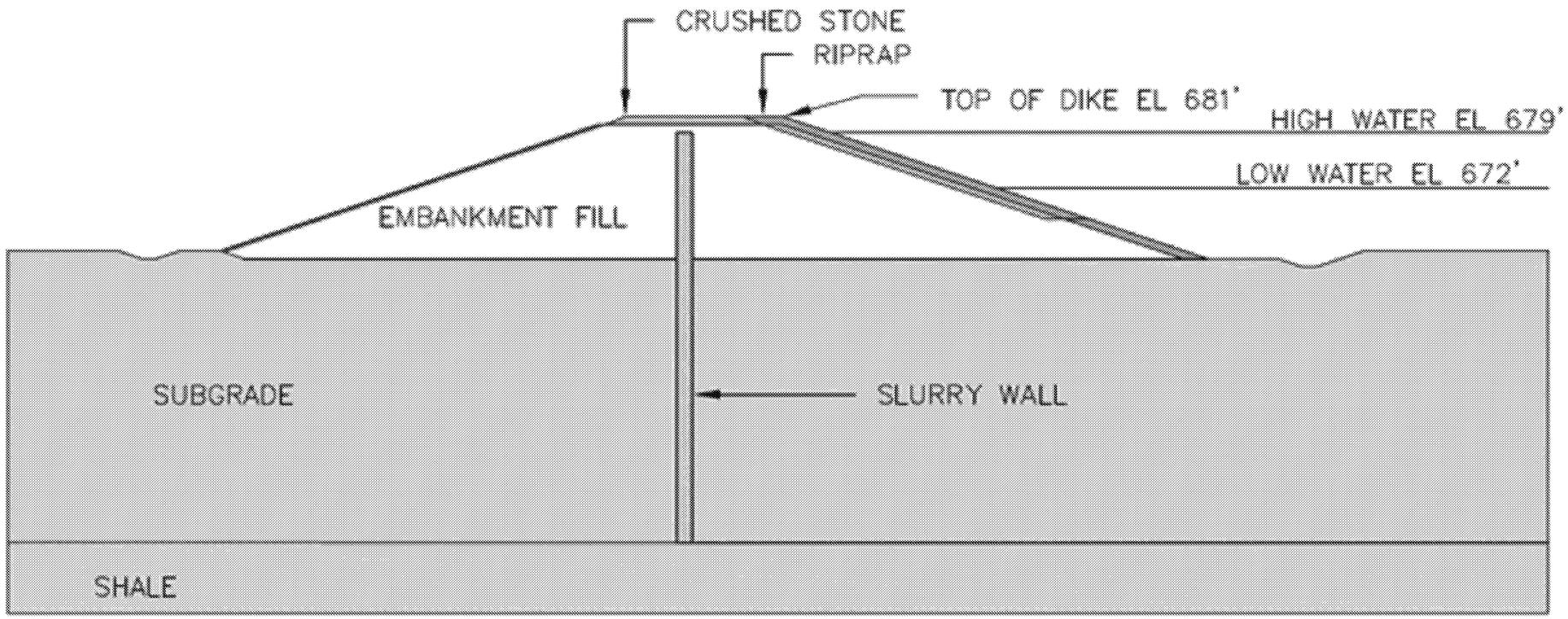
CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-07
DESIGNED	TDJ
PREPARED	DJC
REVIEWED	TDJ
APPROVED	DML

PROJECT NO	CONTROL	REV	FIGURE
1651599	1651599A003.dwg	0	4

WASTE DISPOSAL AREA
TYPICAL PROFILE



REFERENCE
FROM SARGENT & LUNDY CONSTRUCTION; DRAWING C-19; SETTLING BASINS DIKEWORK SECTIONS AND DETAILS; SHEET - 1; REV. F; 1982-07-13.

CLIENT
NIPSCO
SCHAHFER GENERATING STATION
WHEATFIELD, INDIANA

PROJECT
STRUCTURAL STABILITY ASSESSMENT

TITLE
TYPICAL GEOTECHNICAL MODEL AT THE WASTE DISPOSAL AREA EMBANKMENT (NOT TO SCALE)

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-09-07
DESIGNED	TDJ
PREPARED	TDJ
REVIEWED	TDJ
APPROVED	DML

PROJECT NO	CONTROL	REV	FIGURE
1651599	1651599A003.dwg	0	5

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

APPENDIX A
SLOPE STABILITY ANALYSIS RESULTS

2008 United States National Seismic Hazard Maps
USGS
EARTHQUAKES
HAZARDS
LEARN
PREPARE
MONITORING
RESEARCH

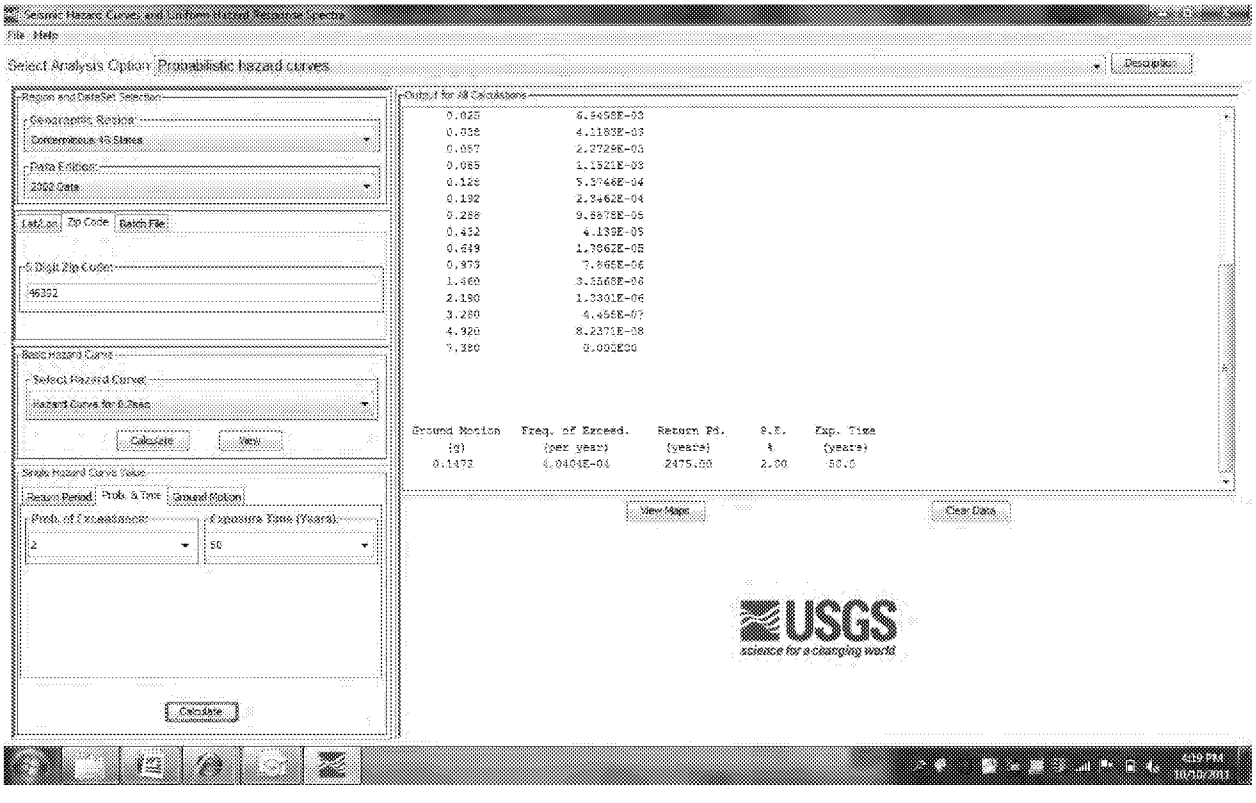

Select Analysis Option: Probabilistic hazard curves
Output for All Calculations
Ground Motion (g)
Freq. of Exceed. (per year)
Return Pd. (years)
Exp. Time (years)
USGS
science for a changing world

FIGURE MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR THE CONTERMINOUS UNITED STATES. OF 0.2 SEC SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

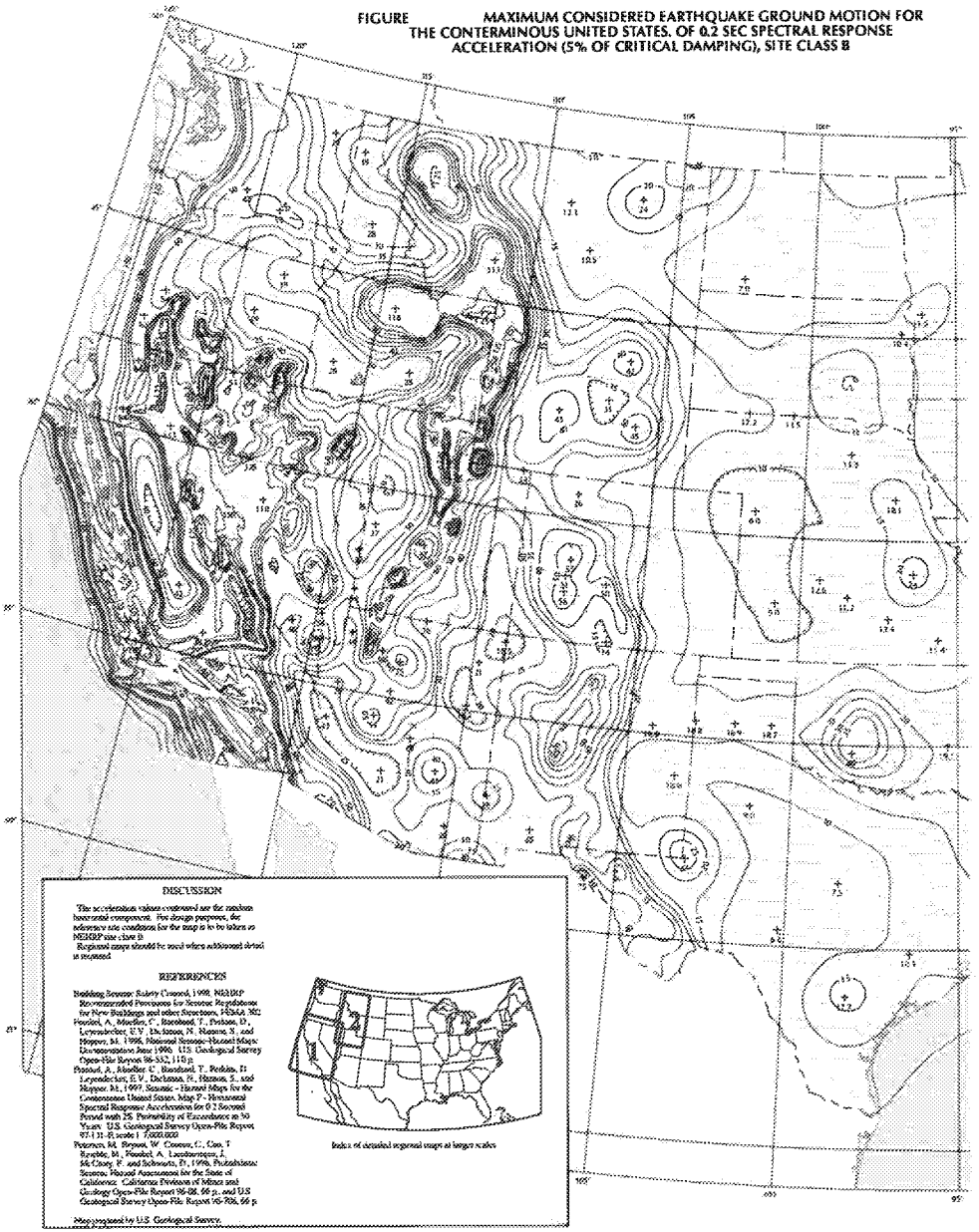
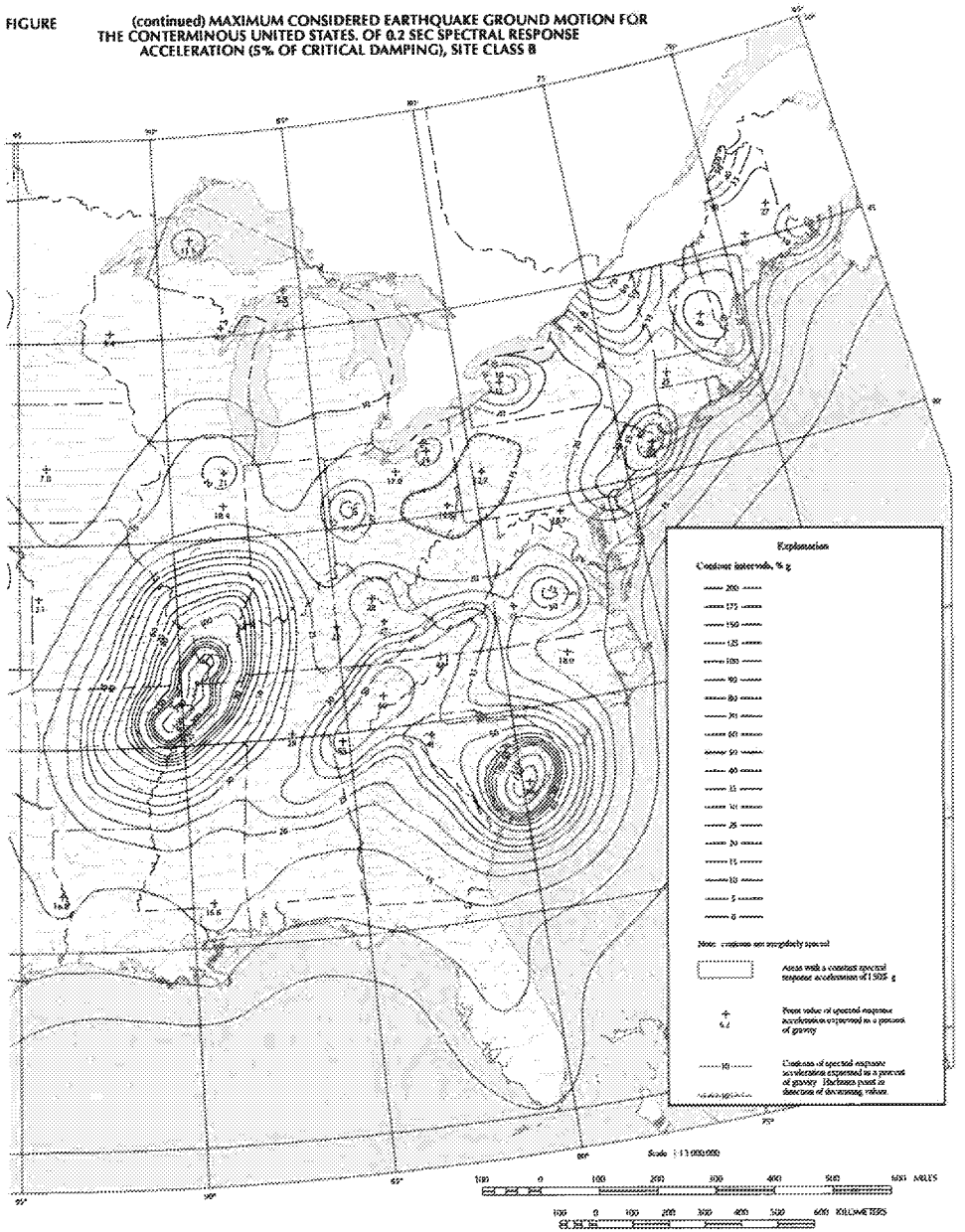


FIGURE (continued) MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR THE CONTERMINOUS UNITED STATES. OF 0.2 SEC SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B



ED_005405A_00000335-00588

1

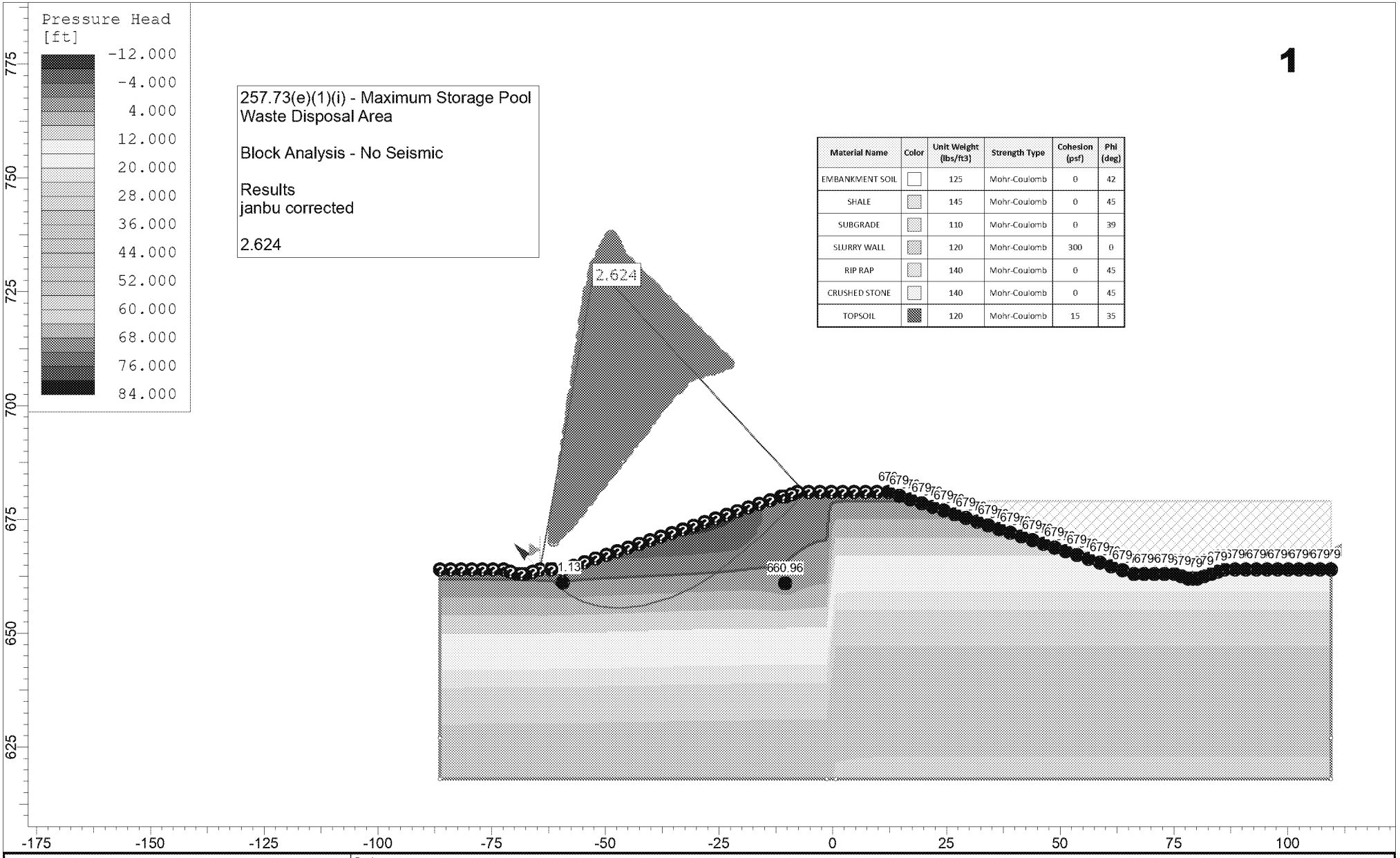
257.73(e)(1)(i) - Maximum Storage Pool
Waste Disposal Area

Block Analysis - No Seismic

Results
janbu corrected

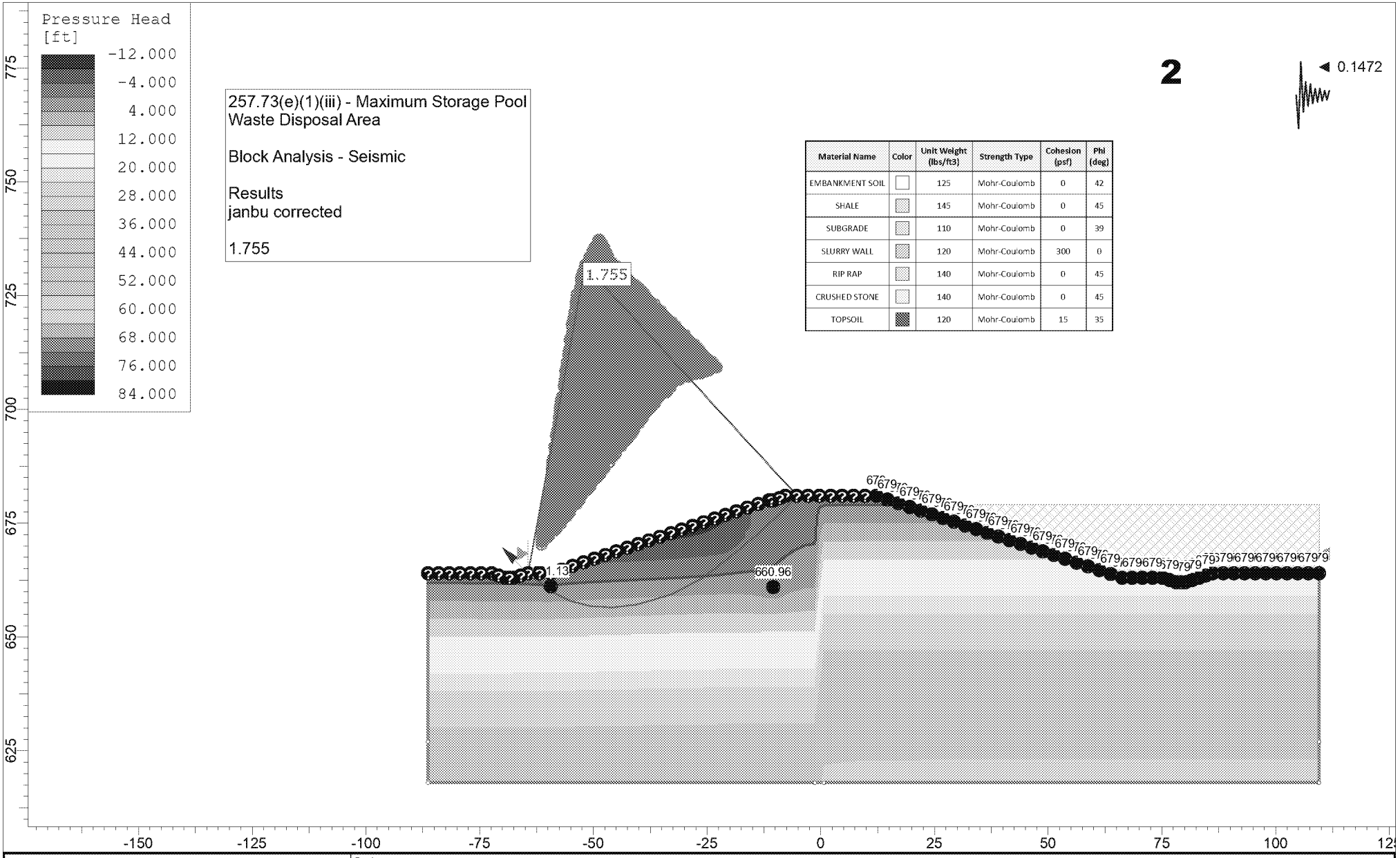
2.624

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35



Project	NIPSCO - WASTE DISPOSAL AREA		
Analysis Description	MAXIMUM STORAGE POOL FOS		
Drawn By: T. JOHNSON	Scale: 1:350	Company: GOLDER	
Date: 9/1/16		File Name: WDA 679.sli	

SLIDEINTERPRET 7.018

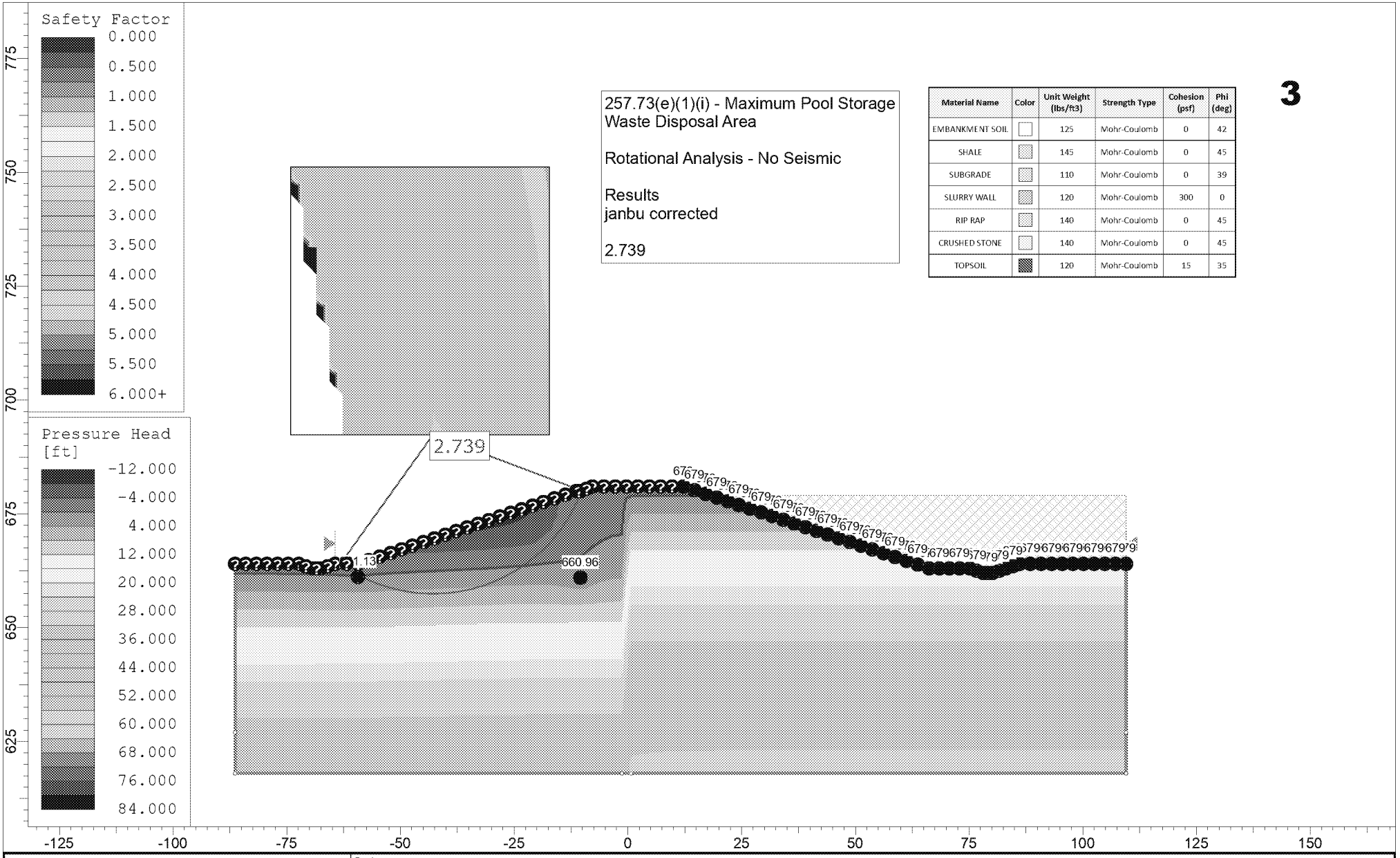


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

rocscience

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA				
Analysis Description	MAXIMUM STORAGE POOL FOS				
Drawn By	T. JOHNSON	Scale	1:350	Company	GOLDER
Date	9/1/16			File Name	WDA 679.sli



257.73(e)(1)(i) - Maximum Pool Storage Waste Disposal Area

Rotational Analysis - No Seismic

Results
janbu corrected

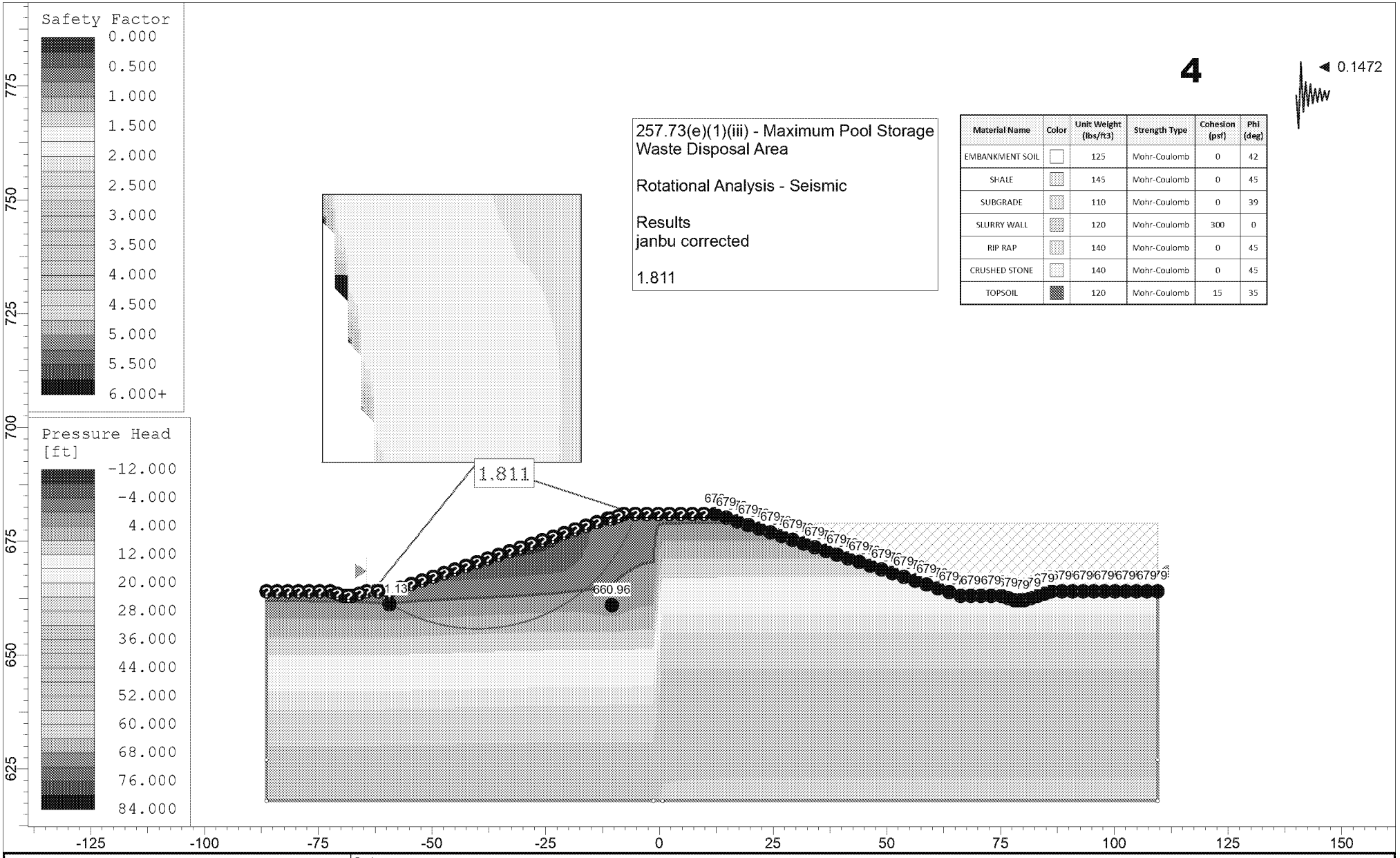
2.739

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

3

rocscience	Project	NIPSCO - WASTE DISPOSAL AREA			
	Analysis Description	MAXIMUM STORAGE POOL FOS			
	Drawn By	T. JOHNSON	Scale	1:350	Company	GOLDER
	Date	9/1/16			File Name	WDA 679 - ROT.slim

SLIDEINTERPRET 7.018



257.73(e)(1)(iii) - Maximum Pool Storage
Waste Disposal Area

Rotational Analysis - Seismic

Results
janbu corrected

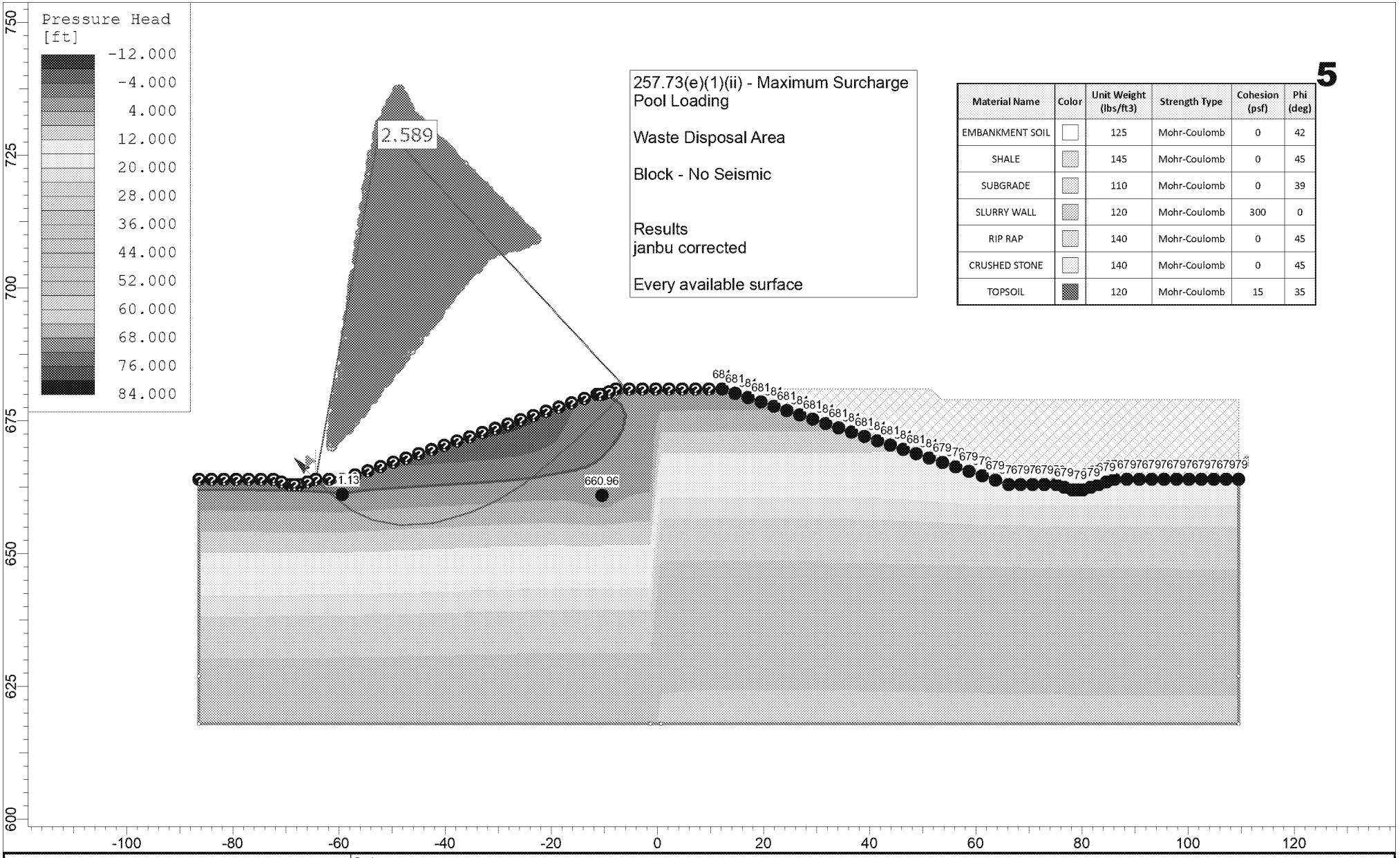
1.811

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA				
Analysis Description	MAXIMUM STORAGE POOL FOS				
Drawn By	T. JOHNSON	Scale	1:350	Company	GOLDER
Date	9/1/16			File Name	WDA 679 - ROT.slim

5



257.73(e)(1)(ii) - Maximum Surcharge Pool Loading

Waste Disposal Area

Block - No Seismic

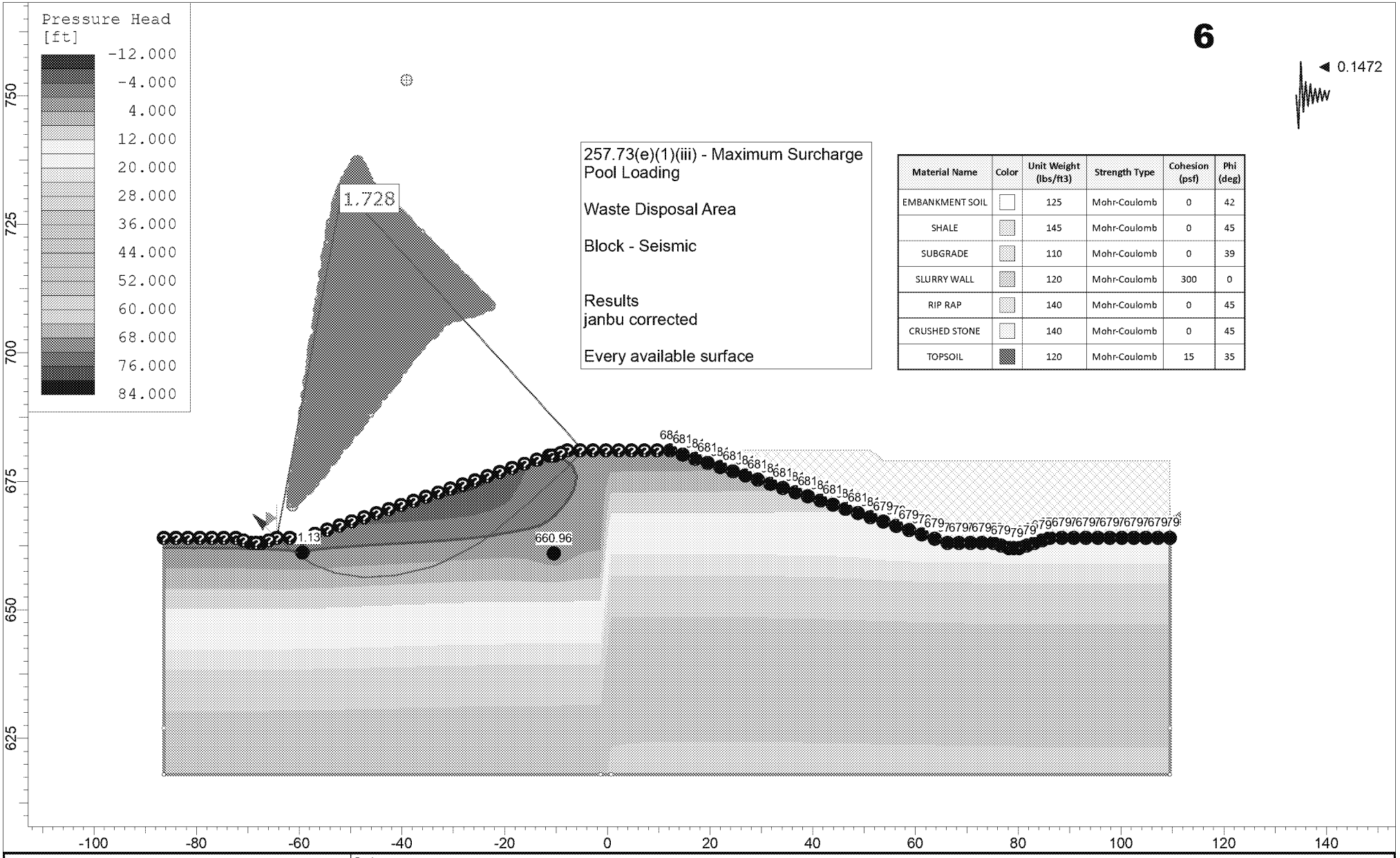
Results
janbu corrected

Every available surface

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA		
Analysis Description	MAXIMUM STORAGE POOL FOS		
Drawn By: T. JOHNSON	Scale: 1:300	Company: GOLDER	
Date: 9/1/16		File Name: WDA 681 - block.slim	



257.73(e)(1)(iii) - Maximum Surcharge Pool Loading

Waste Disposal Area

Block - Seismic

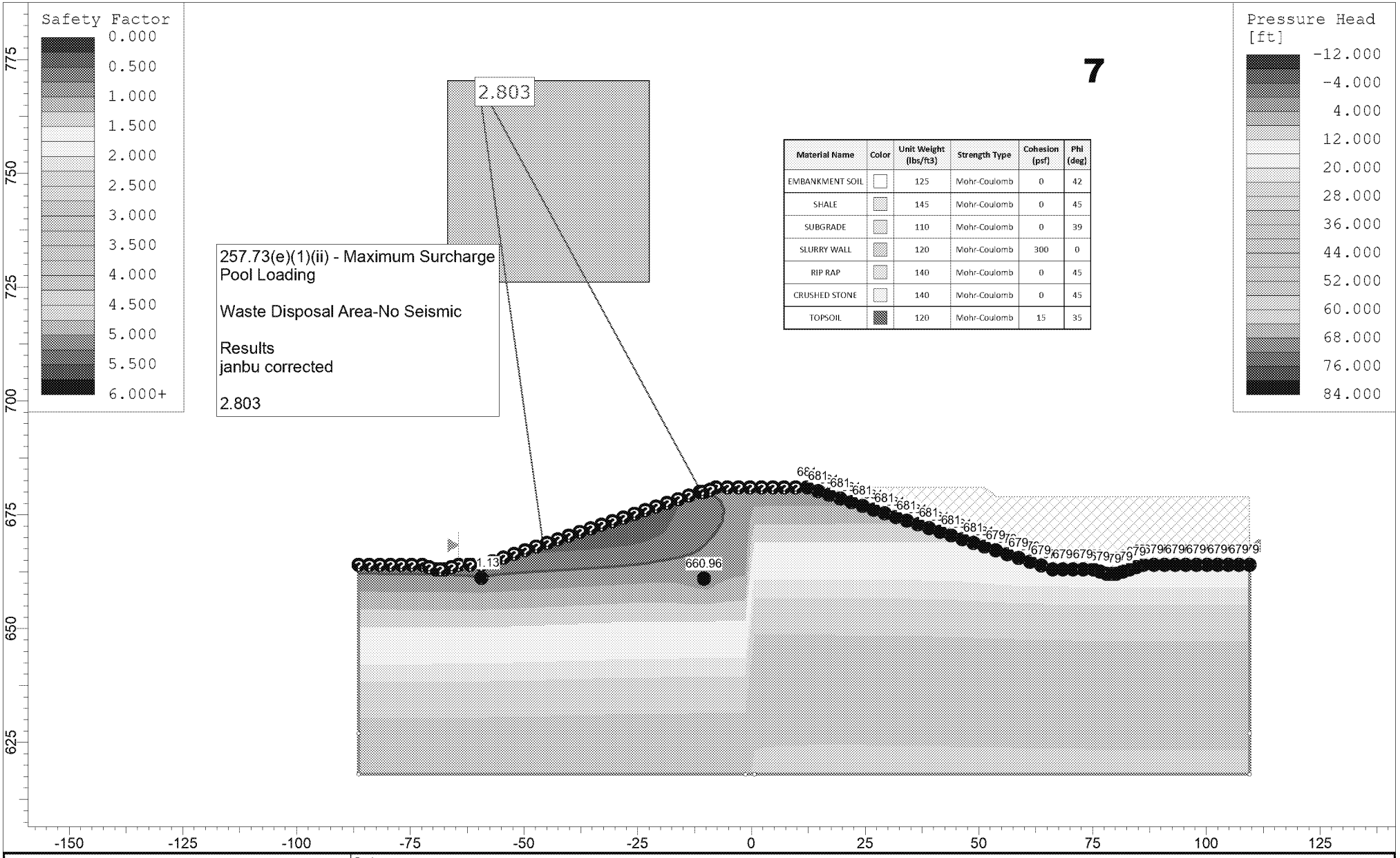
Results
janbu corrected

Every available surface

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA				
Analysis Description	MAXIMUM STORAGE POOL FOS				
Drawn By	T. JOHNSON	Scale	1:310	Company	GOLDER
Date	9/1/16			File Name	WDA 681 - block.slim

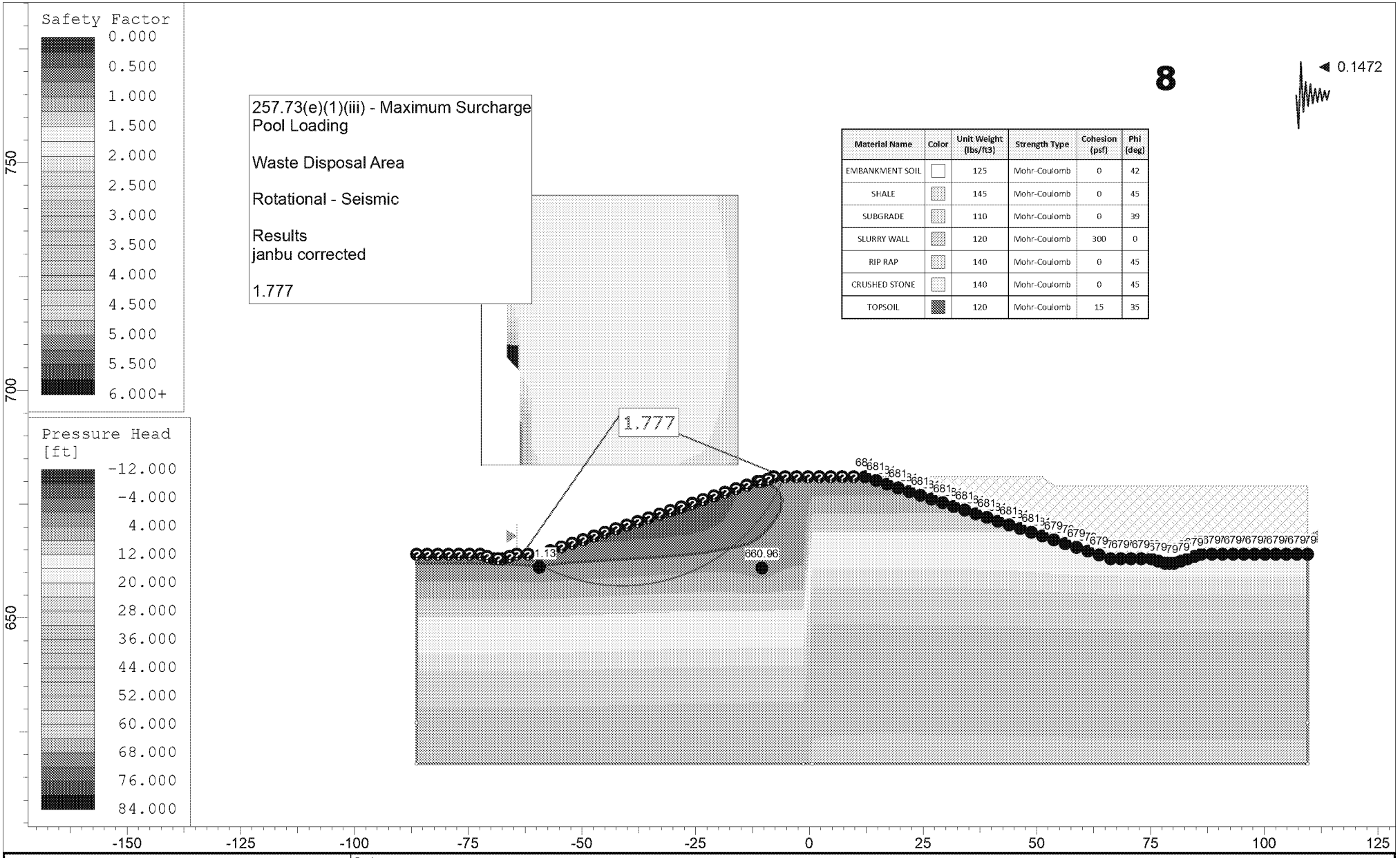


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

rocscience

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA				
Analysis Description	MAXIMUM STORAGE POOL FOS				
Drawn By	T. JOHNSON	Scale	1:350	Company	GOLDER
Date	9/1/16			File Name	WDA 681 - ROT.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
EMBANKMENT SOIL		125	Mohr-Coulomb	0	42
SHALE		145	Mohr-Coulomb	0	45
SUBGRADE		110	Mohr-Coulomb	0	39
SLURRY WALL		120	Mohr-Coulomb	300	0
RIP RAP		140	Mohr-Coulomb	0	45
CRUSHED STONE		140	Mohr-Coulomb	0	45
TOPSOIL		120	Mohr-Coulomb	15	35

rocscience

SLIDEINTERPRET 7.018

Project	NIPSCO - WASTE DISPOSAL AREA		
Analysis Description	MAXIMUM STORAGE POOL FOS		
Drawn By	T. JOHNSON	Scale	1:350
Company	GOLDER		
Date	9/1/16	File Name	WDA 681 - ROT.slim

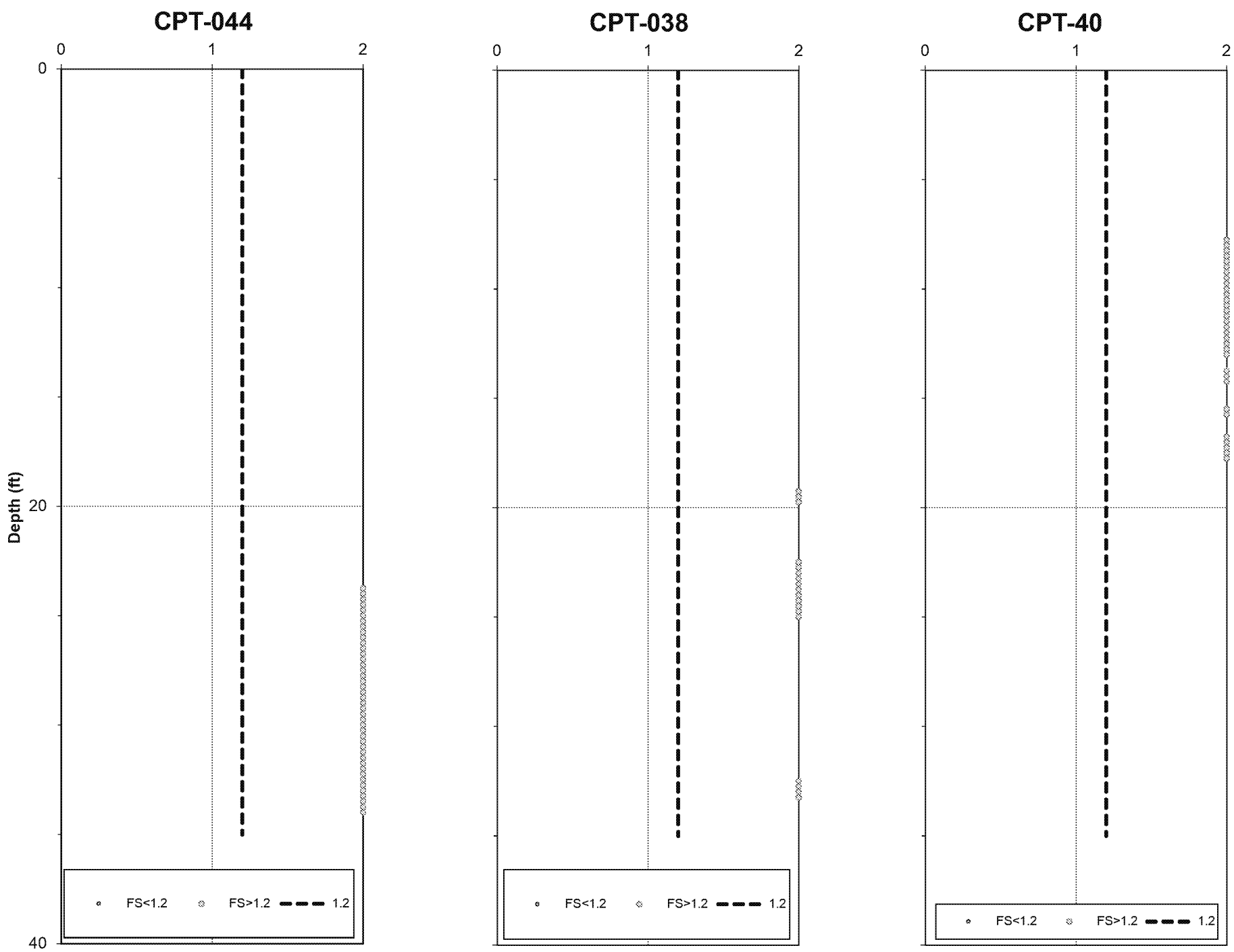
APPENDIX B
LIQUEFACTION POTENTIAL ANALYSIS RESULTS

Project:	WDA RCRA	**Test Type:**	CPTU	**Golder Eng:**	AK	**Design EQ 1**	
Location:	Wheatfield IN	**Device:**	15 cm^2, Type 2 filter	**Check**	AF	**Magnitude:**	4.8 g
Client:	NIPSCO	**Standard:**	ASTM D5778	**Review:**	TDJ		
Proj No.:	1651599	**Push Co.:**	STRATIGRAPHICS	**Max Depth:**	34 ft	**Date:** 10/5/16	
Termination:	Target Depth	**Operator:**	--				

Golder Associates

CPT ID:	CPT-044	**CPT ID:**	CPT-038	**CPT ID:**	CPT-040
Test Date:	6/6/2011	**Test Date:**	6/6/2011	**Test Date:**	6/6/2011
Northing:	2169979	**Northing:**	2170181	**Northing:**	2168808
Easting:	2968359	**Easting:**	2971542	**Easting:**	2970555
Elevation:	680.4 ft	**Elevation:**	680.3 ft	**Elevation:**	664.9 ft
a_{max}:	0.09 g	**a_{max}:**	0.09 g	**a_{max}:**	0.1 g
Water Table:	11.8 ft	**Water Table:**	10.5 ft	**Water Table:**	2.3 ft

CALCULATED LIQUEFACTION FACTOR OF SAFETY



Note: Factor of safeties (FS) greater than 2 are shown equal to 2.

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 9562 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3096 9300

solutions@golder.com
www.golder.com

Golder Associates Inc.
15851 South US 27, Suite 50
Lansing, MI 48906 USA
Tel: (517) 482-2262
Fax: (517) 482-2460

Golder Associates

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation

APPENDIX M

Fifth Annual RCRA CCR Unit Inspection Report Waste Disposal Area- Surface Impoundment 40 CFR Part §257.73(d), dated January 2, 2020

GOLDER

Northern Indiana Public Service Company, LLC
R.M. Schahfer Generating Station

Fifth Annual RCRA CCR Unit Inspection Report
Waste Disposal Area – Surface Impoundment

Submitted to:

Northern Indiana Public Service Company, LLC
2723 East 1500 North, Wheatfield, Indiana USA 46392

Submitted by:

Golder Associates Inc.
15851 South US 27, Suite 50 Lansing, Michigan, USA 48906

+1 517 482-2262

19128503

January 2, 2020

ED_005405A_00000335-00602

Table of Contents

1.0 INTRODUCTION 3

2.0 FACILITY DESCRIPTION 4

3.0 BACKGROUND AND DOCUMENT REVIEW SUMMARY 4

4.0 2019 VISUAL INSPECTION 7

5.0 CLOSING 9

TABLES

Table 1 Summary of Background Document Review

1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated the Resource Conservation and Recovery Act (RCRA) Coal Combustion Residuals (CCR) Rule (Rule) on April 17, 2015, with an effective date of October 19, 2015. The Rule requires owners or operators of existing CCR surface impoundments to have those units inspected on an annual basis by a qualified professional engineer in accordance with 40 CFR 257.83(b)(1). The annual qualified professional engineer inspections are required to be completed and the results documented in inspection reports (per 40 CFR 257.83(b)(2)) for CCR surface impoundments. Golder Associates Inc. (Golder) was retained by Northern Indiana Public Service Company, LLC (NIPSCO) to perform the fifth annual inspection of the Waste Disposal Area (WDA), a CCR surface impoundment located at the R.M. Schahfer Generating Station (RMSGS, Site).

This report presents the results of the 2019 annual inspection of the WDA CCR surface impoundment unit at the RMSGS, located in Wheatfield, Jasper County, Indiana. The inspection was conducted to comply with §257.83 of the CCR Rule.

Per 40 CFR 257.83(b)(1), Golder reviewed available information regarding the status and condition of the CCR unit and performed an onsite visual inspection which was conducted on October 7, 2019. The objectives of the inspection included the following:

- Review of Operational Records (as applicable, see Section 3):
  - Design and construction information.
  - Results of previous structural stability assessments.
  - Results of previous annual inspections.
- A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit and appurtenant structures.
- A visual inspection of hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit for structural integrity and continued safe and reliable operation.

In accordance with §257.83(b)(2), this inspection report has been prepared by a qualified professional engineer documenting the operational records review, visual inspection, and identifying the following since the previous annual inspection:

- Any changes in geometry of the CCR surface impoundment since the previous annual inspection.
- The location and type of existing instrumentation and the maximum recorded readings for each instrument since the previous annual inspection.
- The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection.
- The storage capacity of the impounding structure at the time of inspection.
- The approximate volume of the impounded water and CCR at the time of inspection.
- Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures.

- Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.

2.0 FACILITY DESCRIPTION

The WDA was designed by Sargent & Lundy Engineers of Chicago, Illinois in 1982. The WDA, located in the southwest region of RMSGS, is unlined and formed by an approximately 17-foot high perimeter earth-fill dike with slurry trench core that encloses an area of approximately 83 acres. The embankment crest has a nominal elevation of 681 feet above mean sea level (amsl), but surveyed crest elevations range from 680.0 to 682.3 feet amsl. The WDA receives primarily bottom ash/boiler slag from the generating station through pipes located at the northern end of the unit. Most of the deposited ash/slag is located in the northern half of the WDA. Due to size of the unit and settling/depositional properties of the materials, very little, if any, ash/slag is present in the southern half of the WDA. The east side of the WDA is common with the west side of the adjacent Recycle Settling Basin (RSB). Water exits the WDA via an overflow weir (standpipe), to the RSB, or through the auxiliary spillway located at the northwest side. The overflow weir is located at the southern end of the east side of the WDA. The WDA and the RSB are hydraulically connected and the water level within these impoundments will seek equilibrium when the water level is above the invert elevation of the standpipe connecting the impoundments. A survey of the WDA was performed by Marbach, Brady and Weaver, Inc. in December 2011 (Marbach, 2011).

The auxiliary spillway was modified in 2017 to allow for an increased invert elevation to account for the maximum flood levels. The modified spillway was operational in 2018. The modifications included removal of the former closed-conduit spillway and construction of a concrete open-channel spillway with a concrete down-chute and riprap armoring at the toe of the embankment. The completed spillway has an invert elevation of 677.5 feet amsl.

The revised analysis performed for the WDA's modified spillway and the actions by NIPSCO to operationally control the water surface elevation, satisfy the requirements of 40 CFR 257.82 (Golder, November 2017).

3.0 BACKGROUND AND DOCUMENT REVIEW SUMMARY

The existing reports reviewed for this assessment are summarized below.

Table 1: Summary of Background Document Review

Document	Date	Author
Various construction drawings	1982	Sargent & Lundy Engineers
Assessment of Dam Safety of Coal Combustion Surface Impoundments, NIPSCO, RM Schahfer Generating Station	July 2010	CDM for the EPA
Report on Inspection of The Waste Disposal Area	January 2011	Golder Associates Inc.
Final Hazard Classification Review Report – NIPSCO Schahfer Generating Station	January 2011	Golder Associates Inc.

Document	Date	Author
Embankment Elevation Survey, Waste Disposal Area and Recycle Pond, NIPSCO Schahfer Generating Station	December 2011	Marbach, Brady and Weaver, Inc.
Schahfer Spillway Hydrologic and Hydraulic Evaluation	December 2011	Golder Associates Inc.
Final Geotechnical Investigation and Embankment Stability Analyses	June 2012	Golder Associates Inc.
Report on Inspection of The Waste Disposal Area	September 2012	Golder Associates Inc.
Construction in a Floodway Permit Application, NIPSCO R.M. Schahfer Generating Station,	November 2012	Golder Associates Inc.
Basin Operation, Maintenance and Inspection Plan, NIPSCO R. M. Schahfer Generating Station,	February 2013	Golder Associates Inc.
Emergency Action Plan, Final Settling Basin (FSB), Intake Settling Basin (ISB), Waste Disposal Area (WDA), Recycle Basin (RB), Northern Indiana Public Service Company (NIPSCO), R.M. Schahfer Generating Station	February 2013	Golder Associates Inc.
State of Indiana Department of Natural Resources (DNR), Certificate of Approval, After-the-Fact, Construction in a Floodway	April 23, 2013	State of Indiana DNR
Report on Inspection of The Waste Disposal Area	April 2014	Golder Associates Inc.
Construction Observation Documentation Report, Surface Water Basin Erosion Repairs, NIPSCO R.M. Schahfer Generating Station	October 2014	Golder Associates Inc.
Northern Indiana Public Service Company R.M. Schahfer Generating Station – First Annual RCRA CCR Unit Inspection Report – January 2016 – Waste Disposal Area – Surface Impoundment	January 2016	Golder Associates Inc.

Document	Date	Author
NIPSCO, R.M. Schahfer Generating Station, Hazard Potential Classification Assessment and Visual Inspection Report – RCRA CCR Units	September 2016	Golder Associates Inc.
NIPSCO – R.M. Schahfer Generating Station, Waste Disposal Area, History of Construction	September 2016	Golder Associates Inc.
Statement of Certification, NIPSCO RMSGS, Liner Design Criteria for Existing CCR Surface Impoundments	September 2016	Golder Associates Inc.
NIPSCO R.M. Schahfer Generating Station, CCR Surface Impoundment Inflow Design Flood Control System Plan	October 2016	Golder Associates Inc.
NIPSCO, R.M. Schahfer Generating Station, Waste Disposal Area, Structural Stability and Safety Factor Assessment	October 2016	Golder Associates Inc.
Waste Disposal Area Spillway Improvement Drawings – Bid Drawings, NIPSCO, RMSGS	August 2017	Golder Associates Inc.
Northern Indiana Public Service Company, R.M. Schahfer Generating Station – Second Annual RCRA CCR Unit Inspection Report – January 2017 – Waste Disposal Area – Surface Impoundment	January 2017	Golder Associates Inc.
Weekly Inspection Reports	2017-2019	NIPSCO
WDA Bathymetric Survey	2017	DLZ
Amendment to the R.M. Schahfer Generating Station Inflow Design Flood Control System Plan – Hydraulic Evaluation of the Waste Disposal Area Auxiliary Spillway	November 2017	Golder Associates Inc.

Document	Date	Author
Northern Indiana Public Service Company, R.M. Schahfer Generating Station – Third Annual RCRA CCR Unit Inspection Report – January 2018 – Waste Disposal Area – Surface Impoundment	January 2018	Golder Associates Inc.
Northern Indiana Public Service Company, R.M. Schahfer Generating Station – Fourth Annual RCRA CCR Unit Inspection Report – January 2019 – Waste Disposal Area – Surface Impoundment	January 2019	Golder Associates Inc.

4.0 2019 VISUAL INSPECTION

The 2019 onsite inspection of the WDA was performed by Ms. Tiffany Johnson, P.E. and Ms. Halle Doering of Golder on October 7, 2019. Ms. Johnson is a Professional Engineer, licensed in the State of Indiana. Golder's inspectors were directed by Mr. Joseph Kutch, Team Leader Environmental Compliance with NIPSCO RMSGS and Mr. Kevin Sokolowski, Environmental Coordinator with NIPSCO RMSGS.

The inspection provides the following information as stipulated in 40 CFR 257.83(b)(2):

- Any changes in geometry of the CCR surface impoundment since the previous annual inspection.
  - The auxiliary spillway construction was completed prior to the 2019 inspection (November 2017), as described in Section 2.0.
- The location and type of existing instrumentation and the maximum recorded readings for each instrument since the previous annual inspection.
  - There is currently no instrumentation in place designed to monitor structural stability of the WDA.
- The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection.
  - Maximum: approximately 677.5 feet above mean sea level (based on invert elevation of the improved spillway (Golder, November 2017)
  - Minimum: approximately 675.8 feet above mean sea level (based on visual observation)
  - Present Depth: approximately 13 feet (based on visual observation at overflow weir staff gauge, approximate elevation of 676.7 ft amsl)
- The storage capacity of the impounding structure at the time of inspection.
  - 1,530 acre-feet (based on review of available information)
- The approximate volume of the impounded water and CCR at the time of inspection.

- Impounded water = approximately 183,880,000 gallons (from NIPSCO based on 13-feet depth, no significant change from 2018)
- CCR = approximately 670,000 cubic yards (from NIPSCO)

- Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures.
  - None were observed.
- Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.
  - None were observed.

Based on visual observations made on October 7, 2019, the overall condition of the WDA is acceptable. No structural weaknesses or safety issues were observed within the upstream, downstream, crest, or hydraulic structures of the WDA. Based on visual observations made on October 7, 2019, there were no visual conditions identified that would negatively impact the operation of the WDA.

5.0 CLOSING

This report has been prepared in general accordance with normally accepted civil engineering practices to fulfill the Resource Conservation and Recovery Act (RCRA) reporting requirements in accordance with 40 CFR 257.83(b). Based on our review of the information provided by NIPSCO and on Golder's on-site visual inspection, the overall condition of the WDA is acceptable. Golder's assessment is limited to the information provided to us by NIPSCO and to the features that could be inspected visually in a safe manner. Golder cannot attest to the condition of subsurface or submerged structures.

Sincerely,

Golder Associates Inc.

Halle A. Doering
Project Engineer

Tiffany D. Johnson, P.E.
Principal and Indiana P.E. #11500730

TIFFANY D. JOHNSON
REGISTERED
No. PE11500730
STATE OF INDIANA
PROFESSIONAL ENGINEER

January 2, 2020

p:\major clients\nisource-nipsco\19128503 - 2019 nipsco rmsgs ccr inspections\wda\2019_nipsco ccr wda rcra inspection report_draft - final 1-2-20.docx

GOLDER

golder.com

APPENDIX N

WDA Closure Plan- Version #5- Golder Associates, Inc - October 2020

GOLDER

NIPSCO LLC R. M. Schahfer Generating Station Waste Disposal Area Closure Plan - Version #5

Northern Indiana Public Service Company LLC
Rollin M. Schahfer Generating Station
Wheatfield, Indiana

Submitted to:

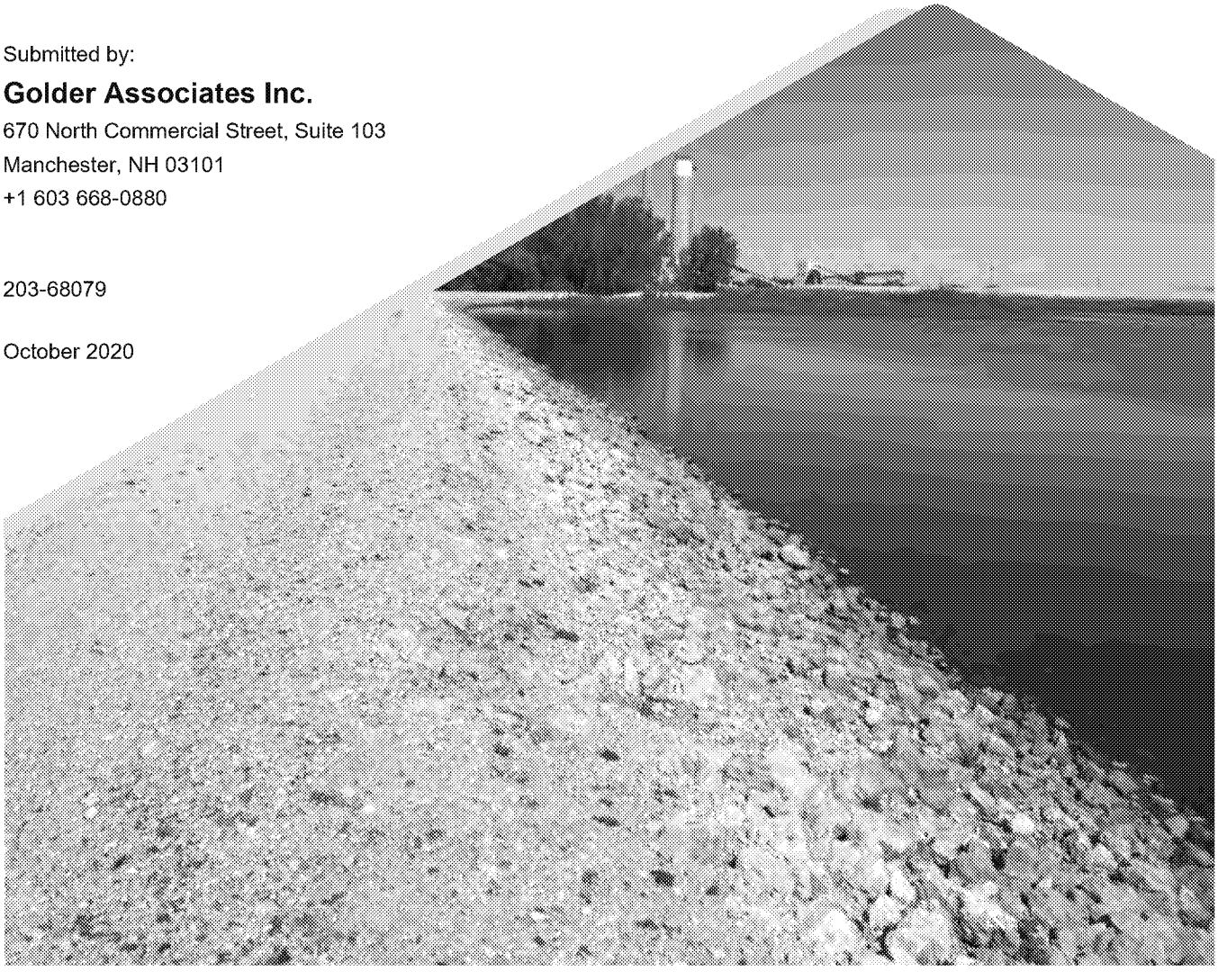
Northern Indiana Public Service Company LLC
2755 Raystone Drive
Valparaiso, IN 46383

Submitted by:

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101
+1 603 668-0880

203-68079

October 2020



Certification

Professional Engineer Certification Statement [40 CFR 257.102(b)(4)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations Section 257.102 (40 CFR Part 257.102), I attest that this Closure Plan is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.102.

Golder Associates Inc.

Signature

October 28, 2020

Date of Report Certification

Richard Wesenberg

Name

PE11500584

Professional Engineer Certification Number

RICHARD A. WESENBERG
REGISTERED
No. 11500584
10-28-2020
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Table of Contents

1.0 INTRODUCTION 1

2.0 CLOSURE PLAN CONTENT [40 CFR §257.102(b)(1)] 1

2.1 Narrative Description [40 CFR §257.102(b)(1)(i-ii)] 1

2.2 WDA Quantity and Area [40 CFR §257.102(b)(1)(iv,v)] 2

2.3 CCR Removal and Unit Decontamination [40 CFR §257.102(b)(1)(ii)] 2

3.0 SCHEDULE [40 CFR §257.102(b)(1)(vi)] 3

3.1 Introduction 3

3.2 Closure Construction 3

3.2.1 Permitting/Engineering/Procurement 3

3.2.2 Dewatering Activities 3

3.2.3 CCR Excavation 4

3.2.4 Soil Backfill / Site Stabilization 4

4.0 CLOSURE PLAN AMENDMENTS 5

5.0 REFERENCES 6

TABLES

Table 3.2: WDA CCR Removal Schedule Milestones
Table 4.1: WDA Closure Plan Amendment Log

FIGURES

Figure 1 – Site Location Map
Figure 2 – Existing Conditions Plan
Figure 3 – Proposed CCR Excavation Grades
Figure 4 – Proposed Backfill Grades
Figure 5 – Cross Sections
Figure 6 – WDA CCR Closure by Removal Schedule

1.0 INTRODUCTION

Northern Indiana Public Service Company LLC (NIPSCO LLC, the owner/operator) maintains and operates the Waste Disposal Area (WDA), an active unlined CCR surface impoundment (the CCR Unit) at its R. M. Schahfer Generating Station, 2723 East 1500 North, Wheatfield, Jasper County, Indiana (RMSGS, Site). See Figure 1 – Site Location Map and Figure 2 – Existing Conditions Plan.

The WDA, located in the southwest area of RMSGS station operations, is formed by an approximately 17-foot high perimeter earth-fill dike with slurry trench core that encloses an area of approximately 80 acres. The WDA receives both CCR (historically bottom ash/boiler slag and sluice water as the predominant CCR influents and, beginning only recently, an FGD stream) and non-CCR waste streams from the generating station. All flow to the WDA is pumped through primarily subsurface lines which daylight and discharge directly into the northern end of the CCR Unit. As determined by bathymetric surveys and overwater drilling programs, most of the deposited ash/slag is in the northern one-third to one-half of the WDA. Due to the size of the unit, percentage of solids to liquids in the influent, location of ash discharge outfalls, and settling/depositional properties of the materials, preliminary studies have shown little ash/slag is present in the southern half of the WDA. Based on these characteristics of the WDA and the potential for future beneficial reuse applications of content CCR, which would remove bottom ash inventory from the impoundment, NIPSCO LLC will pursue a closure by removal from the CCR Unit pursuant to 40 CFR §257.10.This written closure plan, prepared in accordance with the requirements of 40 CFR §257.102(b), describes the steps necessary to close the WDA consistent with recognized and generally accepted good engineering practices.

2.0 CLOSURE PLAN CONTENT [40 CFR §257.102(b)(1)]

This closure plan complies with 40 CFR §257.102(b)(1), which outlines the content required in the written closure plan for CCR units including the information specified in 40 CFR §§257.102(b)(1)(i), (b)(1)(ii), (b)(1)(iv), and (b)(1)(vi) when closing by removal of CCR. The following sections provide a narrative of how the CCR Unit will be closed including procedures, estimated quantities of material management, and schedule of activities and associated durations.

2.1 Narrative Description [40 CFR §257.102(b)(1)(i-ii)]

The WDA will be closed by removing and decontaminating all areas affected by releases from the CCR Unit. For the purposes of this closure plan, removal addresses a) the CCR inventory, and b) affected soils in the perimeter embankments and/or the floor of the impoundment that were in direct contact with the CCR. Removal will be performed during the closure construction activities and certified complete by no later than October 17, 2028.

Decontamination relates to groundwater impacts, if any, above the CCR Unit-specific groundwater protection standards (GWPS). Groundwater decontamination will be achieved and demonstrated following completion of CCR removal activities by one or more of the following: post-closure monitoring, monitored natural attenuation, or other passive (e.g., permeable reactive barrier [PRB]) or active (e.g., groundwater extraction and treatment) methods as deemed appropriate following removal activities and stabilization of the groundwater regime. Post-closure groundwater decontamination and monitoring will be conducted after the 2028 WDA closure certification.

WDA CCR removal and decontamination will be complete when constituent concentrations throughout the CCR Unit and any areas affected by releases from the CCR Unit have been removed and groundwater monitoring concentrations do not exceed the GWPS established pursuant to 40 CFR 257.95(h).

Prior to removal of CCR, discharge of influent waste streams into the WDA will cease and/or be redirected, pipelines will be properly abandoned and associated infrastructure removed as necessary, and the CCR unit will be dewatered by means of gravity discharge and actively pumping surficial and interstitial water downstream (conveyed through the Recycle Basin and Final Settling Basin and ultimately discharged into the Kankakee River) in a manner that maintains National Pollutant Discharge Elimination System (NPDES) permitted effluent limits.

Once the WDA is dewatered and hydraulic structures are abandoned, the remaining CCR and all areas affected by releases from the CCR Unit (i.e., perimeter embankment or underlying soils in direct contact with impoundment CCR contents) will be removed. Anticipated CCR depths were determined by historic Sargent and Lundy drawings and an assessment of CCR depths performed by Golder Associates Inc. (Golder) in summer 2019. Based on the available information, the WDA excavation design extends to a bottom elevation of approximately 663.0' NAD83 as provided in Figure 3 – Proposed CCR Excavation Grades and Figure 5 – WDA Cross Sections. A detailed description and estimated schedule for the dewatering and CCR removal activities are provided in Section 3.

Construction Quality Assurance, including but not limited to, photographic documentation will be conducted in the field during closure construction activities to provide evidence documenting CCR removal. This and related information about construction contractor activities will support the qualified Indiana-licensed professional engineer's certification of closure, to be completed by no later than October 17, 2028. Satisfactory decontamination of any groundwater affected by releases from the CCR Unit will be confirmed when at least two consecutive quarterly groundwater monitoring events demonstrate that groundwater monitoring concentrations do not exceed the GWPS established pursuant to 40 CFR 257.95(h).

2.2 WDA Quantity and Area [40 CFR §257.102(b)(1)(iv,v)]

Golder performed an investigation between July and November 2019 of the relative placement/location and volume of CCR materials in the WDA. Through visual observation of gridded random and supplemental focused core samples, the investigation sampling determined CCR extended to depths that ranged from 0.5 to 20 feet, corresponding to elevations of approximately 653 to 665 (NAVD88) (Golder 2020). In 2017, DLZ Industrial, LLC, on the behalf of NIPSCO LLC, completed a survey mapping the top of CCR deposition topography. The maximum CCR inventory was estimated with AutoCAD Civil 3D by comparing the current surface of the WDA (estimated top of CCR deposition) to the investigation-derived estimated bottom of CCR material surface provided in Figure 3 - Proposed CCR Excavation Grades. Based on this comparison, the estimated maximum documented inventory of CCR in the 80-acre WDA was approximately 1 million cubic yards.

2.3 CCR Removal and Unit Decontamination [40 CFR §257.102(b)(1)(ii)]

Per 40 CFR 257.102(b)(1)(ii), if closure of the WDA will be accomplished through removal of CCR from the CCR Unit, a description of the procedures to remove the CCR and decontaminate the CCR Unit in accordance with this section must be provided in the closure plan. Per 40 CFR §257.102(c), CCR removal and decontamination of the CCR Unit are complete when constituent concentrations throughout the CCR Unit and any areas affected by releases from the CCR unit have been removed, and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to 40 CFR §257.95(h) for constituents listed in Table 2.1.1. The following description includes the procedures to remove and decontaminate the WDA.

The WDA will be dewatered, its hydraulic structures will be abandoned, and CCR will be removed. It is anticipated that the excavation will extend to elevation 663.0 NAD83. Proposed conceptual excavation limits with approximate elevations are provided in Figures 3 and 5. Photographic documentation will be conducted in the

field during closure to provide evidence documenting CCR removal. Further details on construction methods and timelines are provided in Section 3.2.

Groundwater monitoring will be conducted to document that constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit do not exceed the groundwater protection standards per 40 CFR 257.95(h) for constituents listed in Table 2.1.1. Closure will be complete when two consecutive quarterly groundwater monitoring events demonstrate no exceedances.

3.0 SCHEDULE [40 CFR §257.102(b)(1)(vi)]

3.1 Introduction

NIPSCO LLC will initiate closure of the WDA by providing notification pursuant to 40 CFR §257.102(g) when CCR placement is expected to cease and at least one of the following actions or activities have been completed:

- Steps taken to implement the written closure plan
- Completed application submitted for any required state or agency permit or permit modification
- Necessary steps taken to comply with any state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of a CCR unit

Closure construction activities are anticipated to commence by September 15, 2025 and expected to be completed within approximately three years of the notification of intent to initiate closure (by August 17, 2028).

3.2 Closure Construction

NIPSCO LLC anticipates the WDA will cease receipt of CCR and non-CCR waste streams by August 31, 2025 and initiation of closure activities will commence no later than 30 days after final receipt waste. The principal components to complete the WDA closure by removal project include permitting/engineering/procurement, dewatering, CCR excavation and soil backfill as further detailed in the following sections.

3.2.1 Permitting/Engineering/Procurement

Prior to the scheduled final cessation of influent discharge into the WDA, NIPSCO LLC will develop construction plans and specifications for the closure by removal project. In accordance with current State of Indiana CCR surface impoundment closure procedures, these plans will be reviewed and approved by the Indiana Department of Environmental Management (IDEM) prior to NIPSCO LLC initiating closure activities. A temporary or modified NPDES permit for dewatering activities may also be required and will be secured by NIPSCO LLC, if necessary. A duration of six months was assumed for the construction plan development, twelve months for IDEM review and approval of construction plans, four months for the NPDES Permit (if necessary), and three months for contractor selection and procurement. Based on its previous experience conducting CCR surface impoundment closures, NIPSCO LLC believes these are reasonable timeframes for this aspect of the WDA closure process.

3.2.2 Dewatering Activities

Following the cessation and/or redirect of all waste streams out of the WDA and in accordance with applicable NPDES permit requirements, NIPSCO LLC will initiate dewatering activities. Phase 1 of the dewatering activities will involve gravity drainage through the existing overflow weir (drop-inlet structure) into the Recycle Basin. Discharge from the Recycle Basin is pumped via eight existing submersible pumps with a total capacity of 30,000 gallons per minute (gpm) and conveyed to the Final Settling Basin. The surficial water volume is conservatively

estimated to be approximately 263 million gallons (MG, water surface elevation of 669.0' NAD83). The maximum flow through the 36-inch diameter overflow pipe from the WDA into the Recycle Basin is approximately 52 cubic feet per second (cfs) or 23,000 gpm. Therefore, it is estimated that with continuous discharge and full-time pumping operations the surficial water could be removed from the WDA within 8-days. However, to allow for a gradual drawdown of the water, accommodate possible pump repair and maintenance needs, account for precipitation during the surficial dewatering period, and realize passive dewatering of the interstitial water within the CCR deposition, a 90-day period for surficial water removal has been applied to the schedule.

Dewatering of interstitial water and ongoing precipitation will commence following completion of the removal of the surficial water and in conjunction with CCR excavation. Given the WDA is surrounded by a slurry wall, negligible inflow from groundwater is expected. It is anticipated that interstitial water will be removed to an elevation of 2-ft below the bottom of excavation providing a relatively dry, stable floor to complete CCR removal and associated closure verification activities. An interstitial water volume of approximately 206MG with an additional 90MG of precipitation (based on average annual precipitation) is expected to be managed and removed during CCR excavation activities. Actual dewatering means and methods will be determined by the contractor including but not limited to well points and/or internal sump and trenching techniques. A conservative dewatering rate of at least two dewatering systems operating at a rate of 400 gpm (800 gpm total) was used to estimate a twelve month duration for interstitial and precipitation dewatering activities.

3.2.3 CCR Excavation

CCR excavation will be accomplished primarily though mechanical means by excavators, low ground pressure (LGP) dozers and off-road haul trucks. Excavated CCR will be transported to the onsite RMSGS IDEM permitted Landfill located approximately 1.5 miles from the WDA. An excavation rate of 5,000 cubic yards per day (CYD/day) was applied to the schedule and is an appropriate excavation rate assuming at least two excavators and dozers and approximately 10 off-road haul trucks. A 30-cubic yard capacity off-road truck equates to approximately 17 round trips per truck per day to the landfill located 1.5-miles from the WDA. Removal of the estimated 1M CYD of CCR at a rate of 5,000 CYD/day and assuming 5-day work weeks, equates to a duration of ten months for CCR excavation. Given all excavation activities occur within the Site, no seasonal downtime was assumed due to local frost laws on public highways. If necessary, additional means and methods may be employed to adjust the schedule and/or duration of excavation activities, such as increased equipment support and increased work-week and/or work-day schedules.

3.2.4 Soil Backfill / Site Stabilization

Once the CCR has been removed from the WDA, soil backfill will be imported from a local borrow source to efficiently shed stormwater from the closed configuration of the WDA as provided in Figure 4 – Backfill Grading Plan. Approximately 1.6M CYD of soil backfill and 70,000 CYD of topsoil will be required. It should be noted that the 1.6M CYD soil backfill volume assumes that all soil will be imported from an off-site borrow source and that un-impacted berm material outside the slurry wall will not be replaced as soil backfill. NIPSCO LLC may, at a later date, determine that the existing berm material (included in the CCR excavation estimate in Section 2.2) is suitable for soil backfill to reduce the off-site soil backfill volume. In addition, advancement of the closure design may yield other suitable closed configurations resulting in a reduction of required import material.

It is reasonable to apply a placement rate of 6,500 CYD/day for soil backfill assuming two excavators at the soil borrow site, 30 – 35 commercial haul trucks and up to three dozers and two compactors placing, grading and compacting the soil backfill in the WDA. Applying the placement rate to 5 working days per week, omitting soil import during the Jasper County frost law period (January 15th – April 15th), and a suitable borrow site located

within a 20-mile radius, equates to a duration of approximately fourteen months for soil backfill. A reduced placement rate of 1,000 CYD/day for topsoil was applied to account for seeding, fertilizing and mulching the topsoil, equating to three months for initial site stabilization. If necessary, additional means and methods may be employed to adjust the schedule and/or duration of backfill activities such as, increased borrow and on-site stockpile prior to periods of frost law restrictions, increased work-week and/or work-day schedules.

Table 3.2 – WDA CCR Removal Schedule Milestones contains a list of milestone dates that were developed as part of the closure construction planning and scheduling to demonstrate that closure will be completed within the self-implementing closure schedule per 40 CFR 257.102(f)(1)(ii).

Table 3.2: WDA CCR Removal Schedule Milestones

Closure Component	Start Date	End Date	Duration (Months)
WDA Final Closure Construction Plans	7/19/2024	1/15/2025	6
WDA Final Closure Review/Approval by IDEM	1/15/2025	1/15/2026	12
WDA NPDES Permit Review/Approval for Dewatering	5/19/2025	9/16/2025	4
Contractor Bidding/Procurement	11/16/2025	2/14/2026	3
Cease Receipt of WDA Waste Streams	**8/31/2025**	**9/1/2025**	0
Notification of Intent to Initiate Closure	9/2/2025	9/3/2025	0
Begin WDA Closure Construction	**9/15/2025**	**9/16/2025**	0
Surficial Dewatering	9/16/2025	12/15/2025	3
Contractor Mobilization	4/15/2026	5/1/2026	1
Interstitial Dewatering	4/24/2026	4/24/2027	12
CCR Excavation	7/18/2026	5/8/2027	10
Soil Backfill Placement and Grading	4/16/2027	6/22/2028	14
Topsoil / Seed / Fertilizer / Mulch	5/10/2028	8/16/2028	3
WDA Closure Construction Complete	**8/16/2028**	**8/17/2028**	0
PE Closure Certification	8/17/2028	9/17/2028	1

4.0 CLOSURE PLAN AMENDMENTS

NIPSCO LLC may amend the closure approach and closure plan details in the future as provided for in 40 CFR §257.102(b)(3). However, under no circumstances will any closure plan revision propose a closure completion date beyond October 17, 2028. A record of amendments to the closure plan will be tracked below. The latest

version of the closure plan will be noted on the front cover of the closure plan which will be included in the Facility operating record and posted to the NIPSCO LLC's publicly accessible internet website.

Table 4.1: WDA Closure Plan Amendment Log

Version	Date	Description of Changes Made
1	October 12, 2016	Initial Issue (Haley & Aldrich, Inc)
2	February 7, 2019	Date of Closure Updated (Haley & Aldrich, Inc)
3	June 12, 2019	Update to Introductory Text (Haley & Aldrich, Inc)
4	October 8, 2020	Update to Closure by Removal, or Hybrid Closure Approach and Schedule Revision (Haley & Aldrich, Inc)
5	October 30, 2020	Revision to Closure by Removal Approach and Development of Detailed Closure Schedule (Golder Associates, Inc)

5.0 REFERENCES

"Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" Title 40 – Protection of the Environment Part 257 – Criteria for Classification of Solid Waste Disposal Facilities and Practices Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments

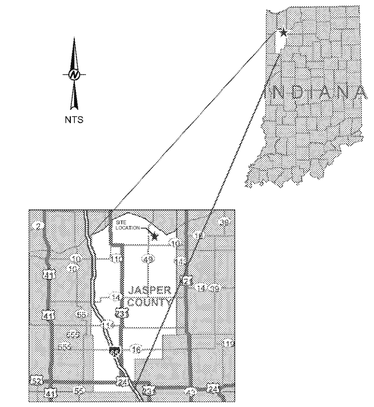
Golder Associates, R. M. Schahfer Generating Station Ash Pond Assessment Report, Revised June 2020.

Golder and the G logo are trademarks of Golder Associates Corporation

Figures

RMSCS
FIGURE 01

PROJECT LOCATION MAP



LEGEND

EXISTING SLURRY WALL

NOTES

REFERENCE

1. AERIAL PHOTO COURTESY OF BING IMAGES, 2020 MICROSOFT CORPORATION, 2020 MAXAR, CNES (2020) DISTRIBUTION AIRBUS DS, PHOTO DATE MARCH-MAY 2019.

0 400 800
1" = 400' FEET

GOLDER
Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
4						
3						
2						
1						

NIPSCO

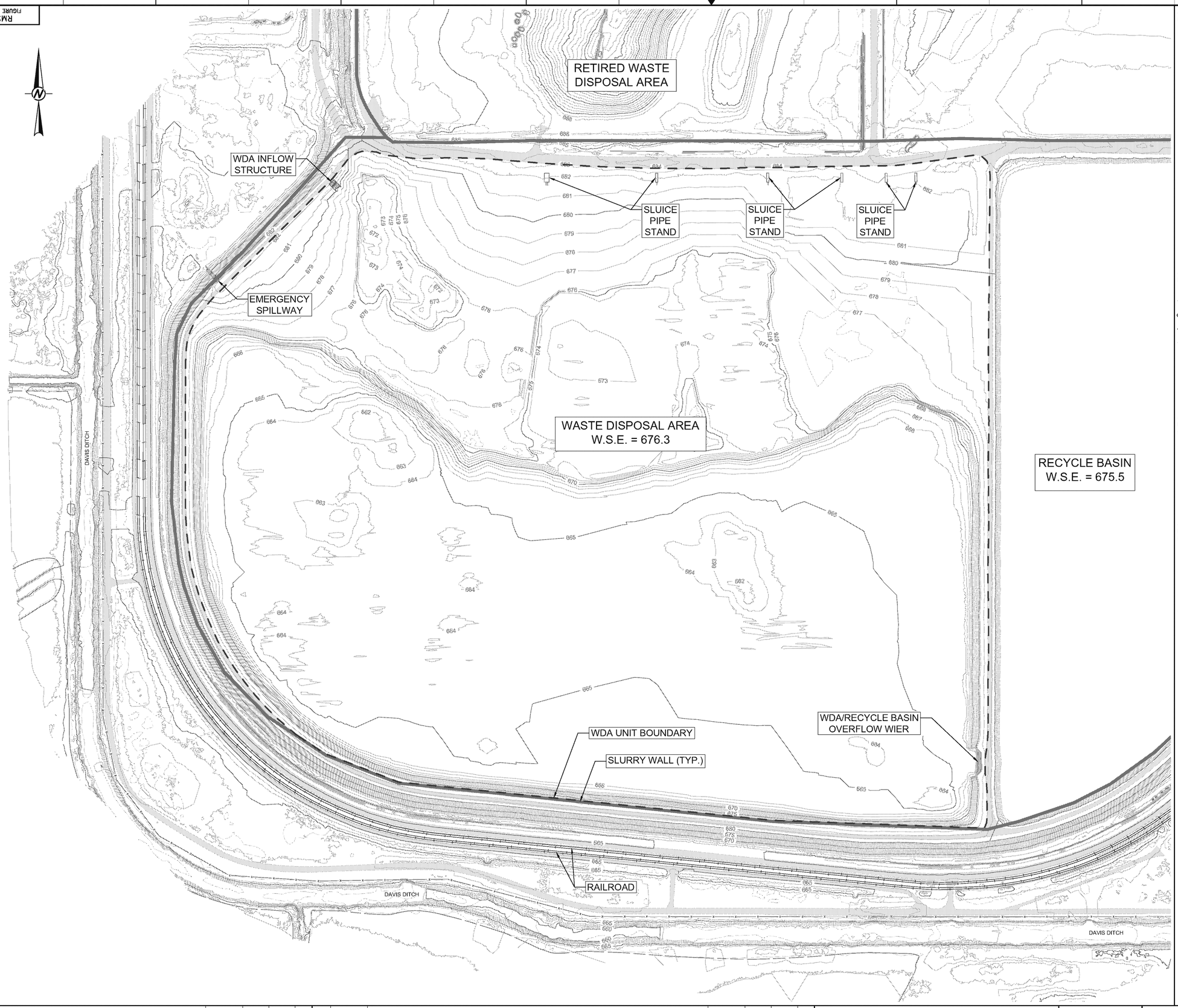
DRAWN:	SDA
ENGINEER:	JDP
APPROVED:	RAW
DATE:	2020-10-27
SCALE:	AS SHOWN

TITLE RM SCHAHFER GENERATING STATION
LOCATION WHEATFIELD, INDIANA
DETAIL SITE LOCATION MAP
WASTE DISPOSAL AREA CLOSURE
W.O./ACCT. NO. 20368079

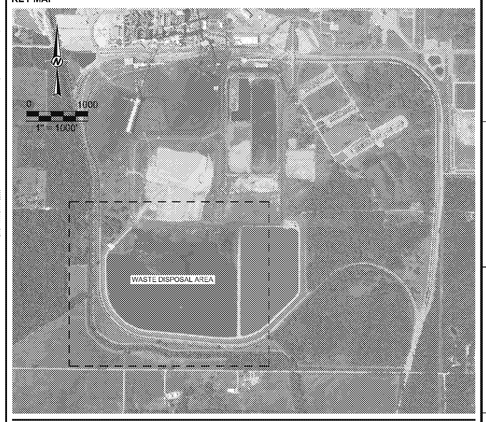
FIGURE 01
REV. 0

P:\NIPSCO\20145846_RMSCS_OwnersEngineering\PRODUCTION\C-Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_OVERALL SITE PLAN.dwg Oct 27, 2020 - 3:51pm By: STanderson

RMSGS
FIGURE 02



KEY MAP



LEGEND

- EXISTING ACCESS ROAD (GRAVEL)
- EXISTING RAILROAD
- EXISTING SLURRY WALL
- EXISTING WDA UNIT BOUNDARY
- 680 EXISTING GROUND ELEVATION CONTOUR (5ft INTERVAL)
- 679 EXISTING GROUND ELEVATION CONTOUR (1ft INTERVAL)

NOTES

1. ONLY UTILITIES OBSERVED AT THE TIME OF SURVEY WERE RECORDED. ADDITIONAL UTILITIES EXIST IN ADDITION TO THOSE SHOWN HEREON.
2. ADDITIONAL INFORMATION:
   STREET ADDRESS: 2723 E 1500 N,WHEATFIELD, INDIANA 46392
   COUNTY: JASPER
   USGS QUADRANGLE MAP: DUNE ACRES
3. USE CAUTION WHEN WORKING BENEATH OVERHEAD ELECTRICAL TRANSMISSION LINES, IN ACCORDANCE WITH THE OWNER'S REQUIREMENTS. VERIFY ADEQUATE CLEARANCE FOR EQUIPMENT. PRIOR TO PERFORMING WORK, SELECT EQUIPMENT AND CONDUCT OPERATIONS TO MAINTAIN ADEQUATE CLEARANCE BENEATH ELECTRICAL CONDUCTORS.

REFERENCES

1. EXISTING TOPOGRAPHIC MAPPING SHOWN WAS DEVELOPED BY DLZ INDUSTRIAL, LLC, 316 TECH DRIVE, BURNS HARBOR, INDIANA 46304, DATED OCTOBER 6, 2017. MAPPING PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. CONTAINED WITHIN AUTOCAD DRAWING FILE "8103TO-RMSGS 2017-09-27.DWG" RECEIVED SEPTEMBER 28, 2020.
2. EXISTING TOPOGRAPHIC CONTOURS SHOWN PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. BASED ON 3D SURFACE MODEL "EXIST" CONTAINED WITHIN AUTOCAD DRAWING FILE "20190507_WDA PERMIT SET.DWG" RECEIVED OCTOBER 15, 2020.
3. HORIZONTAL SURVEY CONTROL HEREON SHOWS COORDINATE VALUES IN INDIANA COORDINATE SYSTEM OF 1983 (NAD 83, WEST ZONE). UNITS ARE IN US FEET.
4. VERTICAL SURVEY CONTROL BASED ON NAVD88 (NORTH AMERICAN DATUM 1988).

0 100 200
1" = 100' FEET

GOLDER
Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

DATE	APP'D DRAFT	APP'D ENGR.	FILM	REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
				4						
				3						
				2						
				1						

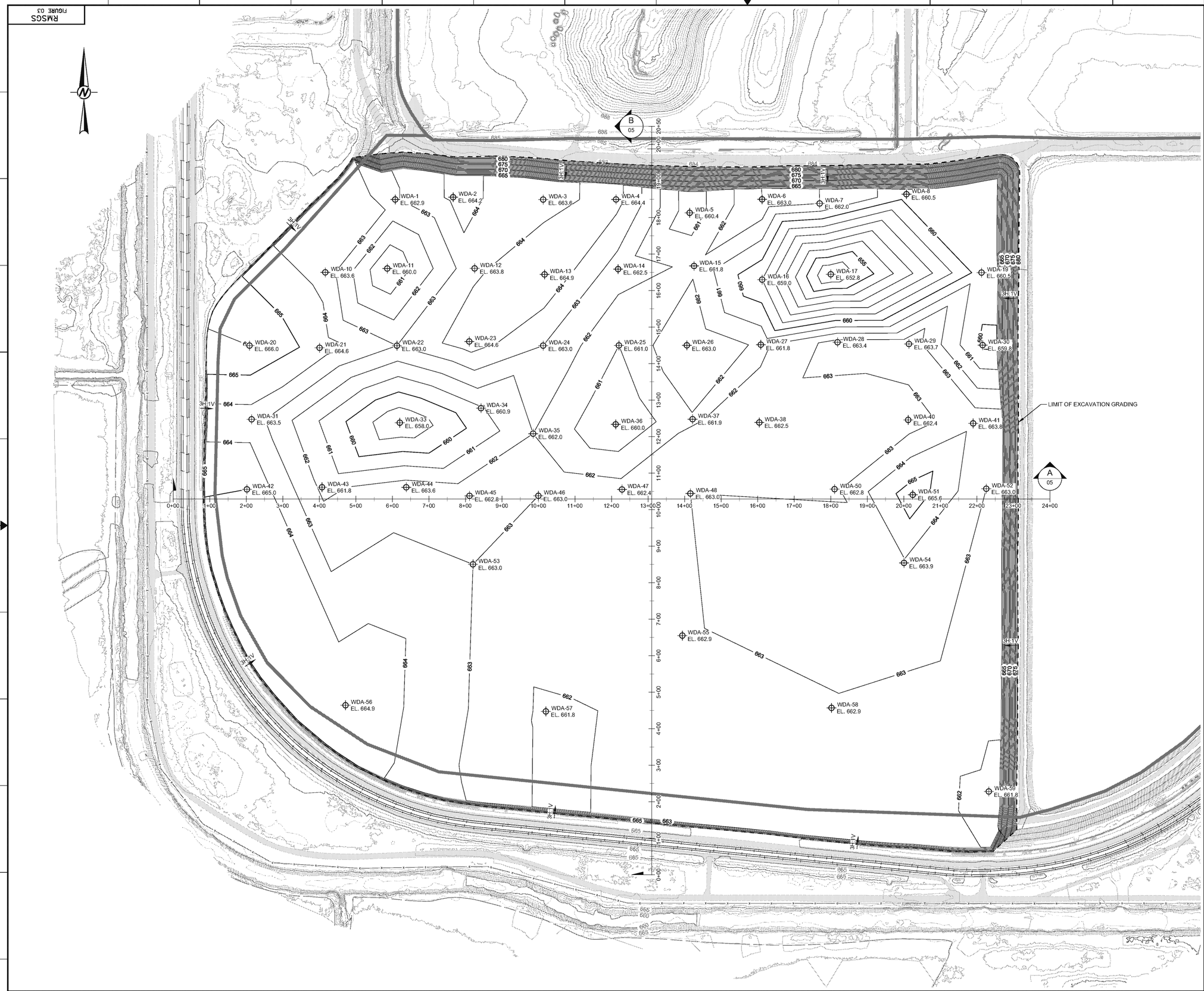
NIPSCO

DRAWN: SDA	TITLE RM SCHAHFER GENERATING STATION
ENGINEER: JDP	LOCATION WHEATFIELD, INDIANA
APPROVED: RAW	DETAIL EXISTING CONDITIONS PLAN
DATE: 2020-10-27	WASTE DISPOSAL AREA CLOSURE
SCALE: AS SHOWN	W.O./ACCT. NO. 20368079

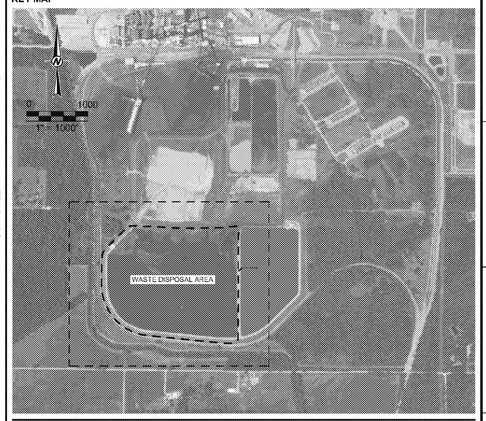
FIGURE 02 — REV. 0

P:\NIPSCO\P2014594B_RMSGS_OwnersEngineering\PRODUCTION\C -Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_Existing-Conditions.dwg Oct 27, 2020 - 3:52pm By: STAnderson

RMSGS
FIGURE 03



KEY MAP



LEGEND

- EXISTING ACCESS ROAD (GRAVEL)
- EXISTING RAILROAD
- EXISTING SLURRY WALL
- 680 — EXISTING GROUND ELEVATION CONTOUR (5ft INTERVAL)
- 673 — EXISTING GROUND ELEVATION CONTOUR (1ft INTERVAL)
- 665 — PROPOSED EXCAVATION CONTOUR (5ft INTERVAL)
- 663 — PROPOSED EXCAVATION CONTOUR (1ft INTERVAL)
- WDA-1 EL. 662.9 — CPT/SPT BORING LOCATION / ID / EXISTING BOTTOM OF CCR ELEVATION

NOTES

1. ONLY UTILITIES OBSERVED AT THE TIME OF SURVEY WERE RECORDED. ADDITIONAL UTILITIES EXIST IN ADDITION TO THOSE SHOWN HEREON.
2. ADDITIONAL INFORMATION:
   STREET ADDRESS: 2723 E 1500 N,WHEATFIELD, INDIANA 46392
   COUNTY: JASPER
   USGS QUADRANGLE MAP: DUNE ACRES
3. USE CAUTION WHEN WORKING BENEATH OVERHEAD ELECTRICAL TRANSMISSION LINES, IN ACCORDANCE WITH THE OWNER'S REQUIREMENTS. VERIFY ADEQUATE CLEARANCE FOR EQUIPMENT. PRIOR TO PERFORMING WORK, SELECT EQUIPMENT AND CONDUCT OPERATIONS TO MAINTAIN ADEQUATE CLEARANCE BENEATH ELECTRICAL CONDUCTORS.

REFERENCES

1. EXISTING TOPOGRAPHIC MAPPING SHOWN WAS DEVELOPED BY DLZ INDUSTRIAL, LLC, 316 TECH DRIVE, BURNS HARBOR, INDIANA 46304, DATED OCTOBER 6, 2017. MAPPING PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. CONTAINED WITHIN AUTOCAD DRAWING FILE "8103TO-RMSGS 2017-09-27.DWG" RECEIVED SEPTEMBER 28, 2020.
2. EXISTING TOPOGRAPHIC CONTOURS SHOWN PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. BASED ON 3D SURFACE MODEL "EXIST" CONTAINED WITHIN AUTOCAD DRAWING FILE "20190507_WDA PERMIT SET.DWG" RECEIVED OCTOBER 15, 2020.
3. HORIZONTAL SURVEY CONTROL HEREON SHOWS COORDINATE VALUES IN INDIANA COORDINATE SYSTEM OF 1983 (NAD 83, WEST ZONE). UNITS ARE IN US FEET.
4. VERTICAL SURVEY CONTROL BASED ON NAVD88 (NORTH AMERICAN DATUM 1988).
5. PROPOSED EXCAVATION TOPOGRAPHY WITHIN THE WDA BASED ON CPT AND SPT BORING LOGS COMPLETED BY GOLDER BETWEEN JULY AND NOVEMBER 2019. LOGS INCLUDED IN GOLDER REPORT "R. M. SCHAHFER GENERATING STATION ASH POND ASSESSMENT REPORT" REVISED JUNE 2020.

CUT DEPTH TABLE

RANGE NUMBER	MAX. DEPTH	MIN. DEPTH	3D AREA (SQ. FT)	2D AREA (ACRES)	VOLUME (CY)
1	-23.8	-15.0	540,607	12.34	62,944
2	-15.0	-10.0	983,618	22.40	196,805
3	-10.0	-5.0	262,076	5.81	302,198
4	-5.0	0.0	1,940,326	44.36	472,198

CUT TOTAL VOLUME ESTIMATE

Base Surface	EG-RMSGS-WDA-ExTopo-2017-10-06
Comparison Surface	DG-RMSGS-WDA-PropExcavation-Concept-1
Cut Factor	1.00
Fill Factor	1.00
Cut volume	1,034,144.85 Cu. Yd.
Fill volume	0.00 Cu. Yd.
Net volume	**1,034,144.85 Cu. Yd.**

0 100 200
1" = 100' FEET

GOLDER
Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
4						
3						
2						
1						

NIPSCO

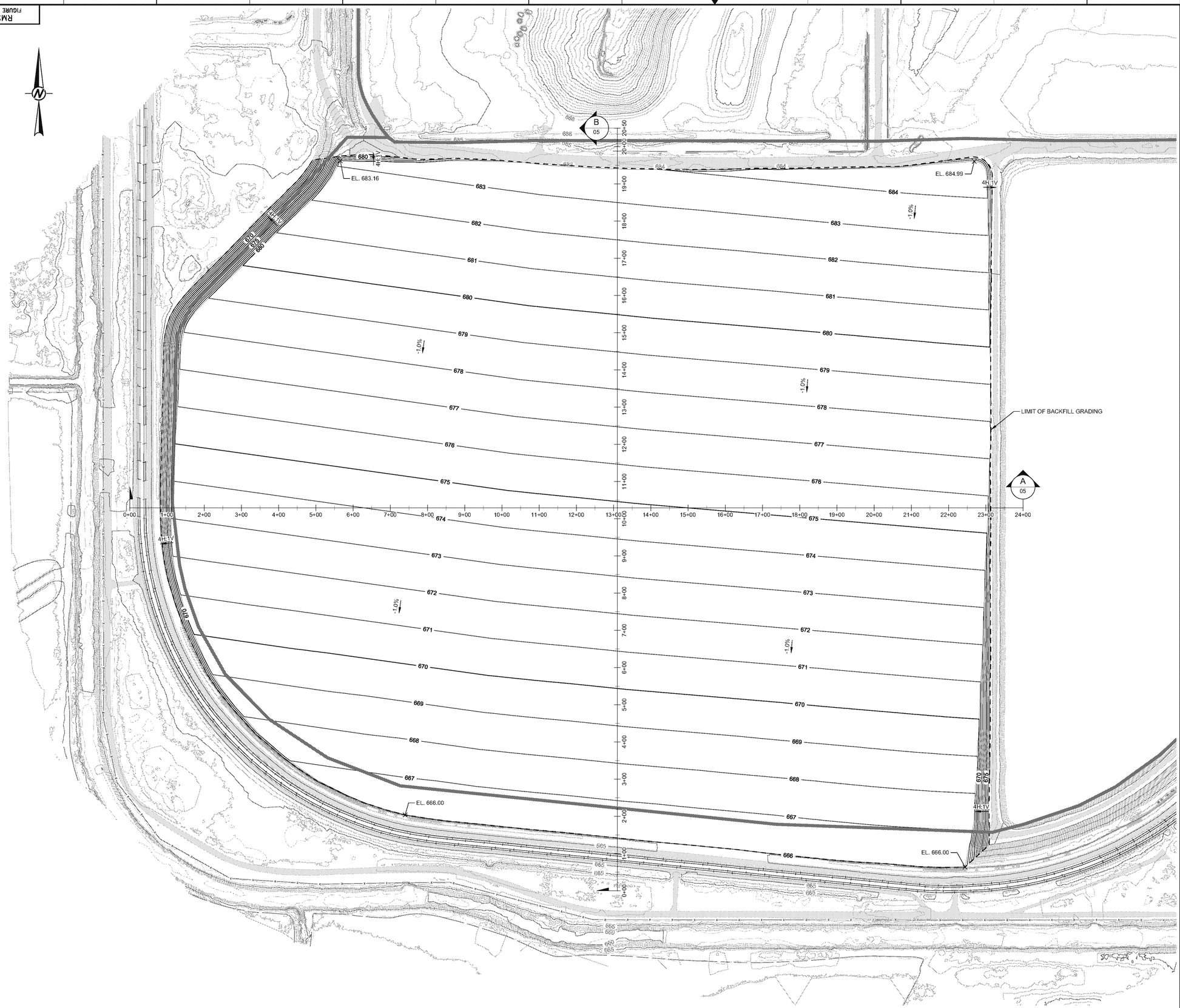
DRAWN: SDA
ENGINEER: JDP
APPROVED: RAW
DATE: 2020-10-27
SCALE: AS SHOWN

TITLE RM SCHAHFER GENERATING STATION
LOCATION WHEATFIELD, INDIANA
DETAIL PROPOSED CCR EXCAVATION GRADES
WASTE DISPOSAL AREA CLOSURE
W.O./ACCT. NO. 20368079

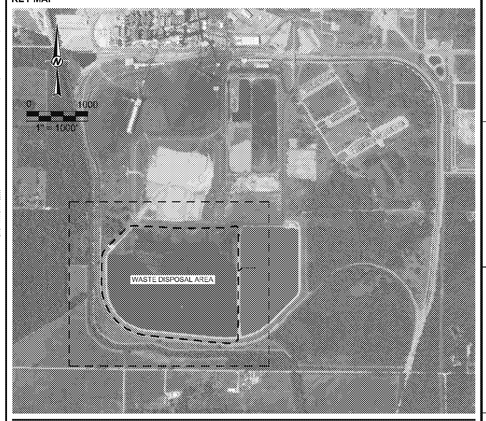
FIGURE 03
REV. 0

P:\NIPSCO\P2014594B_RMSGS_OwnersEngineering\PRODUCTION\C -Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_Excavation-Plan.dwg Oct 27, 2020 - 5:23pm By: STAnderson

RMSGS
FIGURE 04



KEY MAP



LEGEND

- EXISTING ACCESS ROAD (GRAVEL)
- EXISTING RAILROAD
- EXISTING SLURRY WALL
- 680 — EXISTING GROUND ELEVATION CONTOUR (5ft INTERVAL)
- 679 — EXISTING GROUND ELEVATION CONTOUR (1ft INTERVAL)
- 680 — PROPOSED BACKFILL FINAL COVER CONTOUR (5ft INTERVAL)
- 679 — PROPOSED BACKFILL FINAL COVER CONTOUR (1ft INTERVAL)

NOTES

1. ONLY UTILITIES OBSERVED AT THE TIME OF SURVEY WERE RECORDED. ADDITIONAL UTILITIES EXIST IN ADDITION TO THOSE SHOWN HEREON.
2. ADDITIONAL INFORMATION:
   STREET ADDRESS: 2723 E 1500 N,WHEATFIELD, INDIANA 46392
   COUNTY: JASPER
   USGS QUADRANGLE MAP: DUNE ACRES
3. USE CAUTION WHEN WORKING BENEATH OVERHEAD ELECTRICAL TRANSMISSION LINES, IN ACCORDANCE WITH THE OWNER'S REQUIREMENTS. VERIFY ADEQUATE CLEARANCE FOR EQUIPMENT. PRIOR TO PERFORMING WORK, SELECT EQUIPMENT AND CONDUCT OPERATIONS TO MAINTAIN ADEQUATE CLEARANCE BENEATH ELECTRICAL CONDUCTORS.

REFERENCES

1. EXISTING TOPOGRAPHIC MAPPING SHOWN WAS DEVELOPED BY DLZ INDUSTRIAL, LLC, 316 TECH DRIVE, BURNS HARBOR, INDIANA 46304, DATED OCTOBER 6, 2017. MAPPING PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. CONTAINED WITHIN AUTOCAD DRAWING FILE "8103TO-RMSGS 2017-09-27.DWG" RECEIVED SEPTEMBER 28, 2020.
2. EXISTING TOPOGRAPHIC CONTOURS SHOWN PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. BASED ON 3D SURFACE MODEL "EXIST" CONTAINED WITHIN AUTOCAD DRAWING FILE "20190507_WDA PERMIT SET.DWG" RECEIVED OCTOBER 15, 2020.
3. HORIZONTAL SURVEY CONTROL HEREON SHOWS COORDINATE VALUES IN INDIANA COORDINATE SYSTEM OF 1983 (NAD 83, WEST ZONE). UNITS ARE IN US FEET.
4. VERTICAL SURVEY CONTROL BASED ON NAVD88 (NORTH AMERICAN DATUM 1988).

FILL DEPTH TABLE

RANGE NUMBER	MIN. DEPTH	MAX. DEPTH	3D AREA (SQ. FT)	2D AREA (ACRES)	VOLUME (CY)
1	0.0	5.0	442,232	10.01	683,874
2	5.0	10.0	1,199,149	27.45	512,939
3	10.0	15.0	937,250	21.45	311,937
4	15.0	28.6	1,238,608	28.37	157,998

FILL TOTAL VOLUME ESTIMATE

Base Surface	DG-RMSGS-WDA-PropExcavation-Concept-1
Comparison Surface	DG-RMSGS-WDA-PropFinalCover-Concept-1
Cut Factor	1.00
Fill Factor	1.00
Cut volume	0.00 Cu. Yd.
Fill volume	1,666,748.44.88 Cu. Yd.
Net volume	**1,666,748.44 Cu. Yd.<Fill>**

0 100 200
1" = 100' FEET

GOLDER
Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

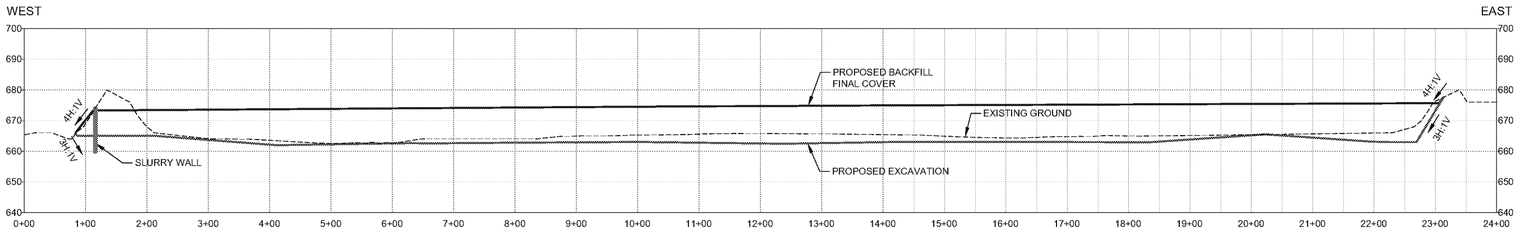
DATE	APP'D DRAFT	APP'D ENGR.	FILM	REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
				4						
				3						
				2						
				1						

NIPSCO

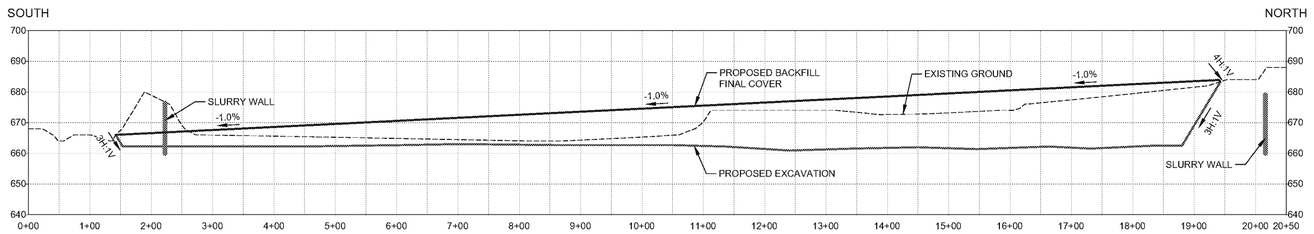
DRAWN: SDA	TITLE RM SCHAHFER GENERATING STATION	FIGURE	REV.
ENGINEER: JDP	LOCATION WHEATFIELD, INDIANA	04	0
APPROVED: RAW	DETAIL PROPOSED BACKFILL GRADES		
DATE: 2020-10-27	WASTE DISPOSAL AREA CLOSURE		
SCALE: AS SHOWN	W.O./ACCT. NO. 20368079		

P:\NIPSCO\P2014594B_RMSGS_OwnersEngineering\PRODUCTION\C -Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_Backfill-Plan.dwg Oct 27, 2020 - 5:33pm By: STAnderson

RMSGS
FIGURE 05

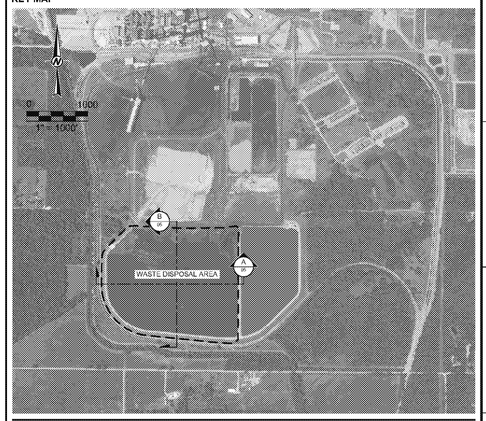


SCALE: 1" = 100' HORIZ.
1" = 20' VERT.
A / 05 SECTION



SCALE: 1" = 100' HORIZ.
1" = 20' VERT.
B / 05 SECTION

KEY MAP



LEGEND

- EXISTING GROUND (SEPTEMBER 2017 SURVEY)
- EXISTING SLURRY WALL
- PROPOSED EXCAVATION GRADE
- PROPOSED BACKFILL FINAL COVER GRADE

NOTES

REFERENCES

1. EXISTING GROUND SHOWN BASED ON MAPPING DEVELOPED BY DLZ INDUSTRIAL, LLC, 316 TECH DRIVE, BURNS HARBOR, INDIANA 46304, DATED OCTOBER 6, 2017.
2. EXISTING GROUND SHOWN PROVIDED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC. BASED ON 3D SURFACE MODEL "EXIST" CONTAINED WITHIN AUTOCAD DRAWING FILE "20190507_WDA PERMIT SET.DWG" RECEIVED OCTOBER 15, 2020.
3. VERTICAL SURVEY CONTROL BASED ON NAVD88 (NORTH AMERICAN DATUM 1988).

0 100 200
1" = 100' HORIZ. FEET
0 20 40
1" = 20' VERT. FEET

GOLDER
Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

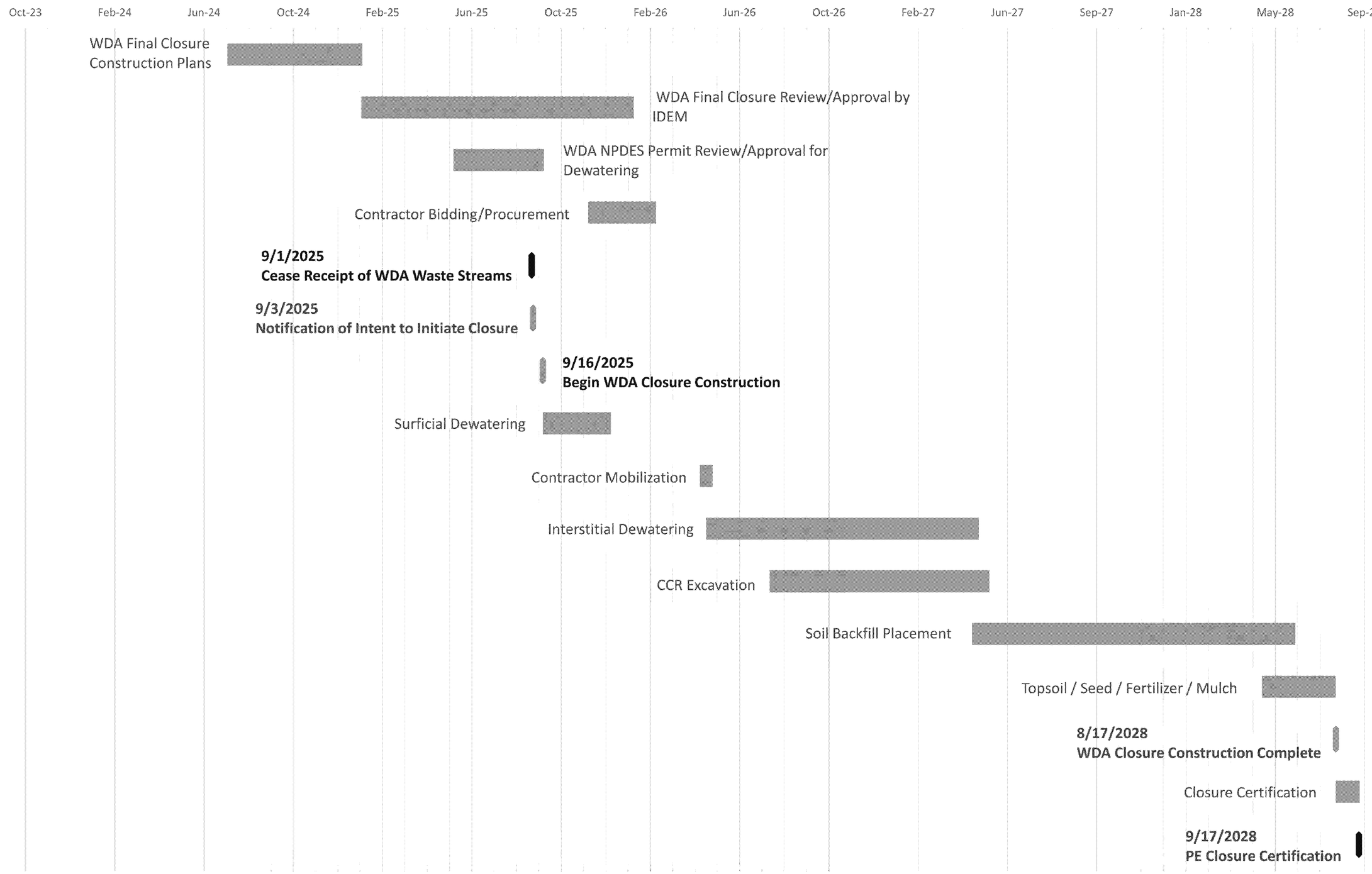
DATE	APP'D DRAFT	APP'D ENGR.	FILM	REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
				4						
				3						
				2						
				1						

NIPSCO

DRAWN: SDA	TITLE RM SCHAFFER GENERATING STATION	FIGURE	REV.
ENGINEER: JDP	LOCATION WHEATFIELD, INDIANA	05	0
APPROVED: RAW	DETAIL CROSS SECTIONS		
DATE: 2020-10-27	WASTE DISPOSAL AREA CLOSURE		
SCALE: AS SHOWN	W.O./ACCT. NO. 20368079		

P:\NIPSCO\P2014594B_RMSGS_OwnerEngineering\PRODUCTION\C-Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_SECTIONS.dwg Oct 27, 2020 - 5:18pm By: STAnderson

RMSGS FIGURE 06



GOLDER

Golder Associates, Inc.
1133 Quail Court, Suite 115, Pewaukee, WI 53072
Phone: +1(262) 347-0561

DATE	APP'D DRAFT	APP'D ENGR.	FILM	REV.	W.O.	DESCRIPTION	DATE	APP'D DRAFT	APP'D ENGR.	FILM
				4						
				3						
				2						
				1						

NIPSCO

DRAWN:	SDA
ENGINEER:	JDP
APPROVED:	RAW
DATE:	2020-10-28
SCALE:	NTS

TITLE RM SCHAHFER GENERATING STATION
LOCATION WHEATFIELD, INDIANA
DETAIL WDA CCR CLOSURE BY REMOVAL SCHEDULE
WASTE DISPOSAL AREA CLOSURE
W.O./ACCT. NO. 20368079

FIGURE 06 REV. 0

C:\Users\mbosivert.GOLDER\Desktop\NIPSCO (7)\NIPSCO\P2014594E_RMSGS_OwnersEngineering\PRODUCTION\C -Waste Disposal Area Conceptual Closure\20368079-WDA-Concept-Closure_GANTT Chart Schedule.dwg Oct 28, 2020 - 1:29pm By: mbosivert

GOLDER

golder.com

GOLDER

golder.com