



Inflow Design Flood Control System Plan

BAILLY GENERATING STATION

CCR SURFACE IMPOUNDMENT INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

Chesterton, Indiana

Pursuant to 40 CFR 257.82

Submitted To: Northern Indiana Public Service Company
2755 Raystone Drive
Valpariso, IN 46383

Submitted By: Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, New Hampshire 03101

October 2016

1650772





CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.82(c)(5)]

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 257.82 (40 CFR Part 257.82), I attest that this Inflow Design Flood Control System 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 257.82.

Golder Associates Inc.


Signature

10-11-2016
Date of Report Certification

Richard A. Wesenberg, PE
Name

PE 11500584
Professional Engineer License Number





Table of Contents

CERTIFICATION..... C-1

1.0 INTRODUCTION..... 1

 1.1 Background 1

 1.2 CCR Surface Impoundments 1

 1.2.1 Boiler Slag Pond (BSP)..... 1

 1.2.2 Primary 1 (P1) 1

 1.2.3 Primary 2 (P2) 2

 1.2.4 Secondary 1 (S1) 2

 1.3 Purpose 2

2.0 FLOOD CONTROL SYSTEM 4

 2.1 CCR Surface Impoundment Analysis 4

 2.1.1 CCR Surface Impoundment Conclusions and Operational Restrictions 5

3.0 PLAN REVISION AND RECORDKEEPING 6

4.0 REFERENCES..... 7

List of Figures

- Figure 1 Site Location Map
- Figure 2 Existing Conditions





1.0 INTRODUCTION

1.1 Background

The Northern Indiana Public Service Company (NIPSCO) Bailly Generating Station (BGS) is an operating coal-fired electric generating plant located in Chesterton, Porter County, Indiana. BGS occupies approximately 350 acres in an industrial area, is bounded to the north by Lake Michigan, to the east by Indiana Dunes National Lakeshore, to the south and west by the ArcelorMittal Steel Company (formerly International Steel Group's Burns Harbor Plant/Bethlehem Steel) and further to the south by Route 12. There are six impoundments for managing operational water and the CCR generated on-site at BGS. These impoundments are located adjacent to one another along a west-east axis as shown on Figure 2 and include (from west to east) Boiler Slag Pond, Primary 1, Primary 2, Secondary 2, Secondary 1, and Forebay.

1.2 CCR Surface Impoundments

Northern Indiana Public Service Company (NIPSCO) has determined that BGS has four CCR surface impoundments that are subject to the requirements of the CCR Final Rule including (from west to east):

- Boiler Slag Pond (BSP) – approximate 2-acre incised, lined impoundment.
- Primary 1 (P1) – approximate 6-acre rectangular, incised, lined impoundment.
- Primary 2 (P2) – approximate 7-acre rectangular, incised, lined impoundment.
- Secondary 1 (S1) - approximate 2-acre rectangular, incised, lined impoundment.

The CCR unit locations identified above are shown in Figure 2. All of the CCR units were designed by Sargent & Lundy Engineers of Chicago, Illinois in 1978.

1.2.1 Boiler Slag Pond (BSP)

The Boiler Slag Pond is the western most CCR impoundment at the facility and is an approximately 2-acre pond that is incised into the existing older fill. The pond is enclosed by a cutoff wall along the northern and western boundaries and the 3H:1V embankment side slope to the south and east. The floor of the pond slopes to the outlet located in the southeast corner and the bottom of the pond was lined with geomembrane and clay overlaid with a protective layer of crushed slag.

The BSP accepts sluiced bottom ash and boiler slag CCR and various sump discharges from the generating station. The sluiced CCR enters the BSP via pipes in the southeast corner. A decant pipe is located within the southeastern corner of the BSP that can direct effluent to P1 via gravity feed. CCR impounded within the BSP is periodically removed as part of BGS operations.

1.2.2 Primary 1 (P1)

Primary 1 is located between the BSP and P2 and is an approximately 6-acre pond that is incised into the existing older fill. The pond was constructed with 3H:1V interior sideslopes and is approximately 7.5 to 26



feet deep. The floor of the pond gradually slopes to the east. The pond was lined with geomembrane and clay under a protective layer of crushed slag. The southwest corner of P1 has been backfilled and is no longer available as operational storage

P1 receives flow from the BSP via a gravity feed, boiler blowdown water, boiler fireside wash water, filter backwash, reverse osmosis reject water, ion exchange waste water, and surface water runoff from a small upland area. A decant pipe located in the southeastern corner of the pond, directs effluent from P1 to S1 via gravity feed.

1.2.3 Primary 2 (P2)

P2 is located between P1 and the Secondary Settling Pond #2 and is an approximately 7-acre pond that is incised into the existing older fill. The pond was constructed with 3H:1V interior sideslopes and is approximately 15 to 24.5 feet deep. The floor of the pond gradually slopes to the east. The pond was lined with geomembrane and clay overlaid with a protective layer of crushed slag.

P2 receives boiler blowdown water, boiler fireside wash water, filter backwash, reverse osmosis reject water, ion exchange waste water, and surface water runoff from a small upland area. A decant pipe located in the southeastern corner of the pond, directs effluent from P2 to S1 via gravity feed.

1.2.4 Secondary 1 (S1)

Secondary 1 is an approximately 2-acre pond that is incised into the existing older fill material similar to the primary settling ponds. It is the easternmost CCR impoundment at BGS and shares an embankment on the north and west with Secondary 2. The pond was constructed with 3H:1V interior sideslopes and is approximately 11.5 to 16.5 feet deep. The floor of the pond gradually slopes to the east. The pond was lined with geomembrane and clay overlaid with a protective layer of crushed slag.

S1 receives flow from P1 and P2 via gravity feed pipes and receives negligible amounts of runoff from the surrounding area. Two outflow pipes located in the northeast corner of S1 direct effluent from S1 to the Forebay.

1.3 Purpose

The purpose of the Inflow Design Flood Control System Plan (Plan) is to provide a basis for the certification required by 40 CFR 257.82 Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments. 40 CFR 257.82(a) requires the owner or operator of a CCR surface impoundment to design, construct, operate, and maintain an inflow flood control system as follows:

- Adequately manage the flow into the CCR unit during and following the peak discharge of the inflow design flood as specified in 40 CFR 257.82(a)(3).



- Adequately manage the flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood as specified in 40 CFR 257.82(a)(3).
- Handle discharge from the CCR unit in accordance with the surface water requirements under 40 CFR 257.3-3.

Since the BSP, P1, P2, and S1 are all determined to be incised impoundments, the flood control system must provide protection to the CCR unit during a 25-year flood event per 40 CFR 257.82(a)(3)(iv).



2.0 FLOOD CONTROL SYSTEM

To satisfy the requirements of 40 CFR 257.82(a), the flood control system must provide flood protection to the CCR unit during the inflow design flood for two cases: 1) floodwater from outside the unit, and 2) controlling internal water levels within the unit. The sections below describe the analysis performed to evaluate the adequacy of the existing flood control structures and list any operational limitations required to maintain adequate flood control measures as required by 40 CFR 257.82(a).

2.1 CCR Surface Impoundment Analysis

The BGS CCR ponds are located adjacent to one another along an east-west axis. All of the impoundments are incised and incorporate a liner system. To evaluate the ability of the BSP, P1, P2, and S1 to adequately manage the flow during and following the peak discharge of the design storm event a hydrologic and hydraulic analysis was performed. This analysis incorporated a HEC-HMS model and a wave action analysis for each impoundment.

In general, water flows through the impoundments by gravity from west to east and water is pumped from the Forebay to the BGS or to a nearby NPDES outfall. These impoundments are all hydraulically connected via gravity pipes and the water levels within them will seek equilibrium with one another. To simplify the analysis, the modeled impoundments were isolated from one another with no interflow between the units during the design storm. Therefore, each pond must impound the precipitation within its own catchment area.

The hydrologic analysis conservatively assumed that all precipitation falling within the ponds and their upland drainage areas reported immediately to the impoundments and without infiltration. As such, there was no lag (delay) or precipitation losses incorporated in this analysis, resulting in larger volumes of storm water to be impounded and higher peak flows.

The analysis also assumed that, during large storm events, BGS operations will be managed to discontinue operational inflows to the impoundments. As such, the modelled input to the impoundments is from direct precipitation and surface water runoff only.

The HEC-HMS model incorporated the following:

- A meteorological model to simulate the 25-year flood that combined the precipitation depth associated with the 24-hour duration, 25-year recurrence interval storm event (5.19 inches) and the Natural Resource Conservation Service (NRCS) Type II temporal rainfall distribution.
- A hydrological model to simulate the collection of surface water and conveyance to the impoundment.
- Geometric model of the impoundments to simulate the water storage and the variation in water levels during and following the design storm event.



- Discharge curves to simulate the outflow of water from the impoundments during the design storm event.

In addition, a wave action analysis was performed to calculate the freeboard required above the maximum water surface elevation during the design storm.

2.1.1 CCR Surface Impoundment Conclusions and Operational Restrictions

The results of the hydraulic and hydrologic analysis of the BGS CCR Surface Impoundments are summarized below. These include the results of HEC-HMS modelling analysis and the results of the wave action analysis.

BGS CCR Ponds Hydrology and Hydraulics Analysis Results

Impoundment Name	Embankment Crest Elevation (ft)	Initial Water Surface Elevation (ft)	Peak Water Surface Elevation (ft)	Maximum Wave Height (ft)	Net Freeboard (ft)	Maximum Operational Water Surface Elevation (ft)
Boiler Slag Pond	43.7	40.7	41.7	0.5	1.5	42.2
Primary 1	42.5	38.0	41.2	0.5	0.8	38.8
Primary 2	42.5	38.0	38.9	0.6	3.0	41.0
Secondary 1	42.5	38.0	38.5	0.4	3.6	41.6

Note: The elevations shown reference a local datum used on the Sargent & Lundy Design Drawings (1978) and are not mean sea level.

As shown, the current configuration of the BGS CCR impoundments is compliant with 40 CFR 257.82(a). This conclusion is based on the assumptions presented herein and the following operational conditions.

- The CCR impoundments must be operated at or below the maximum operational water surface elevations listed in the table above.
- The CCR stored in the BSP and P1 must be maintained at least one foot below the embankment crest.
- BGS operations will be managed to discontinue operational inflows to the BGS CCR impoundments during the design storm event (5.19 inches) or greater.





3.0 PLAN REVISION AND RECORDKEEPING

Per 40 CFR 257.82(c)(2): “The owner or operator of the CCR unit may amend the inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105(g)(3). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.”

Per 40 CFR 257.81(c)(4); “The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic inflow design flood control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).”

Per 40 CFR 257.82(d); “The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(g), the notification requirements specified in §257.106(g), and the internet requirements specified in §257.107(g).”



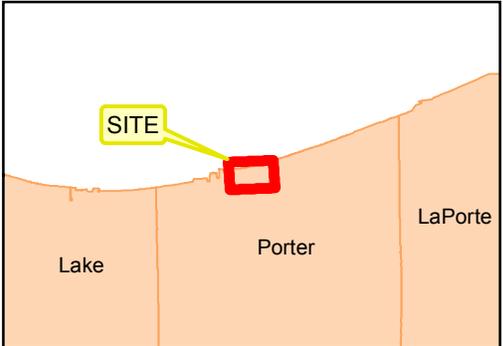
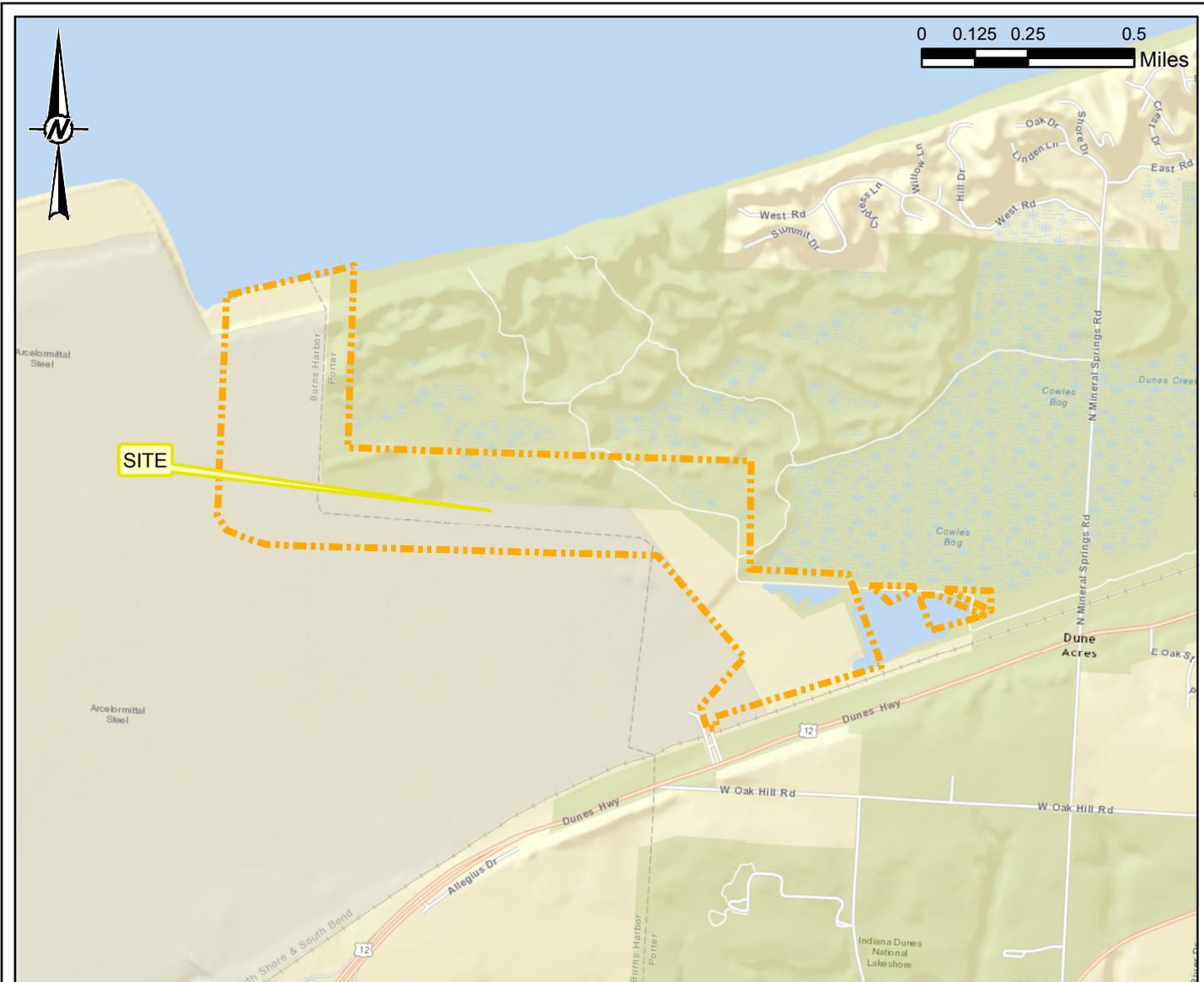
4.0 REFERENCES

Sargent & Lundy Engineers, Ash Pond Lining Design Drawings, Bailly Generating Station, 1978.

Golder Associates, Hydrologic and Hydraulic Analysis for CCR Impoundments – Bailly Generating Station, October 11, 2016.

USEPA (US Environmental Protection Agency). 2015. Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 40 CFR Part 257. Effective Date October 19, 2015.

FIGURES



REFERENCE(S)
 SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, USGS, INTERMAP, INCREMENT P CORP., NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI (THAILAND), MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
 NORTHERN INDIANA PUBLIC SERVICE COMPANY

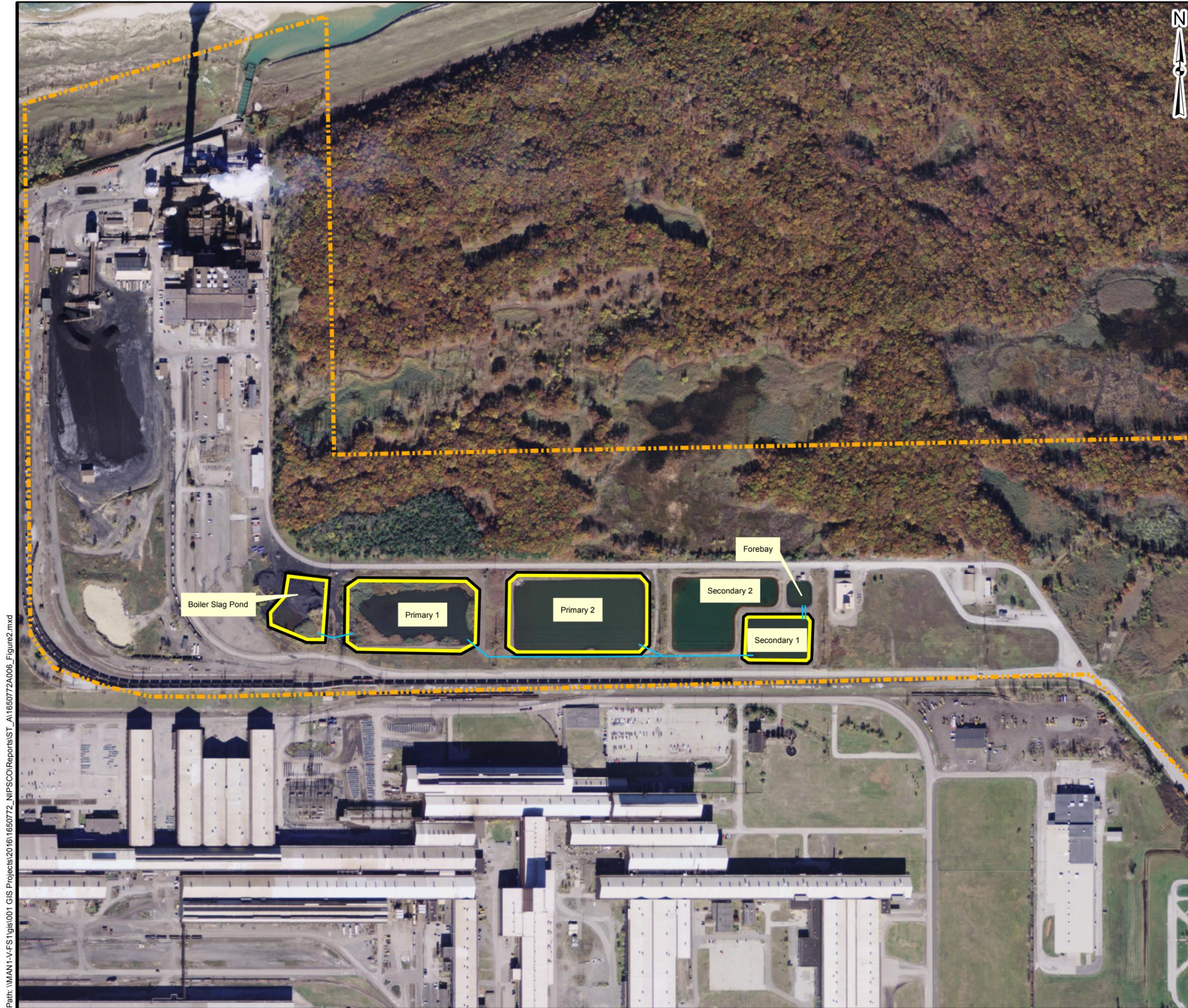
PROJECT CCR SURFACE IMPOUNDMENT
 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
 BAILLY GENERATING STATION
 CHESTERTON, INDIANA

CONSULTANT	YYYY-MM-DD	2016-10-05
	DESIGNED	CDS
	PREPARED	SHL
	REVIEWED	MCM
	APPROVED	RAW

TITLE SITE LOCATION MAP			
PROJECT NO. 165-0772	CONTROL B	REV. 0	FIGURE 1

PATH: V:\001_GIS Projects\2016\1650772_NIPSCO\Reports\ST_A\1650772_A05_Equest.mxd

1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANS/A



LEGEND

- Approximate Property Line
- CCR Units
- Outflow Pipe

NARRATIVE

This figure shows the approximate boundaries of the CCR units requiring submission of an inflow design control system plan for compliance with the final rule, 40 CFR, Part 257.82.

REFERENCES

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Elevations are in North American Vertical Datum 88



REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RWW

PROJECT: CCR SURFACE IMPOUNDMENT
INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
BAILLY GENERATING STATION
CHESTERTON, INDIANA

TITLE: EXISTING CONDITIONS

Golder Associates Manchester, New Hampshire	PROJECT No.	165-0772	FILE No.	1650772A006_Figure2
	DESIGN	MCM	10/11/2016	SCALE: AS SHOWN
	GIS	SHL	10/11/2016	REV. 0
	CHECK	MCM	10/11/2016	FIGURE 2
	REVIEW	RAW	10/11/2016	

Path: \\MAN1-V-FS\gis\001 GIS Projects\2016\1650772_NIPSCO\Reports\ST_A1650772A006_Figure2.mxd

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Inc.
670 North Commercial Street, Suite 103
Manchester, NH 03101 USA
Tel: (603) 668-0880
Fax: (603) 668-1199



Engineering Earth's Development, Preserving Earth's Integrity

Golder Associates and the GA globe design are trademarks of Golder Associates Corporation