



November 16, 2017

Project No. 1668072

Marissa M. Carrillo
R.M. Schahfer Generating Station Engineer
Northern Indiana Public Service Company
2723 E. 1500 N
Wheatfield, Indiana 46392

RE: AMENDMENT TO THE R.M. SCHAHFER GENERATING STATION INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - HYDRAULIC EVALUATION OF THE WASTE DISPOSAL AREA AUXILIARY SPILLWAY

Dear Ms. Carrillo:

At the request of Northern Indiana Public Service Company (NIPSCO) Golder Associates Inc. (Golder) has prepared this letter to assess the ability of the R.M. Schahfer Generating Station's (RMSGs)'s Waste Disposal Area (WDA) to manage inflow during and following the peak discharge of the inflow design flood. Specifically, NIPSCO has requested that Golder evaluate the hydraulic capacity of the improved WDA auxiliary spillway and recommend an acceptable operational water level within the WDA, based on that evaluation.

1.0 BACKGROUND

In April 2015, the United States Environmental protection Agency (EPA) published the Coal Combustion Residuals (CCR) Final Rule (CCR RCRA Rule) to regulate the solid waste management of CCR generated at electric utilities. Pursuant to this rule, NIPSCO retained Golder to provide an Inflow Design Flood Control System Plan compliant with Section 257.82 of the CCR RCRA Rule. In the RMSGs Inflow Design Flood Control System Plan (Golder, 2016) it was identified that the existing auxiliary spillway of the WDA was not sized to manage the flow resulting from the inflow design flood and was, therefore, not compliant with Section 257.73(d)(1)(v) of the CCR RCRA Rule. As such, Golder recommended that NIPSCO reduce the maximum operational water level within the WDA to elevation 675.4 feet above mean sea level (Golder, 2016) to maintain compliance with the CCR RCRA Rule.

In 2017, engineered improvements were made to the WDA auxiliary spillway to increase the hydraulic capacity of the structure (see Attachments 1 and 2) and facilitate an increase to the maximum operational water level within the WDA. These improvements 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.

2.0 HYDRAULIC ANALYSIS

To determine the adequacy of the improved as-built WDA auxiliary spillway, the maximum hydraulic capacity of the spillway was calculated and compared to the peak inflow associated with the design storm (3,708 cubic feet per second; cfs) presented in the Inflow Design Flood Control System Plan (Golder, 2016). Golder calculated the maximum hydraulic capacity of the improved condition of the WDA auxiliary spillway using Manning's open channel flow equation and the as-built dimensions and elevations provided (Attachment 2). The hydraulic analysis performed by Golder (see Attachment 3) indicates that the improved WDA auxiliary spillway can convey 3,768 cfs.

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Golder Associates Inc.
27200 Haggerty Road, Suite B-12
Farmington Hills, MI 48331-5719 USA
Tel: (248) 295-0135 Fax: (248) 295-0133 www.golder.com



Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

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3.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the hydraulic analysis performed by Golder indicate that the improved WDA auxiliary spillway can adequately convey the peak flow rate associated with the inflow design flood without additional attenuation within the WDA. As such, it is no longer necessary to restrict the operational water level within the WDA to maintain compliance with the CCR RCRA Rule.

We appreciate this opportunity to work with the NIPSCO team on this project. This report is respectfully submitted to NIPSCO for use at the RMSGS. If you have any questions or require additional information, please feel free to call.

GOLDER ASSOCIATES INC.



Steven A. McManus
Senior Geotechnical Project Engineer



Tiffany D. Johnson, P.E.
Associate

Cc: Mr. Joseph Kutch – NIPSCO
Mr. Kevin Sokolowski - NIPSCO

References:

Golder Associates Inc. (Golder), 2016. *R.M. Schahfer Generating Station CCR Surface Impoundment Inflow Design Flood Control System Plan*. Submitted to Northern Indiana Public Service Company (NIPSCO). October 2016.

Attachments:

Attachment 1 - Waste Disposal Area Spillway Improvement Drawings; NIPSCO R.M. Schahfer generating Station. Golder Associates Inc., August 29, 2017.

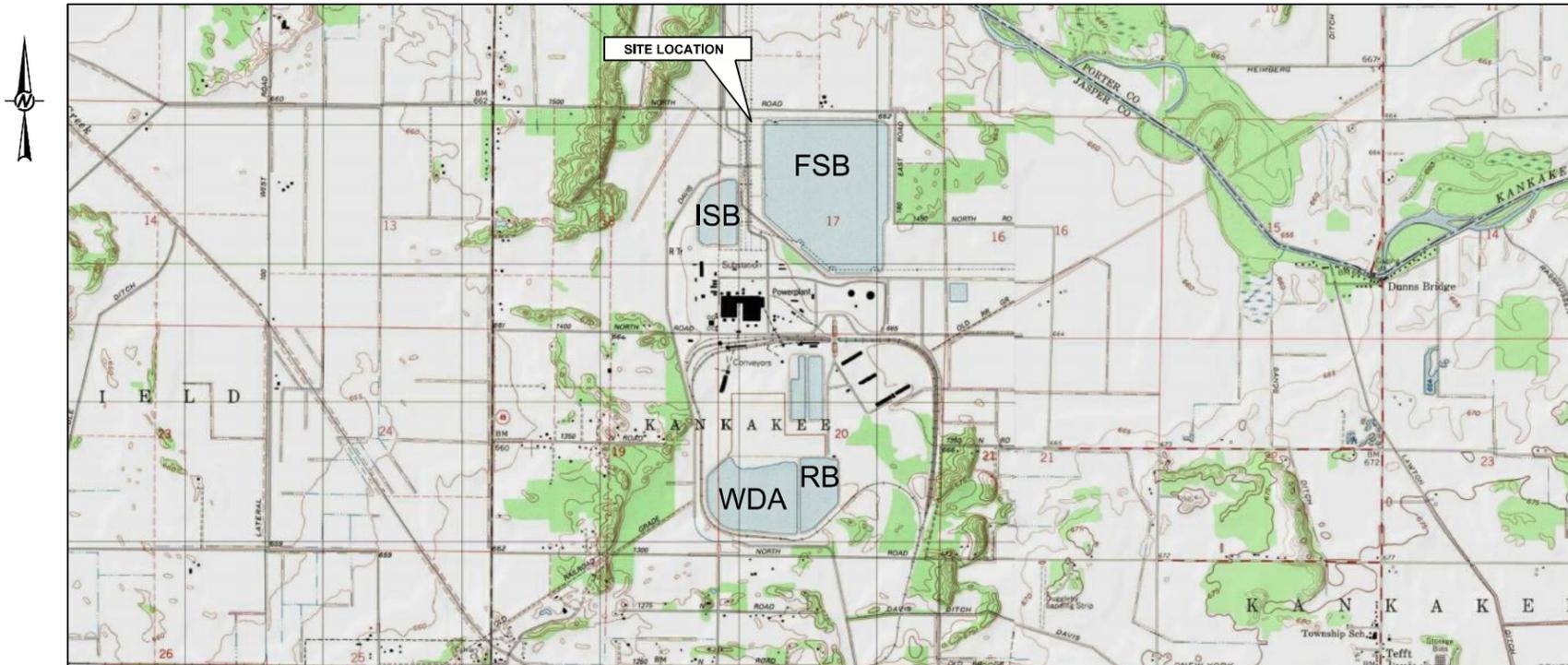
Attachment 2 - WDA Auxiliary Spillway Improvements As-Built Documentation Provided by NIPSCO.

Attachment 3 – Hydraulic Analysis of the WDA Auxiliary Spillway Improvements

ATTACHMENT 1
WASTE DISPOSAL AREA SPILLWAY IMPROVEMENT DRAWINGS
NIPSCO R.M. SCHAFER GENERATING STATION
GOLDER ASSOCIATES INC., AUGUST 29, 2017

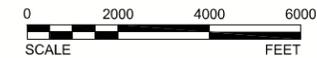
WASTE DISPOSAL AREA SPILLWAY IMPROVEMENT DRAWINGS

NIPSCO
 R.M. SCHAHFER GENERATING STATION
 KANKAKEE TOWNSHIP, JASPER COUNTY, INDIANA



REFERENCE
 REFERENCE: U.S. GEOLOGIC SURVEY, 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP,
 WHEATFIELD, INDIANA; REVISED 1992.

SITE LOCATION
 SCALE: 1"=2000'



INDIANA COUNTIES
 NOT TO SCALE



JASPER COUNTY
 NOT TO SCALE



PREPARED FOR:
**NIPSCO R.M. SCHAHFER
 GENERATING STATION**
 2723 EAST 1500 NORTH
 WHEATFIELD, INDIANA 46392



PREPARED BY:
GOLDER ASSOCIATES INC.
 15851 SOUTH US-27, SUITE 50
 LANSING, MICHIGAN 48906

INDEX OF SHEETS

SHEET NO.	REV	FILE NO.	SHEET TITLE
0	0	1668072B000	TITLE SHEET
1	0	1668072B001	AUXILIARY SPILLWAY IMPROVEMENT PLAN
2	0	1668072B002	AUXILIARY SPILLWAY IMPROVEMENT DETAILS 1 OF 2
3	0	1668072B002	AUXILIARY SPILLWAY IMPROVEMENT DETAILS 2 OF 2
4	0	1668072B003	AUXILIARY SPILLWAY IMPROVEMENT SPECIFICATIONS

AUGUST 2017

ISSUED FOR BID

CLIENT
 NIPSCO
 R.M. SCHAHFER GENERATING STATION
 KANKAKEE TOWNSHIP, JASPER COUNTY, INDIANA

CONSULTANT

Golder Associates Inc.
 15851 South US-27, Suite 50
 Lansing, Michigan 48906
 USA
 (517) 482-2262
 www.golder.com



PROJECT
 WASTE DISPOSAL AREA AUXILIARY
 SPILLWAY IMPROVEMENT

TITLE

TITLE SHEET

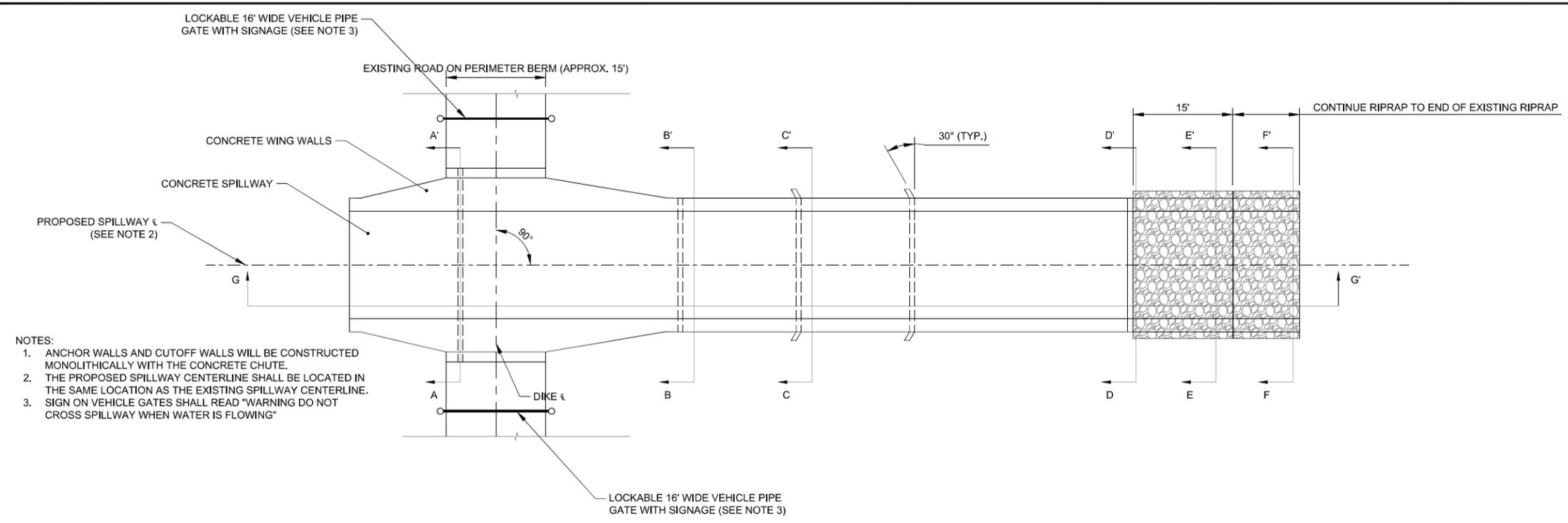
0 2017-08-29 ISSUED FOR BID
 Rev. YYYY-MM-DD DESCRIPTION

DJC SAM TDJ
 PREPARED DESIGN REVIEW APPROVED

PROJECT No. 1668072 CONTROL 1668072B000.dwg Rev. 0 1 of 5 SHEET 0

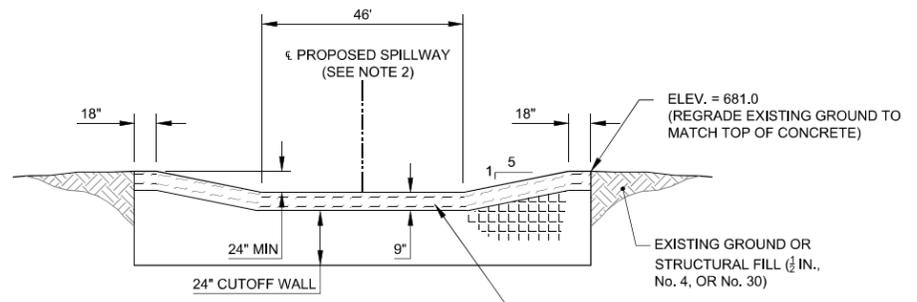
Path: \\vanderknaaf\projects\1668072\NIPSCO R.M. Schahfer Generating Station\Production\B-WDA-Auxiliary Spillway Improvement-REV AUG 15 2017.rvt File Name: 1668072B000.dwg

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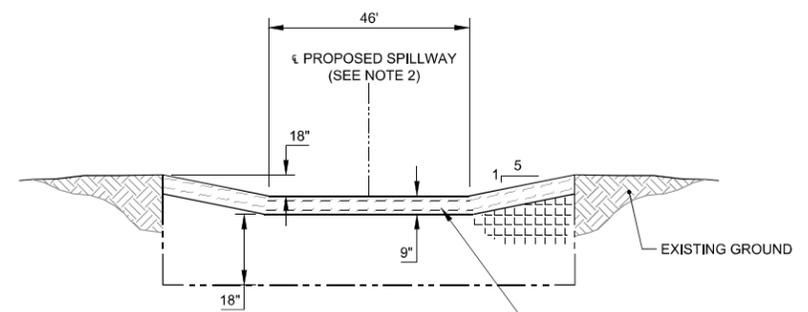
- NOTES:
- ANCHOR WALLS AND CUTOFF WALLS WILL BE CONSTRUCTED MONOLITHICALLY WITH THE CONCRETE CHUTE.
 - THE PROPOSED SPILLWAY CENTERLINE SHALL BE LOCATED IN THE SAME LOCATION AS THE EXISTING SPILLWAY CENTERLINE.
 - SIGN ON VEHICLE GATES SHALL READ "WARNING DO NOT CROSS SPILLWAY WHEN WATER IS FLOWING"

NOT TO SCALE 1 PLAN VIEW 2



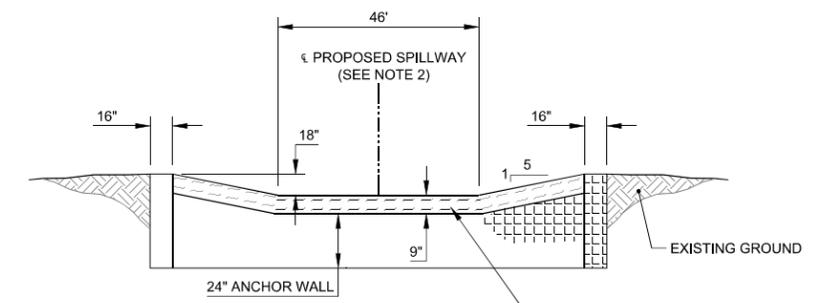
- NOTES:
- WELDED WIRE FABRIC: 6" x 6" MESH, 78 LBS PER 100 S.F., CONFORMING TO THE REQUIREMENTS OF AASHTO, M-55 (2 LAYERS)
 - THE PROPOSED SPILLWAY CENTERLINE SHALL BE LOCATED IN THE SAME LOCATION AS THE EXISTING SPILLWAY CENTERLINE.

SECTION A-A' NOT TO SCALE



- NOTES:
- WELDED WIRE FABRIC: 6" x 6" MESH, 78 LBS PER 100 S.F., CONFORMING TO THE REQUIREMENTS OF AASHTO, M-55 (2 LAYERS)
 - THE PROPOSED SPILLWAY CENTERLINE SHALL BE LOCATED IN THE SAME LOCATION AS THE EXISTING SPILLWAY CENTERLINE.

SECTION B-B' NOT TO SCALE



- NOTES:
- WELDED WIRE FABRIC: 6" x 6" MESH, 78 LBS PER 100 S.F., CONFORMING TO THE REQUIREMENTS OF AASHTO, M-55 (2 LAYERS)
 - THE PROPOSED SPILLWAY CENTERLINE SHALL BE LOCATED IN THE SAME LOCATION AS THE EXISTING SPILLWAY CENTERLINE.

SECTION C-C' NOT TO SCALE

ISSUED FOR BID

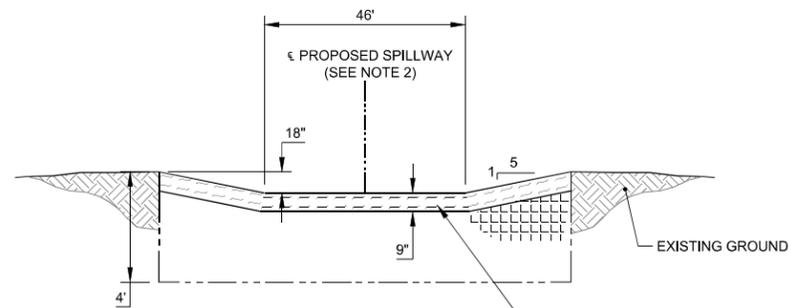
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CLIENT NIPSCO R.M. SCHAFER GENERATING STATION KANKAKEE TOWNSHIP, JASPER COUNTY, INDIANA		PROJECT WASTE DISPOSAL AREA AUXILIARY SPILLWAY IMPROVEMENT	
CONSULTANT 		TITLE AUXILIARY SPILLWAY IMPROVEMENT DETAILS 1 OF 2	
PROJECT No. 1668072		CONTROL 1668072B002.dwg	
Rev. 0		Rev. 3 of 5	
SHEET 2		SHEET 2	

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Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED

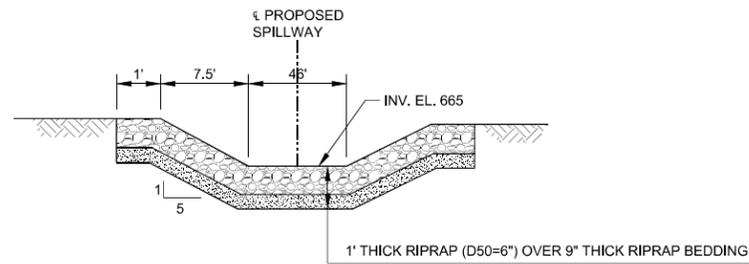
Golder Associates Inc.
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 Lansing, Michigan 48906
 USA
 (517) 482-2262
 www.golder.com

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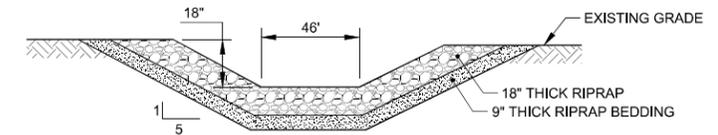


- NOTES:
1. WELDED WIRE FABRIC: 6" x 6" MESH, 78 LBS PER 100 S.F., CONFORMING TO THE REQUIREMENTS OF AASHTO, M-55 (2 LAYERS)
 2. THE PROPOSED SPILLWAY CENTERLINE SHALL BE LOCATED IN THE SAME LOCATION AS THE EXISTING SPILLWAY CENTERLINE.

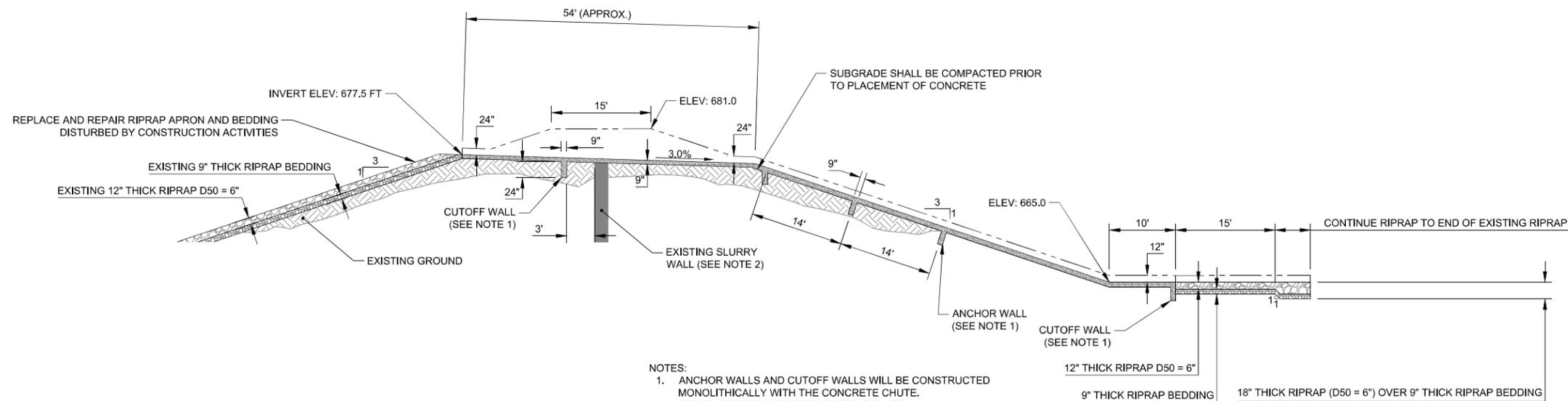
SECTION D-D'
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SECTION E-E'
NOT TO SCALE



SECTION F-F'
NOT TO SCALE



- NOTES:
1. ANCHOR WALLS AND CUTOFF WALLS WILL BE CONSTRUCTED MONOLITHICALLY WITH THE CONCRETE CHUTE.
 2. CONTRACTOR TO PROTECT EXISTING SLURRY WALL, ANY DAMAGE TO SLURRY WALL WILL BE REPAIRED AT NO COST TO NIPSCO.

SECTION G-G'
NOT TO SCALE

ISSUED FOR BID

CLIENT
NIPSCO
R.M. SCHAFER GENERATING STATION
KANKAKEE TOWNSHIP, JASPER COUNTY, INDIANA

CONSULTANT



Golder Associates Inc.
15851 South US-27, Suite 50
Lansing, Michigan 48906
USA
(517) 482-2262
www.golder.com

PROJECT
WASTE DISPOSAL AREA AUXILIARY
SPILLWAY IMPROVEMENT

TITLE
**AUXILIARY SPILLWAY
IMPROVEMENT DETAILS**
2 OF 2

PROJECT No. 1668072 CONTROL 1668072B002.dwg

Rev. 0 4 of 5

SHEET 3

Rev.	YYYY-MM-DD	DESCRIPTION
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ATTACHMENT 2
WDA AUXILIARY SPILLWAY IMPROVEMENTS
AS-BUILT DOCUMENTATION PROVIDED BY NIPSCO



Superior Construction Co., Inc. - General Contractor
1455 Louis Sullivan Drive
Portage, Indiana / 46368
219-787-0850 / (Fax) 219-763-9998

October 26, 2017

Ms. Marissa Carrillo - NIPSCO

Re: RMSGS Waste Disposal Area Auxiliary Spillway

Ms. Carrillo,

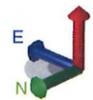
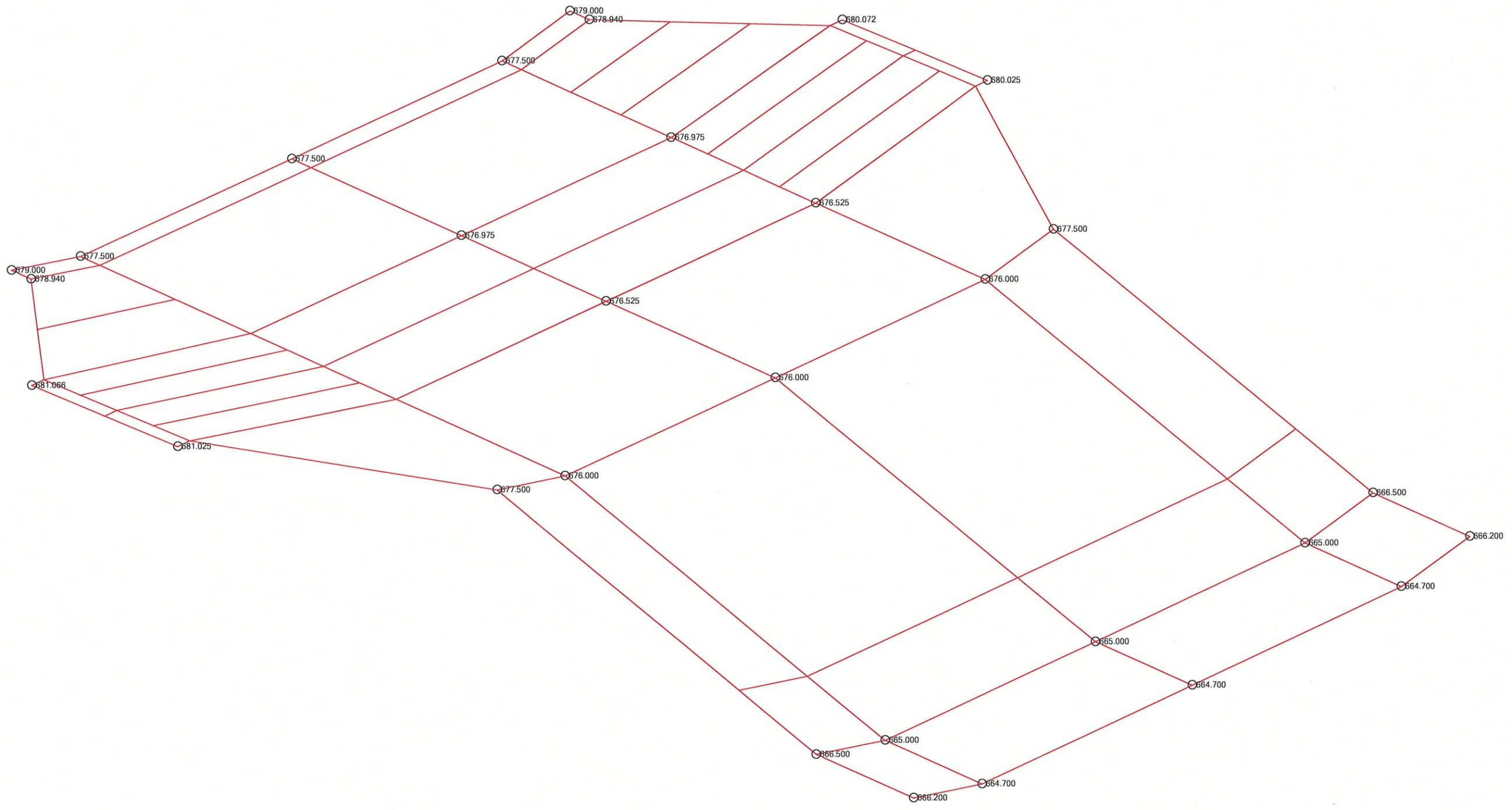
Superior Construction completed work on the Waste Disposal Area Auxiliary Spillway on October 20, 2017. All work was performed in accordance with the drawings provided by Golder Associates. Attached is as-built data that reflects the required top of spillway elevation of 677.50

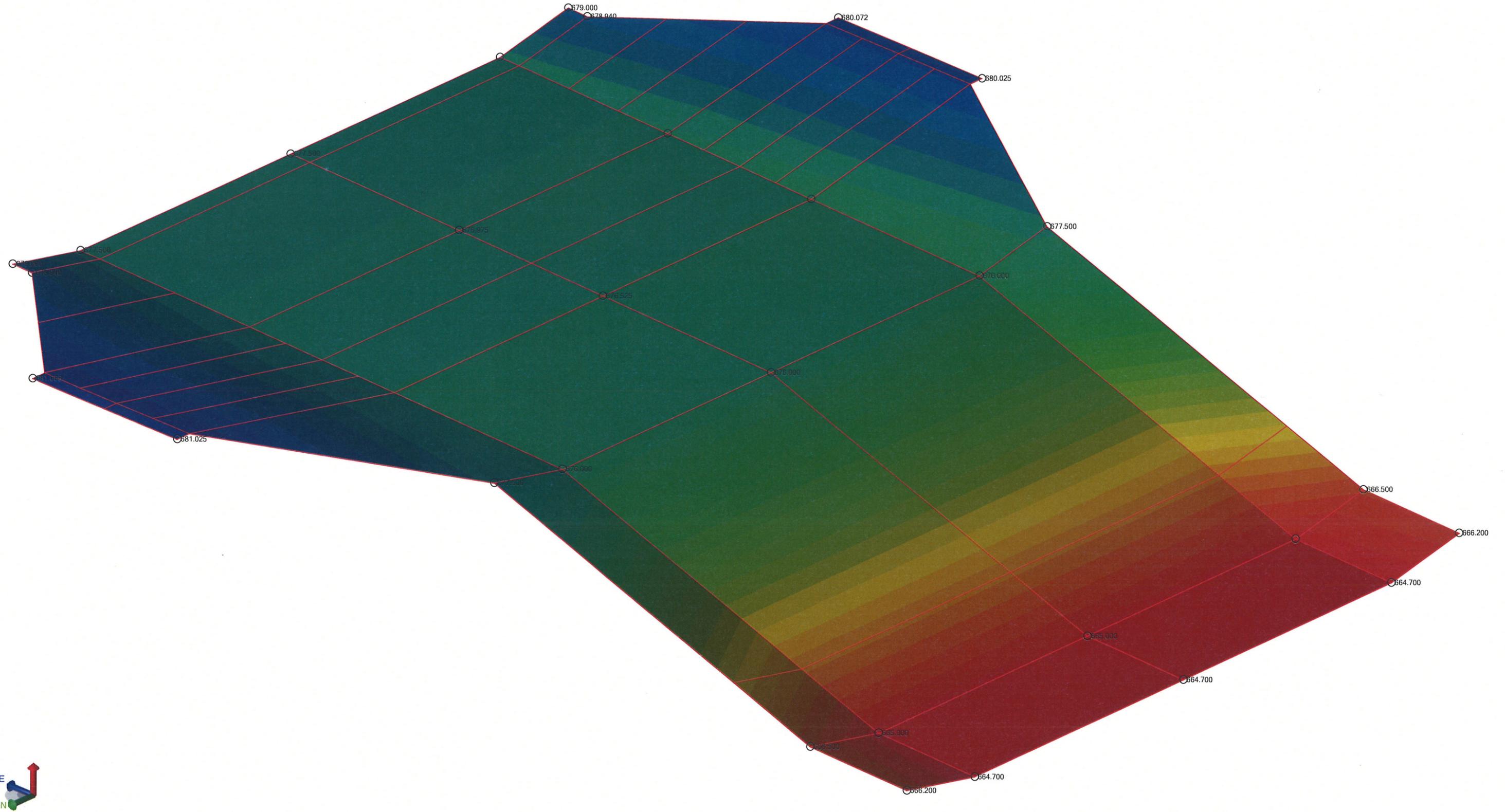
If you have any questions, please do not hesitate to ask.

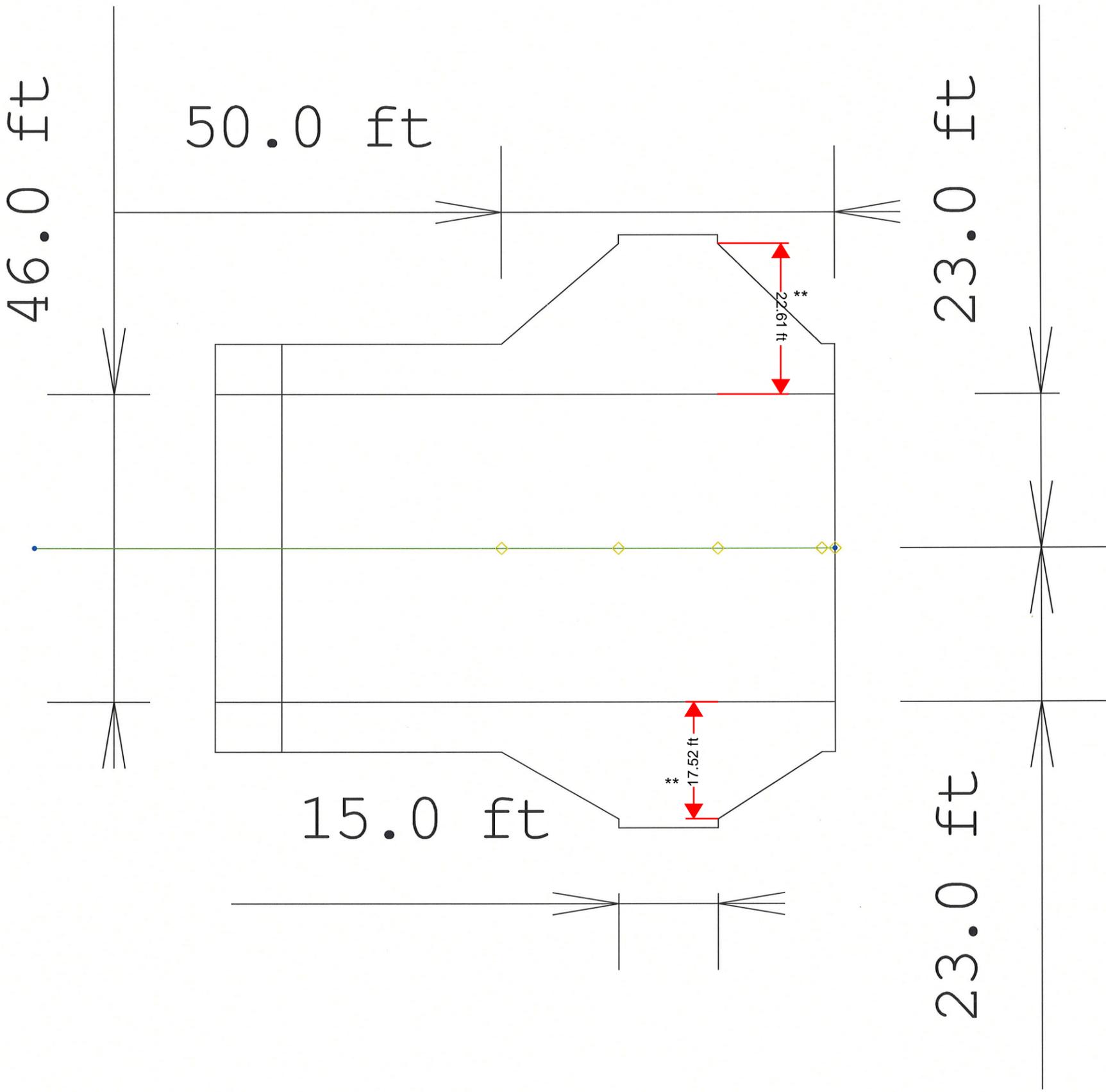
Thank you,

A handwritten signature in blue ink that reads "Robert G. Ryan".

Bob Ryan, Project Manager Superior Construction







20 ft

** Indicates dimensions measured using the drawing scale

ATTACHMENT 3
HYDRAULIC ANALYSIS OF THE WDA AUXILIARY SPILLWAY IMPROVEMENTS

Date:	16-Nov-17	Made by:	Steven McManus
Project No.:	1668072	Checked by:	Samantha Fentress
Subject:	Hydraulic Analysis of the WDA Auxiliary Spillway Improvements	Reviewed by:	Tiffany Johnson
Project Short Title:	R.M Schahfer Generating Station Waste Disposal Area Spillway Improvements		

1.0 OBJECTIVE

The objective of this calculation brief is to assess the adequacy of the R.M. Schahfer Generating Station (RMSGGS) Waste Disposal Area (WDA) auxiliary spillway, as improved during 2017.

2.0 ASSUMPTIONS

As specified in the final rule on coal combustion residuals (CCR) generated by electric utilities (40 CFR 257.73 and 257.82), the WDA must be capable of adequately managing "...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), the inflow design flood for the WDA is the probable maximum flood.

As noted in the RMSGGS CCR Surface Impoundment Inflow Design Flood Control System Plan (Golder, 2016; Reference 1), the condition of the WDA auxiliary spillway at that time was not adequate to control the peak discharge (3,708 cubic feet per second; cfs) resulting from the inflow design flood.

The WDA auxiliary spillway was improved in 2017 in accordance with the design drawings (Golder, 2017; Attachment 1) and the as-built documentation provided to Golder by Northern Indiana Public Service Company (NIPSCO; Attachment 2).

A minimum of 0.5 feet (ft) of freeboard is required to safely operate the impoundment during the design storm event to prevent dam overtopping by wave action.

The lowest point of the embankment crest is at elevation 680.0 ft above mean sea level (amsl), per the most recent survey by Marbach, Brady, and Weaver, Inc. (Attachment 3.1).

3.0 METHODS

Using Manning's open channel flow equation, calculate the maximum flowrate through the improved auxiliary spillway while maintaining the specified minimum freeboard between the maximum water surface and the lowest point of the embankment crest.

Date:	16-Nov-17	Made by:	Steven McManus
Project No.:	1668072	Checked by:	Samantha Fentress
Subject:	Hydraulic Analysis of the WDA Auxiliary Spillway Improvements	Reviewed by:	Tiffany Johnson
Project Short Title: R.M Schahfer Generating Station Waste Disposal Area Spillway Improvements			

4.0 CALCULATIONS

Manning's Open Channel Flow Equation:

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

Reference 2

Flow rate equation:

$$Q = V * A$$

Reference 2

Where:

- Q = flow rate (cubic feet per second; cfs)
- V = average flow velocity (feet/second; ft/sec)
- n = Manning's coefficient
- R = hydraulic radius (ft) = A/P_w
- S = longitudinal channel slope (ft/ft)
- A = cross-sectional area of flow (square feet; ft²)
- P_w = wetted perimeter (ft)
- W = channel bottom width (ft)
- Y = depth of flow (ft)
- Z = slope of channel sides (ZH:1V)

The wetted perimeter is the length of wetted surface for a given cross-section (Reference 2).

680.0	ft	minimum embankment crest elevation
677.5	ft	spillway invert elevation
0.5	ft	required height of freeboard
46.0	ft	spillway channel bottom width, W
0.030	ft/ft	minimum longitudinal slope of the spillway, S
5.7	ZH:1V	slope of left slope of spillway
5.5	ZH:1V	slope of right slope of spillway

2.0	ft	maximum depth of flow, Y
68.72	ft	wetted perimeter, P _w
114.4	ft ²	cross-sectional area of flow, A
1.66	ft	hydraulic radius, R
0.011		Mannings coefficient of smooth concrete, n (Reference 2)
32.9	ft/sec	average flow velocity, V
3,768	cfs	flow rate

Date:	16-Nov-17	Made by:	Steven McManus
Project No.:	1668072	Checked by:	Samantha Fentress
Subject:	Hydraulic Analysis of the WDA Auxiliary Spillway Improvements	Reviewed by:	Tiffany Johnson
Project Short Title:	R.M Schahfer Generating Station Waste Disposal Area Spillway Improvements		

5.0 CONCLUSIONS

The as-built condition of the improved WDA auxiliary spillway can pass a flow rate of 3,768 cfs while maintaining 0.5 ft of freeboard. This is adequate to control the peak discharge (3,708 cfs) of the probable maximum flood.

6.0 REFERENCES AND ATTACHMENTS

6.1 References

1. Golder Associates Inc. (Golder), 2016. *R.M. Schahfer Generating Station CCR Surface Impoundment Inflow Design Flood Control System Plan*. October, 2016.
2. Chow, Ven Te, 1959. *Open-Channel Hydraulics*. McGraw-Hill Publishing Company, New York.

6.2 Attachments

Attachment 3.1 - Embankment Elevation Survey Waste Disposal Area and Recycle Pond; NIPSCO Schahfer Generating Station. Marbach, brady, and Weaver, Inc., December 30, 2011.

ATTACHMENT 3.1
EMBANKMENT ELEVATION SURVEY WASTE DISPOSAL AREA AND RECYCLE POND
NIPSCO SCHAHFER GENERATING STATION
MARBACH, BRADY, AND WEAVER, INC., DECEMBER 30, 2011

NIPSCO Schahfer Generating Station

Station	Elevation
10+00	681.9
10+50	682.1
11+00	682.1
11+50	682.1
12+00	682.1
12+50	682.2
13+00	682.3
13+50	682.3
14+00	682.1
14+50	681.3
15+00	680.3
15+50	680.1
16+00	680.3
16+50	680.5
17+00	680.5
17+50	680.6
18+00	680.5
18+50	680.4
19+00	680.4
19+50	680.5
20+00	680.5
20+50	680.5
21+00	680.5
21+50	680.6
22+00	680.5
22+50	680.4
23+00	680.3
23+50	680.3
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24+50	680.4
25+00	680.4
25+50	680.4
26+00	680.5
26+50	680.5
27+00	680.5
27+50	680.4
28+00	680.4
28+50	680.4
29+00	680.5
29+50	680.6
30+00	680.6
30+50	680.5
31+00	680.4
31+50	680.4
32+00	680.5
32+50	680.5

Station	Elevation
33+00	680.5
33+50	680.4
34+00	680.4
34+50	680.4
35+00	680.4
35+50	680.5
36+00	680.6
36+50	680.7
37+00	680.7
37+50	680.7
38+00	680.6
38+50	680.4
39+00	680.3
39+50	680.2
40+00	680.3
40+50	680.3
41+00	680.3
41+50	680.3
42+00	680.4
42+50	680.4
43+00	680.5
43+50	680.5
44+00	680.5
44+50	680.7
45+00	680.8
45+50	680.8
46+00	680.7
46+50	680.8
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51+00	680.7
51+50	680.7
52+00	680.8
52+50	680.6
53+00	680.5
53+50	680.5
54+00	680.6
54+50	680.4
55+00	680.3
55+50	680.6

Station	Elevation
56+00	680.7
56+50	680.7
57+00	680.5
57+50	680.5
58+00	680.5
58+50	680.6
59+00	680.5
59+50	680.3
60+00	680.2
60+50	680.3
61+00	680.3
61+50	680.4
62+00	680.5
62+50	680.4
63+00	680.3
63+50	680.5
64+00	680.5
64+50	680.5
65+00	680.5
65+50	680.5
66+00	680.5
66+50	680.4
67+00	680.4
67+50	680.1
68+00	680.0
68+50	680.0
69+00	680.0
69+50	680.0
70+00	680.3
70+46.80	680.5
71+85.32	680.8
72+00	680.7
72+50	680.5
72+62.39	680.5
73+00	680.3
73+08.42	680.3
73+50	680.5
74+00	680.7
74+50	680.6
75+00	680.8
75+50	680.8
76+00	680.8
76+50	680.6
77+00	680.6
77+50	680.4
78+00	680.5

Station	Elevation
78+50	680.2
79+00	680.5
79+50	680.8