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Regulation Compliance Report

Weston Units 3 & 4 CCR Surface Impoundment Inflow Design Flood Control System Plan

Weston Generating Station
Rothschild, Wisconsin

Submitted to:
WEC Energy Group – Business Services
333 W. Everett Street, A231
Milwaukee, Wisconsin 53203

Submitted by:
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October 2021, Revision 1
Project 1803049

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Revision 0 October 2016

Revision 1 October 2021: This plan was updated in accordance with § 257.82 (c)(4) which required the owner or operator of the CCR unit to prepare periodic inflow design flood control system every five years. Updated the existing site conditions and engineering calculations.

WSR:cah

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1. Introduction

The WEC Energy Group (WEC) owns and operates the Weston Generating Station located at 2501 Morrison Avenue in Rothschild, Wisconsin. The facility is a base load, coal-fired, electrical power station having two coal-fired boilers, a natural gas-fired generating unit, and two peaking units used for the production of electricity. The two coal-fired units, Units 3 & 4, have nameplate rated nominal capacities of 325 and 595 MW and were commissioned in 1981 and 2008, respectively. WEC burns sub-bituminous coal from the Powder River Basin as the primary fuel source in the boilers. As a result, coal combustion residuals (CCR), such as fly ash, bottom ash, and flue-gas desulfurization (FGD) material, are generated.

CCR are sluiced to one of two primary settling basins where the CCR quickly settles out and the sluice water flows to the secondary basins. In 2005, to increase the rail car capacity of the plant, the secondary bottom ash basins were bisected to facilitate the construction of a rail line. So rather than having north and south secondary bottom ash basins, Weston has Northeast, Northwest, Southeast, and Southwest secondary bottom ash basins. Currently, only the Northeast and Southeast secondary bottom ash basins accept CCR.

In general, the primary basins are dry and the dewatered bottom ash is removed from the primary basins on a weekly basis using a front-end loader and transported via dump truck to the ash storage pad for future beneficial use. The Northeast and Southeast secondary bottom ash basins are designed to provide a residence time for the CCR fines to settle out from the sluice water. To improve residence time and assist in settling the fines, silt curtains are used in the Northeast and Southeast secondary bottom ash basins.

The Northwest and Southwest bottom ash basins are no longer designed to accept CCR and simply provide additional capacity of treated water. Water from the secondary bottom ash basins is treated for pH and suspended solids, as needed, and pumped to a Tertiary Basin where the water is either reused as carriage water for sluicing bottom ash in a closed-loop system, used as non-potable water for the power plant, or discharged to the Wisconsin River under WPDES Permit No. WI-0042756-07-0 through Outfall 002. Figure 1 – Basin Flow Summary shows a generalized cross section with locations of the secondary and tertiary bottom ash basins and the Wisconsin River along with groundwater and flood information.

Based on the Rule, the Weston Units 3 & 4 bottom ash basins are regulated under 40 CFR Part 257 Subpart D as an existing CCR surface impoundment. Each CCR unit will record compliance with these requirements in the facility's operating record, notify the state of decisions, and maintain a publicly available website of compliance information. The Rule specifies that the owner or operator must conduct and complete the assessments required by these sections every five years. The deadline for the assessment is based on the date of completing the previous assessment.

As part of the operating criteria under § 257.82 (c) *Hydrologic and hydraulic capacity requirements for CCR surface impoundment*, the owner or operator must operate and maintain an inflow design flood control system to adequately manage flow into the CCR unit during and following the peak discharge of a specified inflow design flood. The specified inflow design flood is based on the determined hazard potential classification of the CCR unit. The Weston Units 3 & 4 bottom ash basins are low hazard potential CCR surface impoundments.

The following report is a summary of the inflow design flood control system plan developed in general accordance with § 257.82. The appropriate design flood for the low hazard potential ash impoundments is a 100-year flood event. The plan addresses standard operation of the impoundments and confirms the power plant can safely manage inflow to the ponds and outflow from the ponds during peak discharge from the inflow design flood.

The inflow design flood control system plan includes the following sections:

Section 1 – Introduction
Section 2 – Storm Water Inflow Determination
Section 3 – Wind and Wave Run-up Analysis
Section 4 – Surface Impoundment Storage Capacity
Section 5 – Hydraulic Analysis and Storm Water Management
Section 6 – Conclusion
Section 7 – References

2. Storm Water Inflow Determination

The precipitation event of interest specified in § 257.82 for a low hazard potential CCR surface impoundment is the 100-year flood. The purpose of this calculation is to estimate the 24-hour, 100-year precipitation events at Weston Units 3 & 4 Bottom Ash Basins which can be used to determine the inflow volume to the secondary ash impoundments. The rainfall depth estimation follows the procedures outlined in Precipitation-Frequency Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).

The primary and secondary ash basins at the Weston Generating Station have constructed dike impoundments. Based on the as-built documents, the total surface area of the impoundments and contributing surface area draining to the primary impoundments is 2.71 acres. The total surface area and contributing surface area draining to the secondary impoundment is 6.36 acres. The primary ash ponds are designed to completely drain to the secondary ponds, thus, the total contributing surface area to the secondary impoundments is 9.07 acres, as shown on Figure 2 – Contributing Inflow to Ash Impoundments. All other water within the impoundment is pumped in from facility operations. The largest source is the ash sluicing operation, which recycles water from the Tertiary impoundment and pumps 1,800 gallons/minute (GPM) of water to the impoundments twice per day for approximately 1 hour. All other sources include floor drains and various sumps, which are sporadically pumped to the basins on a limited basis. Overall, these flows are insignificant compared to rainfall and the sluicing operations. No runoff from outside the footprint of the basins drains into the basins; therefore, runoff volumes are calculated based on basin size and rainfall depth. No losses for infiltration or otherwise are used in these calculations because the impoundments are lined with a low hydraulic conductivity sand-bentonite liner. Calculations are included in Appendix A: NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume. Table 2-1 summarizes the rainfall and stormwater volume with each storm recurrence interval analyzed.

Table 2-1 Summary of Rainfall Precipitation and Runoff Volume Data

Storm Recurrence Interval	Rainfall Depth (inches)	Inflow Volume (acre-ft)
100-year, 24-hour	5.83	4.41

3. Wind and Wave Run-up Analysis

A wind and wave run-up analysis were performed in accordance with the methodology recommended by the United States Department of the Interior, Bureau of Reclamation (USBR), Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams. The following factors affect wind-generated wave action on the impoundments:

> **Depth of Water:** Water depth within the settling pond affects the size of waves that can be generated and supported. An average pond depth of 7 feet was used to estimate the size of the wind generated waves.
>
> **Effective Fetch Length:** The distance wind travels over open water. The effective fetch is estimated to be 461 feet (0.09 miles). This is a conservative estimate based on the southeast secondary ash impoundment because it has the longest fetch.
>
> **Design Wind:** Design wind is described in terms of velocity and duration. The design wind estimate is approximately 40 miles per hour with a duration of 3.75 minutes.
>
> **Shore Slope:** The shore slope is a factor in how high the wave runs up a dam. The typical upstream slope of the impoundments is 3H:1V.
>
> **Slope Roughness and Permeability:** The impoundment has a coarse gravel/stone surface; that is permeable.

The following table summarizes total wave estimates.

Table 3-1 Summary of Wave Estimates

Wave Run-Up (feet)	Wind Set-Up (feet)	Total Wave Height (feet)
0.33	0.03	0.36

Based on the USBR methodology the minimum freeboard is the sum of the wave run-up plus the wind setup, 0.36 feet. The wave height of 0.36 feet is a conservative estimate for each of the secondary ash ponds because the analysis only considers the largest pond, the southeast secondary pond. The same wave height is applied to all four basins and the wave estimate is based on the largest impoundment. Further information regarding the wave height calculations is included in Appendix B – Wave Height Estimates.

4. Surface Impoundment Storage Capacity

The volume capacity for storm water in the secondary basins was determined by using as-built AutoCAD drawings provided by WEC. The storage capacity of the primary basins was not considered because they act as dewatering pads for sluiced ash and under normal conditions do not impound a significant amount of water. Furthermore, rainfall over the footprint of the Primary impoundments is conveyed into the Secondary basins.

The crest heights of the impoundments are at elevation +1,182.5 feet (NAVD 88). From here on all elevations will be referenced to NAVD 88. The impoundments were not designed with an emergency spillway. The normal maximum operating elevation is +1,180.5.

The storage capacity was determined for elevations +1,173.0 to +1,182.5 feet (minimum crest height of impoundments). Analysis of the provided data revealed the dike crest elevations are generally at or above elevation +1,182.5 feet. The water elevation in the ash basins is controlled using a staff gauge and an automatic level transmitter that is incorporated into the overall structure/process of the bottom ash treatment system facility. Stage-volumes were generated from AutoCAD Civil 3D surfaces of the basins. Incremental ash basin storage area volume for each individual Secondary ash basins and an incremental total storage volume are included in Appendix C – Impoundment Storage Capacity.

The normal maximum operating level of Secondary ash basins is +1,180.5 feet; thus, typically there are approximately 2 feet of freeboard or more in all of the basins. The total storage capacity of the Secondary ash basins is approximately 8.3 million gallons (25.5 acre-feet) (computed to maximum normal operating level, +1,180.5). The storm storage capacity is the volume between elevation +1,181.75 feet [minimum crest height (+1,182.5) minus double the estimated wave height for a 2.0 factor of safety] minus the normal maximum operating level elevation +1,180.5 feet. The estimated total storm storage capacity is 1.9 million gallons (5.78 acre-feet). If wave height is neglected the total storm capacity (elevation +1,180.5 to elevation +1,182.5) is 3.0 million gallons (9.4 acre-feet).

5. Hydraulic Analysis and Storm Water Management

Using the runoff volume developed for various storm recurrence intervals as described in Section 2, and the stage-storage relationship discussed in Section 4, we have estimated the peak pool elevation associated with respective flood events for the ash impoundments using the following assumptions:

- The topographic data via the as-built drawings provided by WEC is accurate and representative of the current site conditions and future retrofit conditions.
- Minimum crest elevation of all secondary impoundments is +1,182.5 feet.
- Normal maximum pool elevation is +1,180.5 feet.
- It is assumed the normal maximum pool elevation is maintained even as ash sluicing and disposal operations in the pond continue; thus, storm volume capacity is not significantly affected by the amount of ash disposed into the impoundments at any particular time.
- Equalizing underground conduits installed beneath the rail lines to maintain the water levels between the Northeast secondary basin and the Northwest secondary basin, and the Southeast secondary basin and the Southwest secondary basin remains clear of obstruction and is able to equalize water levels between basins.
- For sluicing operations, there should never be a net increase of water inflow to the impoundments because water is either reused as carriage water for sluicing bottom ash in a closed-loop system, used as non-potable water for the power plant, or discharged to the Wisconsin River.
- The only storm water inflow into the secondary ash impoundments is the direct rainfall on the impoundments and the precipitation associated with the Primary impoundments.

5.1 Inflow Results

The peak pool elevation in the secondary ash basins for the 100-year scenario is estimated to reach elevation +1,181.5 feet. Including the wave run-up of 0.4 feet, the maximum water elevation is expected to reach +1,181.9 feet for a 100-year flood.

A summary of rainfall precipitation and computed impoundment water elevations for analyzed storm events is shown below in Table 5-1. Based on the available information, the secondary ash impoundments have sufficient capacity to retain the required storm volume (100-year flood) per regulations without overtopping. Figure 3 – Typical Secondary Ash Impoundment Section, is a generalized section of the secondary ash impoundments with computed flood elevations.

Table 5-1 Summary of Rainfall Precipitation and Runoff Volume Data

Storm Recurrence Interval	Rainfall Depth (inches)	Inflow Volume (acre-ft)	Water Elevation (feet)
100-year	5.83	4.41	1,181.5

Note: Elevation are North American Vertical Datum 1988

The ash ponds shall be carefully managed to safeguard human health and to protect the environment. It is of utmost importance that monitoring and general maintenance is completed to avoid the malfunction of the internal pipes and/or pumps, either due to operation error, mechanical and electrical failure, or as a result of plugging with debris/CCRs that could lead to adverse increases in water levels. Operation and maintenance activities shall be conducted to verify the condition of the earthen embankments. Regular formal and informal inspections of the pond shall be conducted by site personnel and include observation of the static pond level, vegetation control, and groundwater conditions surrounding the impoundments.

5.2 Outflow Results

Based on the above analysis the secondary ash impoundments are capable of handling the entire inflow volume from the 100-year flood without relying on any formal emergency spillways or outflow water conveyance structures. The accumulated storm water in the secondary ash impoundments can be pumped to reduce the water level in the ponds back to normal operating levels. A general overview of the CCR unit flow schematic is shown in Figure 4 – Secondary Ash Impoundment Inflow and Outflow Schematic. There are three (3) 800 GPM pumps that convey water from the secondary ash impoundments to a four-way flow split box which enters the bottom ash treatment facility, or it can bypass the treatment facility and be sent directly to the Tertiary basin. From the Tertiary basin, there are two (2) 375 GPM and four (4) 1,000 GPM pumps that are used to convey carriage water for sluicing bottom ash in a closed-loop system and used as non-potable water for the power plant. In addition to the aforementioned pumps, there is a single 800 GPM pump used to discharge water to the Wisconsin River under WPDES Permit No. WI-0042756-07-0 through Outfall 002. For purposes of determining how long it would take to discharge the 100-year storm water event from the pond, we only considered the 800 GPM pump used to discharge water to Outfall 002 because the water would be discharged off-site. The other six (6) previously described pumps are principally part of a closed-loop system that recirculates the water within the plant.

The following table summarizes the calculated inflows and outflow from the impoundments. Based solely on the discharging water in accordance with the plant's surface water discharge permit, it would take approximately 1.25 days to remove the stormwater associated with a 100-year flood.

Table 5-2 Stormwater Outflow Duration

Storm Recurrence Interval	Rainfall Depth (inches)	Stormwater Inflow Volume		Time Required to Discharge Flood (Outfall 002 at 800 GPM pump capacity)	
		(acre-ft)	(gallons)	(hours)	(days)
100-year	5.83	4.41	1,437,208	29.9	1.25

6. Conclusion

The Weston Units 3 & 4 Bottom Ash Basins are regulated under 40 CFR Part 257 Subpart D as an existing CCR surface impoundment. The Rule specifies that existing CCR surface impoundments must conduct and complete the assessments required by these sections every five years. The deadline for the assessment is based on the date of completing the previous assessment. All existing low-hazard potential CCR units must adequately collect and control the peak discharge resulting from the 100-year inflow design flood. The impoundments were determined to have sufficient freeboard to meet the hydraulic requirements and prevent overtopping of the perimeter dikes. Stormwater inflow associated with the 100-year flood is anticipated to be removed from the impoundments within 2 days following the completion of the storm event, if necessary. This report documents that the Weston Units 3 & 4 Bottom Ash Basins can collect and controlling the peak discharge from a 100-year inflow design flood, meet the hydrologic and hydraulic capacity requirements and comply with § 257.82.

This plan was completed under the direction of John, M. Trast, P.E. I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wisconsin Administrative Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wisconsin Administrative Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in 40 CFR Part 257 Subpart D.

7. References

Dewberry Consultants LLC (2014). Coal Combustion Residue Impoundment Round 12 – Dam Assessment Report. Weston Generating Station (Site 26) Northeastern, Northwestern, Southeastern and Southwestern Secondary Bottom Ash Treatment Ponds. Wisconsin Public Service, Rothschild, WI. February 2014.

Perica, S., D. Martin, S. Pavlovic, I. Roy, M. St. Laurent, C. Trypaluk, D. Unruh, M. Yekta, G. Bonnin (2013). NOAA Atlas 14 Volume 8 Version 2.0, *Precipitation-Frequency Atlas of the United States*, *Midwestern States*. National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Maryland.

US Department of Commerce. National Oceanic and Atmospheric Administration, National Weather Service. (2016). Precipitation Frequency Data Server (PFDS). http://hdsc.nws.noaa.gov/hdsc/pdfs/.

U.S. Department of Interior, Bureau of Reclamation. (1981). ACER Technical Memorandum No. 2, *Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams*, December 1981.

Figures

Figure 1 Overall Basin Flow Summary

Figure 2 Contributing Inflow to Ash Impoundments

Figure 3 Typical Secondary Ash Impoundment Section

Figure 4 Secondary Ash Impoundment Inflow and Outflow Schematic

NOTES:

1. AERIAL IMAGERY OBTAINED FROM ArcGIS® ArcMap 10 TM SOFTWARE. IMAGERY PROVIDED BY: USDA FSA. DATE OF IMAGERY:6/27/2015

0 50 100
SCALE: 1" = 50'

N

Attention: 0 1" If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
0	XX	XX	XX

Designed:	CDR
Checked:	JMT
Drawn:	CDR
Submitted By:	-
P.E. Number:	-
Submittal Date:	9/2/2021

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GEI Project 1803049

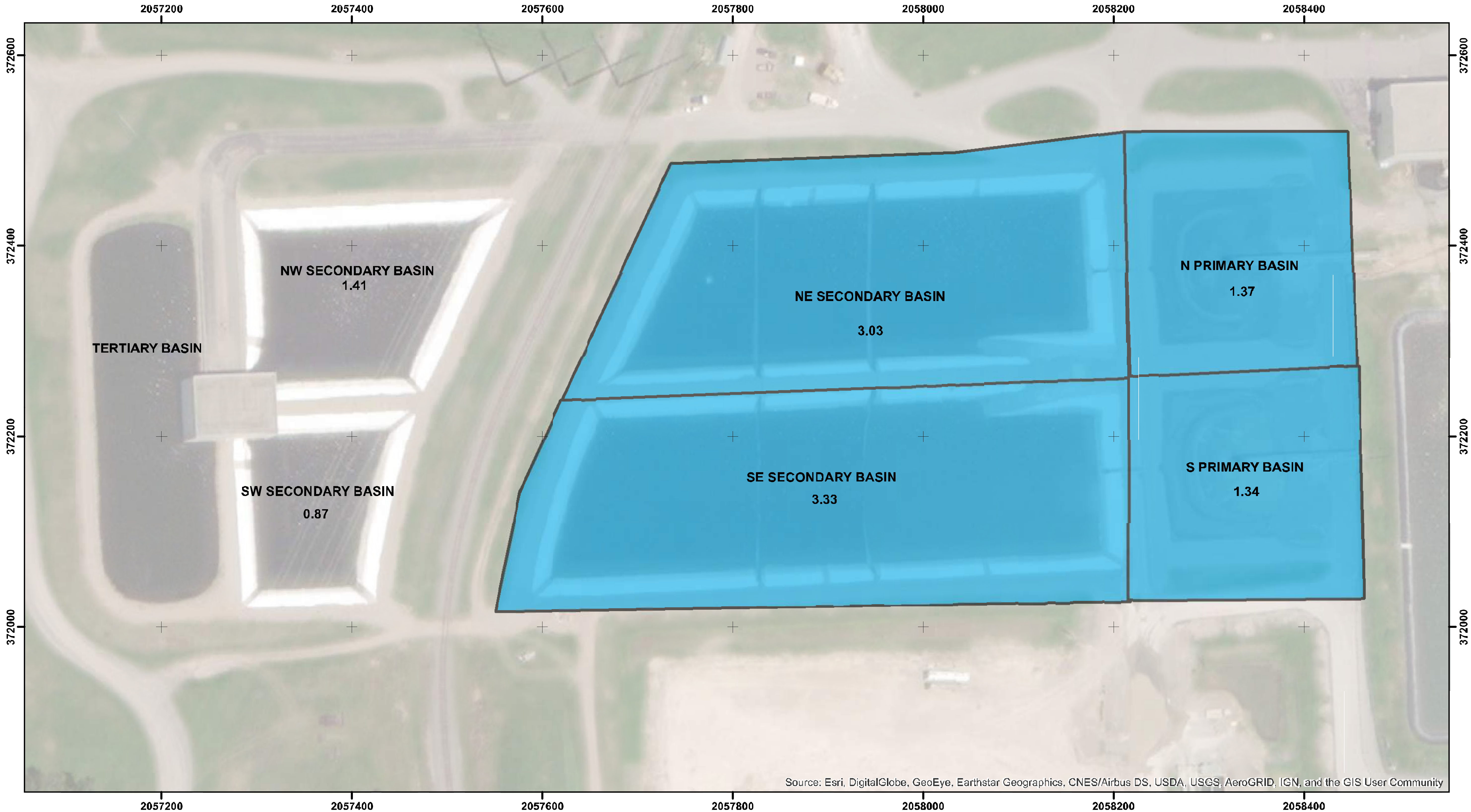
Weston Power Plant
Rothschild, WI

WESTON UNITS 3 & 4
ASH IMPOUNDMENTS

FIGURE 1

REV 1

\\grb-pzcc-1\ J:\Landfills\WE - Weston CCR Ponds\Water Mass Balance\dwg\Ponds_3_4_Water-Mass_Balance.dwg - 8/26/2016



0 100 200 400 Feet

1 inch = 100 feet

Coordinate System: NAD 1983 StatePlane Wisconsin Central FIPS 4802 Feet

Imagery Date: 6/27/2015 - USDA FSA NAIP 2015

N E S W

WEC Weston Units 3 & 4 Bottom Ash Basin
Weston Generating Station, Rothschild, Wisconsin

WEC Energy Group
333 W. Everett Street, A231
Milwaukee, Wisconsin 53203

GEI Consultants

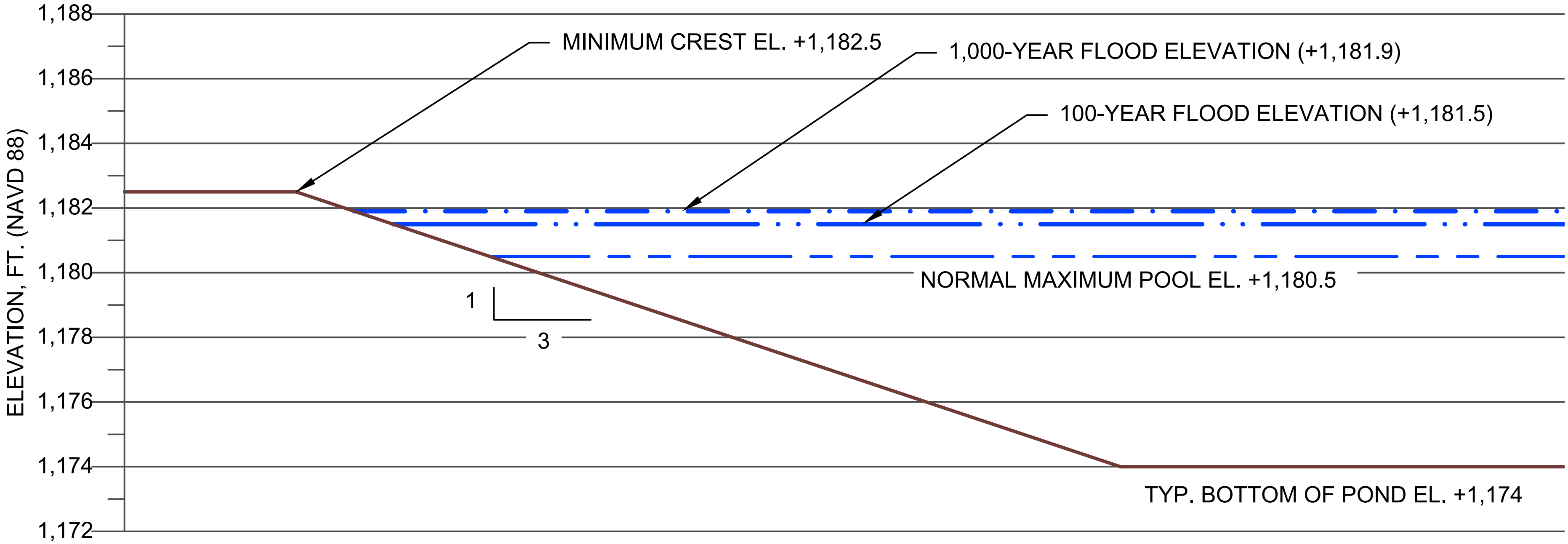
Project 1803049

CONTRIBUTING INFLOW TO ASH IMPOUNDMENTS

Date: June 2021

Figure 2

11AUG2016 K:\WEC Energy Group\16093\0_WPS Weston Units 3-4 Ash Impoundments\CAD_GIS\01_GIS\02_MXDs\1803049_fig02_contributing area_2021.mxd CEF



TYPICAL SECONDARY ASH IMPOUNDMENT SECTION WITH COMPUTED FLOOD ELEVATIONS

HORIZONTAL SCALE: 1" = 5'

0 5' 10'

0 5' 10'

VERTICAL SCALE: 1" = 5'

NOTE: 1x VERTICAL EXAGGERATION

NOTES:

1. Flood elevations shown do not account for estimated wave height.

WEC Weston Units 3 & 4 Bottom Ash Basins
Weston Generating Station, Rothschild, Wisconsin

WEC Energy Group - Business Services
Milwaukee, Wisconsin 53203

GEI Consultants

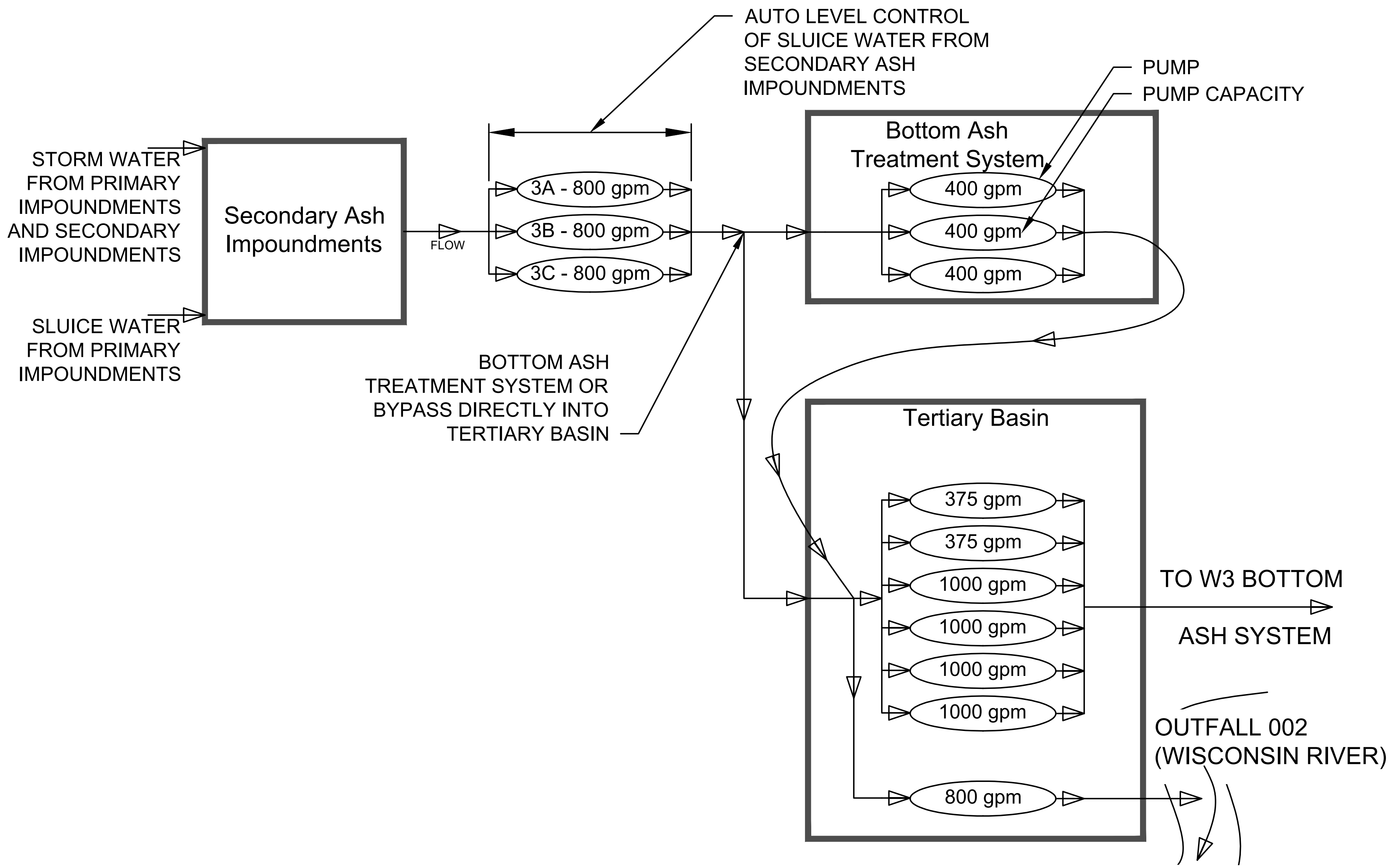
Project 1803049

Typical Secondary Ash Impoundment Section

September 2021

Fig. 3

\\grb-pzcc-1\ K:\WEC Energy Group\1609370_WPS Weston Units 3-4 Ash Impoundments\CAD_GIS\01_GIS\07_CAD Figures\1609370 work_fetch_2021.dwg - 6/16/2021



WEC Weston Units 3 & 4 Bottom Ash Basins Weston Generating Station, Rothschild, Wisconsin	GEI Consultants	Secondary Ash Impoundment Inflow and Outflow Schematic
WEC Energy Group - Business Services Milwaukee, Wisconsin 53203	Project 1803049	June 2021 Fig. 4

Appendix A

NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume

GEI Consultants	Client	WEC Energy Group			Page	1 of 4
	Project	Weston Inflow Design Flood Control Plan			Pg. Rev.	
	By	W. Reybrock	Chk.	A. Schwoerer	App.	A. Schwoerer
	Date	06/16/2021	Date	8/30/21	Date	8/30/21
GEI Project No.	1803049	Document No.	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume					

Purpose:

The purpose of this calculation is to estimate the 24-hr, 100-yr precipitation event at Weston Unit 3 & 4 Bottom Ash Basins. The 24-hr, 100-yr precipitation event is used to determine the inflow volume to the Secondary bottom ash basins.

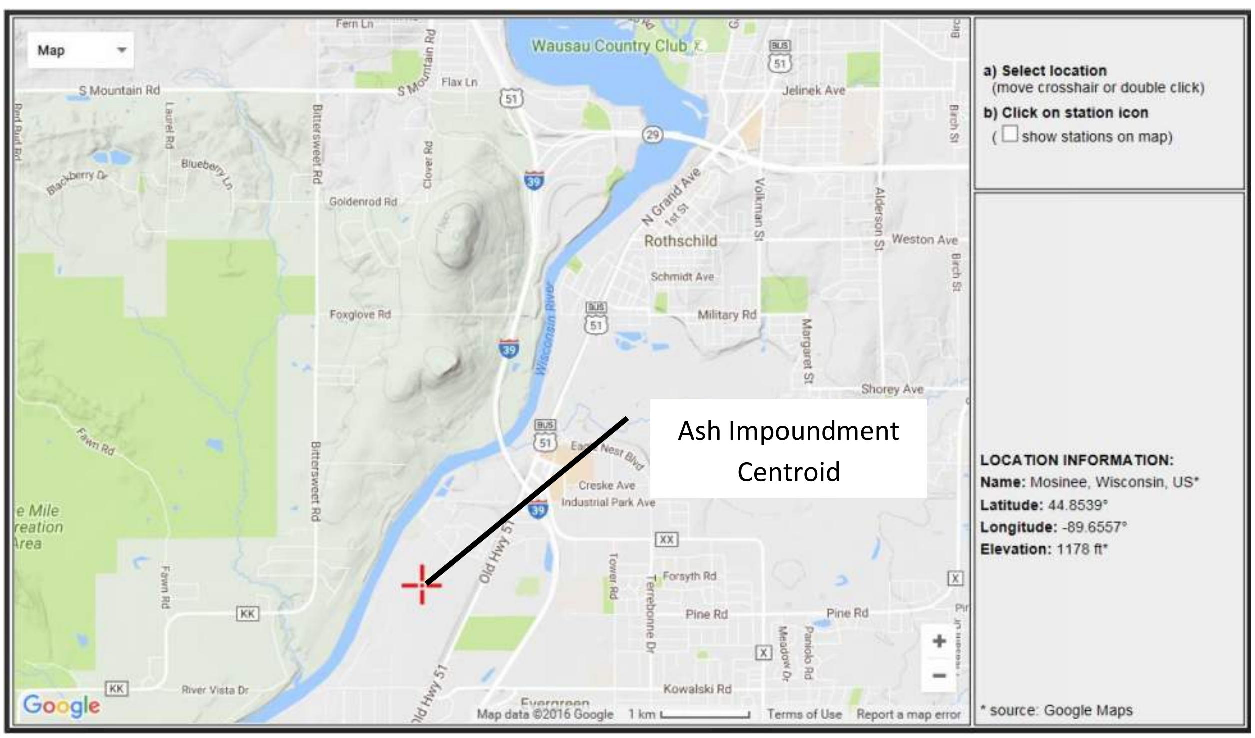
Procedure:

The rainfall depth estimation follows the procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).

As instructed in Atlas 14, the user is referred to the NOAA Precipitation Frequency Data Server (PFDS) http://hdsc.nws.noaa.gov/hdsc/pfds/index.html. The approximate center of the ash impoundments was input into the PFDS and the PF estimates were returned.

Ash Impoundment Centroid Coordinates

44°51'14.06"N	44.853906°
89°39'20.66"W	-89.655740°



GEI Consultants	**Client**	WEC Energy Group			**Page**	2 of 4
	Project	Weston Inflow Design Flood Control Plan			**Pg. Rev.**	
	By	W. Reybrock	**Chk.**	A. Schwoerer	**App.**	A. Schwoerer
	Date	06/16/2021	**Date**	8/30/21	**Date**	8/30/21
GEI Project No.	1803049	**Document No.**	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume					

Tabular Output from the PFDS:

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

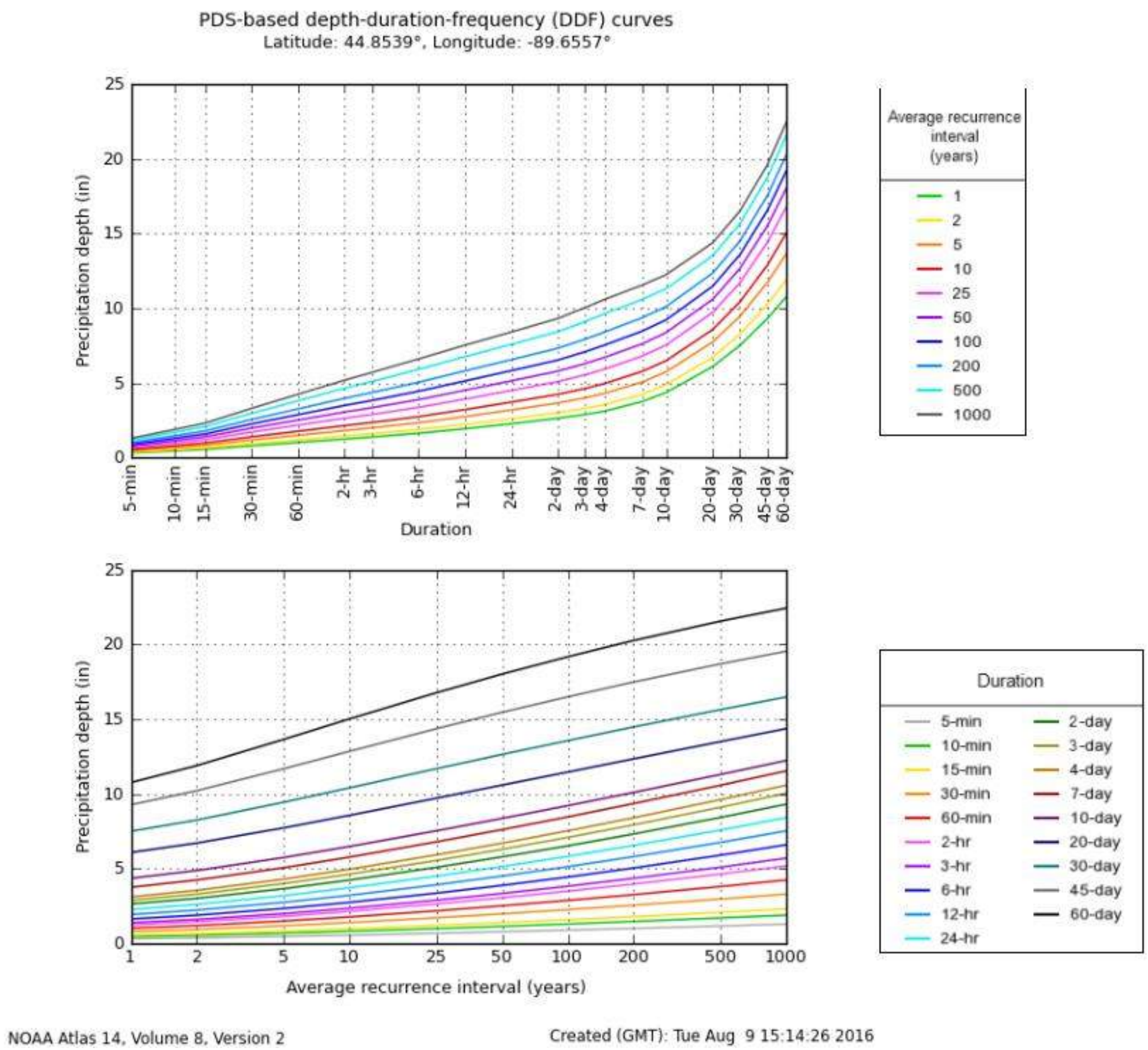
Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.311** (0.253-0.382)	**0.367** (0.298-0.451)	**0.465** (0.375-0.571)	**0.550** (0.442-0.678)	**0.676** (0.529-0.857)	**0.779** (0.595-0.993)	**0.888** (0.655-1.15)	**1.00** (0.710-1.32)	**1.16** (0.793-1.55)	**1.29** (0.856-1.73)
10-min	**0.456** (0.370-0.559)	**0.538** (0.436-0.660)	**0.680** (0.549-0.836)	**0.806** (0.647-0.993)	**0.990** (0.774-1.26)	**1.14** (0.871-1.45)	**1.30** (0.959-1.68)	**1.47** (1.04-1.93)	**1.71** (1.16-2.27)	**1.89** (1.25-2.53)
15-min	**0.556** (0.451-0.682)	**0.656** (0.532-0.805)	**0.830** (0.670-1.02)	**0.983** (0.789-1.21)	**1.21** (0.944-1.53)	**1.39** (1.06-1.77)	**1.59** (1.17-2.05)	**1.79** (1.27-2.35)	**2.08** (1.42-2.77)	**2.31** (1.53-3.09)
30-min	**0.791** (0.642-0.971)	**0.932** (0.756-1.14)	**1.18** (0.952-1.45)	**1.40** (1.12-1.72)	**1.72** (1.34-2.18)	**1.98** (1.51-2.52)	**2.26** (1.67-2.92)	**2.55** (1.81-3.35)	**2.97** (2.02-3.95)	**3.30** (2.19-4.41)
60-min	**1.02** (0.827-1.25)	**1.19** (0.967-1.46)	**1.50** (1.21-1.84)	**1.77** (1.42-2.18)	**2.18** (1.71-2.77)	**2.52** (1.92-3.21)	**2.88** (2.12-3.72)	**3.26** (2.31-4.28)	**3.81** (2.60-5.07)	**4.24** (2.81-5.67)
2-hr	**1.25** (1.02-1.52)	**1.45** (1.18-1.77)	**1.82** (1.48-2.22)	**2.15** (1.73-2.63)	**2.64** (2.09-3.34)	**3.05** (2.35-3.87)	**3.50** (2.60-4.49)	**3.97** (2.84-5.18)	**4.64** (3.20-6.15)	**5.19** (3.47-6.88)
3-hr	**1.38** (1.13-1.68)	**1.60** (1.31-1.94)	**1.99** (1.63-2.42)	**2.35** (1.91-2.86)	**2.89** (2.29-3.64)	**3.34** (2.58-4.22)	**3.83** (2.86-4.90)	**4.35** (3.13-5.66)	**5.10** (3.53-6.73)	**5.70** (3.84-7.54)
6-hr	**1.64** (1.35-1.97)	**1.89** (1.55-2.27)	**2.34** (1.91-2.82)	**2.74** (2.24-3.32)	**3.36** (2.68-4.20)	**3.88** (3.02-4.87)	**4.44** (3.35-5.65)	**5.04** (3.66-6.51)	**5.90** (4.13-7.74)	**6.60** (4.48-8.67)
12-hr	**1.94** (1.60-2.31)	**2.23** (1.84-2.66)	**2.75** (2.27-3.29)	**3.22** (2.64-3.86)	**3.92** (3.15-4.86)	**4.51** (3.53-5.61)	**5.13** (3.90-6.47)	**5.81** (4.24-7.43)	**6.76** (4.76-8.79)	**7.53** (5.16-9.81)
24-hr	**2.27** (1.89-2.69)	**2.61** (2.17-3.09)	**3.19** (2.65-3.80)	**3.72** (3.07-4.43)	**4.50** (3.63-5.52)	**5.14** (4.05-6.34)	**5.83** (4.45-7.29)	**6.56** (4.83-8.33)	**7.59** (5.39-9.79)	**8.41** (5.82-10.9)
2-day	**2.64** (2.21-3.11)	**3.01** (2.52-3.55)	**3.66** (3.05-4.32)	**4.24** (3.52-5.01)	**5.09** (4.13-6.19)	**5.79** (4.59-7.08)	**6.53** (5.03-8.10)	**7.32** (5.44-9.22)	**8.43** (6.05-10.8)	**9.32** (6.51-12.0)
3-day	**2.89** (2.43-3.38)	**3.30** (2.76-3.86)	**4.00** (3.35-4.70)	**4.63** (3.85-5.45)	**5.55** (4.52-6.71)	**6.30** (5.02-7.66)	**7.09** (5.48-8.75)	**7.93** (5.92-9.95)	**9.11** (6.57-11.6)	**10.0** (7.06-12.9)
4-day	**3.11** (2.62-3.63)	**3.55** (2.98-4.15)	**4.30** (3.60-5.03)	**4.96** (4.14-5.82)	**5.92** (4.83-7.14)	**6.71** (5.36-8.13)	**7.53** (5.84-9.26)	**8.41** (6.29-10.5)	**9.62** (6.96-12.2)	**10.6** (7.47-13.5)
7-day	**3.76** (3.18-4.36)	**4.24** (3.58-4.92)	**5.06** (4.27-5.89)	**5.77** (4.84-6.73)	**6.79** (5.56-8.11)	**7.61** (6.11-9.15)	**8.46** (6.60-10.3)	**9.36** (7.05-11.6)	**10.6** (7.71-13.3)	**11.5** (8.21-14.6)
10-day	**4.36** (3.70-5.04)	**4.88** (4.13-5.64)	**5.74** (4.85-6.66)	**6.48** (5.45-7.53)	**7.53** (6.18-8.94)	**8.36** (6.73-10.0)	**9.22** (7.21-11.2)	**10.1** (7.64-12.5)	**11.3** (8.27-14.2)	**12.2** (8.76-15.5)
20-day	**6.09** (5.19-6.99)	**6.71** (5.72-7.71)	**7.73** (6.57-8.89)	**8.57** (7.25-9.88)	**9.72** (8.00-11.4)	**10.6** (8.57-12.5)	**11.5** (9.02-13.8)	**12.3** (9.40-15.1)	**13.5** (9.96-16.8)	**14.4** (10.4-18.0)
30-day	**7.51** (6.43-8.58)	**8.25** (7.06-9.43)	**9.45** (8.06-10.8)	**10.4** (8.84-11.9)	**11.7** (9.65-13.6)	**12.6** (10.3-14.8)	**13.6** (10.7-16.2)	**14.5** (11.1-17.5)	**15.6** (11.6-19.3)	**16.5** (12.0-20.6)
45-day	**9.28** (7.97-10.5)	**10.2** (8.77-11.6)	**11.7** (10.0-13.3)	**12.9** (11.0-14.7)	**14.4** (11.9-16.6)	**15.5** (12.6-18.0)	**16.5** (13.1-19.5)	**17.5** (13.4-21.1)	**18.7** (13.9-22.9)	**19.6** (14.3-24.3)
60-day	**10.8** (9.27-12.2)	**11.9** (10.2-13.5)	**13.7** (11.7-15.5)	**15.0** (12.8-17.1)	**16.8** (13.9-19.3)	**18.0** (14.7-20.9)	**19.2** (15.2-22.6)	**20.3** (15.6-24.3)	**21.6** (16.1-26.3)	**22.4** (16.5-27.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP)

GEI Consultants	Client	WEC Energy Group			Page	3 of 4
	Project	Weston Inflow Design Flood Control Plan			Pg. Rev.	
	By	W. Reybrock	Chk.	A. Schwoerer	App.	A. Schwoerer
	Date	06/16/2021	Date	8/30/21	Date	8/30/21
GEI Project No.	1803049	Document No.	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume					

Graphical Output from the PFDS:



GEI Consultants	Client	WEC Energy Group			Page	4 of 4
	Project	Weston Inflow Design Flood Control Plan			Pg. Rev.	
	By	W. Reybrock	Chk.	A. Schwoerer	App.	A. Schwoerer
	Date	06/16/2021	Date	8/30/21	Date	8/30/21
GEI Project No.	1803049	Document No.	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Inflow Volume					

Background:

The Primary bottom ash basins are dewatering pads for sluiced ash and under normal conditions do not impound a significant amount of water. The Primary bottom ash basins drain to the Secondary bottom ash basins. The Secondary ash impoundments are a series of two (2) interconnected ring dikes and there is no drainage area contributing to the Secondary bottom ash basins other than the surface area associated with the primary basins. The following is a summary of surface areas associated with the impoundments.

Name	Area (acres)	Area (sf)
S PRIMARY BASIN	1.34	58,587
N PRIMARY BASIN	1.37	59,744
Total Primary Surface Area	***2.71***	***118,331***
NE SECONDARY BASIN	3.03	131,894
SE SECONDARY BASIN	3.33	145,125
Total Secondary Surface Area	**6.36**	**277,019**
Total Surface Area	**9.07**	**395,350**

Regulations:

Weston Units 3 & 4 bottom ash basins are regulated under 40 CFR Part 257 Subpart D – Standards for Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments as an existing CCR surface impoundment. The basins are classified as low hazard potential structures. Thus, the regulations specify that CCR units must adequately collect and control the peak discharge resulting from the inflow design flood. The inflow design flood for a low hazard potential dam is the 100-year event.

Conclusion:

The following is a summary of the determined inflow to the Secondary impoundment for the analyzed storm events. The volume was conservatively assumed to be the equal to the surface area * the rainfall depth and does not include losses related to infiltration, evaporation, or depression storage

	Precipitation	
	inches	*feet*
24-hr, 100-yr	5.83	0.486
100-yr Inflow Volume	4.41	*(acre-feet)*

Appendix B

Wave Height Estimate Calculations

GEI Consultants	Client	WEC Energy Group			Page	1 of 2
	Project	Weston Inflow Design Flood Control Plan			Pg. Rev.	
	By	W. Reybrock	Chk.	A. Schwoerer	App.	
	Date	06/16/2021	Date	08/30/21	Date	
GEI Project No.	1803049	Document No.	N/A			
Subject	Wave Height Estimates Calculations					

Purpose: Determine the maximum water surface elevation due to wind induced waves.

Procedure: Follow procedures as described in ACER Technical Memorandum No. 2 (USBR 1981, based on ETL 1110-2-221)

References: ACER Technical Memorandum No. 2, Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams, U.S. Department of Interior Bureau of Reclamation, 1981.

Effective Fetch Calculation (See Attached Site Plan; C-3)

α Degrees	Cos (α)	Xi (feet)	Xi (miles)	Xi * Cos(α)
20	0.940	289.7	0.05	0.052
15	0.966	384.3	0.07	0.070
10	0.985	536.84	0.10	0.100
5	0.996	575.53	0.11	0.109
0	1.000	577.76	0.11	0.109
5	0.996	579	0.11	0.109
10	0.985	538.15	0.10	0.100
15	0.966	368.14	0.07	0.067
20	0.940	279.31	0.05	0.050
Sum =	8.773		Sum =	0.7667

$$Feff = \sum(Xi\cos(\alpha)) \Big/ \sum\cos(\alpha)$$

Effective Fetch = 0.0874 miles

Design Wave Height

Feff =	0.1	miles	
Wind Velocity =	40	mph	(Figure 8 USBR 1981)
Duration =	3.75	mins	(Figure 9 USBR 1981)

* From Figure 9 (USBR 1981) design wave	Hs =	0.6	ft
* From Figure 10 (USBR 1981) wave period	T =	1.3	sec
* Wave Length Lo = $5.12(T)^2$	Lo =	8.7	ft
* Hmax (Highest 1% of waves) = 1.67(Hs)	Hmax =	1.0	ft

GEI Consultants	**Client**	WEC Energy Group		**Page**	2 of 2
	Project	Weston Inflow Design Flood Control Plan		**Pg. Rev.**	
	By	W. Reybrock	**Chk.** A. Schwoerer	**App.**	
	Date	06/16/2021	**Date** 08/30/21	**Date**	
GEI Project No.	1803049	**Document No.**	N/A		
Subject	Wave Height Estimates Calculations				

Wind Setup

* Assume a uniform depth = 7 ft

Wind Setup $$Zs = \frac{Vwind^{2} * F}{1400 * d}$$

Vwind =	40	mph
Feff =	0.09	miles
F = 2*Feff =	0.17	miles
d =	7	ft
Zs =	0.03	ft

Wind Runup

All interior side slopes are 3H:1V with coarse gravel and sand

Design Wave, Hs =	0.6	ft	
Period, T =	1.3	sec	
Design Depth, ds =	7	ft	(depth at toe of impoundment)

ds/Hs = 11.67

Hs = H'o   H'o/(g*T^2) = 0.011

From Figure 11 (USBR 1981)   (COARSE GRAVEL/STONE SURFACE - RUBBLE)

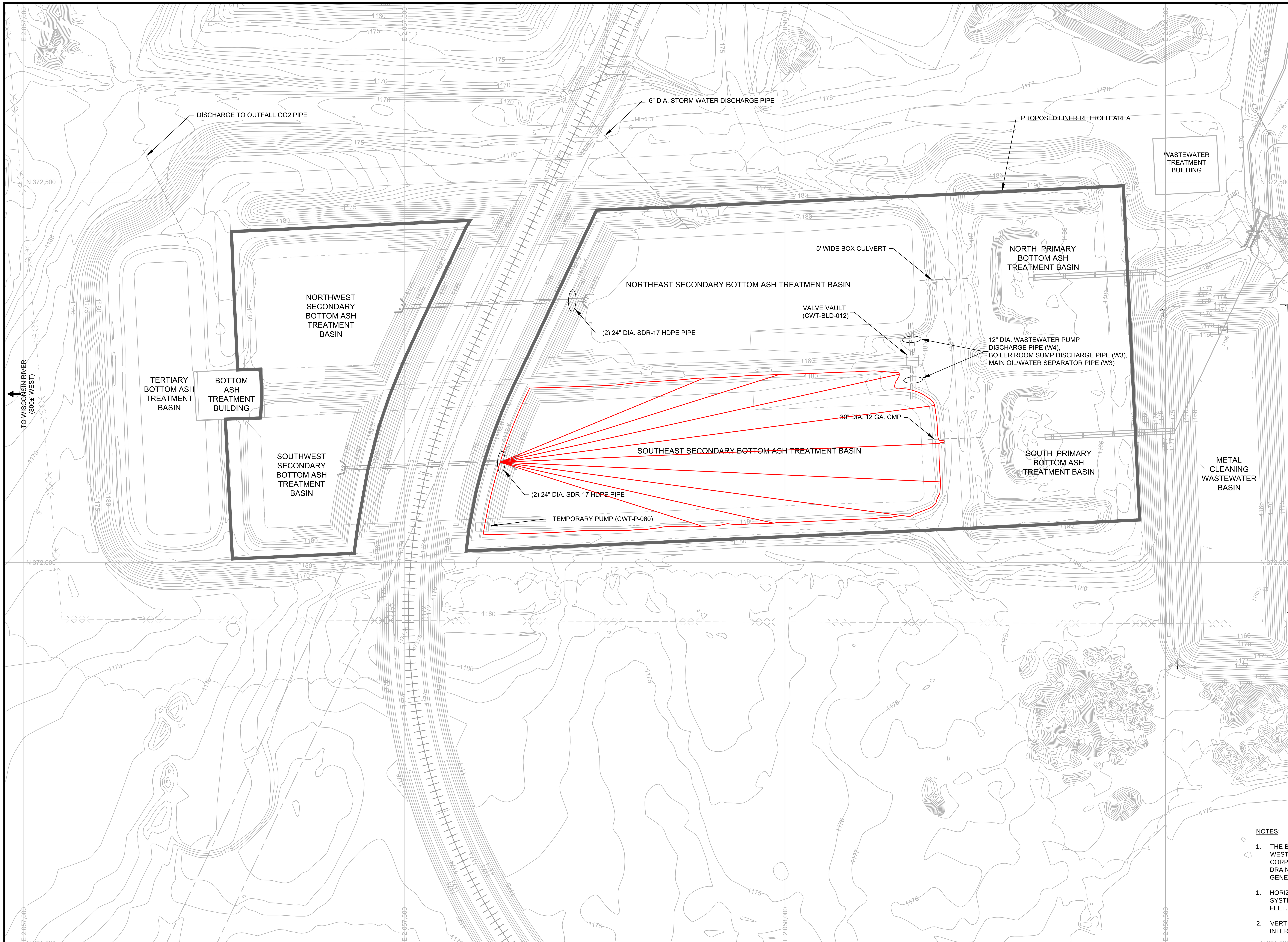
R/H'o =	0.55	
R =	0.33	ft

Summary:

(A) Run-Up (ft)	(B) Set-Up (ft)	(C) Total Wave Height (ft)
0.33	0.03	0.36

Attachments:

C-3 Site Plan with Effective Fetch
USBR Referenced Figures



N

SCALE IN FEET

60' 0 60'

LEGEND

1190	EXISTING GROUND SURFACE CONTOUR
	ROAD, NON PAVED
	ROAD, PAVED
	FENCE
	RAILROAD TRACKS
	CULVERT
	STRUCTURE
	POWER POLE
	LIGHT POLE
MH	MANHOLE
CP4	SURVEY CONTROL MONUMENT
CB	CATCH BASIN ROUND (CB)
MW	MONITORING WELL (MW)
1193.1	SPOT ELEVATION
	UNDERGROUND PIPE (APPROXIMATE)

NOTES:

1. THE BASE MAP WAS DEVELOPED FROM "GRADING, ROADWORK, & DRAINAGE", WESTON GENERATING STATION, UNIT 3, WISCONSIN PUBLIC SERVICE CORPORATION, BY SARGENT & LUNDY ENGINEERS IN 1980 AND "GRADING & DRAINAGE-SITE", WISCONSIN PUBLIC SERVICE CORPORATION, WESTON GENERATING STATION NO. 4, BY BLACK & VEATCH IN 2008.

1. HORIZONTAL DATUM IS REFERENCED TO WISCONSIN STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM (NAD 83/2007), US SURVEY FEET.

2. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88). CONTOUR INTERVAL IS 2 FEET.

Attention:

0 1"

If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
0	X	X	X

DRAFT

Designed: JXT
Checked: JXT
Drawn: JLC
Submittal Date: 8/9/2016

GEI Consultants
3159 Voyager Drive
Green Bay, Wisconsin 54311
920-455-8200

WISCONSIN PUBLIC SERVICE CORPORATION
ROTHSCHILD, WISCONSIN

GEI Project 1609370

WESTON POWER PLANT
ROTHSCHILD, WISCONSIN
UNITS 3 & 4 ASH IMPOUNDMENTS
LINER RETROFIT

EXISTING SITE CONDITIONS - EFFECTIVE FETCH LENGTH

DWG. NO. C-3

SHEET NO. 3

Filename: K:\WEC ENERGY GROUP\1609370_WPS WESTON UNITS 3-4 ASH IMPOUNDMENTS\CAD_GIS\01_GIS\07_CAD FIGURES\1609370 WORK_FETCH.DWG

ACER TECHNICAL MEMORANDUM NO. 2
ASSISTANT COMMISSIONER - ENGINEERING AND RESEARCH
DENVER, COLORADO

FREEBOARD CRITERIA AND GUIDELINES FOR COMPUTING FREEBOARD ALLOWANCES FOR STORAGE DAMS

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
1981

ACER TECHNICAL MEMORANDUM NO. 2

Assistant Commissioner - Engineering and Research
Denver, Colorado

FREEBOARD CRITERIA AND GUIDELINES FOR COMPUTING FREEBOARD ALLOWANCES FOR STORAGE DAMS

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

December 1981

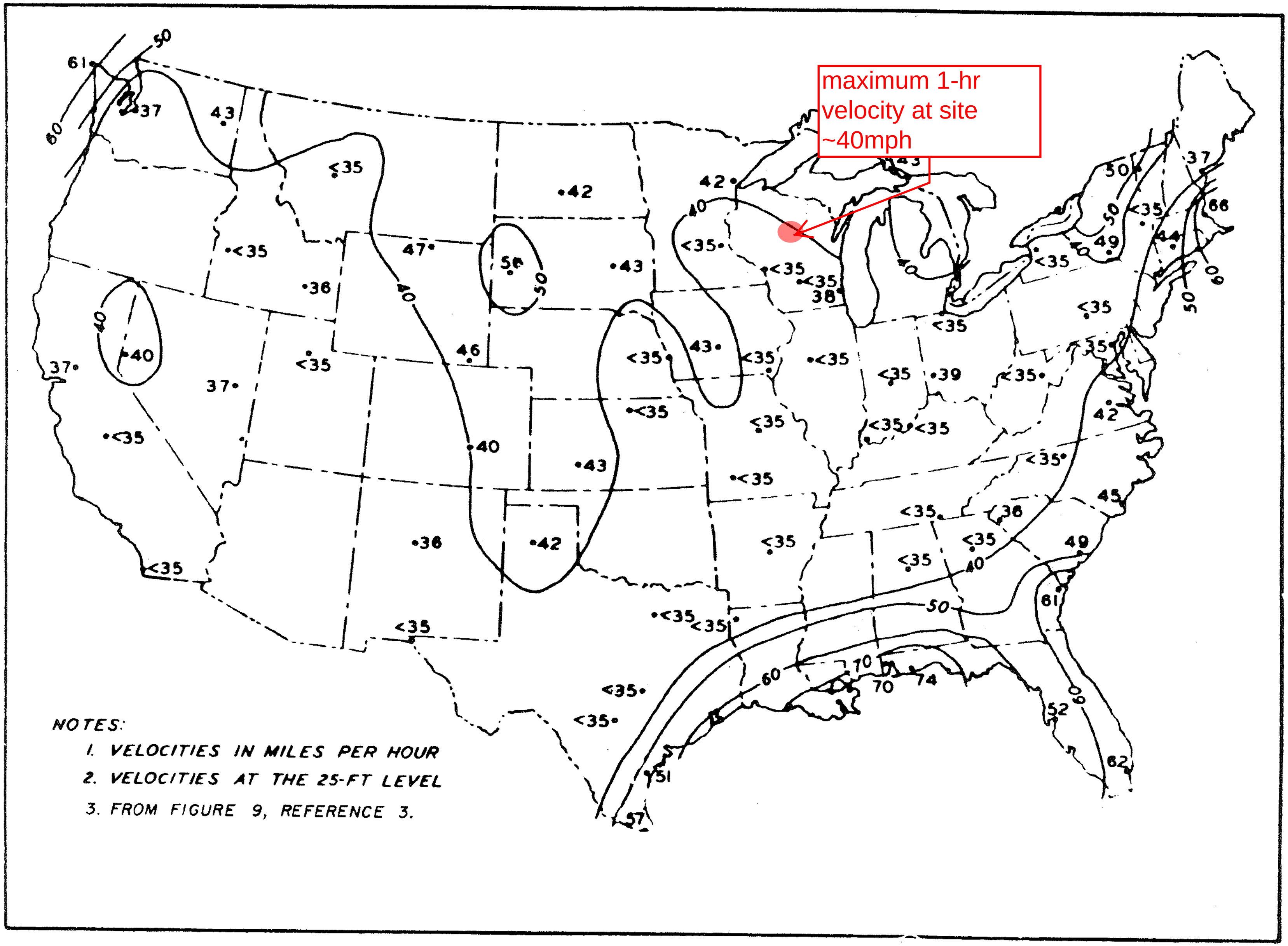


FIGURE 8.-MAXIMUM ONE HOUR VELOCITY-FALL

LEGEND:

Solid Lines represent significant wave heights, in feet,

Dashed Lines represent minimum wind duration, in minutes, required for generation of wave heights indicated for corresponding wind velocities and fetch distance.

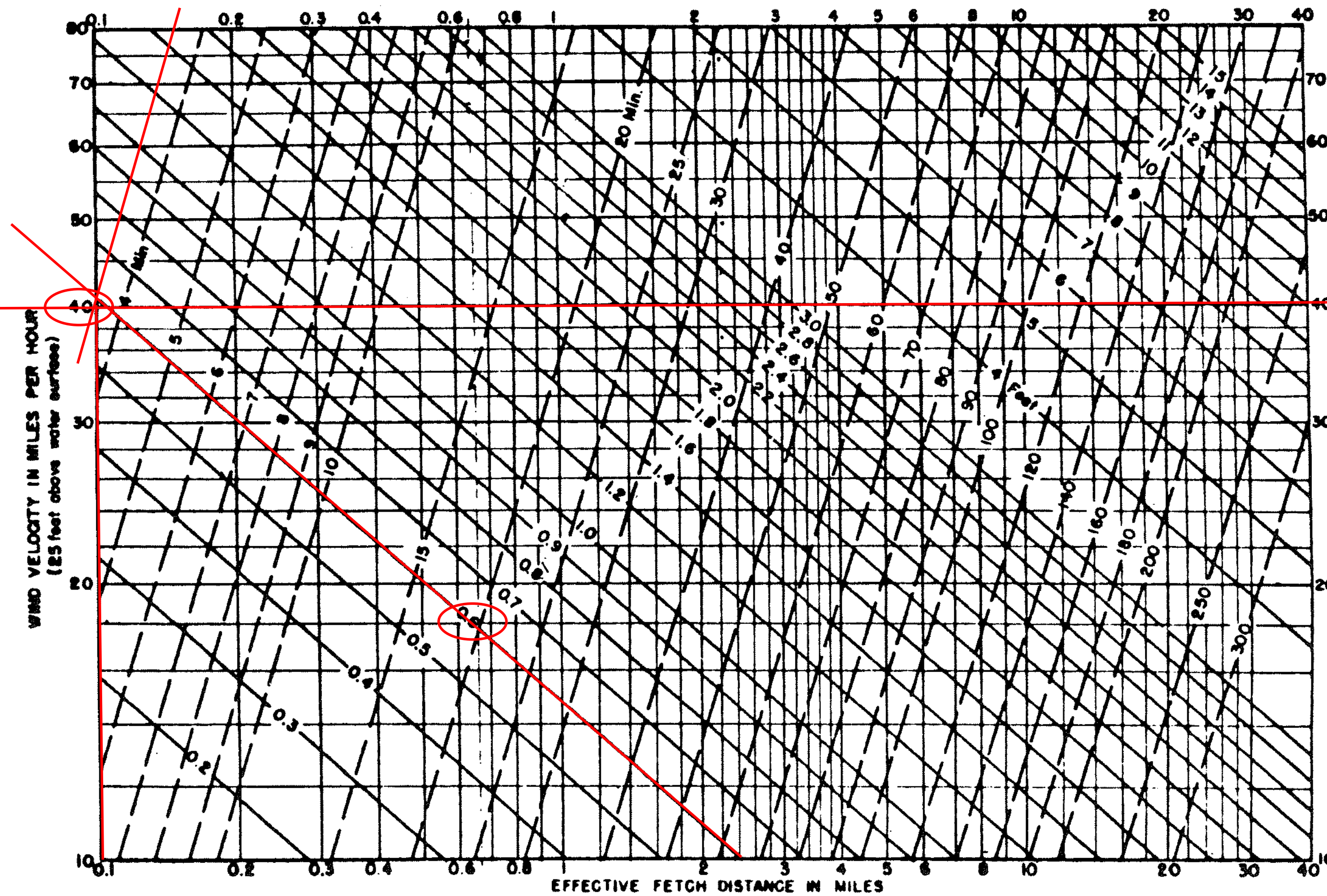


FIGURE 9. - GENERALIZED CORRELATIONS OF SIGNIFICANT WAVE HEIGHTS (H_s) WITH RELATED FACTORS - DEEP WATER CONDITIONS (FROM FIGURE 11, REF. 3)

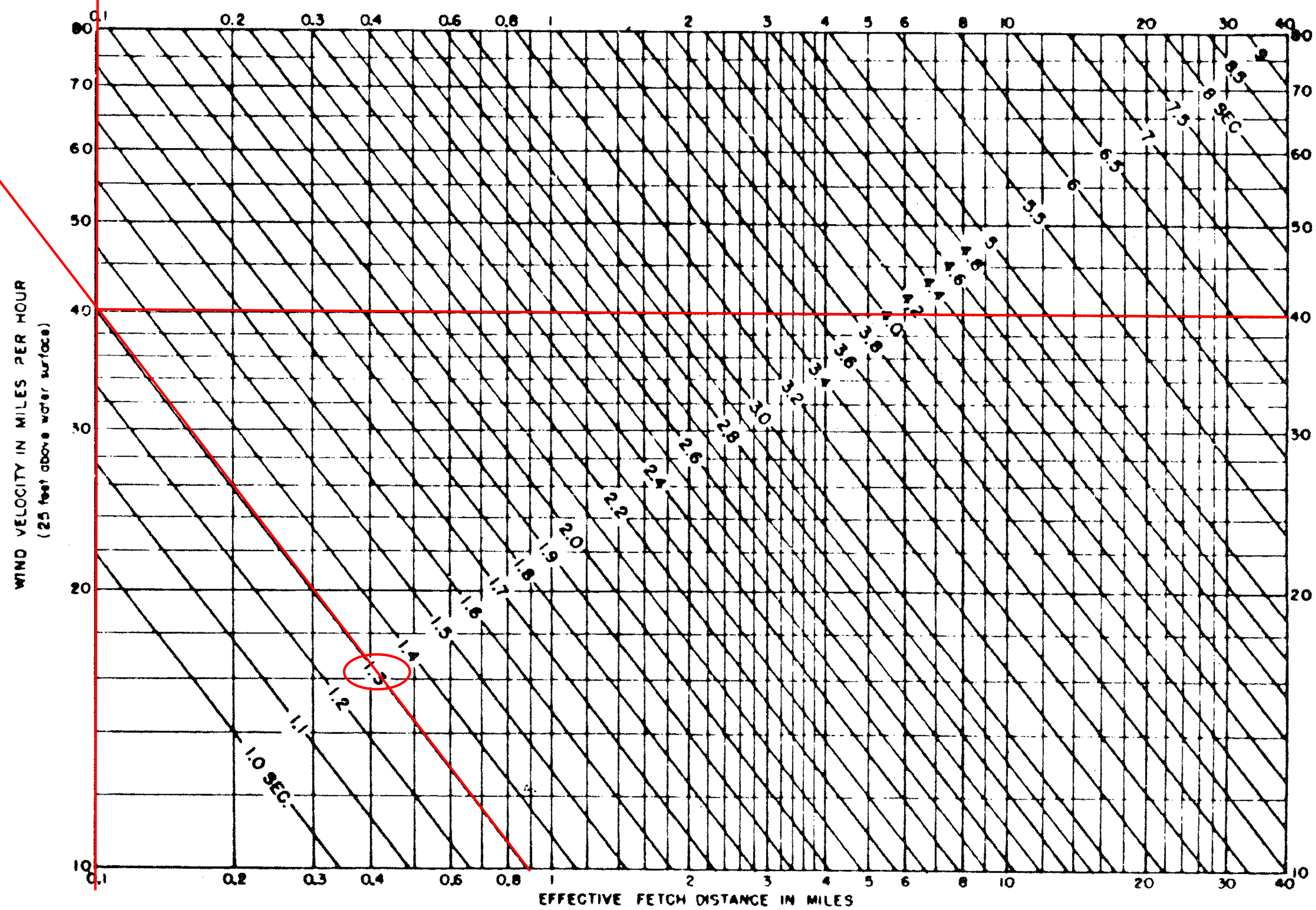


FIGURE 10.- **GENERALIZED RELATIONS BETWEEN WAVE PERIODS AND RELATED FACTORS**

-DEEP WATER CONDITIONS (FROM FIGURE 12, REF. 3)

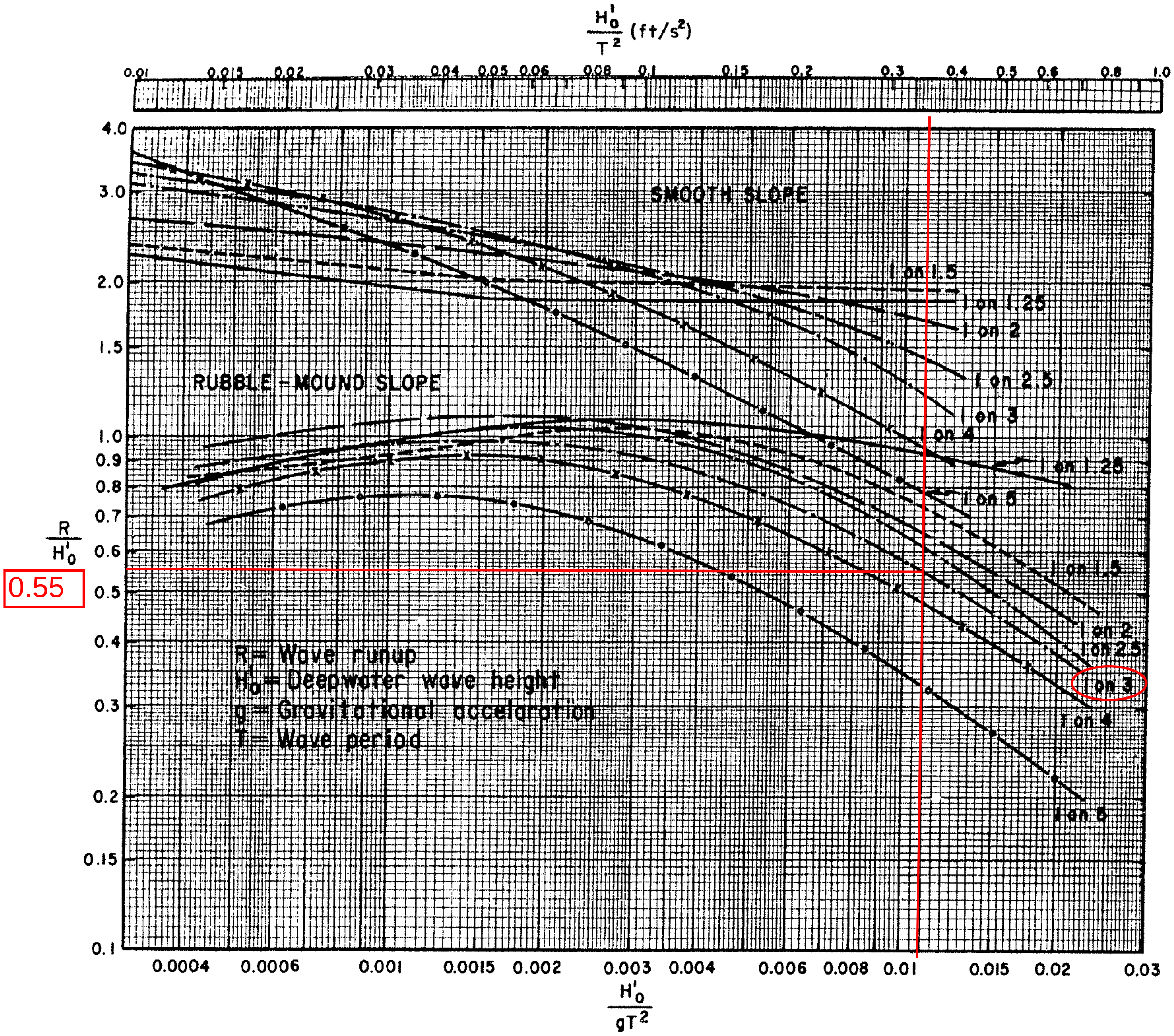


FIGURE 11.- COMPARISON OF WAVE RUNUP ON SMOOTH SLOPES WITH RUNUP ON PERMEABLE RUBBLE SLOPES (DATA FOR $d_s/H'_0 > 3.0$) (FROM FIGURE 7-20, REF. 6)

Appendix C

Impoundment Storage Capacity

Secondary Ash Impoundment Stage-Storage Capacity

GEI Consultants

Elevation (feet) (NAVD 88)	Incremental Storage Capacity by Impoundment: NE Secondary Impoundment	SE Secondary Impoundment	Total Incremental Storage Capacity	Cumulative Secondary Ash Impoundment Storage Capacity		Storm Water Cumulative Secondary Ash Impoundment Storage Capactiy	
	(gallons)	(gallons)	(gallons)	(gallons)	(acre-ft)	(gallons)	(acre-ft)
1,173.00	0	0	0	0	0.00	--	--
1,173.25	0	0	0	0	0.00	--	--
1,173.50	0	0	0	0	0.00	--	--
1,173.75	30,832	57,860	88,692	88,692	0.27	--	--
1,174.00	85,734	115,454	201,188	289,880	0.89	--	--
1,174.25	112,834	143,253	256,087	545,967	1.68	--	--
1,174.50	114,740	145,435	260,175	806,142	2.47	--	--
1,174.75	116,655	147,623	264,278	1,070,420	3.29	--	--
1,175.00	118,578	149,818	268,397	1,338,817	4.11	--	--
1,175.25	120,509	152,020	272,529	1,611,346	4.95	--	--
1,175.50	122,448	154,228	276,676	1,888,022	5.79	--	--
1,175.75	124,395	156,442	280,838	2,168,860	6.66	--	--
1,176.00	126,351	158,663	285,013	2,453,873	7.53	--	--
1,176.25	128,314	160,891	289,205	2,743,078	8.42	--	--
1,176.50	130,286	163,128	293,414	3,036,492	9.32	--	--
1,176.75	132,267	165,372	297,639	3,334,131	10.23	--	--
1,177.00	134,256	167,625	301,882	3,636,012	11.16	--	--
1,177.25	136,255	169,886	306,141	3,942,153	12.10	--	--
1,177.50	138,262	172,156	310,417	4,252,571	13.05	--	--
1,177.75	140,278	174,433	314,711	4,567,282	14.02	--	--
1,178.00	142,303	176,719	319,022	4,886,304	15.00	--	--
1,178.25	144,336	179,013	323,350	5,209,653	15.99	--	--
1,178.50	146,379	181,316	327,695	5,537,349	16.99	--	--
1,178.75	148,430	183,628	332,058	5,869,407	18.01	--	--
1,179.00	150,490	185,948	336,438	6,205,845	19.05	--	--
1,179.25	152,559	188,277	340,836	6,546,682	20.09	--	--
1,179.50	154,637	190,615	345,251	6,891,933	21.15	--	--
1,179.75	156,723	192,961	349,684	7,241,617	22.22	--	--
1,180.00	158,818	195,316	354,134	7,595,751	23.31	--	--
1,180.25	160,923	197,679	358,602	7,954,353	24.41	--	--
1,180.50	163,035	200,052	363,087	8,317,441	25.53	Normal Maximum Operating El. +1,180.5	
1,180.75	165,157	202,433	367,590	8,685,030	26.65	367,590	1.13
1,181.00	167,288	204,822	372,110	9,057,141	27.80	739,700	2.27
1,181.25	169,387	207,180	376,567	9,433,708	28.95	1,116,267	3.43
1,181.50	171,415	209,467	380,881	9,814,589	30.12	1,497,149	4.59
1,181.75	173,411	211,722	385,133	10,199,722	31.30	1,882,281	5.78
1,182.00	175,416	213,985	389,401	10,589,123	32.50	2,271,683	6.97
1,182.25	177,427	216,258	393,685	10,982,808	33.71	2,665,367	8.18
1,182.50	179,427	218,558	397,985	11,380,793	34.93	3,063,352	9.40
Total Impoundment Storage Capacity (gallons)	5,070,555	6,310,238	11,380,793				