Report of Dam Safety Assessment of Coal Combustion Surface Impoundments
NRG Energy
Huntley Generating Station
Tonawanda, NY

AMEC Project No. 3-2106-0194

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3/7/13

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I certify that the management units referenced herein:

NRG Energy's Huntley Generating Station Pond 2, Pond 3 and South Settling Pond were assessed on June 15, 2011. I further certify that this report was prepared under my direct personal supervision.

Signature ______________________

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Senior Geotechnical Engineer

List of AMEC Participants who have participated in the assessment of the management units and in preparation of the report:

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1.0 INTRODUCTION AND PROJECT DESCRIPTION

1.1 Introduction

AMEC was hired by the United States Environmental Protection Agency (EPA) via contract BPA EP09W001702, to perform assessments of selected coal combustion by-products surface impoundments. AMEC was directed by EPA, through the provided scope of work and verbal communications, to utilize the following resources and guidelines to conduct a site assessment and produce a written assessment report for the coal combustion waste facilities and impoundments.

- Coal Combustion Waste (CCW) Impoundment Inspection forms (hazard rating, found in Report Appendix A)
- Coal Combustion Dam Inspection Checklist (found in Report Appendix A)
- Impoundment Design Guidelines of the Mining Safety and Health Administration (MSHA) Coal Mine Impoundment Inspection and Plan Review Handbook (hydrologic, hydraulic, and stability conditions)
- National Dam Safety Review Board Condition Assessment Definitions (condition rating)

As part of this contract with EPA, AMEC was assigned to perform an assessment of NRG Energy's (NRG) Huntley Generating Station (Huntley), which is located in Tonawanda, New York as shown on Figure 1, the Site Location and Vicinity Map. (This figure is presented on the next page and in the figures section of this report.)

A site visit to Huntley was made by AMEC on June 15, 2011. The purpose of the visit was to perform visual observations, to inventory coal combustion waste (CCW) surface impoundments, assess the containment dikes, and to collect relevant historical impoundment documentation.

AMEC engineers, Don Dotson, PE and James Black, PE, were accompanied during the site visit by the individuals listed on Table 1.

Table 1. Site Visit Attendees

Company or Organization	Name and Title
Huntley Power, LLC	Carson Leikam, Plant Manager
Huntley Power, LLC	Joseph Pietro, Environmental Coordinator
NRG Energy, Inc.	Joseph Schwab, Regional Engineering and Construction Manager
NRG Energy, Inc.	Kevin Schroeder, Regional Environmental

NRG reported three ponds in their response letter to EPA dated May 15, 2009. During the site visit, NRG and Huntley personnel reported three additional ponds, Pond 1, Pond 2 and Pond 3, previously used to store and dewater ash. The ponds no longer receive CCW, still contain CCW and actively receive other waste streams from the plant. AMEC engineers included these ponds in the field assessment and took photographs.

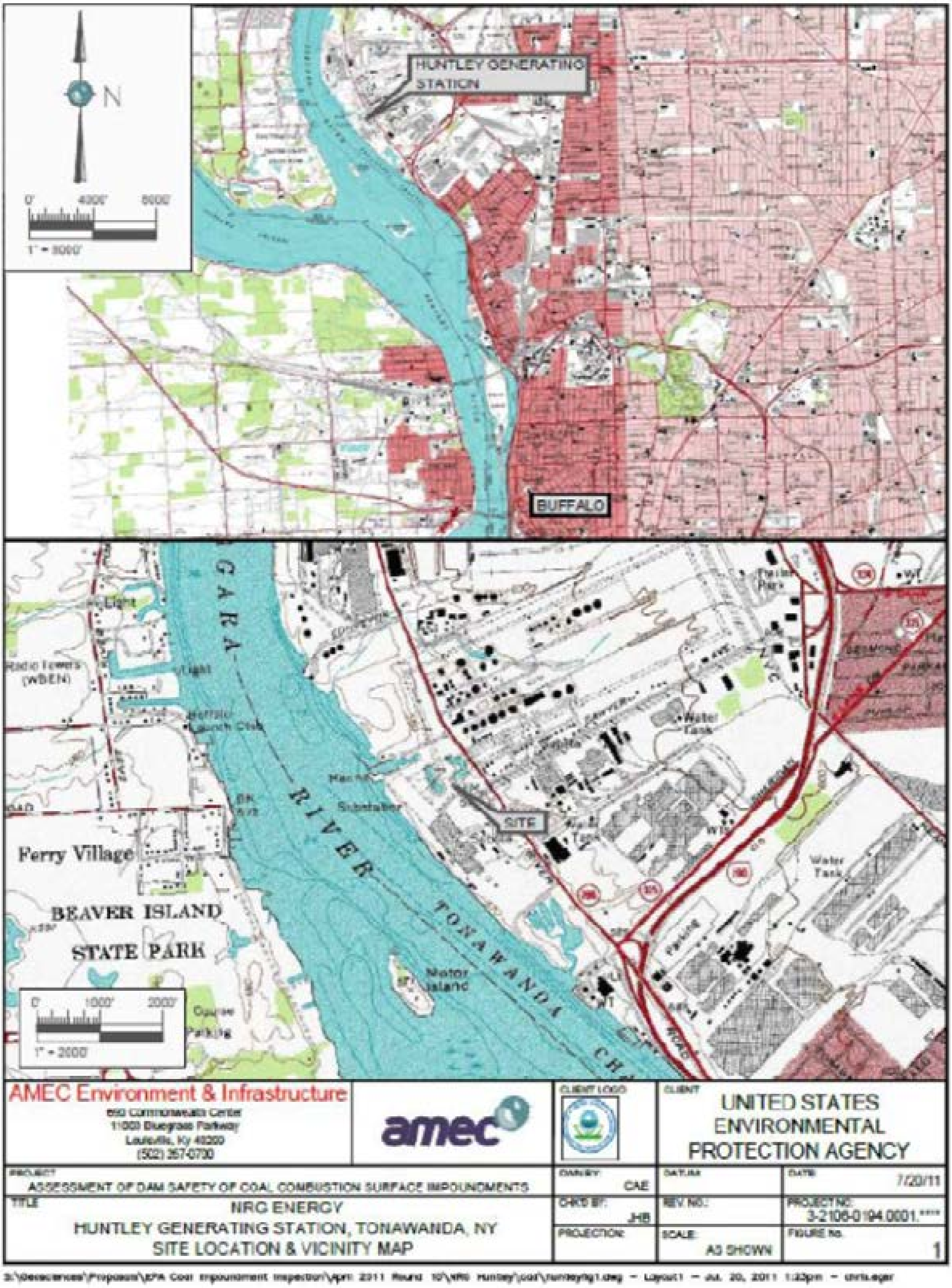


Figure 1. Site Location and Vicinity Map

1.2 Project Background

Coal fired power plants, like NRG's Huntley Generating Station; produce CCW as a result of the power production process. At Huntley, impoundments (dams) were designed and constructed to provide storage and dewatering for the CCW that is produced. CCW impoundment areas at the Huntley facility are referred to as the Pond 1, Pond 2, Pond 3, North Equalization (EQ) Pond, South Equalization Pond and South Ash Settling Pond. Plant north is designated at about 40 degrees west of true north. Unless noted otherwise, directions in this report will be referenced to plant north. Ponds 1, 2 and 3 are located to the north of the plant. The North and South EQ Ponds and the South Pond are located to the south of the plant. Ponds 1 and 2 were commissioned in 1977. The commission date for Pond 3 is unknown. The North and South EQ ponds were commissioned in 1983 and have not been expanded. The South Settling Pond commission date is unknown and the last modification to the pond was performed in 1976 when the outlet channel was relocated for the Erie County Raw Water Intake.

The National Inventory of Dams (NID), administered by the U.S. Army Corps of Engineers (USACE), provides a hazard rating for many dams within the United States. The ash settling ponds at Huntley are not included in the NID. The Huntley ash impoundments are not regulated by the New York State Department of Environmental Conservation and have no hazard potential rating by the state.

1.2.1 Coal Combustion Dam Assessment and Checklist Forms

As part of the observations and evaluations performed at Huntley, AMEC completed EPA's Coal Combustion Dam Assessment Checklists and CCW Impoundment Assessment Forms. Assessment forms for each pond are presented in Appendix A. The Impoundment Inspection Forms include a section that assigns a "Hazard Potential" that is used to indicate what would likely occur following failure of an impoundment. "Hazard Potential" choices include "Less than Low," "Low," "Significant," and "High." As defined on the Assessment Form, dams assigned a Significant Hazard Potential are those dams where "failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant Hazard Potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure". Low Hazard Potential classification definition is reserved for dams where "failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property." Less than Low Hazard Potential classification is reserved for dams where "failure or misoperation results in no probable loss of human life and no economic or environmental losses."

Based on the site visit evaluation of the impoundments, AMEC engineers assigned a "Significant Hazard" potential to Pond 2, Pond 3 and South Settling Pond. A breach of these ponds would likely result in a release of CCW to the Niagara River causing environmental and economic losses. Pond 1 is considered incised within the ash management area. Incised ponds are not given hazard or condition ratings. Upon review of the North and South Equalization Basins, it has been determined that these ponds are not coal combustion waste impoundments and are not given hazard or condition ratings. NRG provided information on these ponds and AMEC included them in the site visit. Information within this report for Pond 1, North Equalization Basin and South Equalization Basin are provided for reference only.

1.2.2 State Issued Permits

The New York State Department of Environmental Conservation (DEC) issued a State Pollution Discharge Elimination System (SPDES) Permit to NRG. The DEC number for the facility is 9-1464-00130/00003 and the current SPDES permit identification number is NY 000 1023. This SPDES Permit authorizes NRG to discharge decant from the ash ponds through multiple outfalls to the Niagara River. The effective date of the permit is June 1, 2003. The permit date of expiration is December 31, 2008. Modification dates are July 19, 2007. The required date to file for renewal of the permit was July 4, 2008. Documentation shows NRG filed for renewal on June 20, 2008. A letter dated June 23, 2008 from the DEC states they are reviewing the renewal and grants the current permit to remain in effect "should the department's technical review and the subsequent permit modification not be completed prior to the expiration date of the current permit." To date, the facility has not been issued a new permit.

1.3 Site Description and Location

The Huntley Generating Station is located at 3500 River Road in the city of Tonawanda, Erie County, New York. NRG provided the following description of the plant location and operations:

> NRG's Huntley Generating Station is located three miles north of Buffalo, NY on a 120-acre site on the east shore of the Niagara River. Though some of the buildings date back to 1916 when the "River Station" first began commercial service, the plant has been continuously modernized and is now comprised of two units totaling a nominal rating of 400 MW. The inactive northern section of the building, known as Huntley 2, housed four Units (Units 63-66) whose commercial operation dates from 1942 through 1954. Units 63 and 64 were retired from service on April 11, 2006 and Units 65 and 66 were retired from service on June 02, 2007. The active southern side of the building, known as Huntley 1, houses two 200 MW units, Units 67 and 68, which entered commercial service in 1957 and 1958, respectively. Huntley Station owns and maintains its own landfill within one mile of the plant for disposal of coal combustion byproducts, which have not been beneficially utilized.

Figure 3, the Critical Infrastructure Map, provides an aerial view of the region and indicates the location of the Huntley ash ponds in relation to schools, hospitals, and other critical infrastructure that is located within approximately 5 miles down gradient of the impoundments. A table that provides names and coordinate data for the infrastructure is included on the map. A Topographic Site Map is included as Figure 1. The Aerial Site Plan, shown on the next page and included in the figures section as Figure 2, provides a view of the pond areas.

Figure 2. Site Map

1.4 Ash Ponds

A May 15, 2009 document, written by NRG Energy in response to EPA's Request for Information under Section 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C 9604(e), provided the following general background for the North and South EQ Ponds and the South Settling Pond:

> Both North and South Equalization Ponds temporarily contain fly ash and other materials including coal pile runoff, boiler and air preheater wash water containing coal fines and fly ash, before these materials are treated by the waste water treatment system. Washes are performed periodically and any collected coal fines and fly ash are removed from the basins and transported to the Huntley Station's off-site landfill. (NRG provided later clarification that the Equalization Ponds just receive coal pile run off and - every few years - waste water from air preheater wash.) The South Settling Pond collects fly ash, bottom ash and boiler slag, including bottom ash and slag from the bottom ash and slag handling systems and minor amounts of fly ash from roadway wash down from the vicinity of the fly ash silo. Bottom ash is dredged at the inlet almost weekly, and the remaining areas of the pond are dredged periodically. Fly ash accumulates in the South Settling Pond between dredging.
>
> Based on its review of readily available records, NRG determined the North and South EQ Ponds were initially designed by Stanley Consultants and constructed in 1984 under the supervision of the Construction Services Department of the previous owner, Niagara Mohawk Power Corporation (NIMO). NRG could not ascertain who supervised the construction for NIMO. The South Settling Pond Modification was designed by Malcolm Pirnie.
>
> The North and South EQ Basins and the South Settling Pond are not presently inspected or monitored by a professional engineer.

The following ash handling summary detailed below was provided by NRG personnel who are knowledgeable concerning the facility's operational processes:

> The Huntley Station's Ponds 1, 2 and 3 currently have drastically reduced flow from designed flow since they primarily served the retired 60 cycle units. The ponds receive flows from drainage from the north wastewater collection system which includes sub-basement sump pumps, Huntley 2 roof and floor drains, auxiliary cooling system drains and treated effluent from the Demineralizer Neutralization Plant. Ponds 2 and 3 discharge into a ditch through SPDES Outfalls 001A and 001B, then into the Niagara River. The North and South Equalization Basins receive flows from the wastewater from the air preheater washes and coal pile runoff sump pumps. The North and South EQ basins are treated by an on-site Wastewater Treatment Facility which discharges into plants Low Level Waste Water Pit through internal SPDES Outfall 007A and ultimately to the Niagara River through the South Settling Pond and SPDES Outfall 008. The South Settling Pond receives flow from sluice waters and suspended solids from Unit 67 and Unit 68 bottom ash and economizer ash systems and discharge from the Low Level Waste Water Pit. The Low Level Pit discharge includes rain water from roadway drains, sub basement sump drains, boiler water releases, Huntley 1 roof and floor drains, auxiliary cooling systems drains and discharge from the Wastewater Treatment facility from treating the North and South EQ basin water.

NRG's May 15, 2009 response to EPA's Request for Information and other provided documentation, as well as recent communications with NRG Energy personnel, provided the following additional information that is specific to each ash pond. Current descriptive information resulting from the site visit and photographic references are provided in Section 2 of this Assessment Report.

1.4.1 Pond 1

Pond 1 is located on the north side of the plant. Provided plans, *Modification ("MOD.") of North Slag Pond System,* for/by Niagara Mohawk Power Corporation, indicates Pond 1 was constructed in 1977. Pond 1 is relatively small in size and was formally used as an ash settling basin. Plans indicate the pond was constructed with a 6 feet wide clay liner on the south embankment (outside embankment). The pond is shown to have a 1-foot thick clay liner on the 2H:1V interior side slopes and a 2-feet thick clay liner on the bottom. The ash pond is inactive as a CCW impoundment and currently used as the initial receiving pond for flows from the north wastewater collection system. Decant from Pond 1 flows by gravity through pipes and is controlled by gates to Pond 2 or Pond 3. NRG reported the ponds no longer receive ash, but may contain residual ash from their former use. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

1.4.2 Pond 2

Pond 2 is located on the north side of the plant and was formerly used as an ash setting basin. Provided plans, *Modification ("MOD.") of North Slag Pond System,* for/by Niagara Mohawk Power Corporation, indicates Pond 2 was also constructed in 1977. Plans indicate the pond was constructed with a 6 feet wide clay liner on the west embankment (outside embankment). The pond is shown to have a 1-foot thick clay liner on the 2H:1V upstream slope adjacent to the common dike with Pond 1 and a concrete bottom. The downstream slopes are shown to be on 2H:1V slopes. The ash pond is inactive as a CCW impoundment and currently used as a secondary receiving pond from Pond 1 for flows from the north wastewater collection system. Decant from Pond 2 flows by gravity through a pipe controlled by a gates to a ditch on the north end of the site. The ditch flows west to discharge to the Niagara River. NRG reported the pond no longer receives ash, but may contain residual ash from their former use. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

1.4.3 Pond 3

Pond 3 is located on the north side of the plant. Plans showing the construction of Pond 3 were not available. A provided plan sheet for the construction of Ponds 1 and 2, *Modification ("MOD.") of North Slag Pond System, 1977*, for/by Niagara Mohawk Power Corporation, indicates Pond 3 was formally called the North Slag Pond. The date of construction of this pond is unknown. The drawing includes a boring within the proposed (current) Pond 2 location with results showing a top horizon of 12.5 feet of ash. This indicates the North Pond was the original ash pond for the facility and at some previous time may have extended over the entire North Pond System area. The drawing indicates a future expansion of the North Pond, but current conditions indicate the expansion has not been constructed but the pond's name was changed to Pond 3. Pond 3 is currently inactive as a CCW impoundment and is used as a secondary receiving pond from Pond 1 for flows from the north wastewater collection system. Decant from Pond 3 flows by gravity through a pipe controlled by a gates to a ditch on the north end of the site. The ditch flows west to discharge to the Niagara River. NRG reported the pond no longer receives ash, but may contain residual ash from their former use. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

1.4.4 North Equalization Basin

The North Equalization Basin (North Basin) is located on the south side of the plant. Provided plans, Coal Pile Drainage Collection System and Equalization Basins, stamped by Charles Meyer with the Niagara Mohawk Power Corporation indicate the North and South Equalization basins were constructed in 1984. Sheet 4 of those plans indicate the basin and coal pile area is located within an “abandoned slag pond.” The North Equalization Basin is a partially below-grade, asphalt lined basin. Discharge from the North Basin normally passes through a Wastewater Treatment System and ultimately discharges to the South Settling Pond. Discharge from the basin is controlled by a flow control structure which can direct flows between the equalization basins, to the treatment system or bypass directly to the South Settling Pond. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

1.4.5 South Equalization Basin

The South Equalization Basin (South Basin) is located on the south side of the plant. The basin is a partially below-grade, asphalt lined basin. Similar to the North Basin, discharge from the South Basin normally passes through a Wastewater Treatment System and ultimately discharges to the South Settling Pond. Discharge from the basin is controlled by a flow control structure which can direct flows between the two equalization basins, to the wastewater treatment system or bypass directly to the South Settling Pond. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

1.4.6 South Settling Pond

The South Ash Settling Pond is located at the south end of the plant facilities and to the east and south of the two equalization basins. The construction date of the pond is unknown. The lower section and outlet of the South Pond previously extended to the south and then to the west to discharge to the river. Modifications occurred in 1976 due to construction of a new raw water intake for the Erie County Water Authority. The lower section was moved to the north to create an almost straight south embankment and a new outlet was installed. Prior to these improvements, the Dunlop Tire plant across River Road discharged to the South Pond. In the early 1980’s, an elevated piped system was installed. The pipe is visible within the pond and extends from east to west just inside the south dike then turns southwest out of the pond to its separate outlet structure located off NRG property. The South Pond is the active primary settling pond for the plant and receives sluiced CCW and other waste streams from the plant. Decant from the South Settling Pond is conveyed by gravity through a 92-inch by 65-inch arched CMP to the Niagara River. Table 2 provides a summary of surface area, height, storage capacity, and stored material volumes for this pond.

Table 2. Pond Size and Storage Data
(All Values Approximate)

Area	Surface Area (acre)	Maximum Height of Management Unit (feet)	Storage Capacity (cubic yards)	Stored Material Volume (cubic yards)
North Ponds[1] (Inactive)				
Pond 1	0.40[6]	5	6,450[6]	Unknown
Pond 2	1.15[6]	7	10,490[6]	Unknown
Pond 3	1.20[6]	7	20,330[6]	Unknown
South Ponds[2] (Active)				
North Equalization	1.58	5[3]	12,520[6]	None
South Equalization	1.58	3[3]	13,165[6]	Unknown
South Ash Settling	7.3	6.75[4]	76,600	7,500[5]

[1] Data for north pond system are as reported or derived from values obtained during June 15, 2011 site visit.
[2] Data for south pond system obtained from 2009 NRG response letter to EPA RFI.
[3] Reported as berm height.
[4] Reported as submerged berm height at outfall.
[5] Based on January 7, 2009 survey.
[6] Provided or edited from information supplied by NRG in comments dated Sept 13, 2012

1.5 Previously Identified Safety Issues

Discussions with plant personnel and review of provided documentation indicate that there are no current or previously identified safety issues from the previous five years at the Huntley Generating Station.

1.6 Site Geology

Based on research on the internet, bedrock underlying the Huntley Generating Station consists of dolomite and shale deposits belonging to the Salina group of the Late Silurian period. Research and Attachment A of the provided document *Appendix B - Stormwater Calculations, Analysis of Drainage Outfall No. 7*, performed by Shaw and dated October 2007 shows NRCS to designate the plant “urban soil” and does not provide any descriptions. A boring in the middle and before construction of Pond 2 on a provided plan sheet, *Modification (“MOD.”) of North Slag Pond System, 1977*, for/by Niagara Mohawk Power Corporation, indicates the soil strata at that location consisted of 12.5 feet of ash underlain by 9 feet of soft mud underlain by 15 feet of fine sand and silt to the boring termination depth. Recent borings were performed in the area of the outlet at the South Pond to obtain data for a stability analysis. The results of these borings are discussed in Section 3 of this report. No other soil or bedrock data was provided.

1.7 Inventory of Provided Materials

NRG provided documents to AMEC that pertained to the design and operation of the Huntley Generating Station. These documents were used in the preparation of this report and are listed in Appendix C, Inventory of Provided Materials.

2.0 FIELD ASSESSMENT

2.1 Visual Observations

AMEC performed visual assessments of Huntley's Ash Ponds, including Pond 1, Pond 2, Pond 3, North Equalization Basin, South Equalization Basin and the South Pond on June 15, 2011. Assessment of the ash ponds was completed in general accordance with FEMA's *Federal Guidelines for Dam Safety, Hazard Potential Classification System for Dams,* April 2004. The EPA Coal Combustion Dam Assessment Checklist and Coal Combustion Waste (CCW) Impoundment Assessment Form were completed for each ash pond during the site visit and provided to EPA via email within five business days following the site visit. The checklists have been updated to reflect changes based on review of data or additional information. Appendix A contains copies of the completed checklist forms. A Photo Location Map (B-1), as well as descriptive photos, can be found in Appendix B. Additionally, some of the photos are provided in this section for easy reference. Rainfall data for the Tonawanda, New York area was collected for thirty-two days prior to the site visit. Table 3, below, summarizes the rainfall data for the days and month immediately preceding AMEC's site visit.

Table 3. Huntley Rainfall Data

Rainfall Prior to Site Visit	
Date	**Rainfall (in.)**
June 6, 2011	0.00
June 7, 2011	0.19
June 8, 2011	T
June 9, 2011	0.00
June 10, 2011	T
June 11, 2011	T
June 12, 2011	T
June 13, 2011	0.03
June 14, 2011	0.08
Total (9 days prior to visit)	0.30
June Rainfall (14 days prior to visit)	0.64
Total (32 days prior to visit)	6.80

2.2 Visual Observations - Pond 1

Pond 1 is located in the ash management area at the north end of the plant (North Ponds). The pond is situated in the southwest corner of this area. Pond 1 is bordered by a section of Pond 3 and a field to the east, Pond 2 to the north, a substation to the west and the plant grounds to the south. Pipes from the plant for wastewaters (and formerly CCW) enter Pond 1 from pipes on its southwest corner. Dense, tall grass and trees prevented a good view of the area (Photos 1-1 and 1-4). See the following photo presented as 1-1 in Appendix B.

2.2.1 Pond 1 - Embankments and Crest

This pond is incised within the ash management area and has common dikes with adjacent ponds to the north and east.. Drawings indicate the land surface elevation on the north side of the pond and common dike with Pond 2 is 579.0 feet. The land surface elevation at the south end of the pond is 580.0 feet. The plan bottom of the pond is 566.0 feet. The lower half of the south bank and the area to the south of Pond 1 was covered with ash. (Photos 1-1 and 3-4). A predominant feature on the upper half of the south bank and all of the north, west and east dikes of the pond was dense, tall grass which hindered the visual assessment of these slopes (Photos 1-1 through 1-5).

2.2.2 Pond 1 - Outlet Control Structures

Pond 1 has outlets to Pond 2 and Pond 3. The location of the outlet pipe to Pond 3 is at the northeast corner of Pond 1 (Photos 1-2 and 1-3). The location of the outlet pipe to Pond 2 is at the northeast embankment of Pond 1 (Photo 1-5). Both outlet pipes are shown on Section 7-7 and 7A-&7A of the provided *Modification ("MOD.") of North Slag Pond System, 1977*, for/by Niagara Mohawk Power Corporation to be 43-inch by 27-inch galvanized arch pipes. The length of the outlet pipes are 70 feet to Pond 2 and 40 feet to Pond 3. Both inlet elevations are 576.1 feet with outlet elevations of 575.7 feet to Pond 3 and 575.4 feet to Pond 2. Under normal conditions, the outlet pipes to Ponds 2 and 3 control the water depth in Pond 1 to 10.1 feet.

2.3 Visual Observations -Pond 2

Pond 2 is located in the ash management area at the north end of the plant (North Ponds). The pond is situated in the northwest portion of this area. Pond 2 is bordered by Pond 3 to the east, a ditch to the north, a substation to the west and Pond 1 to the south. An inlet pipe from Pond 1 enters Pond 2 at the southeast corner. Plans show the width of the top of the common dike of Pond 2 with Pond 1 as 20 feet. Dense, tall grass prevented a good view of the area. See the following photo presented as 2-1 in Appendix B.

2.3.1 Pond 2 - Embankments and Crest

Pond 2 is a diked structure. Drawings indicate the top of berm elevation as 579.0 feet. The plan bottom of the pond is 570.0 feet. Dense, tall grass prevented a good view of the interior and exterior slopes (Photo 2-1, 2-2, 2-5, 2-6 and 2-7). A feature at the northwest corner of the pond consists of a concrete ramp leading down into the pond (Photo 2-2).

2.3.2 Pond 2 - Outlet Control Structures

Pond 2 discharges flow by gravity through a 24-inch diameter gated culvert pipe located on the north dike (Photo 2-3). The flow discharges to a ditch that slopes from east to west along the north boundary of the property and then west to the Niagara River. “Fabriform” slope protection is present upstream and downstream in the outfall area. See the following photo of the outfall area presented as 2-4 in Appendix B. Three other 15-inch diameter gated pipes are present at the outlet and are reported to include an emergency overflow, a bottom drain and unknown drain. The inlet and outlet elevations of the 24-inch pipe are 576.3 and 569.0 feet, respectively.

2.4 Visual Observations - Pond 3

Pond 3 is located in the ash management area at the north end of the plant (North Ponds). The pond is situated in the east section of this area. Pond 3 is the original pond in this area and previously designated as the “North Slag Pond.” Pond 3 is bordered by an open field and River Road to the east; a ditch to the north; an open field with towers, Pond 2 and Pond 1 to the west; and an open field and plant grounds to the south. Pond 3 appeared to be generally below grade on the south and east side. An inlet pipe from Pond 1 enters Pond 3 at the southwest end of the pond. Plans show the width of the top of the common dike of Pond 3 with Pond 1 as 20 feet, or more. Dense, tall grass prevented a good view of the inlet area (Photo 3-1).

2.4.1 Pond 3 - Embankments and Crest

Pond 3 appears to be incised on the south and east embankments and diked on the north and west embankments. Drawings indicate the top of berm elevations range from about 581 to 582 feet on south side to about 576 to 579 feet on the north side. Although as-built information was not available for this pond, sections shown for future improvements (to-date not constructed) indicate a bowl-like shape with generally steeper than 2H:1V side slopes. The elevation of the berms appeared higher during the site visit, but dense, tall grass and occasional trees prevented a good view of the interior and exterior slopes (Photos 3-2 through 3-8). See the following photo presented as 3-2 in Appendix B.

2.4.2 Pond 3 - Outlet Control Structures

Pond 3 discharges flow by gravity through an 18-inch diameter gated culvert pipe located on the north dike (Photos 3-9). Skimmer booms are located upstream of the outlet pipe (Photo 3-10). The flow discharges to a ditch that slopes from east to west along the north boundary of the property and then west to the Niagara River (Photo 3-11). This ditch receives discharge from Pond 3 and Pond 2. The inlet and outlet elevations of the 18-inch pipe are 574.3 and 573.4 feet, respectively.

2.4 Visual Observations - North Equalization Basin

The North Equalization Basin, or Equalization Basin No. 1, is located in the ash management area at the south end of the plant (South Ponds). The North Basin is situated in the northwest section of this area. The basin is bordered by the coal pile area to the north, an open area and the South Pond to the east, the South Equalization basin to the south, and an open area and the Niagara River to the west. A 12-inch diameter inlet pipe from the flow control structure enters the basin at the southeast corner. Plans show the width of the top of the common dike of the North and South Equalization Basins as 12 feet (Photo NEQ-6).

2.5.1 North Equalization Basin - Embankments and Crest

The North Equalization Basin is incised on the north embankment and diked on the east, south and west. Drawings indicate the top of berm (crest) elevation is 580.3 feet. The bottom, upstream slopes, crest and portions of the downstream slopes have an asphalt liner. The liner is shown to consist of 2-inches of binder and 2-inches of surface for a total 4-inch asphalt cover. The lined slopes and crest appeared to be in fair condition with red staining on the lower sections of the upstream slopes and areas of cracks with or without protruding vegetation in several locations (Photos NEQ-1 through NEQ-6). The downstream slopes, especially on the west dike appeared to be in poor to fair condition with more degradation of the asphalt liner as evidenced by more protruding vegetation (Photo NEQ-4 and NEQ-7). As you proceed south along the west dike, the North Basin is located approximately 185 feet to 110 feet from the edge of the bank of the Niagara River. The following photo presented as NEQ-3 in Appendix B presents a view of the crest and the upstream and downstream slopes of the basin.

2.5.2 North Equalization Basin - Outlet Control Structures

The North Equalization Basin discharges flow through a 6-inch pipe to the flow control structure. The outlet pipe is located at the bottom and in the southwest corner of the pond. The inlet and outlet pipes to the pond were under water and could not be seen during the site visit. Plant personnel dictate the location of the discharge from the basin by the flow control structure.

2.6 Visual Observations - South Equalization Basin

The South Equalization Basin, or Equalization Basin No. 2, is located adjacent and south of the North Equalization Basin in the ash management area at the south end of the plant (South Ponds). The South Basin is situated in the west-central section of this area. The basin is bordered by the north basin to the north, an open area and the South Pond to the east, an open area and the South Pond to the south, and an open area and/or the Niagara River to the west. A 12-inch diameter inlet pipe from the flow control structure enters the basin at the northeast corner. Plans show the width of the top of the common dike of the North and South Equalization Basins as 12 feet. See the following photo presented as NEQ-6 in Appendix B.

2.6.1 South Equalization Basin - Embankments and Crest

The South Equalization Basin is a diked impoundment. Drawings indicate the top of berm elevation is 580.3 feet. The bottom, upstream slopes, crest and portions of the downstream slopes have the same type and thickness of asphalt liner as the north basin. The lined slopes and crest appeared to be in fair condition with slight red staining on the lower sections of the upstream slopes and areas of cracks with or without protruding vegetation in several locations (Photos SEQ-1 through SEQ-4). The downstream slopes, especially on the west dike appeared to be in poor to fair condition with more degradation of the asphalt liner as evidenced by more protruding vegetation (Photo SEQ-3 and SEQ-4). As you proceed south along the west dike, the South Basin is located approximately 100 feet to 35 feet from the edge of the bank of the

Niagara River (Photos SEQ-3 through SEQ-5). From the southwest corner of the South Basin looking south, the outlet pipe of the South Pond can be seen (Photo SEQ-6). The following photo presented as SEQ-3 in Appendix B presents a view of the southwest corner of the basin, Niagara River in background.

2.6.2 South Equalization Basin - Outlet Control Structures

The South Equalization Basin discharges flow through a 6-inch pipe to the flow control structure. The outlet pipe is located at the bottom and in the northwest corner of the pond. The inlet and outlet pipes to the pond were under water and could not be seen during the site visit. Plant personnel dictate the location of the discharge from the basin by the flow control structure.

2.7 Visual Observations - South Ash Pond

The South Settling Pond System, also known as the South Ash Pond is located in the ash management area at the south end of the plant (South Ponds). The South Pond is situated in the east and south end of this area. The basin is bordered by the coal pile and an access road to the north, an open area and River Road to the east, the plant property boundary to the south, and both equalization basins and the Niagara River to the west. CCW flows directed by the flow control structure and other plant wastes enter the South Pond through multiple pipes that discharge at the north end of the pond (Photo S-1). Flow through the pond is to the south (as the pond widens) then turns to the west (as the pond narrows) to discharge to the Niagara River.

The South Pond is used to settle and remove bottom ash on a regular basis. The north end of the pond is dredged regularly and the dewatered ash is transported to an off-site landfill. Periodically, the entire pond is dredged, with the last time occurring in 2009. The only construction plans and drawings available for the South Pond are the 1976 Outlet Structure Modifications stamped by Malcolm Pirnie, PE..

2.7.1 South Ash Pond - Embankments and Crest

The South Ash Pond was reported to be a combination incised and diked impoundment. The north and east sections are incised and the west and south sections are diked. Based on a survey drawing prior to the recent dredging, the top of the banks of the South Pond generally range from about 578 feet at the north end to 574 feet at the southwest end/outlet area. The drawing indicates generally lower top of bank areas at the southeast corner and along the south bank.

At the time of the field assessment, the upstream slopes at the north end of the South Pond were steep and void of vegetation (Photo S-2 and S-8). Generally, all other upstream slopes, crests and downstream slopes were covered with high grass preventing a good view of the slopes (Photos S-2, S-3, S-5, S-9 and S-10). Steep slopes appeared to be present on the inside of the curve on the west embankment and at the southeast end of the pond (Photos S-2 and S-10). See the following photo presented as S-2 in Appendix B.

2.7.2 South Ash Pond - Outlet Control Structures

The South Pond was modified in 1984. This modification included the southwest end of the pond and the outlet structure. The South Pond discharges flow by gravity through a 92-inch by 65-inch arched CMP located on the southwest dike (Photos S-3, S-4, S-6 and S-7). Skimmer booms are located upstream of the outlet pipe and the upstream slope is armored with rip-rap (Photo S-4 and S-7). The flow discharges to the Niagara River with grouted rip-rap slopes upstream and downstream of the outlet pipe (Photo S-6). The inlet and outlet elevations of the 92-inch by 65-inch arched CMP are 568.8 and 565.0 feet, respectively. See the following photo presented as S-4 in Appendix B showing the inlet of the outlet pipe.

See the following photo presented as S-6 in Appendix B showing the outlet pipe area to the Niagara River.

2.8 Monitoring Instrumentation

There is no geotechnical or groundwater monitoring instrumentation associated with the Impoundments located at the Huntley Power Station.

3.0 DATA EVALUATION

3.1 Design Assumptions

AMEC has reviewed provided documentation related to design assumptions regarding both hydraulic adequacy and dike stability. However, some design assumptions were not available in the documentation, and have been listed as not provided where necessary.

3.2 Hydrologic and Hydraulic Design

3.2.1 Long Term Hydrologic Design Criteria

The Mine Safety and Health Administration provides minimum hydrologic criteria relevant to CCW impoundments in Impoundment Design Guidelines of the Mining Safety and Health Administration (MSHA) Coal Mine Impoundment Inspection and Plan Review Handbook (Number PH07-01) published by the U.S. Department of Labor, Mine Safety and Health Administration, Coal Mine Safety and Health, October 2007.

When detailing impoundment design storm criteria, MSHA states that dams need “to be able to safely accommodate the inflow from a storm event that is appropriate for the size of the impoundment and the hazard potential in the event of failure of the dam.” Additionally, MSHA notes that sufficient freeboard, adequate factors of safety for embankment stability, and the prevention of significant erosion to discharge facilities, are all design elements that are required for dam structures under their review. Additional impoundment and design storm criteria are as shown in Table 4, MSHA Minimum Long Term Hydrologic Design Criteria.

Table 4. MSHA* Minimum Long Term Hydrologic Design Criteria

Hazard Potential	Impoundment Size	
	< 1000 acre-feet **< 40 feet deep**	**≥ 1000 acre-feet** **≥ 40 feet deep**
Low - Impoundments located where failure of the dam would result in no probable loss of human life and low economic and/or environmental losses.	100 - year rainfall**	½ PMF
Significant/Moderate - Impoundments located where failure of the dam would result in no probably loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities.	½ PMF	PMF
High - Facilities located where failure of the dam will probably cause loss of human life.	PMF	PMF

*Mining Safety and Health Administration (MSHA) Coal Mine Impoundment Inspection and Plan Review Handbook (Number PH07-01) published by the U.S. Department of Labor, Mine Safety and Health Administration, Coal Mine Safety and Health, October 2007

**Per MSHA, the 24-hour duration shall be used with the 100-year frequency rainfall.

Probable maximum flood (PMF) is, per MSHA, “the maximum runoff condition resulting from the most severe combination of hydrologic and meteorological conditions that are considered reasonably possible for the drainage area.” Additionally, MSHA notes the designer should consider several components of the PMF that are site specific. These components are said to include: “antecedent storm; principal storm; subsequent storm; time and spatial distribution of the rainfall and snowmelt; and runoff conditions.” Basic agreement, it was noted, exists between dam safety authorities regarding “combinations of conditions and events that comprise the PMF;” however, there are “differences in the individual components that are used.” MSHA provided the following as a “reasonable set of conditions for the PMF:

- Antecedent Storm: 100-year frequency, 24 hour duration, with antecedent moisture condition II (AMC II), occurring 5 days prior to the principal storm.

- Principal Storm: Probable maximum precipitation (PMP), with AMC III. The principal storm rainfall must be distributed spatially and temporally to produce the most severe conditions with respect to impoundment freeboard and spillway discharge.

- Subsequent Storm: A subsequent storm is considered to be handled by meeting the “storm inflow drawdown criteria,” as described subsequently in the document.

With regard to storm influent drawdown criteria, MSHA Impoundment Design Guidelines noted that:

> *Impoundments must be capable of handling the design storms that occur in close succession. To accomplish this, the discharge facilities must be able to discharge, within 10 days, at least 90 percent of the volume of water stored during the design storm above the allowable normal operating water level. The 10-day drawdown criterion begins at the time the water surface reaches the maximum elevation attainable for the design storm. Alternatively, plans can provide for sufficient reservoir capacity to store the runoff from two design storms, while specifying means to evacuate the storage from both storms in a reasonable period of time - generally taken to be at a discharge rate that removes at least 90% of the second storm inflow volume within 30 days………When storms are stored, the potential for an elevated saturation level to affect the stability of the embankment needs to be taken into account.*

In, Mineral Resources, Department of Labor, Mine Safety and Health Administration, Title *30 CFR § 77.216-2 Water, sediment, or slurry impoundments and impounding structures; minimum plan requirements; changes or modifications, certification*, information relevant to the duration of the probable maximum precipitation is given. Sub-section *(10)* of *77.216-2* states that a “statement of the runoff attributable to the probable maximum precipitation of 6-hour duration and the calculations used in determining such runoff” shall be provided at minimum in submitted plans for water, sediment or slurry impoundments and impounding structures.

The definition of design freeboard, according to the MSHA Guidelines, is “the vertical distance between the lowest point on the crest of the embankment and the maximum water surface elevation resulting from the design storm.” Additionally, the Handbook states that “Sufficient documentation should be provided in impoundment plans to verify the adequacy of the freeboard.” Recommended items to consider when determining freeboard include “potential wave run-up on the upstream slope, ability of the embankment to resist erosion, and potential for embankment foundation settlement.” Lastly, the Handbook states, “Without documentation, and absent unusual conditions, a minimum freeboard of 3 feet is generally accepted for impoundments with a fetch of less than 1 mile.”

The CCW impoundments at the Huntley Power Station fall within the middle storm event designation category on Table 4. Using MSHA long term hydrologic criteria, design for the ½ PMF rainfall event would be recommended.

3.2.2 Hydrologic Design Criteria

AMEC was provided the following documents with hydraulic calculations prior to the draft report:

Analysis of Drainage Outfall No. 7 Calculations dated October, 2007 by Shaw, Stone and Webster, Inc. (Huntley Stormwater Calcs, Part 1).

Analysis of Drainage at Filter Building calculations dated October, 2008 by Shaw, Stone and Webster, Inc. (Huntley Stormwater Calcs, Part 2).

These two documents represent stormwater calculations for only a portion of the site in the filter building area. No hydrologic and hydraulic study specifically for the North Ponds - Pond 1, Pond 2 and Pond 3 and the South Ponds - North Equalization Basin, South Equalization Basin, and South Ash Settling Basin were provided.

In comments to the draft report by NRG, GZA's letter response dated September 13, 2012, Pages 6-14 with attachments, includes hydrologic/hydraulic analyses for the six ponds at the site. GZA used a design flood event for the ponds as ½ Probable Maximum Flood (1/2 PMF) in the calculations. The analysis assumed a 500-year flood elevation for the Niagara River. The SCS (Soil Conservation Service, now known as Natural Resources Conservation Service, i.e. NRCS) Dimensionless Unit Hydrograph method was used in this analysis. The results of the analyses indicated the North Ponds (Ponds 1, 2 and 3) have the ability to safely pass the ½ PMF with calculated minimum freeboard ranging from 2.1 to 2.9 feet. The results of the analyses for the South Ponds (North and South Equalization Basins, and the South Ash Pond) indicated overtopping of the equalization basins during the ½ PMF when the initial water surface is below El.578.7 with no process inflow or below El.577.7 with a maximum process inflow of 500 gpm). The North and South EQ Basins will not be overtopped during the ½ PMF, under either condition, if NRG lowers the top of the existing overflow pipe, and associated maximum operating level, from Elevation 579.3' to 578.3'. The outflow pipe for South Ash Settling Basin can pass the ½ PMF with a freeboard greater than 3 feet, regardless of the conditions in the equalization basins.

3.3 Structural Adequacy & Stability

EPA policy for conventional minimum recommended factors of safety for different loading conditions is shown in Table 6 below.

Table 5. Minimum Stability Factors of Safety

Loading Condition	Minimum Factor of Safety
Rapid Drawdown	1.3
Long-Term Steady Seepage	1.5
Seismic Loading	1.0

To consider the structural adequacy and stability of the ash ponds at the Huntley Generating Station, AMEC reviewed stability analysis material provided by NRG with respect to the load cases shown in Table 6. Factors of safety documented in the provided material were compared with those factors outlined in the table to help determine whether the impoundments meet the requirements for acceptable stability.

AMEC reviewed the July 1, 2009 report entitled *Settling Pond Outlet Embankment Evaluation* prepared by GZA for the Huntley Generating Station prepared for NRG Energy. This report is presented in Appendix D. The completed stability analyses are summarized in Section 3.3.1. The GZA analysis included a study of one cross-section at the southwest dike (outlet area) of the South Settling Pond, as shown on Figure 4. The report presented a summary of the data that was reviewed including a geotechnical exploration that included three borings performed in the study area by Earth Dimensions, Inc. and laboratory test results by GZA as well as the reasoning, methods employed and results of the structural stability analyses performed for one cross-section. The procedures used and factors of safety documented in the provided material were compared with those factors outlined in Table 6 to help determine whether the impoundments meet the requirements for acceptable stability.

GZA evaluated the overall stability of the South Pond by reviewing the cross-section and drilling data for their study, as shown on Figure 5. The report summarizes the soils conditions encountered in the borings as follows:

- *Overburden Fill: The fill thickness varied between test borings including 12.0 feet at B-I, 14 feet at B-2, and 10 feet at B-3. The soils sampled were visually described as varying between gravel and slag in the upper portions of the fill soil to silt and fine sand soil in the lower portions. Smaller amounts of brick, concrete and wood fragments were observed throughout the fill material. The fill soil samples were predominantly course grained and non-plastic.*
- *Silt and Fine Sand: The depth of the silt and fine sand soil encountered varied from about 12 to 14 feet bgs in B-1 and B-2 respectively and is about 8 feet thick. The recovered samples were visually described as generally a dark gray to gray silt and fine sand soil (ML). The silt content of the soil samples tested for grain size ranged from about 53% (B-1) to 55% (B-2) and the clay content ranged from 7% to 9%, respectively, indicating the soil is predominately fine-grained and silt-sized. Atterberg limits were not tested on these soils as they were observed in the field as non plastic.*
- *Sand - A well graded sand layer including very fine sand to coarse sand was observed at depths ranging from about 20 to 22 feet bgs and its presence continued to the end of each boring (26 feel bgs).*

The report describes the “Existing Embankment Conditions” as:

> *The soils encountered in B-1 and B-2 generally consists of a fine to coarse grained fill material over a silt and fine sand layer over a well graded sandy soil. At the boring locations, the composition of the fill material was variable with a greater amount of coarse soil (sand, gravel and slag and lesser amounts of concrete, brick and wood debris) noted closer to the ground surface. Finer grained, sandy silt soils were observed in the lower portions of the fill layer. The soil encountered below the fill and below the water line was predominately a loose silt and fine sand soil (about 6 to 7 feet thick) over a well graded sandy soil.*

> *SPT "N" values from the silt and fine sand layer underlying the fill soils (about 12 to 14 feet bgs) were measured with values ranging from about 2 to 7 indicating a loose relative density.*
>
> *The "N" values of 2 to 7 measured and recorded for the silt and fine sand soils sampled below the water table may not be representative of in-situ conditions. More representative "N" values may be higher. During soil sampling and SPT work, a hydrostatic in-balance was present due to a higher assumed groundwater elevation outside the HSAs, compared to inside the HSAs. This hydrostatic in-balance may result in a disturbance at the bottom of the HSAs in the zone where split-spoon sampling and SPT work occurred. Earth Dimensions attempted to maintain a water column inside the hollow stem augers during sampling through the saturated soil layer that balanced the outer water pressure.*
>
> *SPT "N" values from the fill soils located above the silt and fine sand and the well graded sandy soils below were generally observed to be higher.*

Groundwater elevations obtained immediately after drilling ranged from 563.1 feet to 565.8 feet. The groundwater elevation in B-2 after the water was allowed to stabilize overnight was 565.6 feet. Other elevations used or considered include the water elevation of the Niagara River at approximately 566 feet and the water elevation in the South Pond at 570.0 feet.

The cross-section analyzed at the southwest end of the South Pond corresponds to the outlet embankment. The report describes the section as:

> *This embankment was generally observed to have an asphalt pavement access road over its top portion. Rip rap armor was observed on the side slopes between the asphalt and the shorelines on both sides of the embankment. The rip rap located on the settlement pond side has a grassy vegetation cover and the rip rap on the Niagara River side is interlocked with a cement grout, a limited amount of vegetation is present.*

The report notes the side slopes are generally observed to be 3H:1V. Measurements on the submitted stability analyses plots indicate a top width of about 20 feet with 8 to 10-feet wide slightly sloping shoulders and side slopes of 3.5H:1V on the downstream slope and 3H:1V on the upstream slope. Sheet 3 of the design drawings for the "Intake Modification" shows the section for the South Pond outlet, but the design slopes are not clearly labeled/represented.

Laboratory work included limited tests to determine classification and consistency, such as measurement of natural water content and sieve analyses. Soil strength of cohesive material was determined using one consolidated undrained triaxial compression test. The triaxial test results for the sandy silt provided two strength parameter scenarios (noted as 1 and 2 in Table 7). It appears that cohesionless shear strengths were correlated to blow counts. Table 7 provides a summary of the soil properties utilized in GZA's report.

Table 6. Soil Properties for Stability Analysis

Material	Unit Weight γ (lb/ft^3) Dry/Wet	Friction Angle, σ' (Degrees)	Cohesion, c' (lb/ft^2)
Rip-Rap Cover	140/140	40	0
Fill	128/130	30	0
Sandy Silt (1)	120.5/124.5	19	560
Sandy Silt (2)	120.5/124.5	25	0
Sand	130/132	32	0

3.3.1 South Ash Pond - Structural Adequacy & Stability

Static Analysis - South Ash Pond

The South Ash Pond was analyzed for static long term conditions utilizing soil strengths described above. The slope stability analyses were performed using the computer program PCSTABL (version 6). GZA provided, as Attachment 3 of their report, plots from the program showing the cross-section which outlines their estimated soil profiles along with their corresponding soil parameters and stability analyses results. The cross-section utilized for the South Ash Pond includes a top width of about 20 feet with 8 to 10-feet wide slightly sloping shoulders and side slopes of 3.5H:1V on the downstream slope and 3H:1V on the upstream slope. The section has a top of dike elevation of about 575 feet, a downstream toe elevation of 566 feet at the Niagara River shoreline and an upstream toe elevation of 570 feet at the pond shoreline. The analysis included the phreatic surface through the embankment from the normal pond elevation to the normal river elevation.

The results of GZA's stability analyses indicated minimum factors of safety of 1.79 and 1.78 for circular failure surfaces and minimum factors of safety of 3.53 and 2.20 for block failure surfaces on the exterior face of the outlet dike. The two sets of factors of safety for each case are based on the sandy silt (1) and sandy silt (2) parameters, respectively (as discussed above and shown in Table 7).

In their evaluation of the results, GZA states: "*Slopes with factors of safety greater than 1.5 are generally considered in a stable condition.*" GZA also provides an infinite slope analysis using a friction angle of 30 degrees and a slope angle of about 18.4 degrees (corresponding to a 3H:1V slope) and a resultant factor of safety of 1.7. GZA states because the factor of safety is greater than 1.5, a shallow slope failure is not expected to occur. They also note additional slope stability is provided by the rip-rap which was not utilized in the infinite slope analysis.

In the considerations and recommendations section of the report GZA notes the section as measured and evaluated indicates the embankment is stable. They note surficial erosion on the downstream slope due to the Niagara River did not appear to be an issue. GZA recommended periodic inspection and maintenance of the grouted rip rap and clay pipe drains on the downstream slope and the outlet pipe from the basin.

Seismic Analysis - South Ash Pond

A seismic analysis was not performed for the outlet cross-section of the South Ash Pond, but is addressed in the *Considerations and Recommendations* section of the GZA report as follows:

Although it is our opinion that the embankment is stable in its current condition, there is the possibility that the silt and fine sand soils located below the fill material may be susceptible to liquefaction resulting from seismic activity. Liquefaction of the soil may cause it to "flow" (i.e., become liquid) and be displaced by the overlying embankment fill. Based on our observations and evaluation of the settling pond embankment, it is our opinion that the embankment would have a hazard rating classification of low to remote.

This soil, a loose lacustrine deposited soil, is located beneath the groundwater table and appears to be of relatively uniform size (tine sand and silts with low SPT "N" values recorded from the test borings). Based on these observations and a limited literature review pertaining to liquefaction potential[1,] *this soil unit may have characteristics that make it prone to "possible" or "probable" liquefaction.*

We note that the impact of liquefaction experienced by a soil material is a function of the intensity of seismic activity and other site specific factors. It is our opinion that if the silt and fine sand soil were to experience liquefaction, it is unlikely that the embankment would experience catastrophic failure (i.e., entire embankment sliding into the river allowing uncontrolled now from the settlement basin). Rather, the embankment may undergo settlement from the displacement of the silt and fine sand layer beneath the embankment requiring repair and maintenance.

[1] Simplified Procedure for Evaluating Soil Liquefaction Potential, Seed, H.B; Idriss, I.M.; Journal of the Soil Mechanics and Foundation Division, ASCE; Sept 1971.

3.3.2 Additional Stability Analyses

Since Pond 1 is considered to be incised, stability analyses are not required. In comments to the draft report by NRG, GZA's letter response dated September 13, 2012, Pages 15-16 with attachments, includes geotechnical comments, stability analyses for Ponds 2 and 3 and the embankment between these two ponds, and a seismic analysis and rapid drawdown analysis for the South Ash Pond (see Appendix G). The analyses for the North Ponds (Ponds 2, 3 and the embankment between Ponds 2 and 3) used estimated effective strength parameters of 30 degrees for the internal friction angle of the fill and foundation soils and 35 degrees for the surficial layer where concrete matting exists along embankment slopes. The static analyses were done with a phreatic surface representing the ½-PMF rain event, and the seismic analyses were done with a phreatic surface representing normal pool elevations. Rapid drawdown analyses were not done since the change in water level was considered negligible for the given conditions. The following factors of safety were calculated.

Table 7. Results of Stability Analyses – North Ponds

Loading Condition	Calculated Factor of Safety	Minimum Factor of Safety
POND 3		
Long-Term Steady Seepage	1.8	1.5
Seismic Loading	1.1	1.0
POND 2		
Long-Term Steady Seepage	2.1	1.5
Seismic Loading	1.2	1.0
POND 2/INTERNAL LOW-LYING AREA		
Long-Term Steady Seepage	2.7	1.5
Seismic Loading	1.4	1.0

Stability analysis was not performed for the North and South Equalization Basins. In the September 2012 letter response GZA states: “We do not believe that a stability analysis is required for these basins for the following reasons.

- The majority of the basins embankments are shallow ranging from about 0 to less than 5 feet high on the outside slopes, with the interior slopes having shallow 5H:1V slopes. The highest embankment, about 5 feet high, is located in the southwest corner of the South Equalization Basin, where the embankment is curved providing radial reinforcement.” Figure 4 was presented showing a photograph of this corner with dimensions shown.
- NRG typically alternates filling these basins so that one of the basins is empty or near empty while the other basin is filled or partially filled. Given that water in each basin has a low occupancy period, and that the pond interior is constructed with highly impermeable asphalt, it is our opinion that an elevated phreatic condition is highly unlikely to occur through the embankment section.”

Discussion in the letter response on the analyses for the South Ash Pond provides justification for the friction angle of 30 degrees for the fill based on typical published values for the soil type. GZA also states “Due to the presence of gravel, slag, concrete, brick, cobbles and wood debris in the fill soils, plus the presence of the 65” x 92” steel arch pipe providing reinforcement, it is GZA’s opinion that the debris and pipe gives greater interlocking and a higher shear strength that warranted assigning a mid-range friction angle of 30 degrees to the fill layer.” GZA also notes “the critical failure surface, shown on the attached stability analyses, occurs at a shallow depth where denser soils exist. Less critical failure surfaces, having higher factors of safety, occur at greater depth through the loose fill soils.” For the seismic analysis, GZA applied a maximum horizontal acceleration (MHA) of 0.2g (90 percent probability of not being exceeded in 250 years), based on “Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico”, U.S. Geologic Survey, Map MF-2120. This is a conservative value based on published information. More recent published data, which has catalogued earthquake activity, indicates lower MHA values.

GZA did additional evaluation of the South Ash Settling Basin embankment stability to:

- Conduct a seismic analysis; and
- Conduct a rapid drawdown analysis to evaluate the elevated phreatic conditions based on the hydrologic study completed.

The following factors of safety were calculated.

Table 8. Results of Additional Stability Analyses – South Ash Pond

Loading Condition	Calculated Factor of Safety	Minimum Factor of Safety
Rapid Drawdown	1.8	1.3
Long-Term Steady Seepage	1.8	1.5
Seismic Loading	1.1	1.0

3.4 Foundation Conditions

Foundation conditions for the South Pond were provided in the July 2009 Settling Pond Outlet Embankment evaluation presented in Section 3.3.

The provided *Modification ("MOD.") of North Slag Pond System, 1977*, for/by Niagara Mohawk Power Corporation with plans, sections and details shows a boring in the area of the present Pond 2. The boring indicates a soil profile from the surface as 12.5 feet of ash underlain by 3 feet of soft mud underlain by 13 feet of fine sand and silt. Based on the limited provided information for the foundation soils, there is no evidence the exterior embankments of Ponds 1, 2 and 3 and the South Ash Pond are built over wet ash, slag or other unsuitable materials.

One of the provided plans for the construction of the North and South Equalization Basins, Sheet C-34738, indicate an unknown area of the coal pile and basin(s) are located within an "Abandoned Slag Pond" (shown in lower right of drawing). This drawing is presented in Appendix E. No other information on this former slag pond was provided. Boring information dated June, 1983 for borings performed prior to construction of the equalization basins indicate the North and South Equalization basins are constructed within an ash management area. The borings indicate generally stiff to medium stiff material in the upper 10 feet in the borings along the west (Niagara River) side of the basins, and soft ash below this depth, i.e. below surrounding grade.

3.5 Operations and Maintenance

3.5.1 Safety Assessments

NRG reported weekly inspections of the North Ponds (Ponds 1, 2 and 3) and daily inspections of the South Ponds (North and South Equalization Basins and the South Ash Settling Pond) by plant personnel. The inspections are not documented. No other plant or consultant inspection documentation addressing the stability of the impoundments was provided.

Comments to the draft report submitted by NRG included a "Current Inspection Report for all Huntley Ponds and Basins" performed by GZA in September 2012 (See Appendix F). The inspection report notes NRG had mowed heavy vegetation to allow better inspection of the embankments, and had patched distressed asphalt areas and applied asphalt sealant on the bottom liners and embankments of the South and North Equalization Basins. Photographs were submitted with the inspection and denoted as Attachments 1 through 4. The photographs show a better view of the embankments as a result of the mowing and show the improvements to the basins. The report noted the results of this visual inspection indicated the embankments were in good to fair condition, with no signs of structural, erosion or animal activity deficiencies. The inspection report recommended the vertical-walled incised embankments located at the north end of the South Ash Pond be sloped back or reinforced with large-size riprap/concrete slabs to provide better stabilization. GZA made this recommendation for safety purposes for dredging noting they did not feel that these embankments pose an environmental concern.

In comments to the draft report by NRG, GZA's letter response dated September 13, 2012, Pages 17, 18 and 20, (Appendix G) includes hazard mitigation plans should deficiencies occur in the embankments.

3.5.2 Instrumentation

Based on the provided documents, groundwater monitoring wells are present on the plant property. There is no geotechnical or groundwater monitoring instrumentation for the embankments of the ponds at the Huntley Power Station.

3.5.3 State or Federal Inspections

No State or Federal inspections regarding the condition of the ponds have taken place at the Huntley Power Station.

4.0 COMMENTS AND RECOMMENDATIONS

Condition assessment definitions, as accepted by the National Dam Safety Review Board, are as follows:

SATISFACTORY

No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.

FAIR

No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.

POOR

A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are necessary.

UNSATISFACTORY

A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

NOT RATED

The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

4.1 Acknowledgement of Management Unit Conditions

I certify that the management units referenced hereinafter were personally assessed by me and was found to be in the following condition:

NORTH PONDS

Pond 1: Not Rated

Pond 2: Fair

Pond 3: Fair

SOUTH PONDS

North Equalization Basin: Not Rated

South Equalization Basin: Not Rated

South Ash Settling Pond: Fair

4.2 Recommendations

(Pond 1, North Equalization Basin and South Equalization Basin were rated Poor in the Draft Report for lack of documentation. Upon further review, Pond 1 was determined to be incised within the ash management area. Incised ponds are not given condition ratings. The North and South Equalization Basins were determined to not be CCW impoundments and are not rated.) Pond 2 and Pond 3 were rated Poor in the Draft Report due to lack of documentation including hydrologic and hydraulic (H&H) study and stability analysis. NRG has since submitted H&H studies and stability analysis for these ponds. AMEC noted that the strength parameters used in the stability analysis are not based on specific borings at the ponds. For this reason, Ponds 2 and 3 are assigned a Fair rating.

The South Ash Settling Pond was rated Poor in the draft Report due to lack of hydrologic and hydraulic study for the pond, and more complete stability analysis for the ponds. NRG has since submitted an H&H study for the pond and provided additional stability analysis. The South Ash Settling Pond has been assigned a Fair rating. The fair rating reflects that rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. More specifically, strength parameters used for the fill material could be less than assumed with a marginal calculated factor of safety above the required minimum.

4.2.1 Hydrologic and Hydraulic Recommendations

In comments to the draft report by NRG, GZA's letter response dated September 13, 2012, Pages 6-14 with attachments, includes hydrologic/hydraulic analyses for the six ponds at the site. GZA used a design flood event for the ponds as ½ Probable Maximum Flood (1/2 PMF) in the calculations. The analysis assumed a 500-year flood elevation for the Niagara River. The SCS (Soil Conservation Service, now known as Natural Resources Conservation Service, i.e. NRCS) Dimensionless Unit Hydrograph method was used in this analysis. The results of the analyses indicated the North Ponds (Ponds 1, 2 and 3) have the ability to safely pass the ½ PMF with calculated minimum freeboard ranging from 2.1 to 2.9 feet. The results of the analyses for the South Ponds (North and South Equalization Basins, and the South Ash Pond) indicated overtopping of the equalization basins during the ½ PMF when the initial water surface is below El.578.7 with no process inflow or below El.577.7 with a maximum process inflow of 500 gpm). The North and South EQ Basins will not be overtopped during the ½ PMF, under either condition, if NRG lowers the top of the existing overflow pipe, and associated maximum operating level, from Elevation 579.3' to 578.3'. The outflow pipe for South Ash Settling Basin can pass the ½ PMF with a freeboard greater than 3 feet, regardless of the conditions in the equalization basins.

AMEC's comments on review of the submitted analysis include:

Calculation of the PMP is in keeping with the current NOAA guidance for the best available method of determining the all-season PMP for most of the eastern United States, including western New York State.

The 72-hour All-Season PMP generated by BOSS HMR52 specifically for this site is 33.0 inches and reasonable. The material submitted does not indicate the drawdown time of the impoundments to determine if a longer design storm duration is necessary due to long storage time in the ponds.

The report states that the ½ PMF was generated by taking 50% of the calculated discharge from application of the PMP to each watershed. The full model or output was not provided, so it is now known how this reduction was done in HEC-HMS.

The 500-year flood elevation on the Niagara River was used as the tailwater condition for the pond H&H analysis. This elevation is given in the report as 570.65 when converted to the IGLD 1955 datum used in the H&H analysis. It is incorrectly labeled on the drawings accompanying the report as the ½ PMF water surface elevation for the river. The 500-year flood event is not directly related to the PMF, and the ½ PMF flow in the Niagara River could be larger or smaller than the 500-year flow. There may be a determination of the of the PMF for the Niagara River performed by a State, Federal, or Canadian agency. If it is possible to obtain a PMF flowrate for the river it could be compared to the flowrates given in the effective FIS to determine if the ½ PMF flow is similar to the 500-year flow. If no estimate of the PMF exists for the Niagara River, using the 500-year elevation as an example extreme flood condition is defensible, especially as it falls approximately 2.7 ft lower than the lowest outlet of the North Basins, 1.1 ft lower than the bottom of the equalization basins and 8.6 ft lower than the overflow outlet, and the South Ash Settling Pond has over 3 feet of freeboard even with the tailwater condition.

The HEC-HMS models were not provided for review, and no output was included with the report. This review is based only on the given input and output tables in the report and the attached routing diagram. No drainage area maps were provided. The elevations of the various pipe inlets and outlets and tops of the berms are given in the report and the attached drawings. These have been assumed to be correct and entered into the HEC-HMS model accurately, but this can't be verified.

South Basins (South Ash Settling Basin and Equalization Basins)

The Equalization Basins drainage area is equal to its total pond footprint of 132,400, which matches up with the aerial photo, and indicates that no rainfall runoff from adjacent areas will surface drain into it. The drainage area of the South Ash Settling Pond is 343,700, which is larger than the pond footprint and indicates some adjacent area flowing to the pond. Page 6 of the report states that some roadway and building areas flow to this pond. The drainage area for this pond should be delineated on a map for review.

Case B, considering the tailwater impacts of Ponds 2 and 3 on Pond 1 is the most appropriate scenario to consider for the North Basins. It shows freeboard of at least 2.1 ft in each pond. The Conclusion section of the report (Page 17-19), however, shows different ponding elevation for each pond that does not match the values in the results table (Table 8, Page 12). The freeboard values from the conclusion are less than 2 feet for Ponds 2 and 3. No model or detailed output was submitted to verify the results presented in the report and to determine which freeboard values are correct.

The Equalization Basins range from overtopping to minimal freeboard for most scenarios, and only have substantial freeboard when the starting elevation is very low and no process flow is being discharged into them. In this scenario (H), the freeboard is 2.4 in the Equalization Basins. The Alternate scenario lowering the overflow outlet pipe and results in minimal freeboard (0.2 ft) when the pond starts full and process flow is being discharged to the basins.

Freeboard Guidelines

The freeboard guidelines as stated in Chapter 8, Section 9 of the MSHA Coal Mine Impoundment Inspection and Plan Review Handbook states:

“Items that should be considered in determining freeboard requirements include: frequency of the design storm, duration of high water level, effective wind fetch, water depth, potential wave run-up on the upstream slope, ability of the embankment to resist erosion, potential for embankment/foundation settlement, and potential for mine subsidence. Without documentation, and absent unusual conditions, a minimum freeboard of 3 feet is generally accepted for impoundments with a fetch of less than 1 mile. “

The South Settling basin meets this general minimum requirement based on using the 500-year water surface elevation in the Niagara River as a tailwater. The freeboards of less than three feet in the North Basins are arguably adequate for these small impoundments in the extreme ½ PMF event, assuming that the drainage areas can be verified. The Equalization Basins have zero or less freeboard throughout many operating scenarios, even with the suggested plan to lower the overflow outlet pipe.

4.2.2 Geotechnical and Stability Recommendations

Conventional minimum factor of safety criteria are 1.3 for rapid drawdown, 1.5 for static long-term stability and 1.0 for earthquake stability (by pseudo-static method). Likewise, if the dam does not meet the seismic factor of safety, then the stability of the embankment should be analyzed and the amount of embankment deformation or settlement that may occur should be evaluated to assure that sufficient section of the crest will remain intact to prevent a release from the impoundment.

North Ponds (Ponds 2 and 3)

Pond 1 is considered incised and stability analyses are not required. Stability analysis was presented for Ponds 2 and 3 in the September 2012 response letter (Appendix G). There is no specific boring information to verify the strength parameters used in the analyses. If NRG would like these ponds to be considered for a Satisfactory rating, AMEC recommends a geotechnical study be performed to confirm the strength parameters used in the analyses If a geotechnical study is performed, AMEC recommends at least one piezometer be installed at each pond to monitor the phreatic level in the embankment.

At the time of AMEC’s site visit, vegetation on the embankment slopes of the North Ponds was too tall to inspect the embankments closely. No visible signs of major slope failures were observed. NRG mowed these areas and had a third party inspection (GZA GeoEnvironmental) of the embankments in September 2012. No signs of embankment problems were observed. AMEC recommends NRG continue regular mowing to allow inspection of the embankments and detection of any problems.

South Ponds (North and South Equalization Basins and South Ash Settling Pond)

Stability analysis was not performed for the North and South Equalization Basins. In the September 2012 response letter GZA stated they do not believe that a stability analysis is required based on the low height of the embankment slopes, highest embankment of about 5 feet high in the southwest corner of the South Basin where the embankment is curved providing radial reinforcement. GZA also provided their opinion than an elevated phreatic condition is highly unlikely to occur through the embankment section since filling of the basins is alternated so the water in each basin has a low occupancy period, and the pond interior is constructed with asphalt.

The southwest corner of the south basin is adjacent to the bank of the Niagara River. With a top embankment height of 580.3 feet and the bottom of the river at approximate elevation 565 feet, the embankment height is about 15 feet. Boring information dated June, 1983 for borings performed prior to construction of the equalization basins indicate the North and South Equalization basins are constructed within an ash management area. The borings indicate generally stiff to medium stiff material in the upper 10 feet in the borings along the west (Niagara River) side of the basins, and soft ash below this depth, i.e. below surrounding grade. Since these ponds are not considered CCW impoundments, stability analysis are not required. However, given the close proximity of the basins to the Niagara River, AMEC suggests a geotechnical study and static and seismic stability analysis would be prudent engineering practice.

South Ash Settling Pond

A July 2009 report by GZA, titled *Settling Pond Outlet Embankment Evaluation,* for the Huntley Generating Station presents stability analyses for the South Ash Pond. One cross section was analyzed for static long term conditions. The location of the cross section was selected to represent the most critical area on the southwest or outlet embankment. In the letter response dated September 2012, GZA provided justification for the strength parameters used in the analysis and submitted results for long term, seismic and rapid draw down conditions. The calculated factors of safety meet or exceed the minimum required factors of safety from Table 6.

A condition rating of Fair was given to this pond due to the seismic calculated factor of safety (1.05) being marginally above the minimum required factor of safety (1.0) in light of the interpretation and use of the 30 degree friction angle for the fill soils. This friction angle may be high due to the presence of soft zones and debris noted in the borings. Using the Infinite Slope Analysis as presented in the report for a 3H:1V slope, a friction angle of 26 degrees corresponds to a factor of safety of 1.46, neglecting the additional slope stability provided by the surface rip-rap. Based on the Infinite Slope Analysis, it appears that the calculated factor of safety of the outlet embankment of the South Pond approximately meets the minimum required factor of safety from Table 6. AMEC recommends this embankment be monitored for any signs of distress, especially during extreme events. If NRG would like this pond to be considered for a Satisfactory rating, AMEC recommends a geotechnical study be performed to confirm the strength parameters used in the analyses If a geotechnical study is performed, AMEC recommends at least one piezometer be installed to monitor the phreatic level in the embankment.

At the time of AMEC's site visit, vegetation on the embankment slopes of the South Ash Pond was too tall to inspect the embankments closely. Although step interior slopes were observed, no visible signs of major slope failures affecting the overall stability of the embankments were observed. NRG mowed these areas and had a third party inspection (GZA GeoEnvironmental) of the embankments in September 2012. No signs of embankment problems were observed. AMEC recommends NRG continue regular mowing to allow inspection of the embankments and detection of any problems.

4.2.3 Inspection Recommendations

Inspection procedures at the Huntley Generating Station include weekly (North Ponds) and daily (South Ponds), undocumented inspection of the grounds by plant personnel.

AMEC recommends NRG perform periodic documented inspections of the impoundments, preferably bi-annual inspections with one performed by a Professional Engineer, either by a consultant or by internal, off-site personnel. Maps and/or photos, preferably both, can maintain a visual record of the location of problems and can be used to develop work orders. Inspection reports should be maintained by the facility. Additionally, routine inspections (daily or weekly) performed by facility O&M personnel could be supported by an inspection checklist to serve as documentation of the inspection. A record of work items can also be used to document work performed and work needed to be done.

In comments to the draft report submitted by NRG, Appendix B consisted of a “Current Inspection Report for all Huntley Ponds and Basins” performed by GZA in September 2012. The inspection report notes NRG had mowed heavy vegetation to allow better inspection of the embankments, and had patched distressed asphalt areas and applied asphalt sealant on the bottom liners and embankments of the South and North Equalization Basins. Photographs were submitted with the inspection and denoted as Attachments 1 through 4. The photographs show a better view of the embankments as a result of the mowing and show the improvements to the basins. The report noted the results of this visual inspection indicated the embankments were in good to fair condition, with no signs of structural, erosion or animal activity deficiencies. The inspection report recommended the vertical-walled incised embankments located at the north end of the South Ash Pond be sloped back or reinforced with large-size riprap/concrete slabs to provide better stabilization. GZA made this recommendation for safety purposes for dredging noting they did not feel that these embankments pose an environmental concern.

In comments to the draft report by NRG, GZA’s response in Appendix C, Conclusions, page 17, 18 and 20 include hazard mitigation plans should deficiencies occur in the embankments. AMEC recommends NRG develop formal emergency actions plans for the ponds.

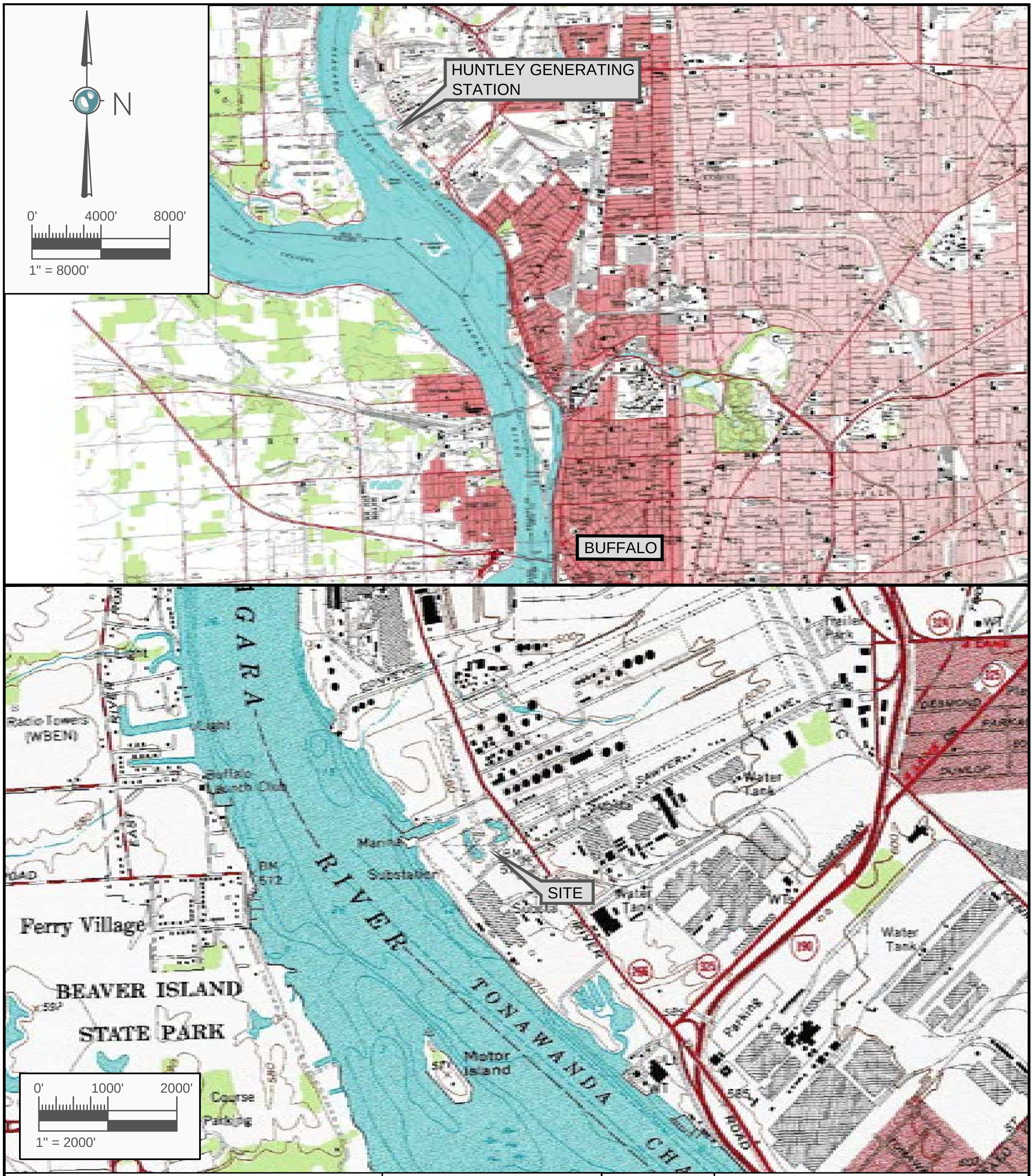
Vegetation on the impoundments should be aggressively managed. We further recommend that vegetation be managed based on guidance in (a) Corps of Engineers EM 1110-2-301, *Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams* and (b) FEMA 534, *Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams*. Additionally, animal impact can be mitigated based on guidance in FEMA 473, *Technical Manual for Dam Owners: Impacts of Animals on Earthen Dams*.

5.0 CLOSING

This report is prepared for the exclusive use of the Environmental Protection Agency for the site and criteria stipulated herein. This report does not address regulatory issues associated with storm water runoff, the identification and modification of regulated wetlands, or ground water recharge areas. Further, this report does not include review or analysis of environmental or regional geo-hydrologic aspects of the site, except as noted herein. Questions or interpretation regarding any portion of the report should be addressed directly by the geotechnical engineer.

Any use, reliance on, or decisions to be made based on this report by a third party are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions and recommendations given in this report are based on visual observations, our partial knowledge of the history of Huntley's impoundments, and information provided to us by others. This report has been prepared in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.



AMEC Environment & Infrastructure

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PROTECTION AGENCY

PROJECT
ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS

DWN BY: CAE
DATUM:
DATE: 7/20/11

TITLE
NRG ENERGY
HUNTLEY GENERATING STATION, TONAWANDA, NY
SITE LOCATION & VICINITY MAP

CHK'D BY: JHB
REV. NO.:
PROJECT NO: 3-2106-0194.0001.****
PROJECTION:
SCALE: AS SHOWN
FIGURE No. 1

S:\Geosciences\Proposals\EPA Coal Impoundment Inspection\April 2011 Round 10\NRG Huntley\cad\huntleyfig1.dwg — Layout1 — Jul. 20, 2011 1:23pm — chris.eger

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ENVIRONMENTAL PROTECTION AGENCY

AMEC Earth & Environmental
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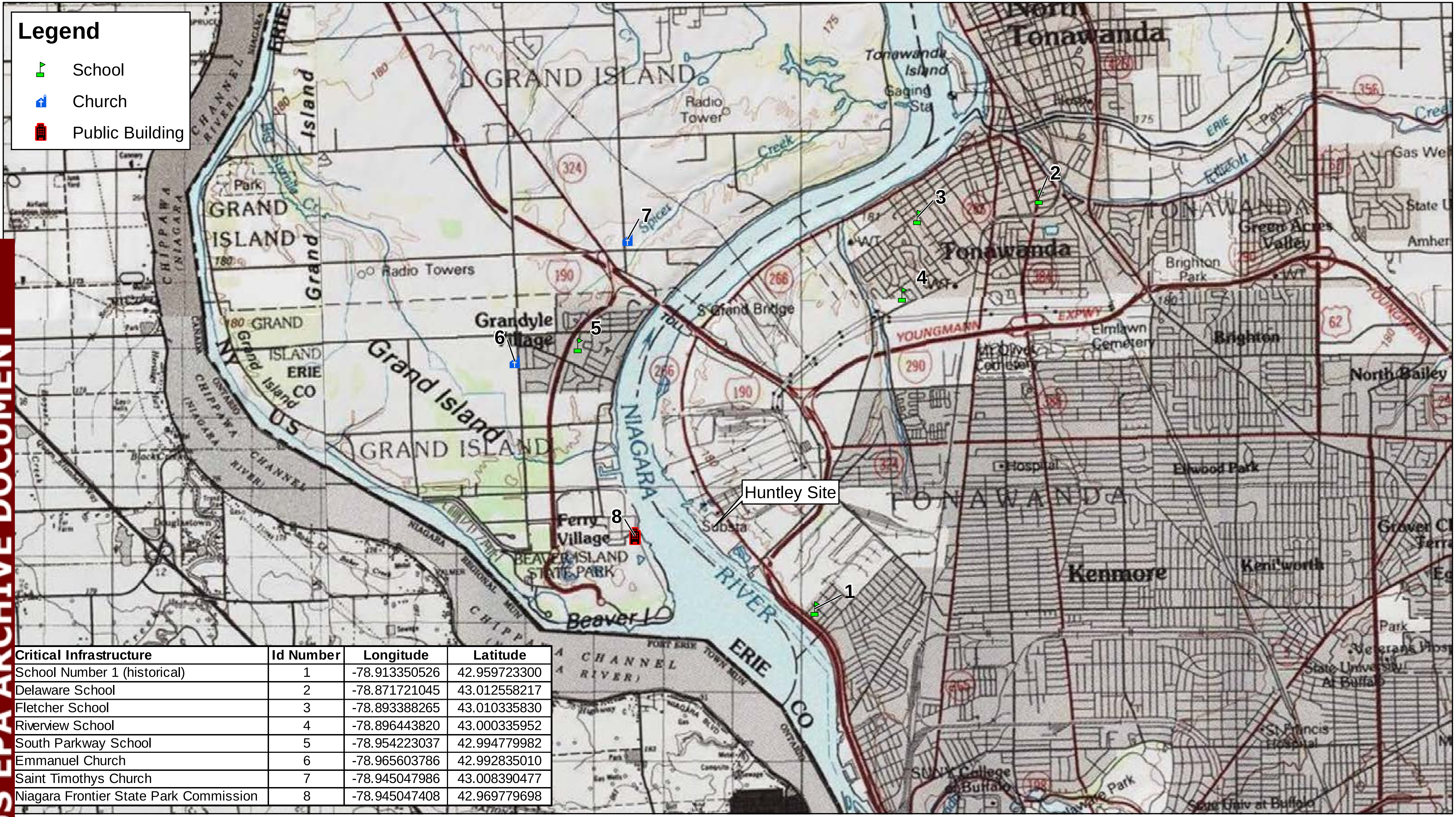
11003 Bluegrass Parkway
Louisville, KY 40299

DWN BY: SAM
CKD BY: MS
Datum: NAD 83
Projection: UTM 17
Scale: As Shown

ASSESSMENT OF DAM SAFETY OF
COAL COMBUSTION SURFACE IMPOUNDMENTS

NRG ENERGY
HUNTLEY GENERATING STATION,
TONAWANDA, NY
SITE MAP

REV. No.: A
Date: 7-22-11
Project No: 3-2106-0194.0001.****
Figure No: 2



Critical Infrastructure	Id Number	Longitude	Latitude
School Number 1 (historical)	1	-78.913350526	42.959723300
Delaware School	2	-78.871721045	43.012558217
Fletcher School	3	-78.893388265	43.010335830
Riverview School	4	-78.896443820	43.000335952
South Parkway School	5	-78.954223037	42.994779982
Emmanuel Church	6	-78.965603786	42.992835010
Saint Timothys Church	7	-78.945047986	43.008390477
Niagara Frontier State Park Commission	8	-78.945047408	42.969779698

MEC Earth & Environmental
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1003 Bluegrass Parkway
ouisville, KY 40299

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ENVIRONMENTAL PROTECTION AGENCY

DRAWN BY: SAM
CHK'D BY: MS
DATUM: NAD83
PROJECTION: Albers
SCALE: AS SHOWN
DATE: 7/22/2011

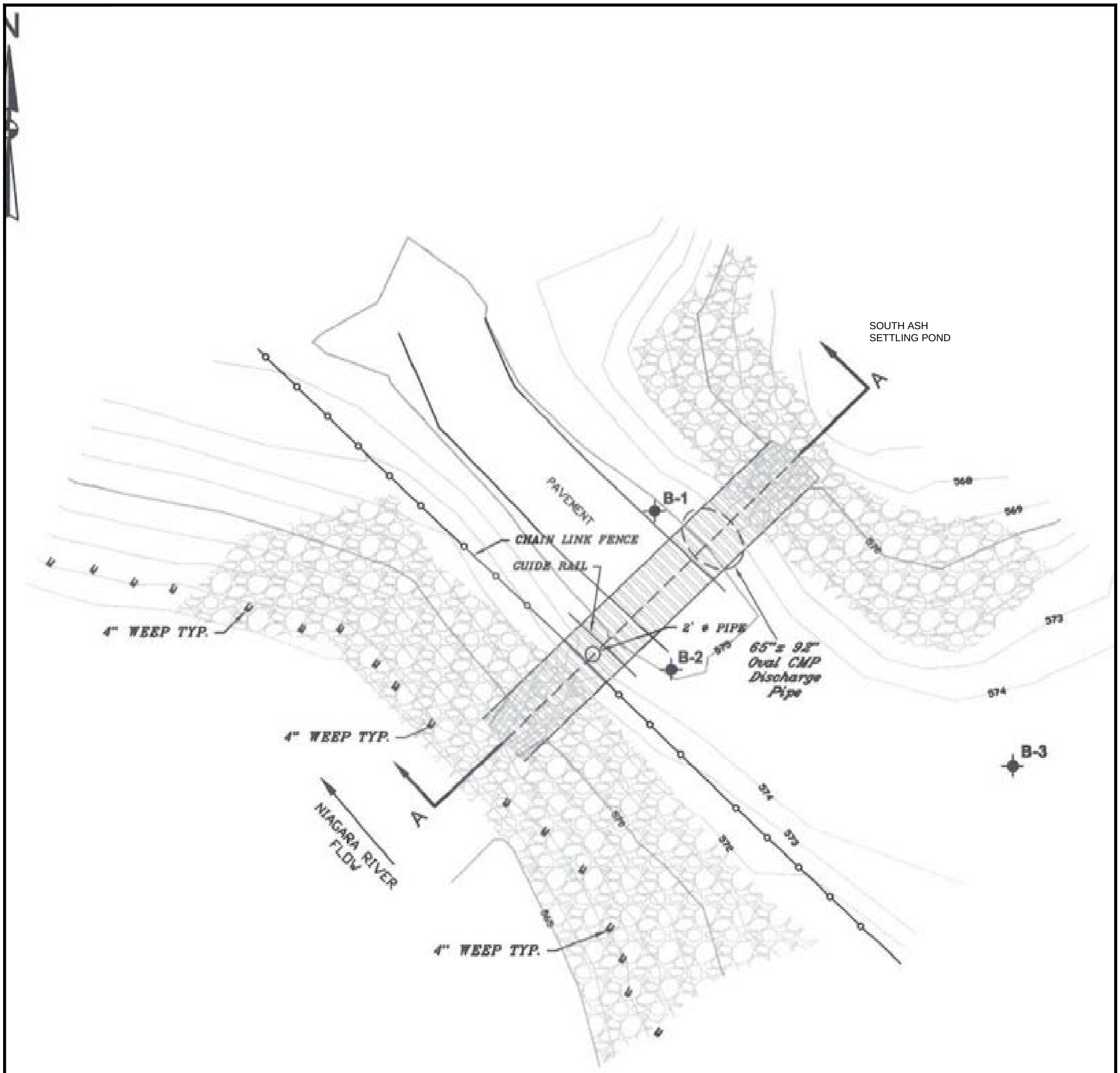
ASSESSMENT OF DAM SAFETY OF
COAL COMBUSTION SURFACE IMPOUNDMENTS

NRG ENERGY
HUNTLEY GENERATING STATION, TONAWANDA, NY
CRITICAL INFRASTRUCTURE

N
0 1 Miles
0 1 Kilometers

Notes: Critical infrastructure data provided by ESRI

FIGURE
3



NOTES:

1. BASE TOPOGRAPHY MAP PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, MAY 2009.

0 10 20 40
SCALE IN FEET

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PROTECTION AGENCY

PROJECT
ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS

DWN BY: CAE
DATUM:
DATE: 7/20/11

TITLE
NRG ENERGY
HUNTLEY GENERATING STATION, TONAWANDA, NY
LOCATION OF ANALYZED STABILITY SECTION

CHK'D BY: JHB
REV. NO.:
PROJECT NO: 3-2106-0194.0001.****
PROJECTION:
SCALE: AS SHOWN
FIGURE No. 4

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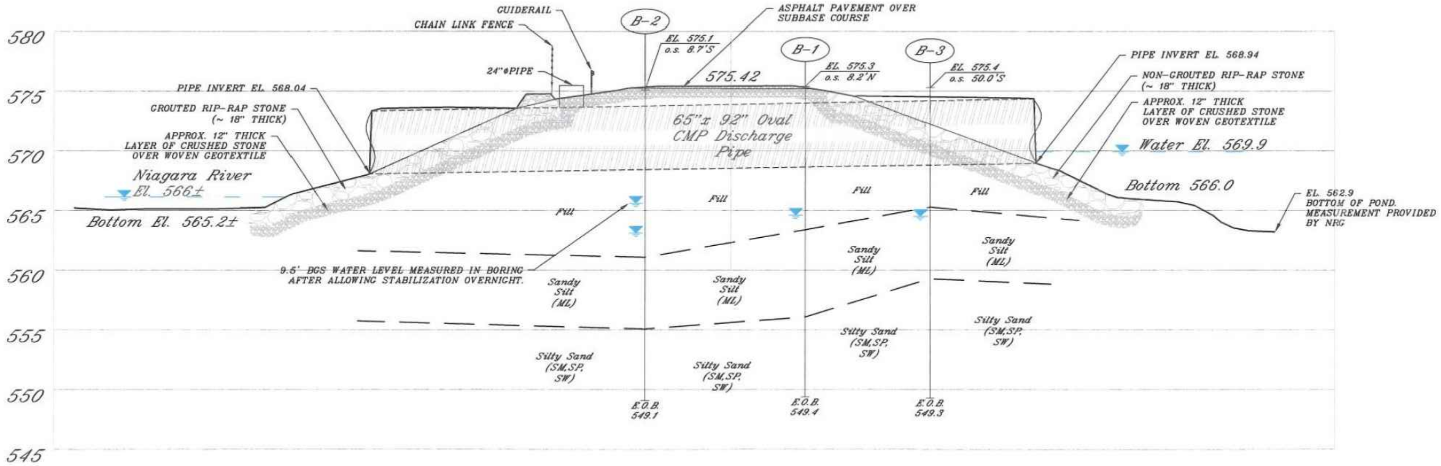
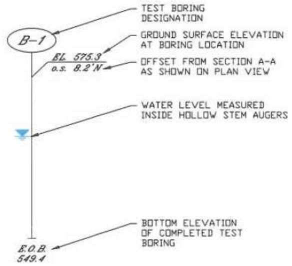


Cross Section A–A
through Access Road

LEGEND:



NOTES:

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.

2. WATER LEVEL MEASUREMENTS MADE INSIDE AUGERS AT BORING COMPLETION.

3. SEE BORING LOGS FOR ADDITIONAL SUBSURFACE SOIL DESCRIPTIONS.

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DWN BY: CAE
CHK'D BY: JHB
DATUM:
PROJECTION:
SCALE: AS SHOWN

PROJECT
ASSESSMENT OF DAM SAFETY OF COAL
COMBUSTION SURFACE IMPOUNDMENTS

TITLE
NRG ENERGY
HUNTLEY GENERATING STATION,
TONAWANDA, NY
CRITICAL CROSS-SECTION, SOUTH POND

REV. NO.: A
DATE: 7/20/11
PROJECT NO: 3-2106-0194.0001.****
FIGURE No. 5

APPENDIX A

EPA COAL COMBUSTION DAM INSPECTION CHECKLISTS AND COAL COMBUSTION WASTE IMPOUNDMENT INSPECTION FORMS DATA - OCTOBER 2010

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station
Date: June 15, 2011, Revised January 2013
Unit Name: Pond 1
Operator's Name: NRG Energy Inc.
Unit I.D.:
Hazard Potential Classification: **Not Rated**
Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly		18. Sloughing or bulging on slopes?	See Comment	
2. Pool elevation (operator records)?	576.3+/-		19. Major erosion or slope deterioration?	See Comment	
3. Decant inlet elevation (operator records)?	See Comment		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	579.0 ft		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below): See Note		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?	See Comment	
10. Cracks or scarps on crest?	See Comment		At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?	See Comment		Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?	See Comment		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. By plant personnel, not documented.

3. Invert Elevation 576.1 feet to Pond 2 and Pond 3, regulated by gates.

9. Tree diameter estimated at 4-inches.

10, 11, 17, 18, 19 and 21 Couldn’t see due to high vegetation.

23. Common outlet dikes with Pond 2 and Pond 3.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011, Revised January 2013

Impoundment Name Huntley Pond 1
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address

Name of Impoundment Huntley Pond 1
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Inactive CCW impoundment, currently receives other wastewater from plant.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 55.34 Seconds
Latitude 42 Degrees 58 Minutes 22.5 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur): **Pond is incised, Not Rated.**

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

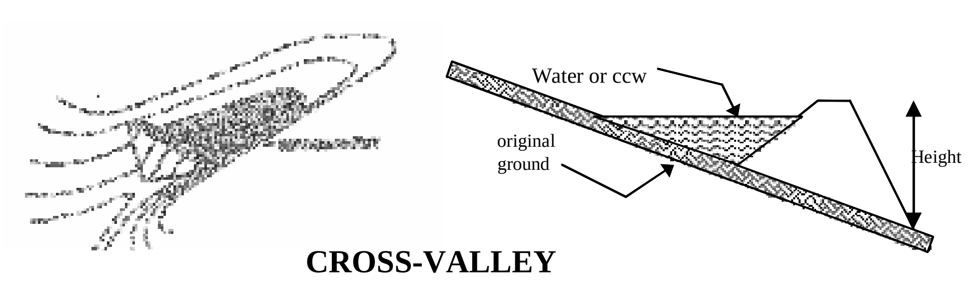
______**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

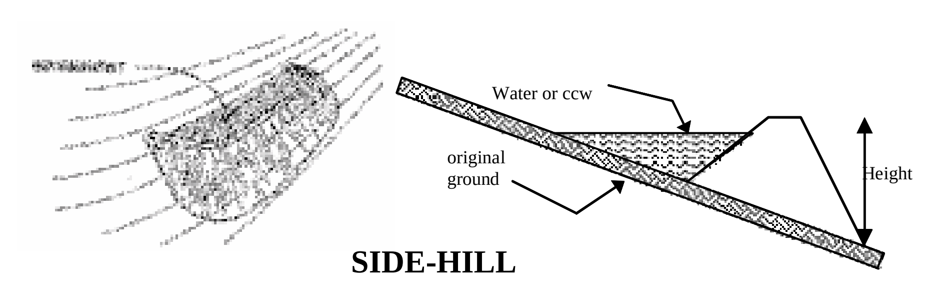
______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

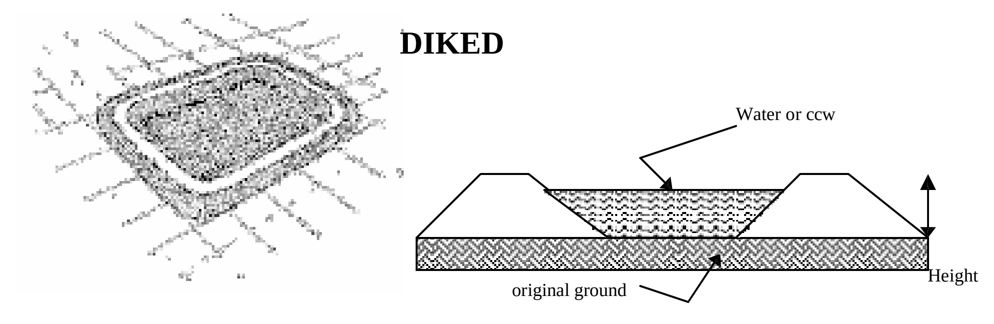
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

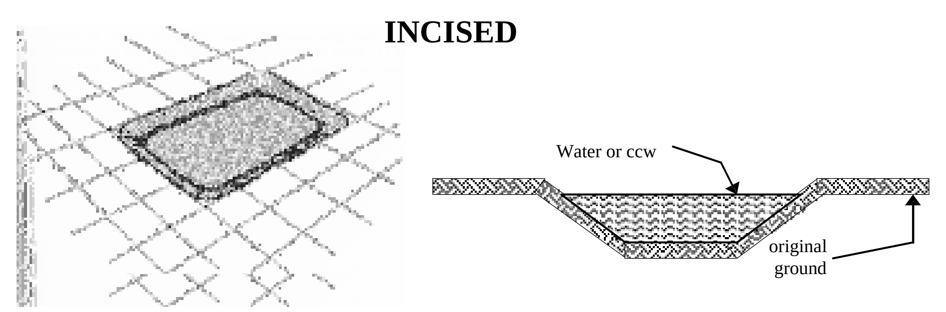
Small pond discharging to Pond 2 and Pond 3. Unlikely failure would be to one of these ponds with little impact.

CONFIGURATION:


CROSS-VALLEY


SIDE-HILL


DIKED


INCISED

______Cross-Valley

______Side-Hill

______Diked

__X__Incised (form completion optional)

______Combination Incised/Diked

Embankment Height 0-5 feet Embankment Material Unknown

Pool Area 0.58 acres Liner Clay per 1977 plans

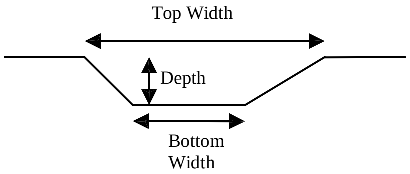
Current Freeboard 2.7 feet Liner Permeability Unknown

TYPE OF OUTLET (Mark all that apply)

______Open Channel Spillway
______Trapezoidal
______Triangular
______Rectangular
______Irregular

______depth
______bottom (or average) width
_____top width

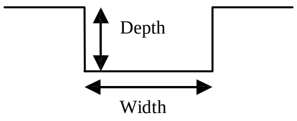
TRAPEZOIDAL



TRIANGULAR

Top Width
Depth

RECTANGULAR

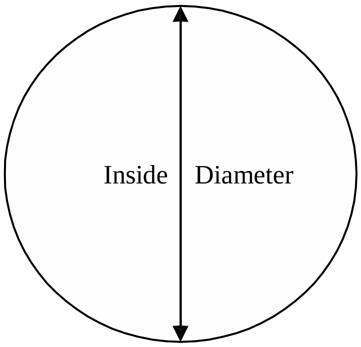


IRREGULAR

Average Width
Avg Depth

__X__Outlet

(2) 43”x27” inside diameter
Discharge pipes to Pond 2 and Pond 3



Material
__X__corrugated metal
______welded steel
______concrete
______plastic (hdpe, pvc, etc.)
______other (specify) ______________________

Is water flowing through the outlet? YES ___X___ NO _______

_____No Outlet

_____Other Type of Outlet (specify) ______________________________________

The Impoundment was Designed By Niagara Mohawk Power Corporation

Has there ever been a failure at this site? YES ____________NO ____X______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO ___X___

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station

Date: June 15, 2011

Unit Name: Pond 2

Operator's Name: NRG Energy Inc.

Unit I.D.:

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly		18. Sloughing or bulging on slopes?	See Comment	
2. Pool elevation (operator records)?	576.3		19. Major erosion or slope deterioration?	See Comment	
3. Decant inlet elevation (operator records)?	575.3		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	579.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	See Comment	
10. Cracks or scarps on crest?	See Comment		At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?	See Comment		Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	See Comment		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	By plant personnel, not documented.
10, 11, 17, 18, 19 and 21.	Couldn't see due to high vegetation.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011

Impoundment Name Huntley Pond 2
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address

Name of Impoundment Huntley Pond 2
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Inactive CCW impoundment, currently receives flow from Pond 1.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 58.41 Seconds
Latitude 42 Degrees 58 Minutes 23.93 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

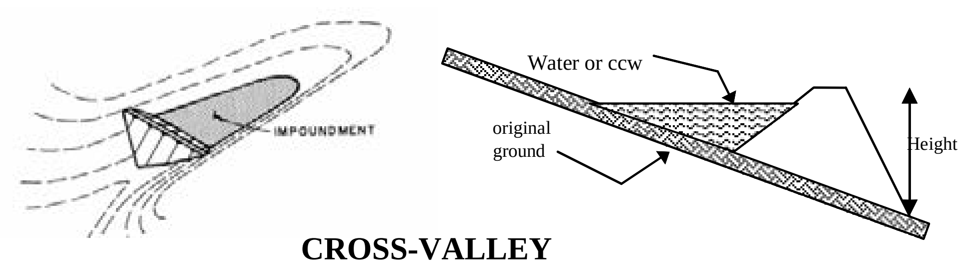
__X__**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

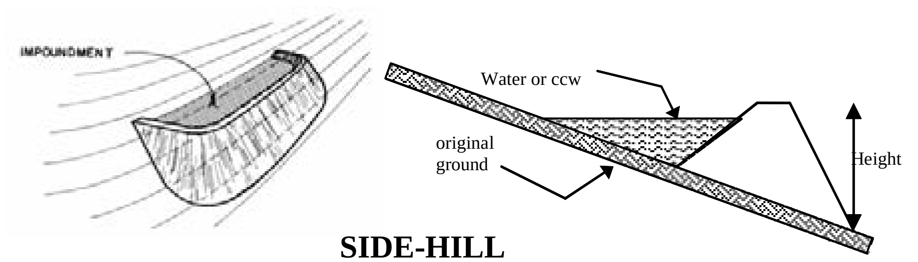
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Release from Pond 2 outlets to ditch discharging to Niagara River. Failure would cause economic and/or environmental damage.

CONFIGURATION:

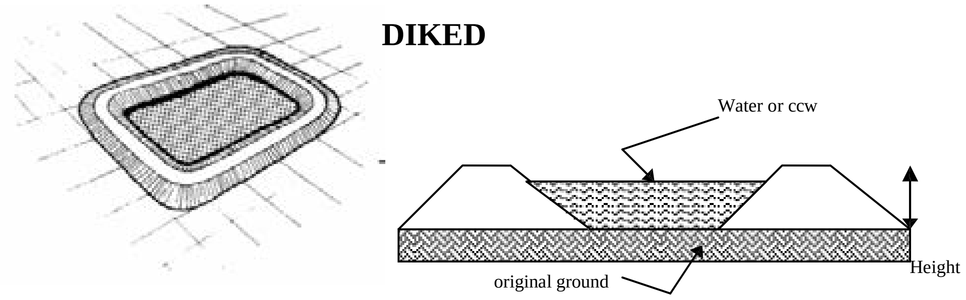


CROSS-VALLEY

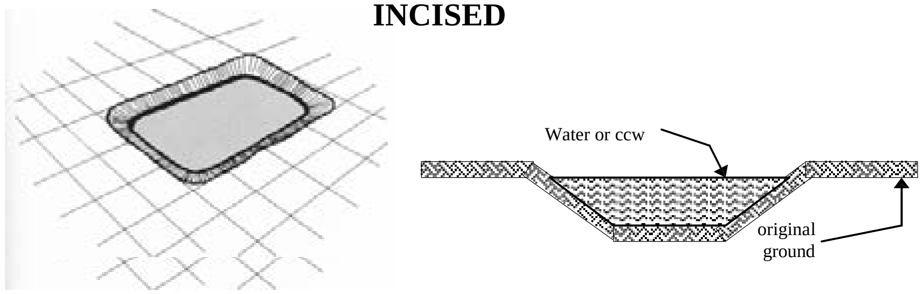


SIDE-HILL

DIKED



INCISED



______Cross-Valley
______Side-Hill
__X__Diked
______Incised (form completion optional)
______Combination Incised/Diked

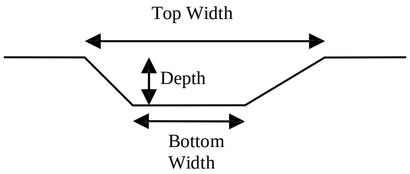
Embankment Height 10 feet
Embankment Material Unknown
Pool Area 1.03 acres
Liner No
Current Freeboard 2.7 feet
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

_____Open Channel Spillway
_____Trapezoidal
_____Triangular
_____Rectangular
_____Irregular

_____depth
_____bottom (or average) width
_____top width

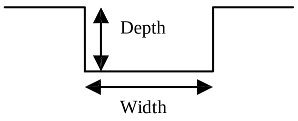
TRAPEZOIDAL



TRIANGULAR

Top Width
Depth

RECTANGULAR

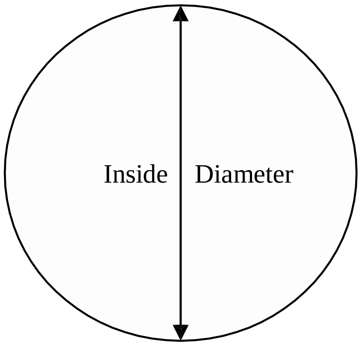


IRREGULAR

Average Width
Avg Depth

__X__Outlet

24” inside diameter
Normally used decant pipe, others present.



Material
__X__corrugated metal
_____welded steel
_____concrete
_____plastic (hdpe, pvc, etc.)
_____other (specify) ____________________

Is water flowing through the outlet? YES __X__ NO ______

_____No Outlet

_____Other Type of Outlet (specify) ________________________________

The Impoundment was Designed By Niagara Mohawk Power Corporation

Has there ever been a failure at this site? YES ___________ NO ___X___

If So When? ______________________________

If So Please Describe : ______________________________

Has there ever been significant seepages at this site? YES ________NO ___X____

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station

Date: June 15, 2011

Unit Name: Pond 3

Operator's Name: NRG Energy Inc.

Unit I.D.:

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly		18. Sloughing or bulging on slopes?	See Comment	
2. Pool elevation (operator records)?	574.9+/-		19. Major erosion or slope deterioration?	See Comment	
3. Decant inlet elevation (operator records)?	574.35		20. Decant Pipes:	■	■
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	578.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	■	■
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?	See Comment	
10. Cracks or scarps on crest?	See Comment		At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?	See Comment		Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	See Comment		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	By plant personnel, not documented.
9.	Tree diameter estimated at 4-inches.
10, 11, 17, 18, 19 and 21.	Couldn't see due to high vegetation.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011

Impoundment Name Huntley Pond 3
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address ______________________
____

Name of Impoundment Huntley Pond 3
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Inactive CCW impoundment, currently receives flow from Pond 1.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 52.30 Seconds
Latitude 42 Degrees 58 Minutes 26.01 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

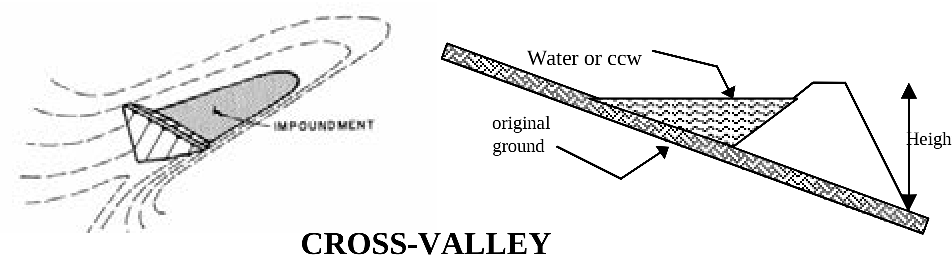
__X__**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

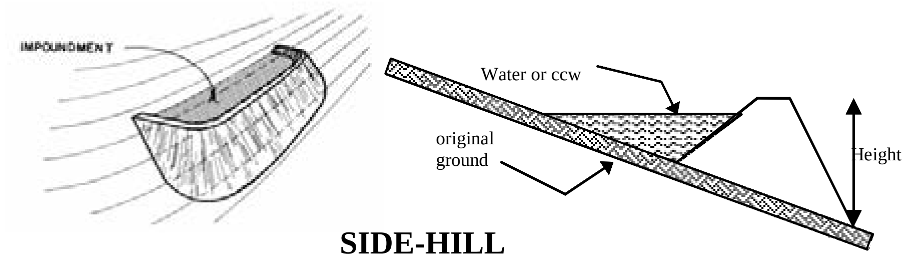
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Release from Pond 3 outlets to ditch discharging to Niagara River. Failure would cause economic and/or environmental damage.

CONFIGURATION:

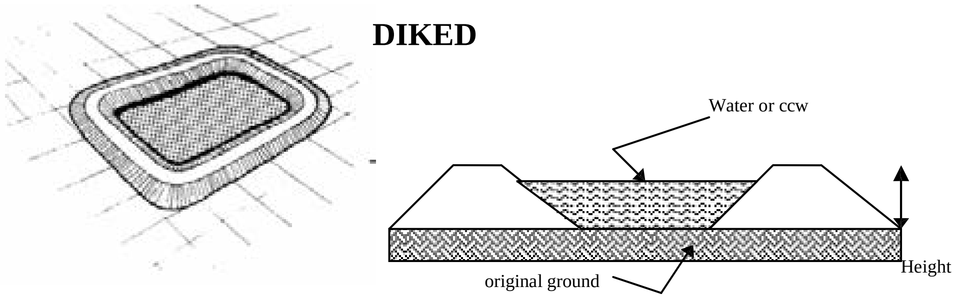


CROSS-VALLEY

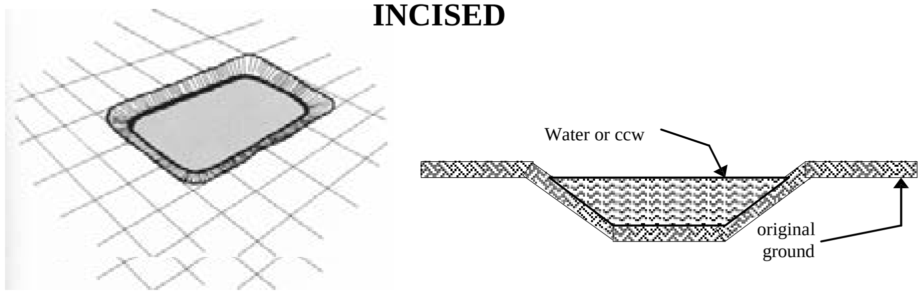


SIDE-HILL

DIKED



INCISED



______Cross-Valley

______Side-Hill

______Diked

______Incised (form completion optional)

__X__Combination Incised/Diked

Embankment Height __+/- 9____feet Embankment Material Unknown

Pool Area __1.15____________ acres Liner _No________________________

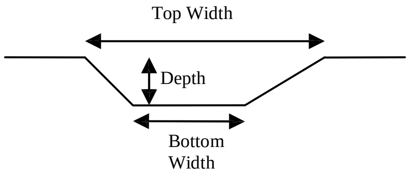
Current Freeboard _3.1________ feet Liner Permeability _N/A____________

TYPE OF OUTLET (Mark all that apply)

______Open Channel Spillway
______Trapezoidal
______Triangular
______Rectangular
______Irregular

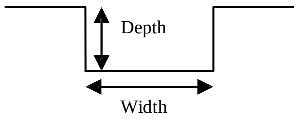
______depth
______bottom (or average) width
_____top width

TRAPEZOIDAL



TRIANGULAR

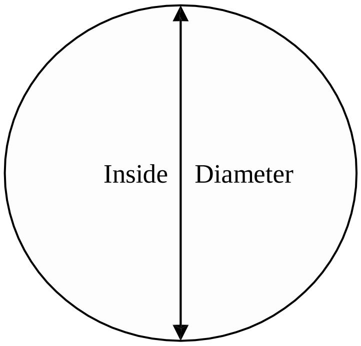
RECTANGULAR



IRREGULAR

__X__Outlet

18” inside diameter



Material
X corrugated metal
______welded steel
______concrete
______plastic (hdpe, pvc, etc.)
______other (specify) ______________________

Is water flowing through the outlet? YES __X__ NO _______

______No Outlet

_____Other Type of Outlet (specify) ____

The Impoundment was Designed By Unknown

Has there ever been a failure at this site? YES ____________NO ____X______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station
Date: June 15, 2011, Revised January 2013
Unit Name: North Equalization Basin
Operator's Name: NRG Energy Inc.
Unit I.D.:
Hazard Potential Classification: **Not Rated**
Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	See Comment		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	571.8		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	580.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	See Comment	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	See Comment		23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	By plant personnel, not documented.
2.	Pool elevation regulated through Flow Control Structure by plant personnel.
16 and 20.	Decant pipes submerged on bottom of pond, regulated as above.

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011, Revised January 2013

Impoundment Name Huntley North Equalization Basin
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address

Name of Impoundment Huntley North Equalization Basin
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling basin, low amounts of CCW, can decant to South Eq. Basin or South Pond.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 36.63 Seconds
Latitude 42 Degrees 58 Minutes 00.77 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

Pond does not receive direct CCW, Not Rated

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

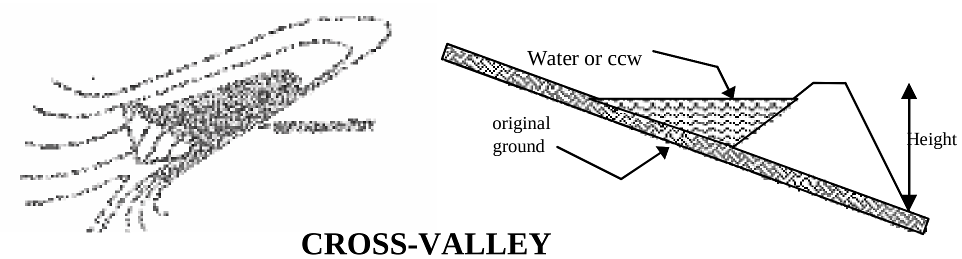
______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

______**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

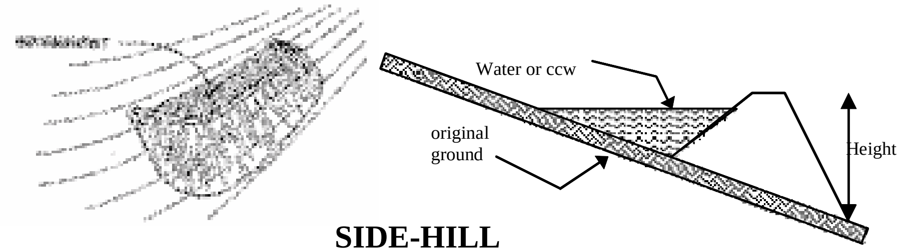
______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

CONFIGURATION:

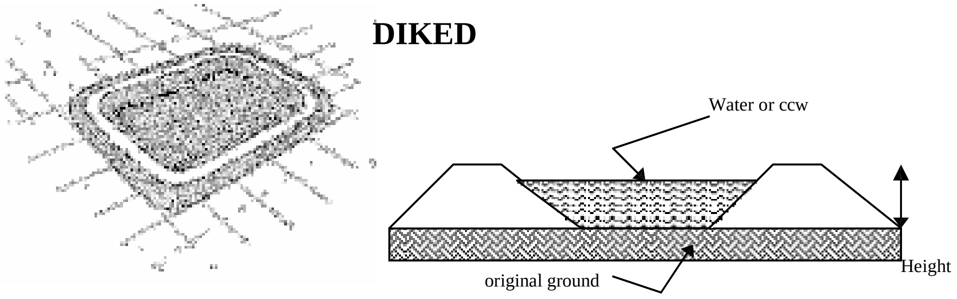


CROSS-VALLEY

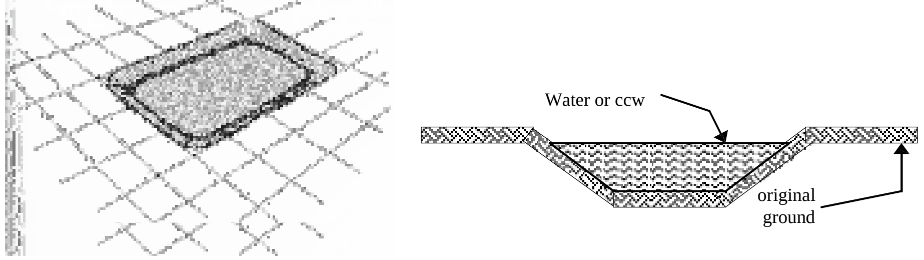


SIDE-HILL

DIKED



INCISED



______Cross-Valley

______Side-Hill

______Diked

______Incised (form completion optional)

__X__Combination Incised/Diked

Embankment Height __3________feet Embankment Material Clay

Pool Area __1.576___________ acres Liner _Asphalt (Interior and Exterior)___

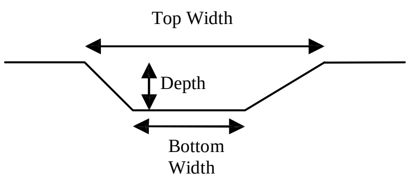
Current Freeboard _5_________ feet Liner Permeability _Unknown__________

TYPE OF OUTLET (Mark all that apply)

______Open Channel Spillway
______Trapezoidal
______Triangular
______Rectangular
______Irregular

______depth
______bottom (or average) width
_____top width

TRAPEZOIDAL

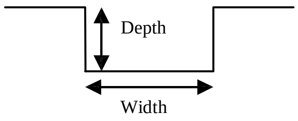


TRIANGULAR

Top Width

Depth

RECTANGULAR



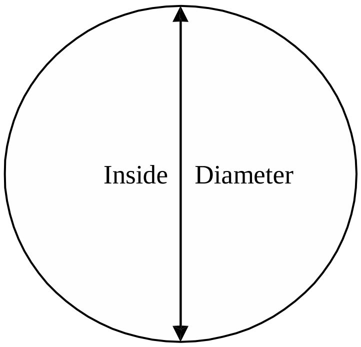
IRREGULAR

Average Width

Avg
Depth

__X__Outlet

__6”__inside diameter



Material
______corrugated metal
______welded steel
______concrete
______plastic (hdpe, pvc, etc.)
__X__other (specify) Unknown, probably HDPE

Is water flowing through the outlet? YES __*__ NO ________
*** Outlet Submerged**

______No Outlet

______Other Type of Outlet (specify) ____________________________________
____
____

The Impoundment was Designed By Stanley Consultants ____________________
____

Has there ever been a failure at this site? YES ____________NO ____X______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X_____

If so, which method (e.g., piezometers, gw pumping,...)? ______________________

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station

Date: June 15, 2011, Revised January 3013

Unit Name: South Equalization Basin

Operator's Name: NRG Energy Inc.

Unit I.D.:

Hazard Potential Classification: **Not Rated**

Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	See Comment		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	572.3		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	580.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	See Comment	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	See Comment		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?	See Comment	
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	See Comment		23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. By plant personnel, not documented.

2. Pool elevation regulated through Flow Control Structure by plant personnel.

12, 16 20 and 21. Decant pipes submerged on bottom of pond, regulated as above.

23. Downstream slope at southwest corner daylights to bench above and adjacent to Niagara River. Crest to river approximately 50 feet at southwest corner.

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011, Revised January 2013

Impoundment Name Huntley South Equalization Basin
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address ______________________
____

Name of Impoundment Huntley South Equalization Basin
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling basin, low amounts of CCW, can decant to North Eq. Basin or South Pond.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 35.08 Seconds
Latitude 42 Degrees 57 Minutes 58.45 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

Pond does not receive direct CCW, Not Rated

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

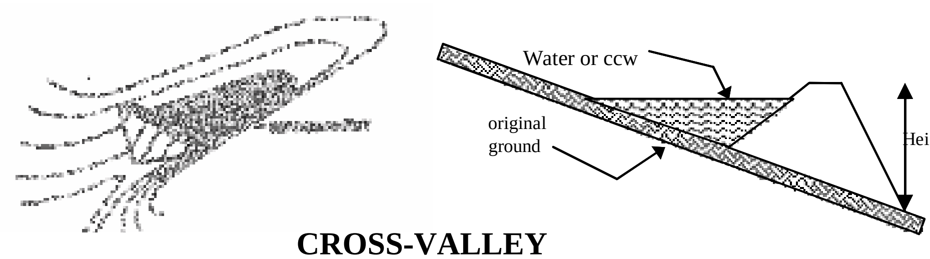
______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

______**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

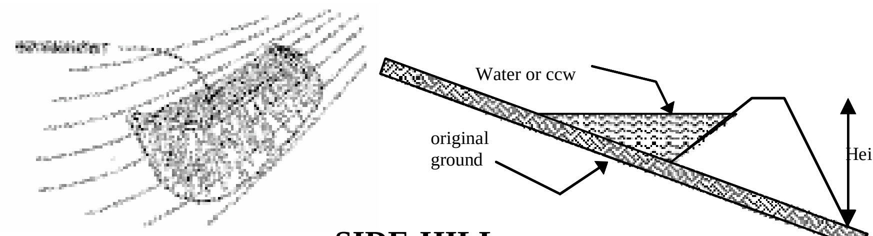
______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

CONFIGURATION:

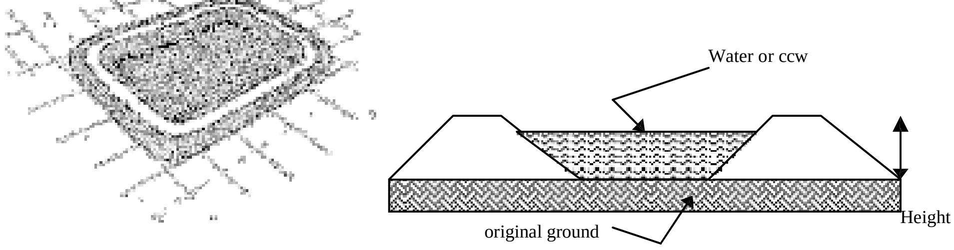


CROSS-VALLEY

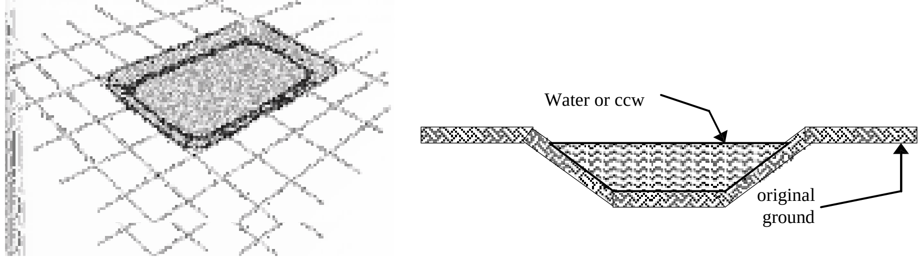


SIDE-HILL

DIKED



INCISED



______Cross-Valley
______Side-Hill
______Diked
______Incised (form completion optional)
__X__Combination Incised/Diked

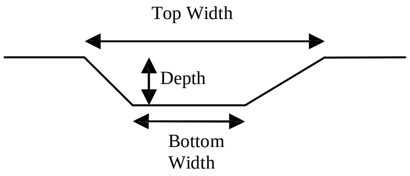
Embankment Height 5 feet Embankment Material Clay
Pool Area 1.576 acres Liner Asphalt (Interior and Exterior)
Current Freeboard 5 feet Liner Permeability Unknown

TYPE OF OUTLET (Mark all that apply)

______**Open Channel Spillway**
______Trapezoidal
______Triangular
______Rectangular
______Irregular

______depth
______bottom (or average) width
______top width

TRAPEZOIDAL

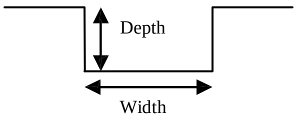


TRIANGULAR

Top Width

Depth

RECTANGULAR



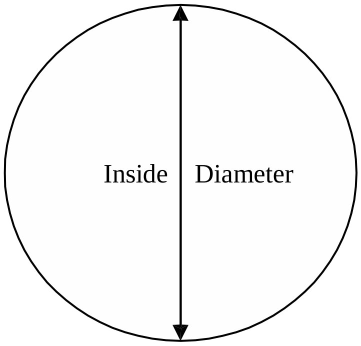
IRREGULAR

Average Width

Avg Depth

__X__**Outlet**

__**6”**__inside diameter



Material
______corrugated metal
______welded steel
______concrete
______plastic (hdpe, pvc, etc.)
__X__other (specify) Unknown, probably HDPE

Is water flowing through the outlet? YES __*__ NO ________
*** Outlet Submerged**

______**No Outlet**

______**Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By Stanley Consultants

Has there ever been a failure at this site? YES ___________NO ____X______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________NO __X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X_____

If so, which method (e.g., piezometers, gw pumping,...)? ______________________

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Huntley Generating Station

Date: June 15, 2011

Unit Name: South Ash Settling Pond

Operator's Name: NRG Energy Inc.

Unit I.D.:

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Don Dotson/AMEC and James Black/AMEC

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	569.3		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	569.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	575 +/-		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	See Comment		23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?	See Comment		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	By plant personnel, not documented.
16.	Skimmer booms in front of outlet.
17, 18, 19 and 21.	High vegetation prevented good assessment of dikes, some steep interior slopes.
23.	Southwest/Outlet dike discharges to Niagara River.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NY0001023 INSPECTOR Dotson/Black

Date June 15, 2011

Impoundment Name Huntley South Ash Settling Pond
Impoundment Company NRG Energy
EPA Region 2
State Agency (Field Office) Address ______________________
____

Name of Impoundment Huntley South Ash Settling Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Active CCW impoundment.

Nearest Downstream Town : Name Tonawanda, NY
Distance from the impoundment approx. 3 miles
Impoundment
Location: Longitude -78 Degrees 55 Minutes 31.42 Seconds
Latitude 42 Degrees 58 Minutes 01.04 Seconds
State NY County Erie

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______**LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______**LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

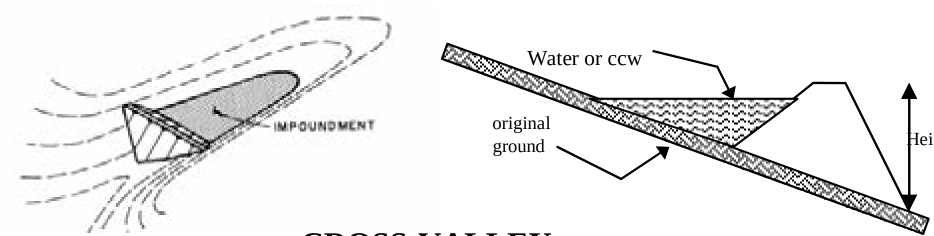
__X__**SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______**HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

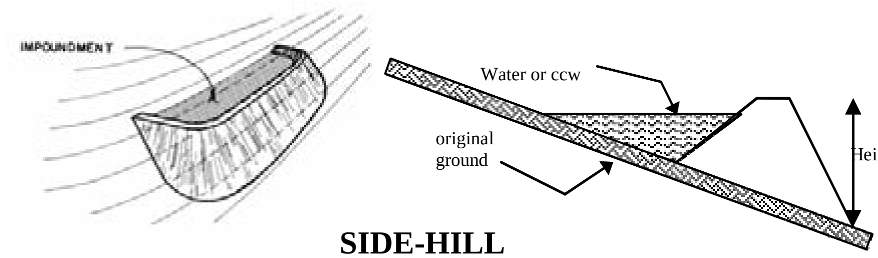
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Release from basin would discharge directly to Niagara River causing economic and/or environmental damage.

CONFIGURATION:

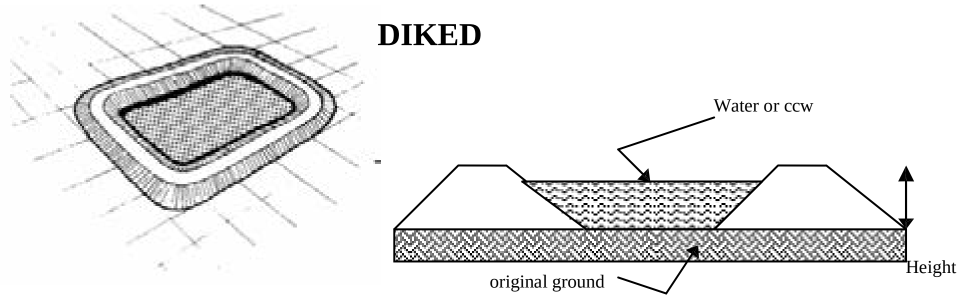


CROSS-VALLEY

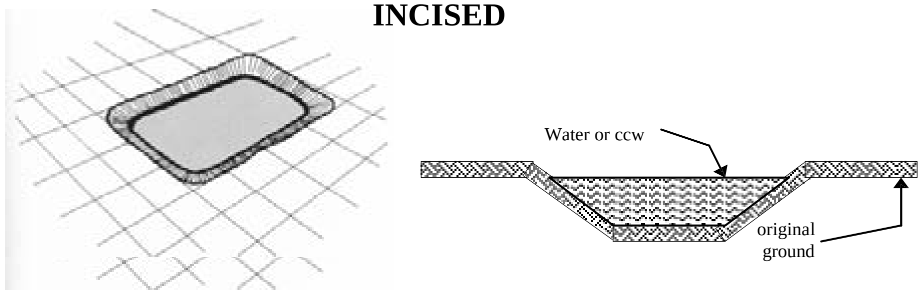


SIDE-HILL

DIKED



INCISED



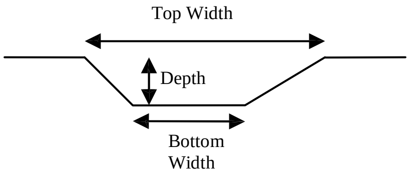
______Cross-Valley
______Side-Hill
______Diked
______Incised (form completion optional)
__X__Combination Incised/Diked
Embankment Height __10*______feet Embankment Material Unknown
Pool Area __7.3______________ acres Liner _No__________________________
Current Freeboard __4.2_________ feet Liner Permeability _N/A______________
* Based on 2009 Stability Analysis

TYPE OF OUTLET (Mark all that apply)

______Open Channel Spillway
______Trapezoidal
______Triangular
______Rectangular
______Irregular

______depth
______bottom (or average) width
_____top width

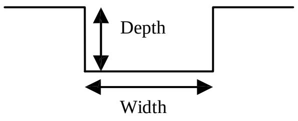
TRAPEZOIDAL



TRIANGULAR

Top Width
Depth

RECTANGULAR

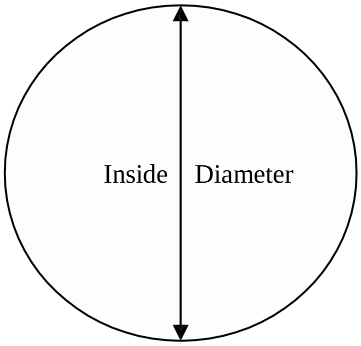


IRREGULAR

Average Width
Avg Depth

__X__Outlet

______inside diameter



Material
______corrugated metal
______welded steel
______concrete
______plastic (hdpe, pvc, etc.)
__X__other (specify) **92” x 65” Arched CMP**

Is water flowing through the outlet? YES __X__ NO _______

______No Outlet

______Other Type of Outlet (specify) ______________________________________

The Impoundment was Designed By: **Unknown (Niagara Mohawk Power Corporation?), Malcolm Pirnie designed latest improvement to move outlet structure.**

Has there ever been a failure at this site? YES ____________NO _____X______

If So When? _______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________NO ___X____

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X_____

If so, which method (e.g., piezometers, gw pumping,...)? ______________________

If so Please Describe : ____

APPENDIX B

SITE PHOTO LOG MAP AND SITE PHOTOS

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

AMEC Earth & Environmental
690 Commonwealth Business Center
11003 Bluegrass Parkway
Louisville, KY 40299

DWN BY:	SAM
CKD BY:	MS
Datum:	NAD 83
Projection:	UTM 17
Scale:	As Shown

ASSESSMENT OF DAM SAFETY OF
COAL COMBUSTION SURFACE IMPOUNDMENTS

NRG ENERGY
HUNTLEY GENERATING STATION,
TONAWANDA, NY
PHOTO LOCATION MAP

REV. No.:	A
Date:	7-22-11
Project No:	3-2106-0194.0001.****
Figure No:	B-1

1-1

LOOKING NORTHWEST AT POND 1, HIGH VEGETATION

1-2

LOOKING NORTHEAST AT POND 1 AND OUTLET PIPE TO POND 3, HIGH VEGETATION

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

CLIENT LOGO	CLIENT UNITED STATES ENVIRONMENTAL PROTECTION AGENCY		
PROJECT ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS	DWN BY: CAE	DATUM:	DATE: 7/21/11
TITLE NRG ENERGY HUNTLEY GENERATING STATION, TONAWANDA, NY POND 1 SITE PHOTOS	CHK'D BY: JHB	REV. NO.:	PROJECT NO: 3-2106-0194.0001.****
	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-2

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1-3

LOOKING NORTHEAST AT POND 1, CLOSEUP OF
OUTLET TO POND 3, HIGH VEGETATION

1-4

LOOKING WEST AT INLET PIPE FROM
PLANT TO POND 1, HIGH VEGETATION

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

amec

CLIENT LOGO

CLIENT
UNITED STATES
ENVIRONMENTAL
PROTECTION AGENCY

PROJECT
ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS

TITLE
NRG ENERGY
HUNTLEY GENERATING STATION, TONAWANDA, NY
POND 1 SITE PHOTOS

DWN BY: CAE
CHK'D BY: JHB
PROJECTION:
DATUM:
REV. NO.:
SCALE: AS SHOWN
DATE: 7/21/11
PROJECT NO: 3-2106-0194.0001.****
FIGURE No. B-3

1-5

LOOKING WEST POND 1 AND OUTLET
PIPE TO POND 2, HIGH VEGETATION

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

CLIENT LOGO

CLIENT
UNITED STATES
ENVIRONMENTAL
PROTECTION AGENCY

PROJECT
ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS

DWN BY: CAE
DATUM:
DATE: 7/21/11

TITLE
NRG ENERGY
HUNTLEY GENERATING STATION, TONAWANDA, NY
POND 1 SITE PHOTOS

CHK'D BY: JHB
REV. NO.:
PROJECT NO: 3-2106-0194.0001.****

PROJECTION:
SCALE: AS SHOWN
FIGURE No. B-4

2-1

LOOKING SOUTH AT INTERIOR OF
POND 2, HIGH VEGETATION

2-2

LOOKING SOUTHEAST AT INTERIOR OF POND 2,
HIGH VEGETATION, RAMP INTO POND

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

CLIENT LOGO

CLIENT	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY	
PROJECT ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS	DWN BY: CAE	DATUM:	DATE: 7/21/11
TITLE NRG ENERGY HUNTLEY GENERATING STATION, TONAWANDA, NY POND 2 SITE PHOTOS	CHK'D BY: JHB	REV. NO.:	PROJECT NO: 3-2106-0194.0001.****
	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-5

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2-3

NORMAL GATED OUTLET PIPE FROM POND 2

2-4

LOOKING NORTH AT OUTFALL TO DITCH FROM POND 2

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

amec

CLIENT LOGO

CLIENT
UNITED STATES
ENVIRONMENTAL
PROTECTION AGENCY

PROJECT ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS	DWN BY: CAE	DATUM:	DATE: 7/21/11
TITLE NRG ENERGY HUNTLEY GENERATING STATION, TONAWANDA, NY POND 2 SITE PHOTOS	CHK'D BY: JHB	REV. NO.:	PROJECT NO: 3-2106-0194.0001.****
	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-6

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2-5

LOOKING SOUTHWEST AT NORTHWEST DOWNSTREAM EMBANKMENT OF POND 2, HIGH VEGETATION

2-6

LOOKING SOUTH AT SOUTHWEST DOWNSTREAM EMBANKMENT OF POND 2, HIGH VEGETATION

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

amec

CLIENT LOGO

CLIENT
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PROJECT ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS	DWN BY: CAE	DATUM:	DATE: 7/21/11
TITLE NRG ENERGY HUNTLEY GENERATING STATION, TONAWANDA, NY POND 2 SITE PHOTOS	CHK'D BY: JHB	REV. NO.:	PROJECT NO: 3-2106-0194.0001.****
	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-7

2-7

LOOKING NORTH AT NORTHWEST DOWNSTREAM
EMBANKMENT OF POND 2

AMEC Environment & Infrastructure
690 Commonwealth Center
11003 Bluegrass Parkway
Louisville, Ky 40299
(502) 267-0700

CLIENT LOGO	CLIENT UNITED STATES ENVIRONMENTAL PROTECTION AGENCY		
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TITLE NRG ENERGY HUNTLEY GENERATING STATION, TONAWANDA, NY POND 2 SITE PHOTOS	CHK'D BY: JHB	REV. NO.:	PROJECT NO: 3-2106-0194.0001.****
	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-8

3-1

LOOKING NORTH AT INLET TO POND
3 FROM POND 1, HIGH VEGETATION

L

3-2

LOOKING WEST AT SOUTH END OF POND 3, HIGH VEGETATION

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-9

3-3

LOOKING WEST AT NORTH END OF POND 3, HIGH VEGETATION

3-4

LOOKING WEST AT SOUTH SIDE OF POND 3 (FOREGROUND)
AND POND 1 (BACKGRROUND), HIGH VEGETATION

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POND 3 SITE PHOTOS

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-10

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3-5

N

LOOKING NORTHEAST AT EAST SIDE
OF POND 3, HIGH VEGETATION

3-6

LOOKING SOUTH AT EAST SIDE
OF POND 3, HIGH VEGETATION

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-11

3-7

LOOKING SOUTHWEST AT POND 3, HIGH VEGETATION

3-8

LOOKING WEST AT NORTH END OF POND 3 (FOREGROUND)
AND POND 2 (MOUND IN BACKGROUND)

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-12

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3-9

INLET OF OUTLET PIPE FROM POND 3

3-10

LOOKING SOUTH AT SKIMMER
ABOVE OUTLET PIPE FROM POND 3

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-13

3-11

LOOKING NORTH AT OUTLET TO
DITCH FROM POND 3

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-14

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NEQ-1

LOOKING SOUTHEAST AT EAST CREST AND INTERIOR SLOPES OF NORTH AND SOUTH EQUALIZATION BASINS

NEQ-2

LOOKING SOUTHWEST ACROSS NORTH EQUALIZATION BASIN, NIAGARA RIVER IN BACKGROUND

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PROJECTION:
SCALE: AS SHOWN
FIGURE No. B-15

NEQ-3

LOOKING WEST AT NORTHWEST
CORNER OF NORTH EQUALIZATION BASIN

NEQ-4

BETWEEN EQ PONDS LOOKING NORTH AT
WEST END OF NORTH EQUALIZATION BASIN

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-16

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NEQ-5

BETWEEN EQ PONDS LOOKING NORTHEAST AT INTERIOR OF NORTH EQUALIZATION BASIN

NEQ-6

BETWEEN EQ PONDS LOOKING EAST AT CREST BETWEEN NORTH AND SOUTH EQUALIZATION BASIN

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PROJECTION:
SCALE: AS SHOWN
FIGURE No. B-17

NEQ-7

SOUTHWEST CORNER OF SOUTH EQUALIZATION BASIN LOOKING NORTH AT WEST DIKE OF SOUTH EQULIZATION BASIN (FOREGROUND) AND NORTH EQUALIZATION BASIN (BACKGROUND)

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-18

SEQ-1

BETWEEN EQUALIZATION BASINS LOOKING EAST AT COMMON DIKE

SEQ-2

NORTHWEST CORNER OF SOUTH EQUALIZATION
BASIN LOOKING SOUTHEAST ACROSS BASIN.

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PROJECTION:
SCALE: AS SHOWN
FIGURE No. B-19

SEQ-3

SOUTH EQUALIZATION BASIN - LOOKING SOUTHWEST AT CREST AND DOWNSTREAM SLOPE OF WEST EMBANKMENT, HIGH VEGETATION

SEQ-4

SOUTHWEST CORNER OF SOUTH EQUALIZATION BASIN LOOKING NORTH

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-20

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SEQ-5

SOUTHWEST CORNER OF SOUTH EQUALIZATION BASIN LOOKING WEST AT TOE OF DOWNSTREAM SLOPE/BANK OF NIAGARA RIVER

SEQ-6

SOUTHWEST CORNER OF SOUTH EQUALIZATION BASIN LOOKING SOUTH AT DOWNSTREAM SLOPE, SOUTH POND OUTLET IN BACKGROUND.

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-21

S-1

LOOKING NORTHWEST AT SLUICE PIPES
INLETS AT NORTH END OF SOUTH POND

S-2

LOOKING SOUTH/SOUTHWEST INTO INTERIOR OF NORTH END
OF SOUTH POND, SLOPES WITH STEEP ASH AND HIGH VEGETATION

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PROJECTION:
SCALE: AS SHOWN
FIGURE No. B-22

S-3

LOOKING SOUTH TOWARD AREA AT SOUTHWEST END OF SOUTH POND AND OUTLET, SOUTH POND OUTLET PIPE EXPOSED IN BACKGROUND

S-4

INLET OF OUTLET PIPE AT SOUTH POND, SKIMMER BOOMS UPSTREAM FROM OUTLET.

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		PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-23

S-5

NEAR SOUTH POND OUTLET LOOKING EAST
AT INTERIOR OF POND, HIGH VEGETATION

S-6

OUTLET OF SOUTH POND TO NIAGARA RIVER

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PROJECTION:

SCALE: AS SHOWN

FIGURE No. B-24

S-7

AT SOUTH POND OUTLET LOOKING EAST AT
INTERIOR OF SOUTH END OF POND, HIGH VEGETATION

S-8

FROM SOUTH DIKE LOOKING NORTH AT POND INTERIOR
AND SLURRY INLET PIPES, NOTE ADJACENT BARE AREAS

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	PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-25

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S-9

FROM SOUTH DIKE LOOKING WEST AT POND
INTERIOR AND OUTLET TO NIAGARA RIVER, HIGH VEGETATION

S-10

FROM SOUTH DIKE LOOKING EAST AT SOUTHEAST CORNER OF POND,
SOUTH US SLOPES AND CREST, HIGH VEGETATION

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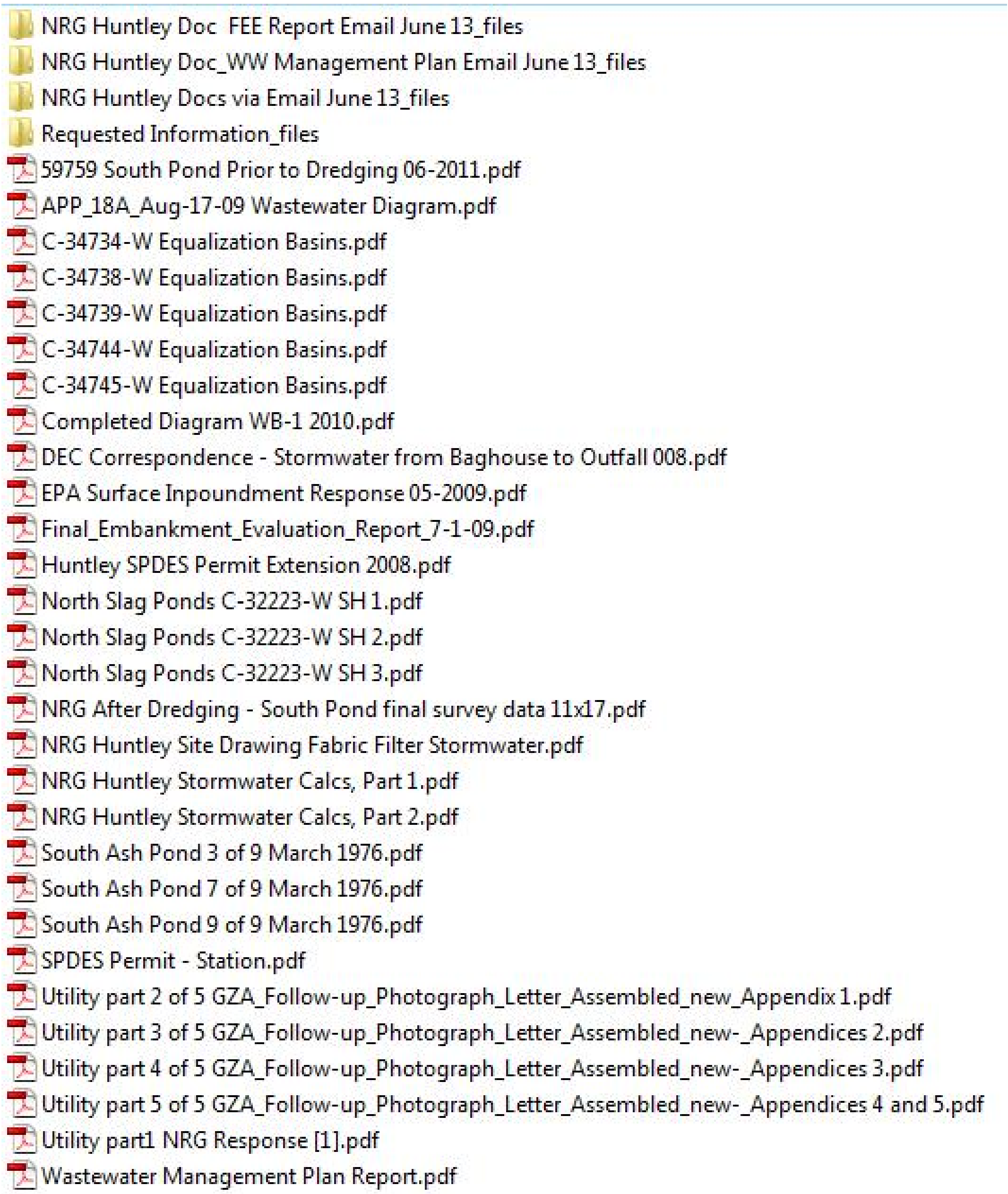
PROJECTION:	SCALE: AS SHOWN	FIGURE No. B-26

APPENDIX C

INVENTORY OF PROVIDED MATERIALS

NRG Huntley Provided Documents



NRG Huntley Doc FEE Report Email June 13_files
NRG Huntley Doc_WW Management Plan Email June 13_files
NRG Huntley Docs via Email June 13_files
Requested Information_files
59759 South Pond Prior to Dredging 06-2011.pdf
APP_18A_Aug-17-09 Wastewater Diagram.pdf
C-34734-W Equalization Basins.pdf
C-34738-W Equalization Basins.pdf
C-34739-W Equalization Basins.pdf
C-34744-W Equalization Basins.pdf
C-34745-W Equalization Basins.pdf
Completed Diagram WB-1 2010.pdf
DEC Correspondence - Stormwater from Baghouse to Outfall 008.pdf
EPA Surface Inpoundment Response 05-2009.pdf
Final_Embankment_Evaluation_Report_7-1-09.pdf
Huntley SPDES Permit Extension 2008.pdf
North Slag Ponds C-32223-W SH 1.pdf
North Slag Ponds C-32223-W SH 2.pdf
North Slag Ponds C-32223-W SH 3.pdf
NRG After Dredging - South Pond final survey data 11x17.pdf
NRG Huntley Site Drawing Fabric Filter Stormwater.pdf
NRG Huntley Stormwater Calcs, Part 1.pdf
NRG Huntley Stormwater Calcs, Part 2.pdf
South Ash Pond 3 of 9 March 1976.pdf
South Ash Pond 7 of 9 March 1976.pdf
South Ash Pond 9 of 9 March 1976.pdf
SPDES Permit - Station.pdf
Utility part 2 of 5 GZA_Follow-up_Photograph_Letter_Assembled_new_Appendix 1.pdf
Utility part 3 of 5 GZA_Follow-up_Photograph_Letter_Assembled_new-_Appendices 2.pdf
Utility part 4 of 5 GZA_Follow-up_Photograph_Letter_Assembled_new-_Appendices 3.pdf
Utility part 5 of 5 GZA_Follow-up_Photograph_Letter_Assembled_new-_Appendices 4 and 5.pdf
Utility part1 NRG Response [1].pdf
Wastewater Management Plan Report.pdf

APPENDIX D

SLOPE STABILITY ANALYSIS

GZA
GeoEnvironmental
of New York

Engineers and
Scientists

July 1, 2009
File No. 21.0056497.00

Mr. Joe Schwab
Joseph.Schwab@nrgenergy.com
Huntley Power LLC
3500 River Road
Tonawanda, New York 14150

Re: Settling Pond Outlet Embankment Evaluation
Huntley Generation Plant
Tonawanda, New York

535 Washington Street
11th Floor
Buffalo, New York
14203
716-685-2300
Fax: 716-685-3629
www.gza.com

Dear Mr. Schwab:

GZA GeoEnvironmental of New York (GZA) is pleased to submit this Settling Pond Embankment Evaluation Report to NRG / Huntley Power LLC (NRG) for the south settling pond located in the southern portion of the Huntley Generation Plant at 3500 River Road in Tonawanda, New York (Site). The settling pond embankment is located between the south settling pond to the east and the Niagara River to the west (see Figure 1). This report summarizes:

- The subsurface conditions encountered at the site based on the recently completed test boring program; and
- Our embankment evaluation findings and recommendations.

INTRODUCTION

GZA was engaged by NRG to drill three (3) test borings to observe subsurface conditions and provide a geotechnical and stability assessment of the above referenced embankment. An existing discharge pipe is present within this embankment that allows surface water to drain from the settling pond to the Niagara River in the southern portion of the NRG Huntley Power Plant. GZA completed the following scope of services.

- Retained the services of Earth Dimensions Inc. (Earth Dimensions) of Elma, New York to complete three test borings at the Site (see Figure 1). Two borings were done in the embankment area on each side of the existing discharge pipe and one test boring was done in an area of presumed undisturbed soils located south of the settlement pond and discharge pipe. Overburden soil samples were collected and logged by Earth Dimensions. Ground water measurements were made from within the drilling augers at the completion of the borings.
- Selected overburden soil samples were tested by GZA's geotechnical laboratory for grain size analysis (i.e., sieve and hydrometer tests). Additionally, one Shelby tube sample was collected from a layer of fine grained soils and was submitted to our soils laboratory for consolidated undrained triaxial testing and unit weight determination.

- Ground surface elevations in the area of the embankment area were measured by GZAs subcontractor, Clear Creek Land Surveying, LLC (Clear Creek) of Springville, New York. The ground surface elevation and location of the three test borings were recorded, as well as, existing embankment features including rip-rap location, the shoreline of the Niagara River the settlement pond water level, and discharge pipe inverts, among others. These locations were tied into an existing Site benchmark that was provided by NRG for our use.
- Evaluated the stability of the embankment via the slope stability analysis program PCSTABL, Version 6 to provide an assessment of existing conditions at the Site.
- Prepared this evaluation report that summarizes the findings of the subsurface explorations, laboratory testing program, and embankment evaluation. This report also presents our recommendations of whether or not a more detailed slope stability analysis of the embankment is required.

SITE CONDITIONS

The settlement pond currently is designed to receive stormwater runoff and process water associated with NRG's bottom ash removal system. This ash is pumped to the settling pond, where the larger solids (e.g., bottom ash) being discharged settle out closer to the pipe discharge into the pond and the smaller particles (e.g., fly ash) settle out at distances further from the discharge pipes. Although the discharge volume into the settlement pond reportedly varies from time to time, the surface elevation of the water within the pond typically remains consistent at an approximate elevation (el.) 570, which is slightly above the invert of the discharge pipe inlet that drains to the Niagara River. The settlement pond is reportedly about 6 feet deep and is periodically (about once every five years) dredged to remove accumulated sediments (e.g., ash). The pond was reportedly last dredged in December of 2008.

The study area consists of the embankment located between the south end of the settling pond and the Niagara River. This embankment was generally observed to have an asphalt pavement access road over its top portion. Rip rap armor was observed on the side slopes between the asphalt and the shorelines on both sides of the embankment. The rip rap located on the settlement pond side has a grassy vegetation cover and the rip rap on the Niagara River side is interlocked with a cement grout, a limited amount of vegetation is present.

Additional observations were made on the Niagara River side where an approximate 12-inch thick layer of crushed stone underlain by a woven geotextile separation fabric was noted below the rip rap. Several 4-inch diameter clay weep pipes were also observed on the Niagara River side of the embankment. These weep pipes were observed to be spaced about every 5-feet and at the same approximate elevations. It is assumed that these weep pipes function to drain the accumulated water beneath the grouted rip rap. At the time of our observations, a trickle of water flow was observed draining from some of the clay pipes. Other pipes were observed clogged with debris washed up from the river (e.g., wood and plastic material).

A corrugated metal discharge pipe (CMP) is present through the embankment that allows drainage from the settlement pond to the Niagara River. This CMP is oval shaped, with approximate dimensions of 65-inches tall by 95 inches wide. At the time of our visit, water was flowing through the pipe at an approximate depth of about 2 to 3 inches. Some sandbags and other small debris were observed inside the pipe.

As shown on the attached Figure 2, the ground surface elevations of the existing embankment range from elevation (el.) 566 at the Niagara River shoreline (outside toe-of-slope) to el. 575.4 across the paved access road on top of the embankment to el. 569.9 at the pond shoreline (inside toe-of-slope).

SUBSURFACE EXPLORATIONS

The subsurface exploration program consisted of three test borings, designated B-1 to B-3, drilled on Monday April 27 and Tuesday April 28, 2009. The test boring locations are shown on Figure 1 and Figure 2. General test boring procedures include the following.

- Overburden drilling was done using 3-1/4 inch inside diameter hollow stem augers (HSA).
- Standard Penetration Tests (SPT) were completed in each boring in general accordance with ASTM D1586. SPT "N" values were determined by driving a 2-inch diameter split spoon sampler with a 140-pound automated hammer falling 30-inches. Soils were sampled over a 24-inch interval. The number of blows required to drive the split spoon sampler each 6-inch interval was recorded. The "N" value is the number of blows required to drive the sampler between the 6-inch to 18-inch interval.
- Split-spoon samples were recovered continuously to the bottom of each boring, at a depth of about 26 feet.
- One Shelby tube sample was collected from test boring B-1. The soil sample was collected at an approximate depth of about 14 to 16 feet bgs in a silt and fine sand soil.
- Water level measurements were made inside the HSAs at completion of the borings. Additionally, the HSAs at the B-2 location were left in place overnight and the water level inside the augers was measured the next morning.

Earth Dimensions prepared test boring logs based on visual observations of the recovered soil samples, using apparent grain size distribution and plasticity. Characteristics such as relative density and consistency (based on the SPT), color, grain size, moisture, etc. were recorded on the boring logs. Test boring logs are included as Attachment 1.

The test boring locations were marked in the field by the GZA representative during our April 22, 2009 Site visit. Clear Creek measured the ground surface elevations at each boring location referencing a Site benchmark provided by NRG.

LABORATORY TESTING

After review of the boring logs, and soil samples and in consultation with NRG, GZA selected representative soil samples for laboratory testing to confirm field descriptions and to assist in estimating engineering properties of the silt and fine sand layer encountered within and beneath the embankment. The laboratory testing program consisted of:

- Two (2) soil samples for grain size analyses including hydrometer testing (ASTM D422);
- One (1) Shelby tube soil sample for consolidated undrained triaxial compression test (ASTM D4767) and three (3) grain size (sieve analysis) analyses (ASTM D422).

The laboratory soil test results are included as Attachment 2.

SUBSURFACE CONDITIONS

The soil stratigraphy conditions observed are described in this section. A generalized profile between the test borings is depicted on Figure 3. The general thickness and elevations of the various soil layers encountered at the boring locations are summarized below.

Test boring B-1 was located proximate to the northern side of the discharge pipe closer to the settlement pond. Test boring B-2 was located along the southern side of the discharge pipe closer to the Niagara River (along the eastern side of the chain link fence) approximately 21 feet south of B-1. The ground surface elevation at B-1 is approximately 575.3 feet above sea level (MSL), B-2 is approximately 575.1 feet MSL and B-3 is approximately 574.4 ft MSL. In general, the overburden conditions encountered at the three (3) locations explored are summarized in the following paragraphs.

- Overburden Fill: The fill thickness varied between test borings including 12.0 feet at B-1, 14 feet at B-2, and 10 feet at B-3. The soils sampled were visually described as varying between gravel and slag in the upper portions of the fill soil to a silt and fine sand soil in the lower portions. Smaller amounts of brick, concrete and wood fragments were observed throughout the fill material. The fill soil samples were predominantly course grained and non-plastic.

- Silt and Fine Sand: The depth of the silt and fine sand soil encountered varied from about 12 to 14 feet bgs in B-1 and B-2 respectively and is about 8 feet thick. The recovered samples were visually described as generally a dark gray to gray silt and fine sand soil (ML). The silt content of the soil samples tested for grain size ranged from about 53% (B-1) to 55% (B-2) and the clay content ranged from 7% to 9%, respectively, indicating the soil is predominately fine-grained and silt-sized. Atterberg limits were not tested on these soils as they were observed in the field as non plastic.

- Sand – A well graded sand layer including very fine sand to coarse sand was observed at depths ranging from about 20 to 22 feet bgs and its presence continued to the end of each boring (26 feet bgs).

GROUNDWATER CONDITIONS

Groundwater was measured inside the HSAs at the completion of each test boring. Water was measured in the three test borings and the observed measurements are presented below.

Test Boring	Date of Measurement	Water measurement (bgs)	Groundwater Elevation (ft above MSL)
B-1	4-28-09	10.8	564.5
B-2*	4-28-09	9.5	565.6
B-2	4-28-09	12.0	563.1
B-3	4-27-09	8.6	565.8

*Measurement made after the water was allowed to equilibrate overnight within the HSAs and prior to completion/removal.

These measurements may not be reflective of the actual groundwater elevation due to the assumed low permeability silt soils and the fact that sufficient time may not have elapsed for the water level to fully stabilize.

Additionally, water was observed seeping from several of the 4-inch diameter clay tile weeps located on the Niagara River side of the embankment. The elevations of the weeps were measured at approximately 567± feet, about one foot above the Niagara River (approximate elevation of 566 feet). These weeps are assumed to function as drains for the stone layer underlying the grouted rip-rap layer.

SLOPE STABILITY ANALYSIS

EXISTING EMBANKMENT CONDITIONS

The soils encountered in B-1 and B-2 generally consists of a fine to coarse grained fill material over a silt and fine sand layer over a well graded sandy soil. At the boring locations, the composition of the fill material was variable with a greater amount of coarse soil (sand, gravel and slag and lesser amounts of concrete, brick and wood debris) noted closer to the ground surface. Finer grained, sandy silt soils were observed in the lower portions of the fill layer. The soil encountered below the fill and below the water line was predominately a loose silt and fine sand soil (about 6 to 7 feet thick) over a well graded sandy soil.

SPT "N" values from the silt and fine sand layer underlying the fill soils (about 12 to 14 feet bgs) were measured with values ranging from about 2 to 7 indicating a loose relative density.

The "N" values of 2 to 7 measured and recorded for the silt and fine sand soils sampled below the water table may not be representative of in-situ conditions. More representative "N" values may be higher. During soil sampling and SPT work, a hydrostatic in-balance was present due to a higher assumed groundwater elevation outside the HSAs, compared to inside the HSAs. This hydrostatic in-balance may result in a disturbance at the bottom of the HSAs in the zone where split-spoon sampling and SPT work occurred. Earth Dimensions attempted to maintain a water column inside the hollow stem augers during sampling through the saturated soil layer that balanced the outer water pressure.

SPT "N" values from the fill soils located above the silt and fine sand and the well graded sandy soils below were generally observed to be higher.

The rip rap side slopes extending upward from the edge of the river and pond to the top of the embankment are generally observed to be sloped at 3-feet horizontal (H) to 1-foot vertical (V).

GZA EVALUATION OF TRIAXIAL COMPRESSION TEST RESULTS

GZA estimated an internal friction angle (ϕ) of the silt and fine sand layer based on the one tri-axial compression test done. Our interpretation of the test indicates the following.

- Plot 1: A stress path aligned tangential to the stress circles plotted for failure at low minor principal inter-granular stress (σ_3) and high σ_3 produces a ϕ angle of 19 degrees with a shear strength intercept (cohesion (c)) of 560 psf.

- Plot 2: A stress path beginning at the plot origin (shear strength = 0 psf) and extending tangentially to the stress circle for failure at high σ_3 produces a ϕ angle of 25 degrees.

GZA analyzed the embankment's stability considering these 2 friction angle/cohesion results. Plot 1 and Plot 2 are included in Attachment 2 – Laboratory Test Results.

SLOPE STABILITY EVALUATION

Using the computer program PCSTABL (version 6) to analyze the stability of the slope embankment at the study area and our assumed soil index parameters (which are based on soil test results, published values for similar soils and based on our experience with similar soils) presented in the table below provides an analysis that indicates that the embankment slope is stable. Our analysis is further discussed below.

SOIL PARAMETERS USED FOR PCSTABL INPUT

Soil Type	Wet Unit Weight (pcf)	Model 1		Model 2	
		Friction Angle	Cohesion (psf)	Friction Angle	Cohesion (psf)
Fill Material (SM, SW, ML, GL)	130	30	0	30	0
Silt and Fine Sand Soil (ML)	120.5	19	560	25	0
Sand (SW)	132	32	0	32	0

Note: Model 1 and Model 2 represents values used to generate Plots 1 and 2, respectively, as shown in Attachment 3.

A piezometric (water) level was assumed to range in elevation from about 566 (river elevation) to 569 (pond elevation) feet. Our stability analyses considered circle, sliding block failure and infinite slope considerations. The following factors of safety were calculated for static conditions. Copies of the different run models are included in Attachment 3.

Circle and Sliding Block Failures: We evaluated circle and sliding block failures by directing a limited number of failure surfaces through the silt and fine sand layer having the lower shear strength value. The stability analysis for the circular surface and the sliding block failure estimated factors of safety ranging from about 1.8 to greater than 3. Slopes with factors of safety greater than 1.5 are generally considered in a stable condition.

Infinite Slope Analysis:

This analysis evaluates the thin soil layer or laminate stability along the slope. The factor of safety is computed using the following equation.

$$F.S. = \tan\phi/\tan\beta$$

Where:

ϕ = soils internal friction angle and β = slope angle

Using the friction angle for the fill material, immediately underlying the rip-rap layer, of 30 degrees and the embankment slope angle of about 18.4 degrees (3H:1V) gives a factor of safety of 1.7. Because the factor of safety is greater then 1.5, a shallow slope failure is not expected to occur. Additional slope stability is provided by the confining surficial rip-rap that was not utilized for this analysis.

CONSIDERATIONS AND RECOMMENDATIONS

The current slope and subsurface conditions measured and evaluated for the existing embankment indicates that the embankment is stable. Surficial erosion, due to the potential undercutting of the slope by the Niagara River, did not appear to be an issue based on our field observations. The rip rap present on the Niagara River side of the embankment is interlocked with concrete grout and appears to be suitably drained via the 4-inch diameter clay weep pipes.

GZA recommends that periodic inspection and maintenance of the grouted rip rap and clay pipe drains be made at least semi-annually or when allowable. Areas of damaged grout between the rip rap should be filled and the clay pipes should periodically be cleared of accumulated river debris. Additionally, the existing corrugated metal drainage pipe located between the settling pond and the Niagara River should periodically be inspected and maintained free of accumulating debris to allow for proper pond drainage.

Although it is our opinion that the embankment is stable in its current condition, there is the possibility that the silt and fine sand soils located below the fill material may be susceptible to liquefaction resulting from seismic activity. Liquefaction of the soil may cause it to “flow” (i.e. become liquid) and be displaced by the overlying embankment fill. Based on our observations and evaluation of the settling pond embankment, it is our opinion that the embankment would have a hazard rating classification of low to remote.

This soil, a loose lacustrine deposited soil, is located beneath the groundwater table and appears to be of relatively uniform size (fine sand and silts with low SPT “N” values recorded from the test borings). Based on these observations and a limited literature review pertaining to liquefaction potential[1], this soil unit may have characteristics that make it prone to “possible” or “probable” liquefaction.

We note that the impact of liquefaction experienced by a soil material is a function of the intensity of seismic activity and other site specific factors. It is our opinion that if the silt and fine sand soil were to experience liquefaction, it is unlikely that the embankment would experience catastrophic failure (i.e., entire embankment sliding into the river allowing uncontrolled flow from the settlement basin). Rather, the embankment may undergo settlement from the displacement of the silt and fine sand layer beneath the embankment requiring repair and maintenance.

---

[1] Simplified Procedure for Evaluating Soil Liquefaction Potential, Seed, H.B; Idriss, I.M.; Journal of the Soil Mechanics and Foundation Division, ASCE; Sept 1971.

We appreciate the opportunity to have completed this work for NRG / Huntley Power LLC, We will contact you in a few days to discuss this report and address any questions or comments you may have.

Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

Daniel Troy, P.E.
Project Manager

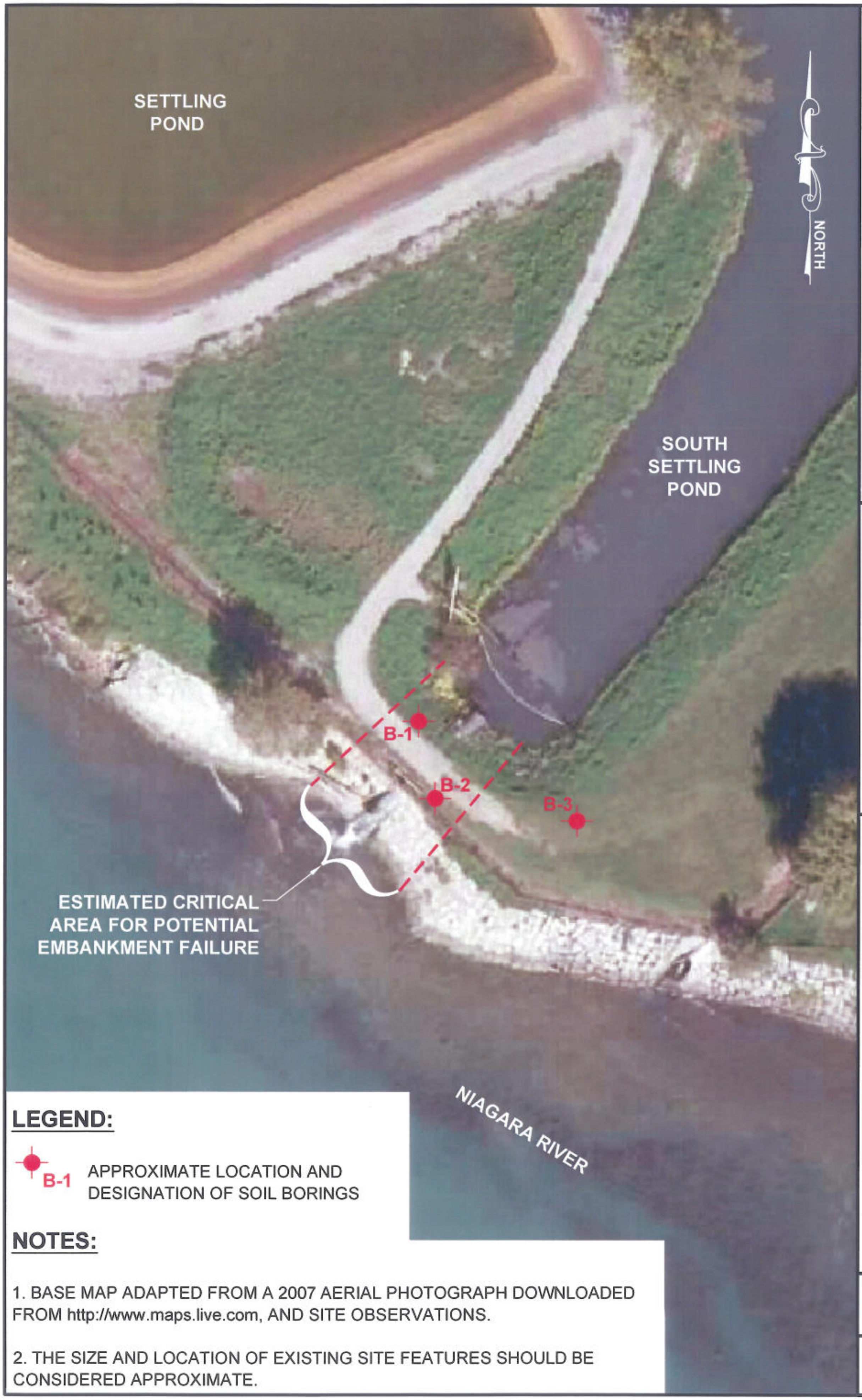
Ernest Hanna, P.E.
Consultant Reviewer

Bart Klettke, P.E.
Associate Principal

DANIEL JOHN TROY
No. 81139

Attachments: Figures 1 through 3
Attachment 1 – Subsurface Boring Logs
Attachment 2 – Laboratory Test Results
Attachment 3- Slope Stability Model Analysis

FIGURES



LEGEND:

● B-1 APPROXIMATE LOCATION AND DESIGNATION OF SOIL BORINGS

NOTES:

1. BASE MAP ADAPTED FROM A 2007 AERIAL PHOTOGRAPH DOWNLOADED FROM http://www.maps.live.com, AND SITE OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

DRAWN BY: **MDK**

DATE: **MAY 2009**

GZA GeoEnvironmental of New York

APPROXIMATE SCALE IN FEET

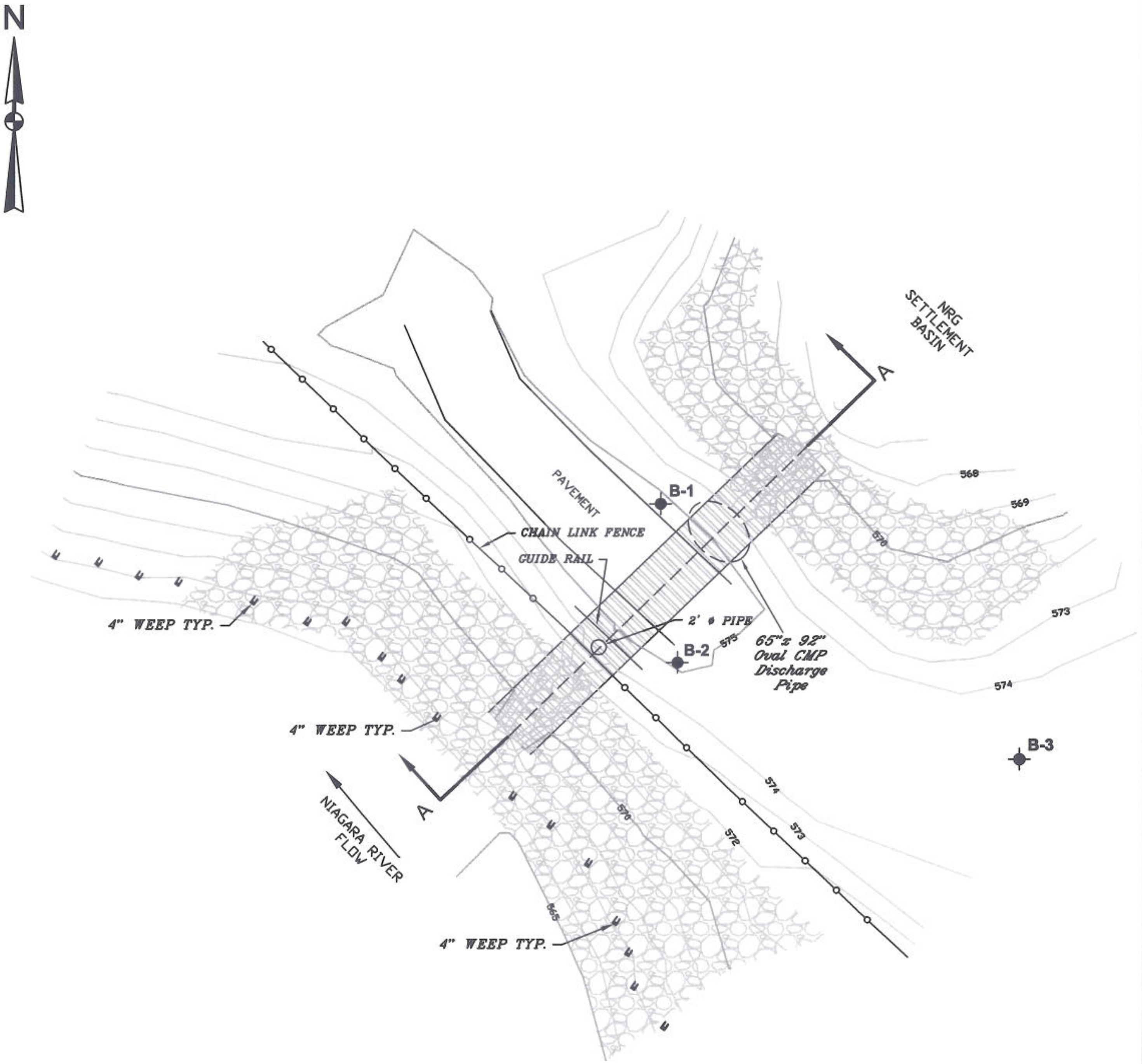
0 25 50 100

NRG HUNTLEY POWER, LLC
HUNTLEY GENERATION PLANT
3500 RIVER ROAD
TONAWANDA, NEW YORK
SUBSURFACE INVESTIGATION AND ENGINEERING EVALUATION
SITE PLAN

PROJECT No.
21.0056497.00

FIGURE No.
1

GZA-T:\PROJECTS\56400s\56497 NRG Huntley Embankment Evaluation\Site Plan.dwg [Figure 1] May 20, 2009 - 2:51pm michael.kress



NOTES:

1. BASE TOPOGRAPHY MAP PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, MAY 2009.

0 10 20 40

SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

PREPARED BY:

GZA GeoEnvironmental of N.Y.
Engineers and Scientists
535 WASHINGTON STREET 11th FLOOR
BUFFALO, NEW YORK 14203
(716) 685-2300

HUNTLEY GENERATION PLANT
SUBSURFACE INVESTIGATION AND
ENGINEERING EVALUATION

FIGURE

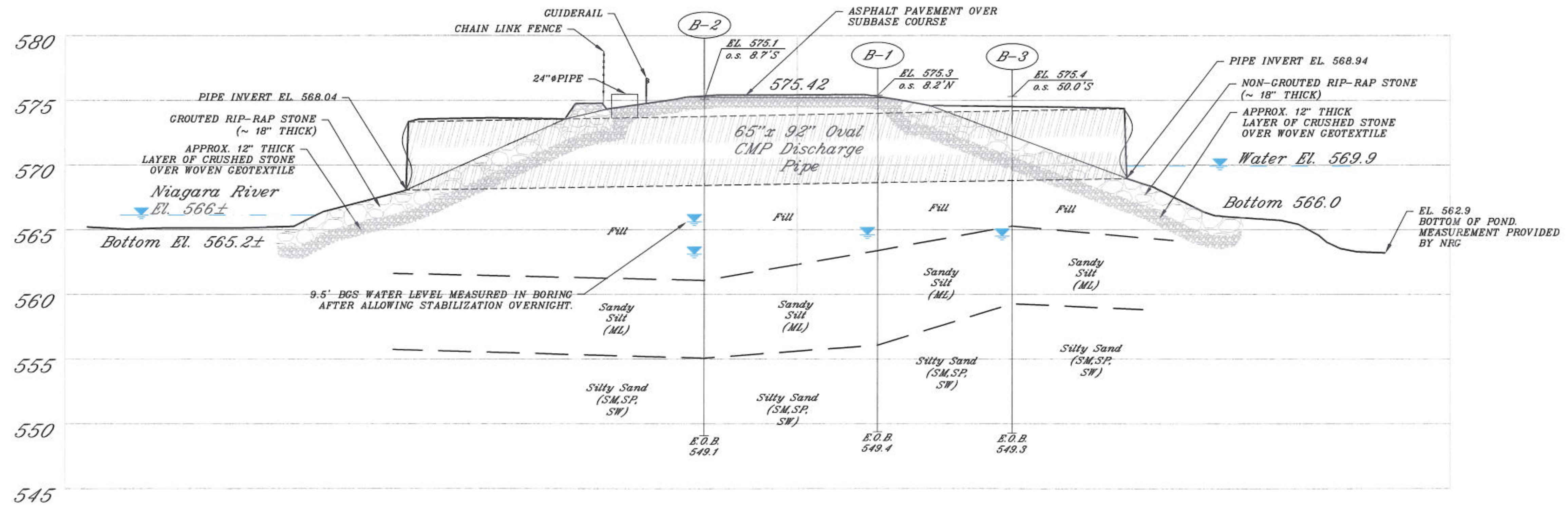
2

PREPARED FOR:

NRG HUNTLEY POWER, LLC
3500 RIVER ROAD
TONAWANDA, NEW YORK

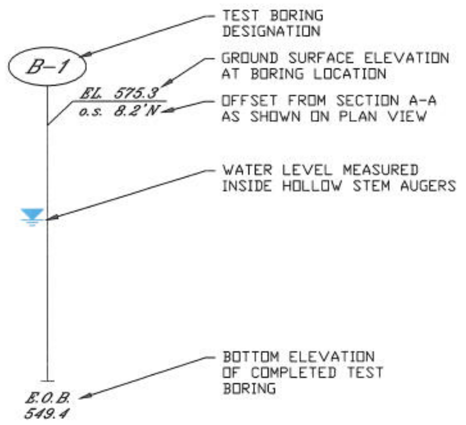
PROJ MGR: DJT
REVIEWED BY: ERH
CHECKED BY: BAK
DESIGNED BY: DJT
DRAWN BY: MDK
SCALE: 1" = 20'
DATE: MAY 2009
PROJECT NO. 21.0056497.00
REVISION NO.

GZA-T:\PROJECTS\56400s\56497 NRG Huntley Embankment Evaluation\section.dwg [FIG 2 PLAN VIEW] May 22, 2009 – 10:01am bart.klettke



Cross Section A–A
through Access Road

LEGEND:



NOTES:

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.

2. WATER LEVEL MEASUREMENTS MADE INSIDE AUGERS AT BORING COMPLETION.

3. SEE BORING LOGS FOR ADDITIONAL SUBSURFACE SOIL DESCRIPTIONS.

NO.	ISSUE/DESCRIPTION	BY	DATE

HUNTLEY GENERATION PLANT
SUBSURFACE INVESTIGATION AND
ENGINEERING EVALUATION

PREPARED FOR:
NRG HUNTLEY POWER, LLC
3500 RIVER ROAD
TONAWANDA, NEW YORK

PREPARED BY:
GZA GeoEnvironmental of N.Y.
Engineers and Scientists
535 WASHINGTON STREET 11th FLOOR
BUFFALO, NEW YORK 14203
(716) 685-2300

PROJ MGR: DJT	REVIEWED BY: ERH	CHECKED BY: BAK	FIGURE
DESIGNED BY: DJT	DRAWN BY: MDK	SCALE: 1" = 10'	3
DATE MAY 2009	PROJECT NO. 21.0056497.00	REVISION NO.	

ATTACHMENT 1

SUBSURFACE SOIL BORINGS

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09 HOLE NO. Bore Hole 1-09 SURF. ELEVATION –

PROJECT NRG Huntley Plant – 3500 River Road LOCATION –
Town of Tonawanda, Erie Co., NY

CLIENT GZA GeoEnvironmental of New York DATE STARTED 04/28/09 COMPLETED 04/28/09

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N
	1 20	3	6	31	17	37
	2 18	15	19	25	15	44
5	3 2	6	1	1	3	2
	4 24	4	8	10	9	18
	5 1	3	1/12		1	<1
10	6 12	13	3	2	1	5
	7 24	3	3	4	5	7
15	ST	#1				
	8 20	1	1	2	3	3
20	9 24	1	1	4	5	5

LITH

DESCRIPTION AND CLASSIFICATION

Extremely moist dark brown (SANDY-SILT) topsoil fill with 5 to 10% gravel, little sand and organic matter, very loose, massive soil structure, (ML). 0.3

Gravel, slag and concrete debris.

grades downward to 6.0

Wet grayish black gravelly (SILTY-SAND) fill with 20 to 40% gravel and slag, mostly very fine to fine size sand, little silt, compact becoming very loose and loose below 8.0 feet, massive soil structure, (SM).

grades downward to 12.0

Wet dark gray (SANDY-SILT) with little mostly very fine to fine size sand, loose, massive soil structure with occasional fine size sand lens <0.05 feet in thickness, (ML).

grades downward to 16.0

Wet dark gray (SANDY-SILT) with little mostly very fine to fine size sand, very loose and loose, weakly thinly bedded with occasional fine size sand lens <0.05 feet in thickness, (ML). 19.3

See next sheet.

WATER TABLE AND REMARKS

Advanced 3 1/4 inch hollow stem auger casing while continuously split spoon sampling to 26.0 feet. Bore hole tremmie grouted to surface at completion.

Sample #3: Two attempts were made, both with poor recovery.

Sample #5: Poor recovery, low end value indicates potentially very loose material.

Sample #6: Visual evidence and odor of petroleum contamination.

Samples 7 & 8: slight petroleum odor.

ST#1: Shelby tube sample #1 taken between 14.0 to 16.0 foot depth. Recovery 24"/24".

▼ Water level at 10.8 feet below ground surface at completion.

Coarse silty topsoil fill with little sand and organic matter, trace gravel to 0.3 feet over gravel, slag and concrete debris to 6.0 feet over sandy soil fill with some gravel and slag, little silt to 12.0 feet over coarse silty slack water sediment with little sand to 19.3 feet over water sorted and deposited sand with some gravel, little silt to 20.0 feet over water sorted and deposited sand with some gravel, trace silt to 24.0 feet over water sorted and deposited sand with some gravel to end of boring.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist, (mw) SHEET 1 OF 2

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09

HOLE NO. Bore Hole 1-09

SURF. ELEVATION _

PROJECT NRG Huntley Plant - 3500 River Road
Town of Tonawanda, Erie Co., NY

LOCATION _

CLIENT GZA GeoEnvironmental of New York

DATE STARTED 04/28/09 COMPLETED 04/28/09

DEPTH IN FT

BLOWS ON SAMPLER

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	10 24	3	3	6	5	9		Wet dark gray gravelly (SILTY-SAND) with 20 to 40% mostly subrounded gravel, mostly very fine to fine size sand, little silt, loose, stratified, (SM). grades downward to 20.0	
	11 18	4	7	13	15	20		Wet dark gray gravelly (SAND) with 20 to 40% mostly subrounded gravel, very fine to very coarse size sand, trace silt, loose becoming compact, loose when disturbed below 22.0 feet, stratified, (SW). grades downward to 24.0	
25	12 16	4	4	4	6	8		Wet gray gravelly (SAND) with 20 to 40% mostly subrounded gravel, very fine to very coarse size sand, loose, stratified, (SW). 26.0	
								Boring completed at 26.0 feet.	
30									
35									
40									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist. (mw)

SHEET 2 OF 2

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09 HOLE NO. Bore Hole 2-09 SURF. ELEVATION _

PROJECT NRG Huntley Plant - 3500 River Road
Town of Tonawanda, Erie Co., NY

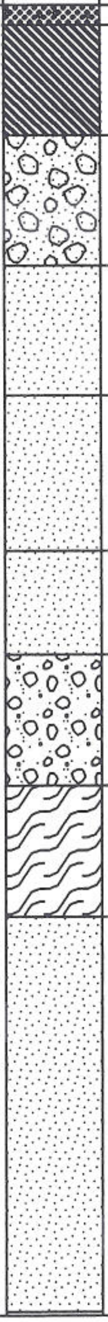
LOCATION _

CLIENT GZA GeoEnvironmental of New York

DATE STARTED 04/27/09 COMPLETED 04/28/09

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N
	1 20	5	12	17	23	29
	2 24	11	19	14	11	33
5	3 24	6	4	6	7	10
	4 24	3	1	8	17	9
10	5 18	11	13	14	12	27
	6 18	8	7	16	8	23
	7 4	1	1	3	5	4
15	8 22	1	1	1	3	2
	9 24	1	2	1	3	3
20	10 24	2/12		2	5	<3

LITH



DESCRIPTION AND CLASSIFICATION

Extremely moist dark brown (SANDY-SILT) topsoil fill with 5 to 10% gravel, little sand and organic matter, compact, massive soil structure, (ML). 0.3

Cobble fill. 2.0

Moist gray very gravelly (SANDY-SILT) fill with 40 to 60% gravel, little sand, occasional brick fragments, dense, massive soil structure, (ML), (GM).
clear transition to 4.0

Moist dark blackish gray (SANDY-SILT) fill with little mostly very fine to fine size sand, trace slag, loose, massive soil structure, (ML).
clear transition to 6.0

Wet dark blackish gray (SANDY-SILT) with little mostly very fine to fine size sand, trace woody debris and glass fragments, occasional concrete debris, loose, massive soil structure, (ML).
clear transition to 8.4

Wet grayish black (SANDY-SILT) fill with little to some mostly very fine to fine size sand, trace slag, occasional concrete debris, compact, massive soil structure, (ML).
grades downward to 10.0

Wet grayish black gravelly (SILTY-SAND) fill with 20 to 40% gravel, mostly very fine to fine size sand, little silt, trace slag, occasional woody debris, compact, massive soil structure, (SM). 12.0

Woody debris.
grades downward to 14.0

~~See next sheet.~~

WATER TABLE AND REMARKS

Coarse silty topsoil fill with little sand and organic matter, trace gravel to 0.3 feet over cobble fill to 2.0 feet over coarse silt and gravel fill with little sand, occasional brick fragments to 4.0 feet over coarse silty soil fill with sand, trace slag to 6.0 feet over coarse silty soil fill with little sand, trace woody debris and glass fragments, occasional concrete debris to 8.4 feet over coarse silty soil fill with little to some sand, trace slag, occasional concrete debris to 10.0 feet over sandy soil fill with some gravel, little silt, trace slag, occasional concrete debris to 12.0 feet over woody debris to 14.0 feet over coarse silty slack water sediment with little to some sand to 20.0 feet over water sorted and deposited sand with trace gravel, occasional woody debris to 22.0 feet over water sorted and deposited sand with some gravel to end of boring.

Morning of 4/28/09, water level at 9.5 feet below ground surface with augers at 23.5 feet.

Water level at 12.0 feet below ground surface at completion.

Advanced 3 1/4 inch hollow stem auger casing while continuously split spoon sampling to 26.0 feet. Bore hole tremmie grouted to surface at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist. (mw)

SHEET 1 OF 2

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09

HOLE NO. Bore Hole 2-09

SURF. ELEVATION –

PROJECT NRG Huntley Plant - 3500 River Road
Town of Tonawanda, Erie Co., NY

LOCATION –

CLIENT GZA GeoEnvironmental of New York

DATE STARTED 04/27/09 COMPLETED 04/28/09

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	11	4						Wet gray (SANDY-SILT) with little to some mostly very fine to fine size sand, very loose, weakly thinly bedded to massive soil structure, (ML).	
	18		3			9			
				6					
					7			clear transition to 20.0	
	12	1						Wet gray (SAND) with 5 to 10% gravel, mostly very fine to fine size sand, occasional woody debris, loose, stratified, (SP).	
	18		5			17			
				12					
					13			grades downward to 22.0	
	13	5						Wet gray gravelly (SAND) with 20 to 40% subrounded gravel, very fine to very coarse size sand, compact, loose when disturbed, stratified, (SW).	
25	18		9			19			
				10					
					8			26.0	
								Boring completed at 26.0 feet.	
30									
35									
40									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist. (mw)

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09

HOLE NO. Bore Hole 3-09

SURF. ELEVATION _

PROJECT NRG Huntley Plant - 3500 River Road
Town of Tonawanda, Erie Co., NY

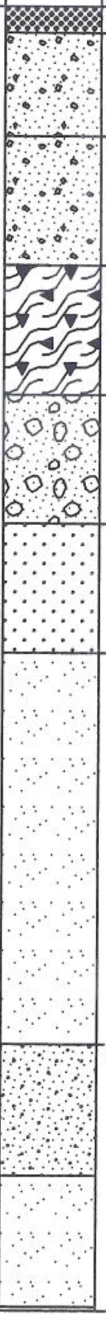
LOCATION _

CLIENT GZA GeoEnvironmental of New York

DATE STARTED 04/27/09 COMPLETED 04/27/09

DEPTH IN FT	BLOWS ON SAMPLER SN REC	0/6	6/12	12/18	18/24	N
	1	4				
	24		4			16
				12		
					52	
	2	29				
	24		23			42
				19		
					19	
	3	12				
5	5		8			11
				3		
					17	
	4	4				
	8		3			5
				2		
					2	
	5	3				
	12		6			15
				9		
10					7	
	6	12				
	18		5			9
				4		
					6	
	7	1				
	20		2			3
				1		
					3	
	8	1				
15	22		2			3
				1		
					2	
	9	2				
	20		2			4
				2		
					3	
	10	2				
	20		1			3
				2		
20					7	

LITH



DESCRIPTION AND CLASSIFICATION

Extremely moist dark brown (SANDY-SILT) topsoil fill with little sand and organic matter, loose, massive soil structure, (ML). 0.4

Extremely moist brown and dark brown mix (SANDY-SILT) fill with 5 to 10% gravel, occasional cobble, little sand, trace brick fragments and slag, compact, massive soil structure, (ML). 2.0

Moist black (SANDY-SILT) fill with 5 to 10% gravel, occasional cobble, little to some very fine to very coarse size sand, trace slag, dense, loose when disturbed, massive soil structure, (ML). 4.0

Slag and woody debris.
grades downward to 6.0

Extremely moist grayish black gravelly (SANDY-SILT) fill with 20 to 40% gravel, little sand, loose, massive soil structure, (ML).
grades downward to 8.0

Wet grayish black (SAND) fill with very fine to very coarse size sand, occasional concrete and woody debris, compact, loose when disturbed, massive soil structure, (SW).
grades downward to 10.0

Wet gray (SANDY-SILT) with little mostly very fine to fine size sand, loose becoming very loose below 12.0 feet, massive soil structure, (ML).
grades downward to 16.0

See next sheet.

WATER TABLE AND REMARKS

Advanced 3 1/4 inch hollow stem auger casing while continuously split spoon sampling to 26.0 feet. Bore hole tremmie grouted to surface at completion.

▼ Water level at 8.6 feet below ground surface at completion.

Coarse silty topsoil fill with little sand and organic matter to 0.4 feet over coarse silty soil fill with little sand, trace gravel, brick fragments and slag, occasional cobble to 2.0 feet over coarse silty soil fill with little to some sand, trace gravel and slag, occasional cobble to 4.0 feet over slag and woody debris to 6.0 feet over coarse silty soil fill with some gravel, little sand to 8.0 feet over sandy soil fill with occasional concrete and woody debris to 10.0 feet over coarse silty slack water sediment with little sand to 16.0 feet over water sorted and deposited sand with little to some silt to 18.0 feet over water sorted and

Continued next sheet.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist, (mw)

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

12D09 HOLE NO. Bore Hole 3-09 SURF. ELEVATION _

PROJECT NRG Huntley Plant - 3500 River Road
Town of Tonawanda, Erie Co., NY
LOCATION _

CLIENT GZA GeoEnvironmental of New York DATE STARTED 04/27/09 COMPLETED 04/27/09

DEPTH IN FT — BLOWS ON SAMPLER

SN REC	0/6	6/12	12/18	18/24	N
11 18	4	11	6	10	17
12 18	8	4	3	3	7
13 10	3	3	2	3	5

DEPTH: 25, 30, 35, 40

LITH

DESCRIPTION AND CLASSIFICATION

Wet gray (SILTY-SAND) with mostly very fine to fine size sand, little to some silt, very loose, weakly thinly bedded, (SM).

grades downward to 18.0

Wet gray (SAND), mostly very fine to fine size, trace silt and woody debris, very loose, stratified, (SP).

clear transition to 20.0

Wet gray gravelly (SAND) with 20 to 40% subrounded gravel, very fine to very coarse size sand, compact, loose when disturbed, stratified, (SW).

grades downward to 22.0

Wet gray gravelly (SAND) with 20 to 40% subrounded gravel, very fine to very coarse size sand, loose, stratified, (SW).

grades downward to 24.0

Wet gray very gravelly (SAND) with 40 to 60% subrounded gravel, very fine to very coarse size sand, loose, stratified, (SW), (GW).

26.0

Boring completed at 26.0 feet.

WATER TABLE AND REMARKS

deposited sand with trace silt and woody debris to 20.0 feet over water sorted and deposited sand with some gravel to 24.0 feet over water sorted and deposited sand and gravel to end of boring.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Steven J. Currie, Soil Scientist. (mw)

ATTACHMENT 2

LABORATORY TEST RESULTS

LABORATORY TESTING DATA SHEET

Project Name NRG Huntley Embankment Evaluation
Project No. 21.0056497.00
Project Engineer D. Troy

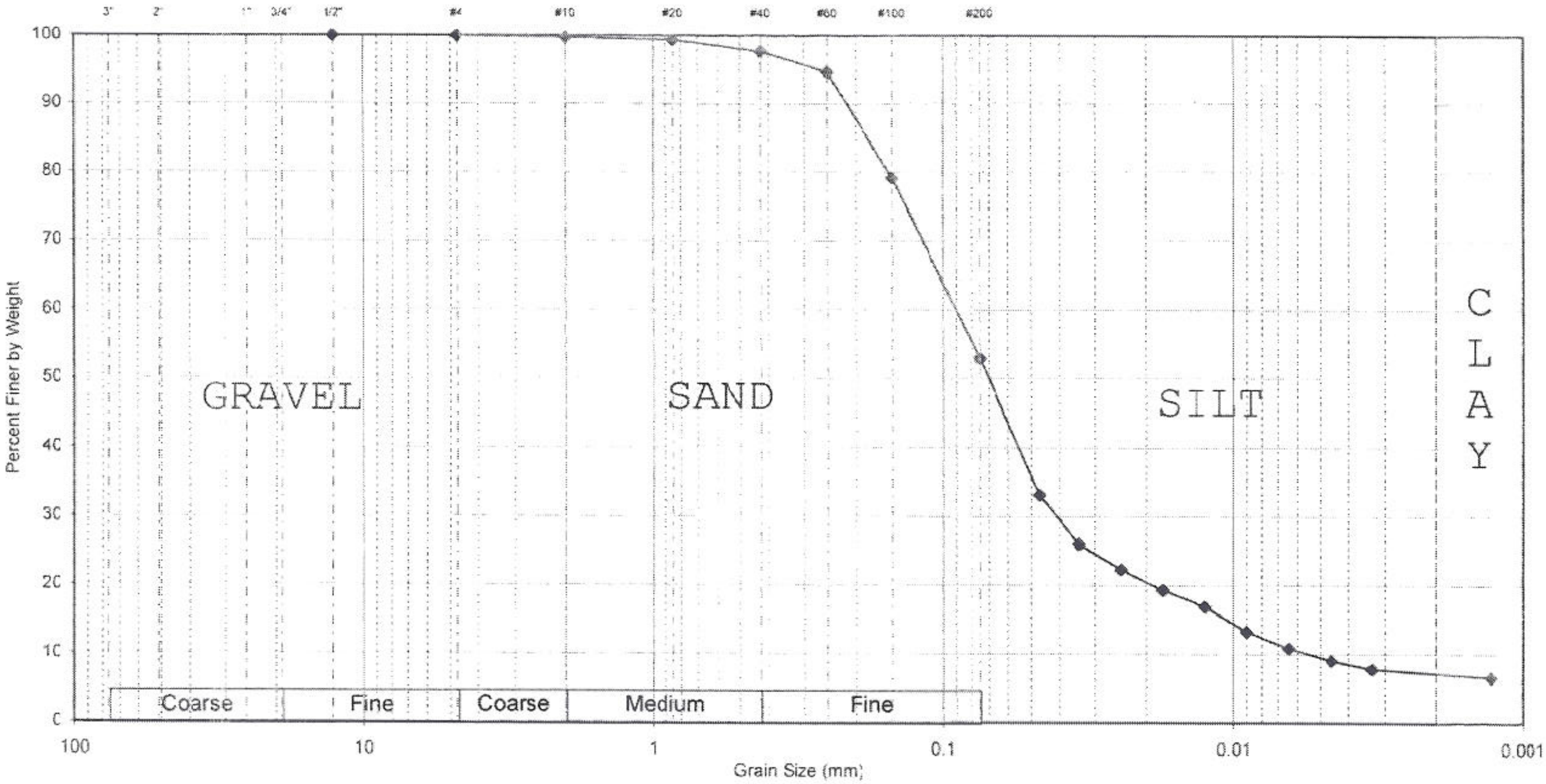
Project Location Tonawanda, NY
Assigned By B. Klettke
Date 5/20/2009

Reviewed By
Date Reviewed 5/20/09

				Identification Tests								Density		Strength Tests					Consol.	
Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) W_{opt} (%)	Permeability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1+e_0}$	Laboratory Log and Soil Description
B-1	S-9	12-14	1				53	7												Brown SILT and fine SAND
B-1	ST-1	14-16	2		Average Total Unit Weight (14.0-16.0') = 120.5 pcf															
		14.3		32.6										Tv= 0.22 tsf						From 14.0 to 14.8': Gray-brown SILT and fine SAND (homogenous)
		14.3-14.8		30.6			57				90.5			CIU	1010	σ_1/σ_3 Max	2243	4.2		
		14.8		31.1										Tv= 0.23 tsf						From 14.8 to 15.3': alternating layers of: SILT and SAND Silt layers are 1" thick Sand layers are ½" thick
		14.8-15.3		29.4			39				93.0			CIU	2000	σ_1/σ_3 Max	3357	5.6		
		15.3		29.9										Tv= 0.22 tsf						
		15.4-15.8		30.0			44				91.4			CIU	4000	σ_1/σ_3 Max	4643	15.6		From 15.3 to 16.0': Gray-brown fine SAND and SILT with $^1/_{16}$" to $^1/_8$" Silt layers
B-2	S-9	16-18	3				55	9												Brown SILT and fine SAND

GZA GeoEnvironmental, Inc.
Engineers and Scientists

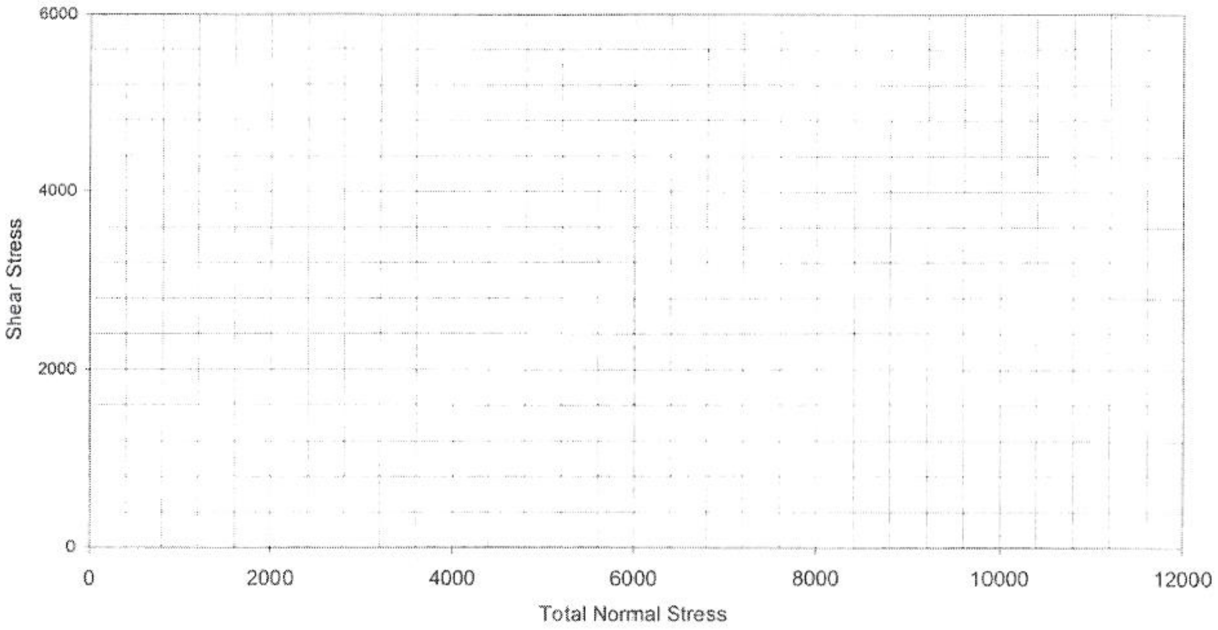
U.S. STANDARD SIEVE AND HYDROMETER

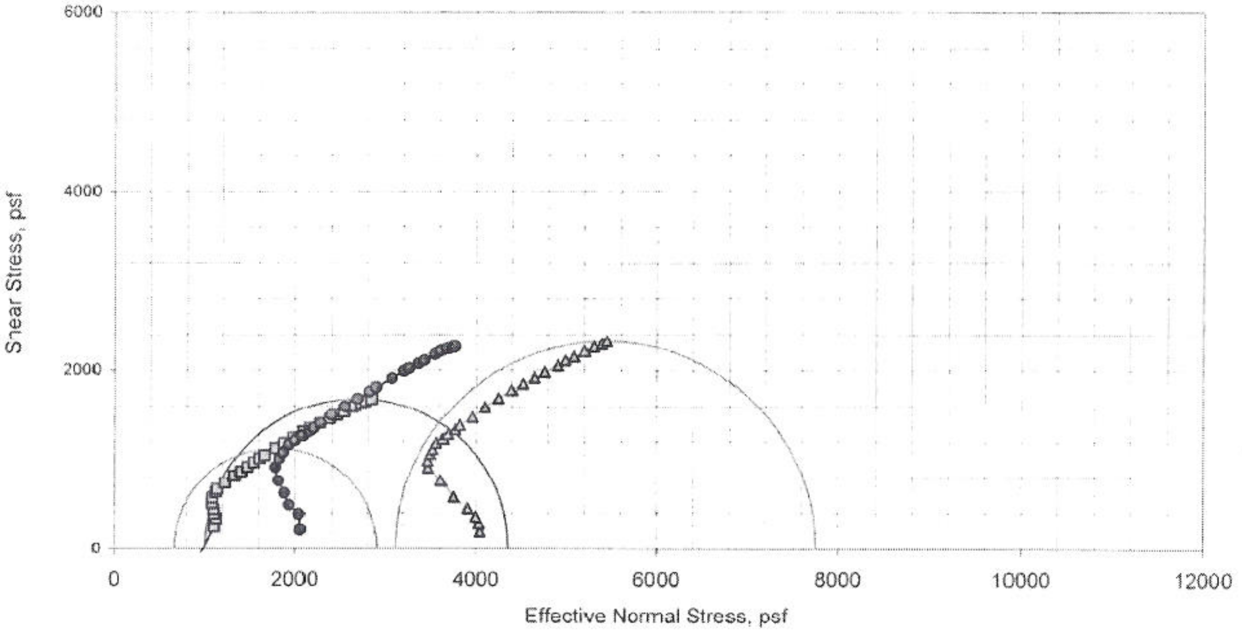


Gravel	Sand	Fines
0.0%	47.0%	53.0%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
1	B-1	S-9	12-14'	Brown SILT and fine SAND				

NRG Huntley Embankment Evaluation
Tonawanda, NY
GZA File # 21.0056497.00
Tested by: PEC Date: 5/8/09
Reviewed by: MBP Date: 5/14/09





SOIL DESCRIPTION		Brown SILT and fine SAND			
LIQUID LIMIT:	NT	PLASTIC LIMIT:	NT	SPECIFIC GRAVITY:	NT

FAILURE CRITERIA: σ_1/σ_3 MAX

REMARKS:

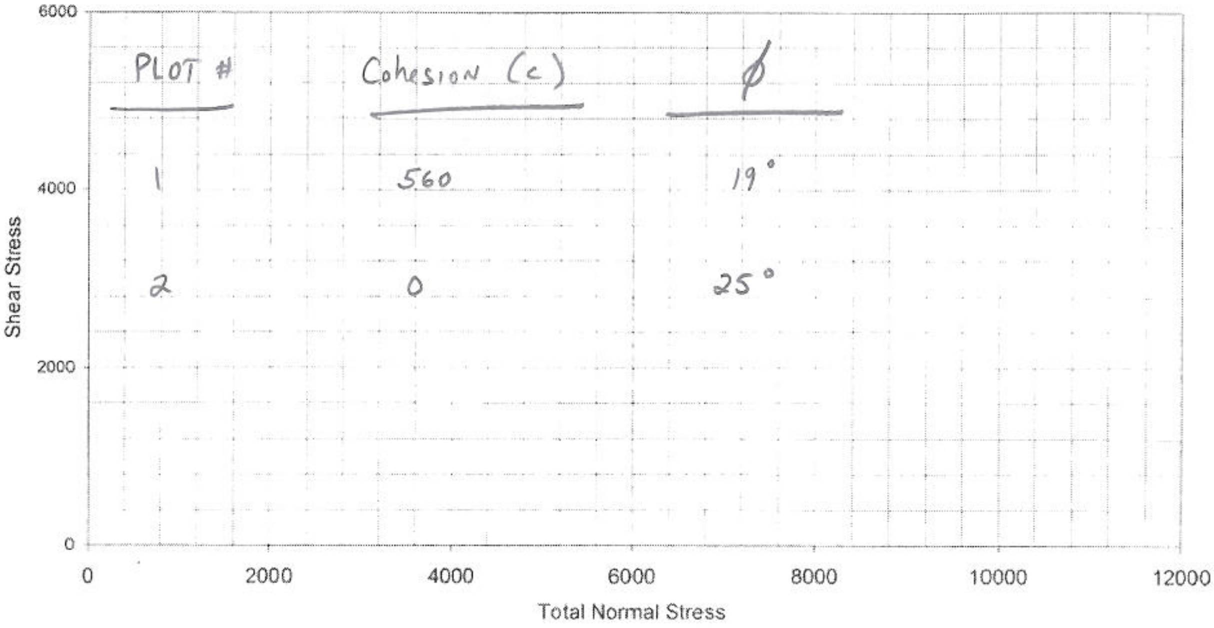
NRG Huntley Embankment Evaluation

Tonawanda, NY

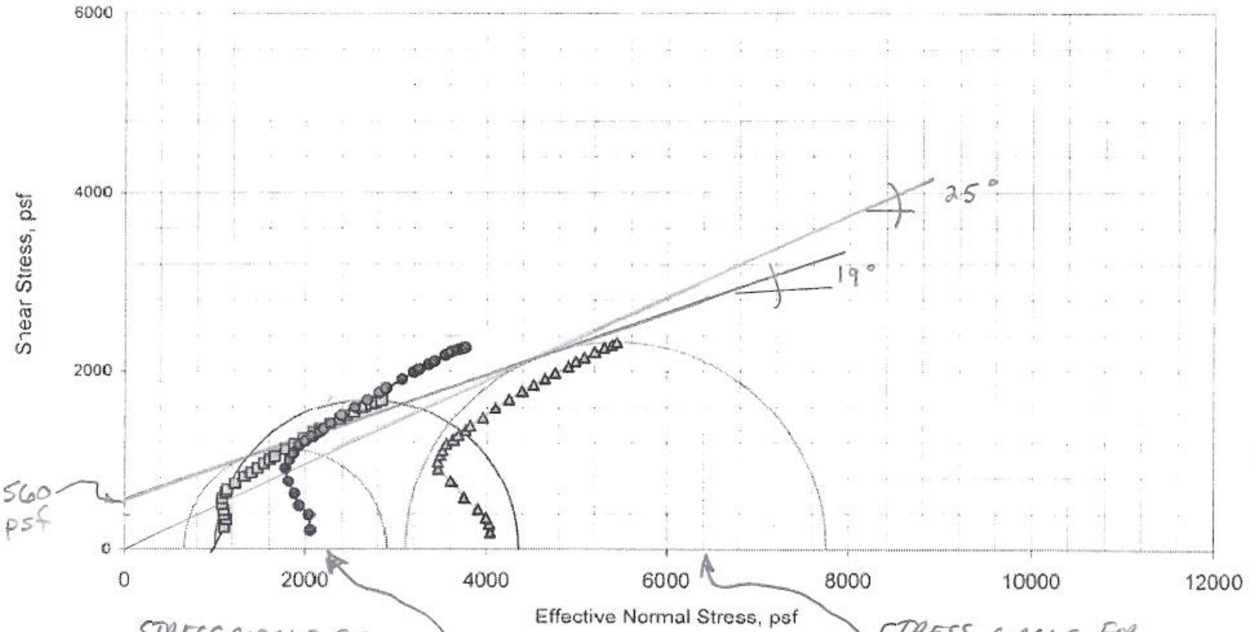
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B-1	FILE NO: 21.0056497.00
SAMPLE: ST-1	Date: 5/13/2009
DEPTH:	Tech.: MST
TEST SERIES: 2	Reviewer: DAS

GZA GeoEnvironmental, Inc.



PLOT #	Cohesion (c)	φ
1	560	19°
2	0	25°



c = 560 psf

STRESS CIRCLE FOR FAILURE at Low σ_3

STRESS CIRCLE FOR FAILURE AT HIGH σ_3

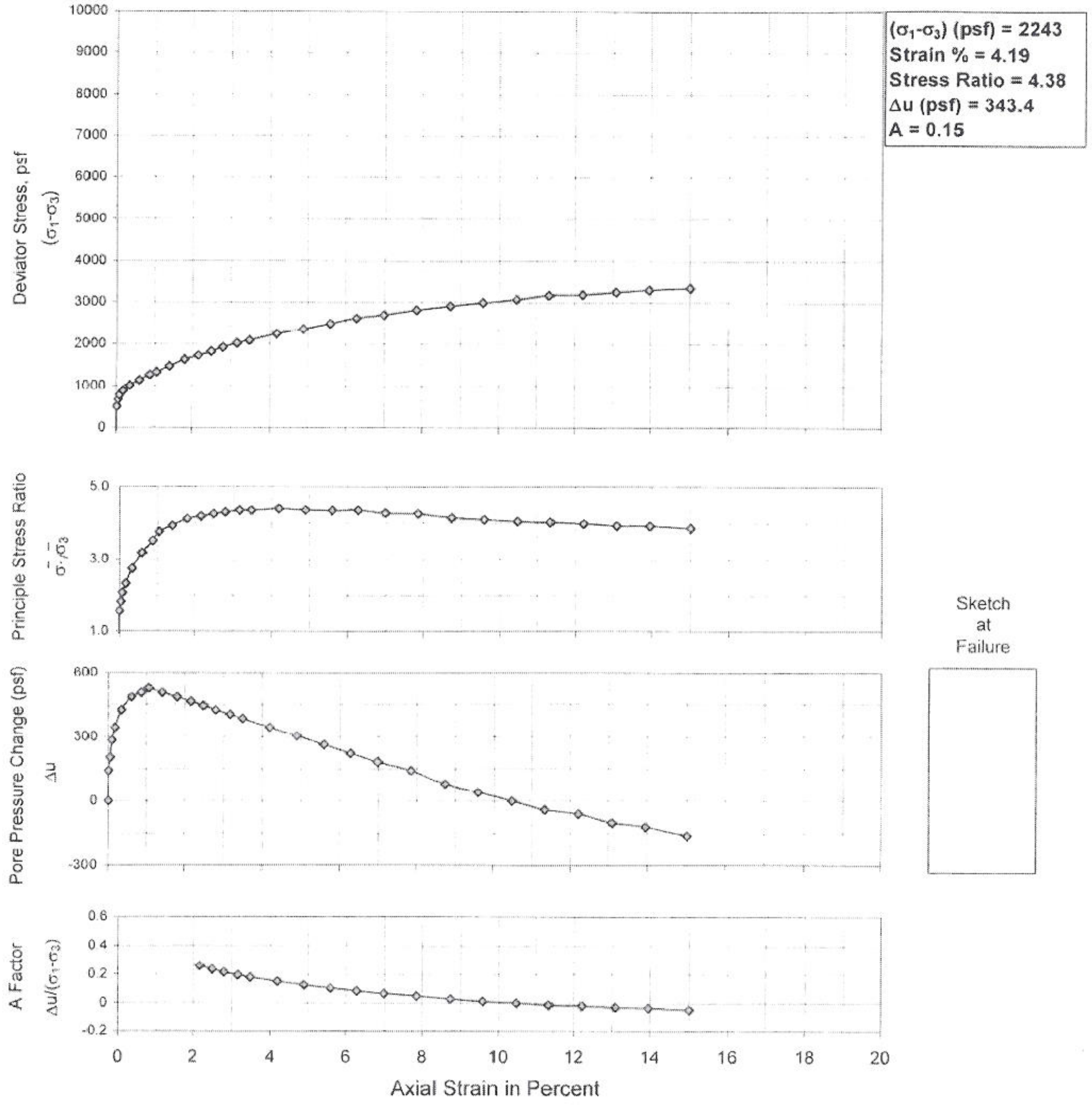
SOIL DESCRIPTION	Brown SILT and fine SAND	
LIQUID LIMIT: NT	PLASTIC LIMIT: NT	SPECIFIC GRAVITY NT

FAILURE CRITERIA: σ_1/σ_3 MAX

REMARKS:

NRG Huntley Embankment Evaluation Tonawanda, NY **TRIAXIAL** COMPRESSION TESTS (CIU)	
BORING: B-1	FILE NO: 21.0056497.00
SAMPLE: ST-1	Date: 5/13/2009
DEPTH:	Tech.: MST
TEST SERIES: 2	Reviewer: DAS

GZA GeoEnvironmental, Inc.



$(\sigma_1-\sigma_3)$ (psf) = 2243
Strain % = 4.19
Stress Ratio = 4.38
Δu (psf) = 343.4
A = 0.15

Sketch
at
Failure

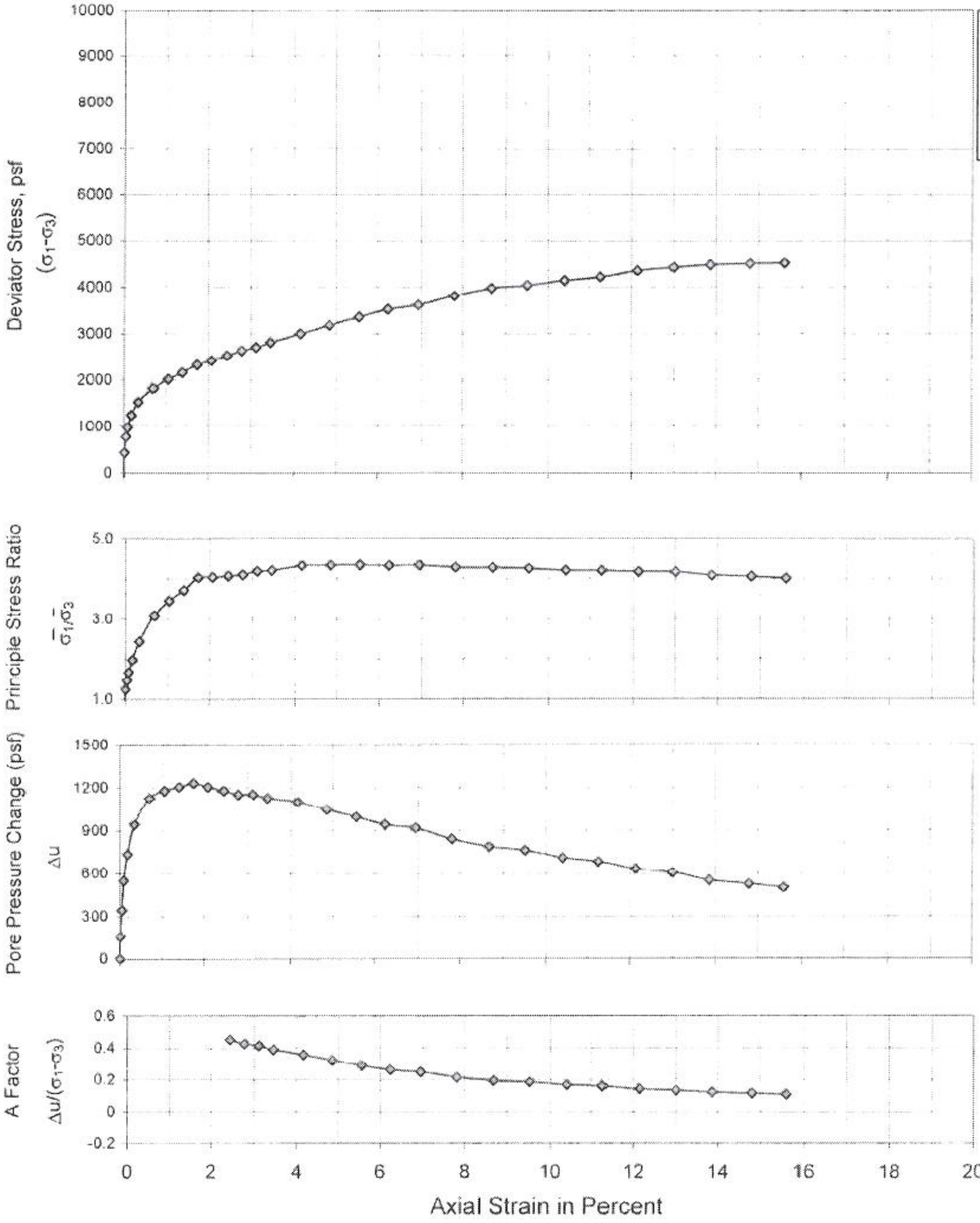
GZA GeoEnvironmental, Inc.

SOIL DESCRIPTION: Brown SILT and fine SAND
LIQUID LIMIT: NT
PLASTIC LIMIT: NT
SPECIFIC GRAVITY: NT

TEST NO / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS		RATE OF STRAIN, PERCENT PER MINUTE
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER IN.	INITIAL STRESS, ksf $\bar{\sigma}_1=\bar{\sigma}_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	
T2.1.1	30.6	90.5	5.77	2.88	1.01	13.0	2.05	98.2	29.0	92.4	0.069

NRG Huntley Embankment Evaluation
Tonawanda, NY
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B-1	FILE NO: 21.0056497.00
SAMPLE: ST-1	Date: 5/12/2009
DEPTH: 14.3-14.8'	Tech.: MST
TEST NO: T2.1.1	Reviewer: DAS



$(\sigma_1-\sigma_3)$ (psf) = 3357
Strain % = 5.55
Stress Ratio = 4.33
Δu = 994.8
A = 0.29

Sketch
at
Failure

GZA GeoEnvironmental, Inc.

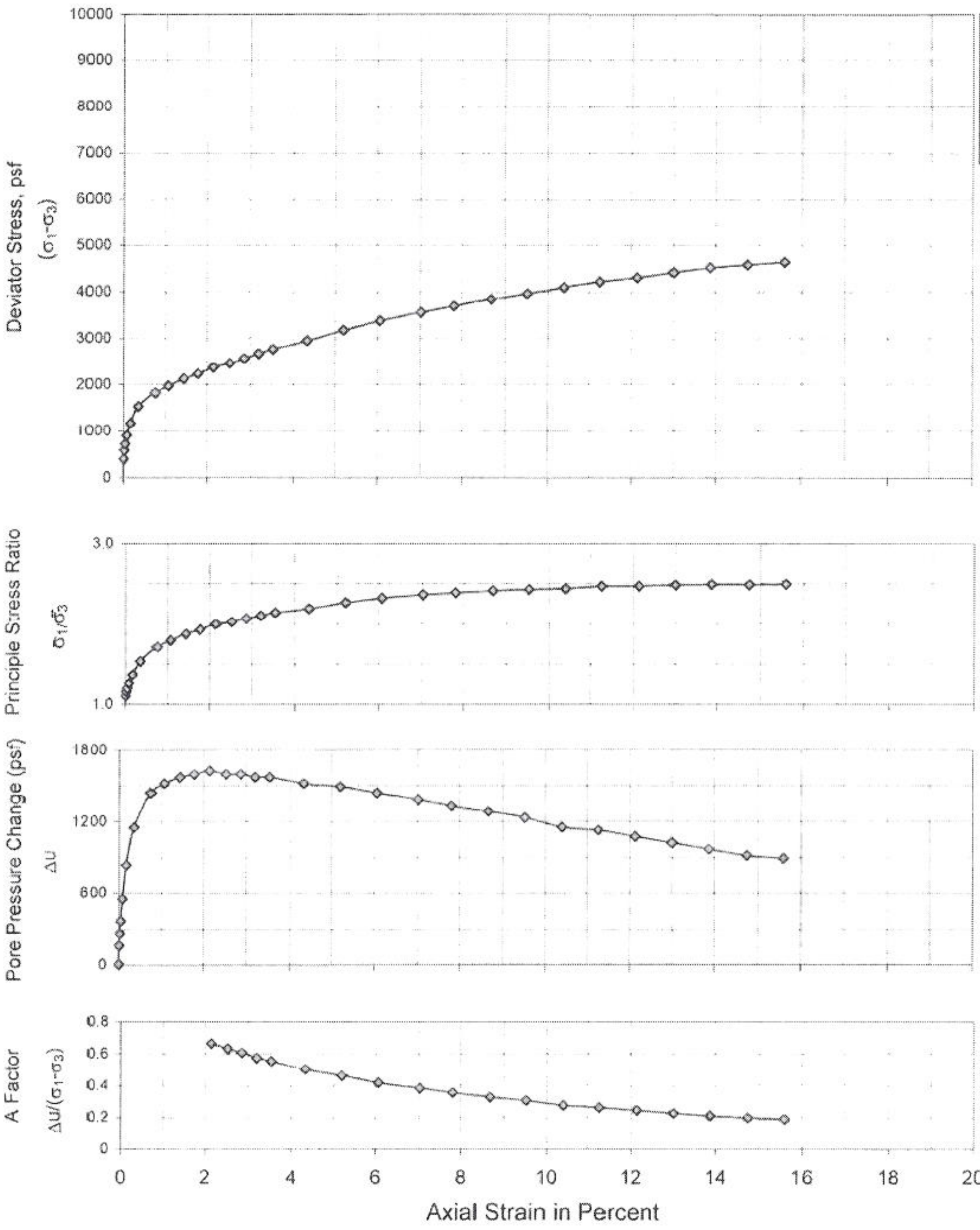
SOIL DESCRIPTION: Brown SILT and fine SAND
LIQUID LIMIT: NT PLASTIC LIMIT NT SPECIFIC GRAVITY: NT

	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS		
TEST NO / SYMBOL	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN	SAMPLE DIAMETER, IN	INITIAL STRESS, ksf $\bar{\sigma}_1=\bar{\sigma}_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	RATE OF STRAIN, PERCENT PER MINUTE
T2.1.2	29.4	93.0	5.82	2.85	2.00	13.0	2.68	96.3	28.3	95.6	0.103

NRG Huntley Embankment Evaluation
Tonawanda, NY
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B-1
SAMPLE: ST-1
DEPTH: 14.8-15.3'
TEST NO: T2.1.2

FILE NO: 21.0056497.00
Date: 5/12/2009
Tech.: MST
Reviewer: DAS



$(\sigma_1-\sigma_3)$ (psf) = 4643
Strain % = 15.61
Stress Ratio = 2.49
Δu = 890.1
A = 0.19

Sketch
at
Failure

GZA GeoEnvironmental, Inc.

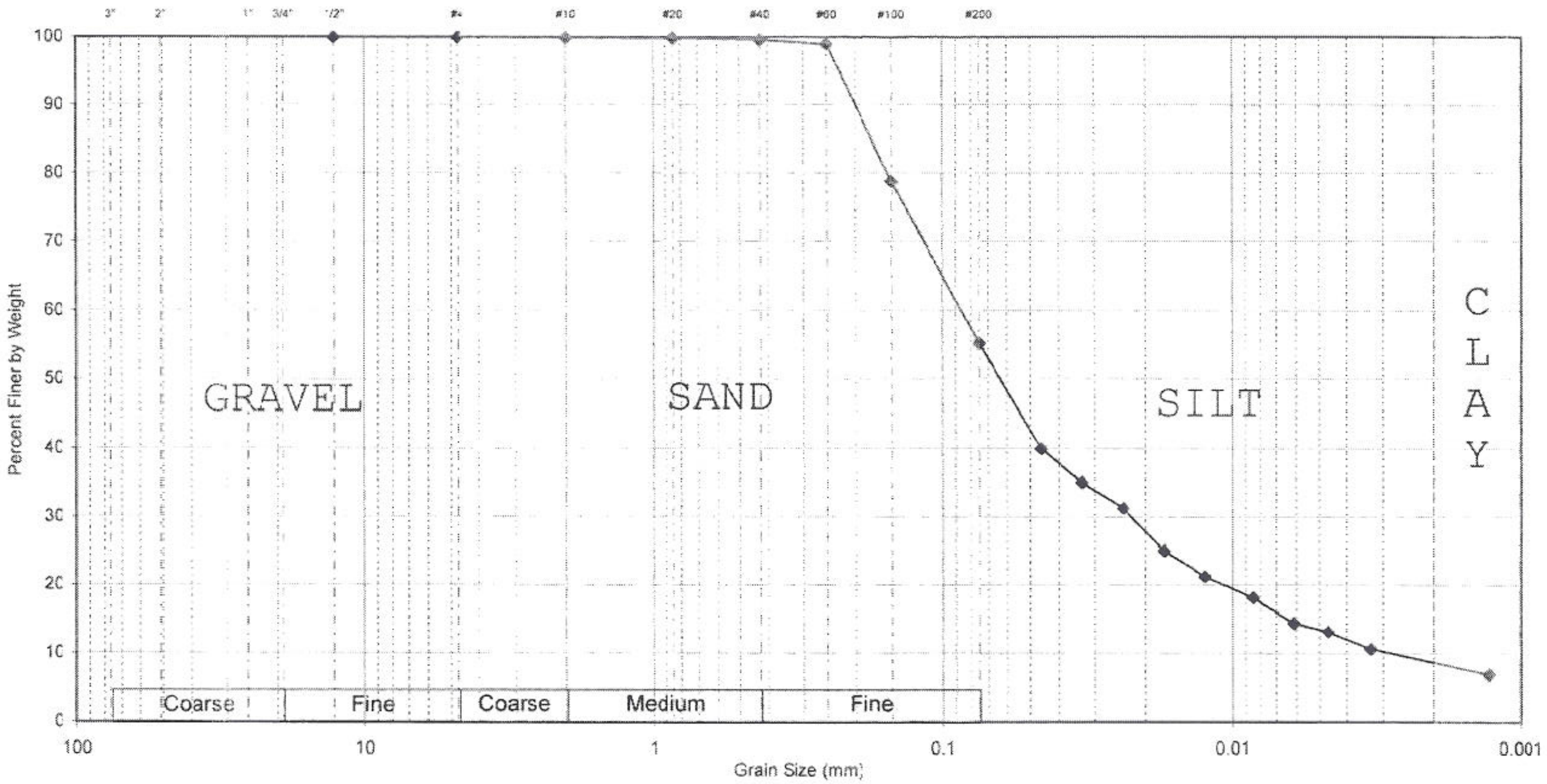
TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS		RATE OF STRAIN, PERCENT PER MINUTE
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN	SAMPLE DIAMETER, IN	INITIAL STRESS, ksf $\bar{\sigma}_1=\bar{\sigma}_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	
T2.1.3	30.0	91.4	5.82	2.86	4.00	13.0	2.72	98.2	28.7	94.0	0.069

SOIL DESCRIPTION: Brown SILT and fine SAND
LIQUID LIMIT: NT PLASTIC LIMIT NT SPECIFIC GRAVITY NT

NRG Huntley Embankment Evaluation
Tonawanda, NY
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B-1	FILE NO: 21.0056497.00
SAMPLE: ST-1	Date: 5/13/2009
DEPTH: 15.4-15.8'	Tech.: MST
TEST NO: T2.1.3	Reviewer: DAS

U.S. STANDARD SIEVE AND HYDROMETER



Gravel
0.0%

Sand
44.7%

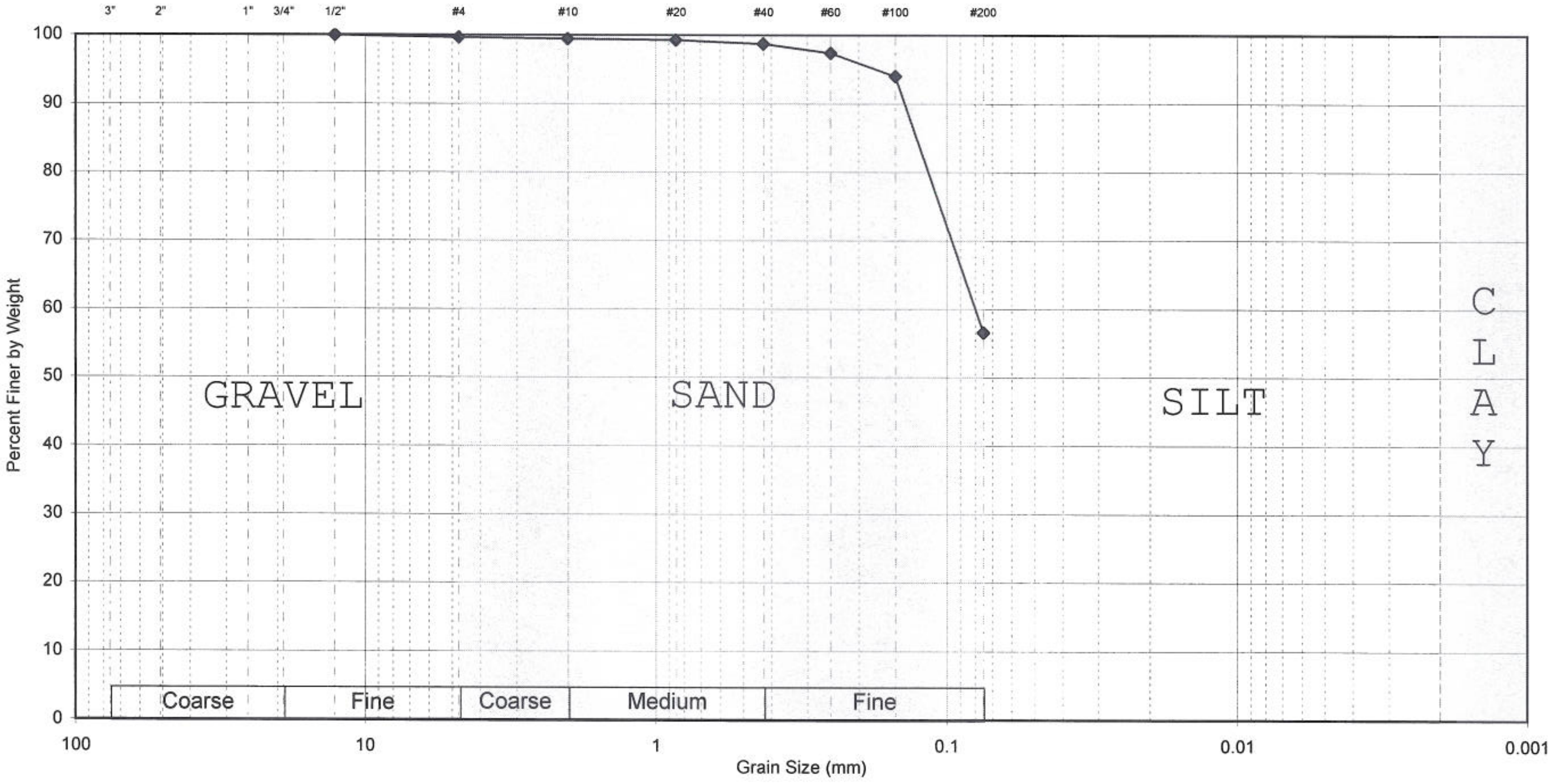
Fines
55 3%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
2	B-2	S-9	16-18'	Brown SILT and fine SAND				

NRG Huntley Embankment Evaluation
Tonawanda, NY
GZA File # 21.0056497.00

Tested by:	PEC	Date:	5/8/09
Reviewed by:	MBP	Date:	5/14/09

U.S. STANDARD SIEVE AND HYDROMETER



Gravel
0.3%

Sand
43.1%

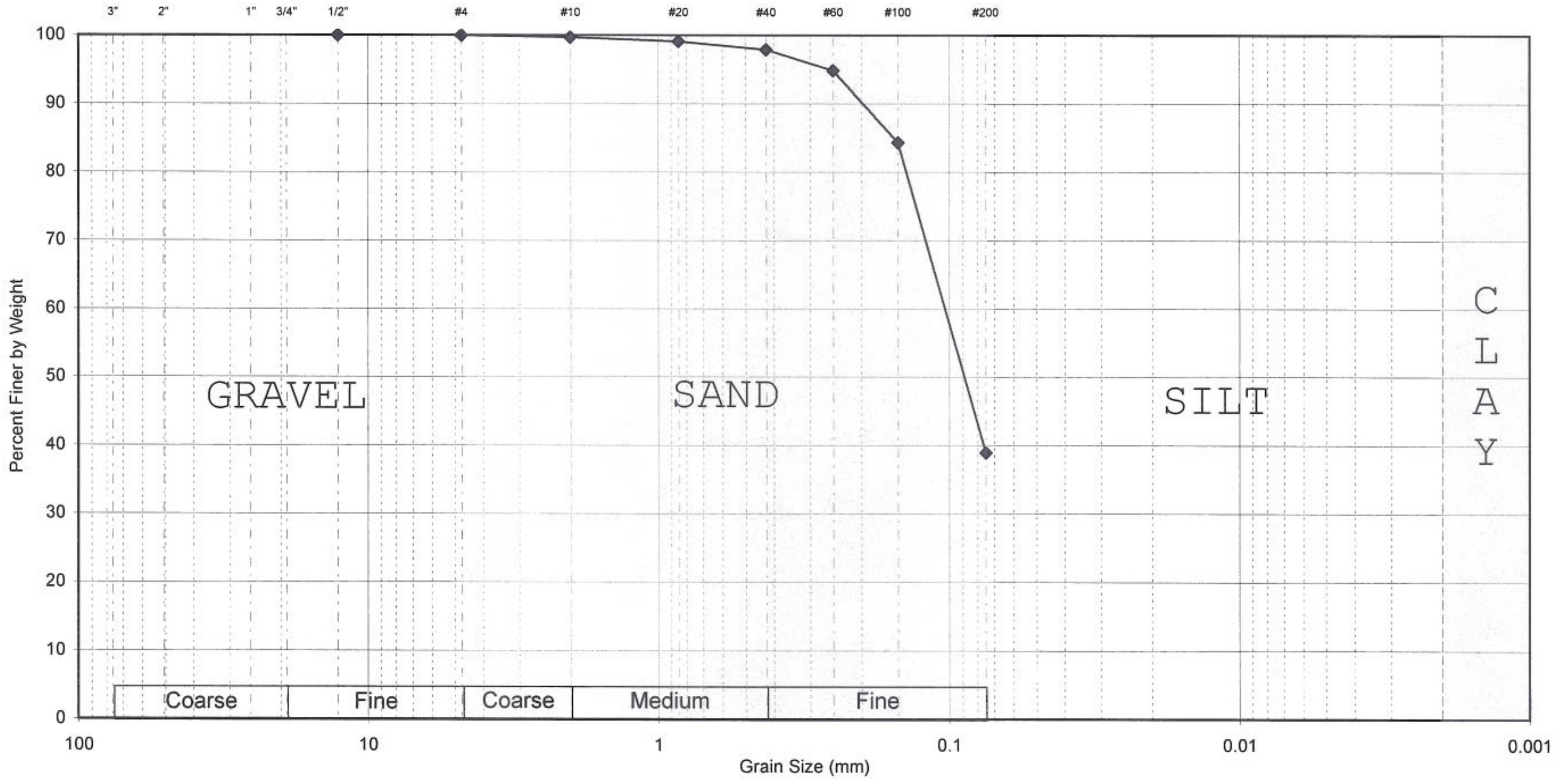
Fines
56.6%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
2.1.1	B-1	ST-1	14.2-14.8'	Brown SILT and fine SAND				

NRG Huntley Embankment Evaluation
Tonawanda, NY
GZA File # 21.0056497.00

Tested by:	PEC	Date:	5/18/09
Reviewed by:	MBP	Date:	5/19/09

U.S. STANDARD SIEVE AND HYDROMETER



Gravel
0.0%

Sand
61.1%

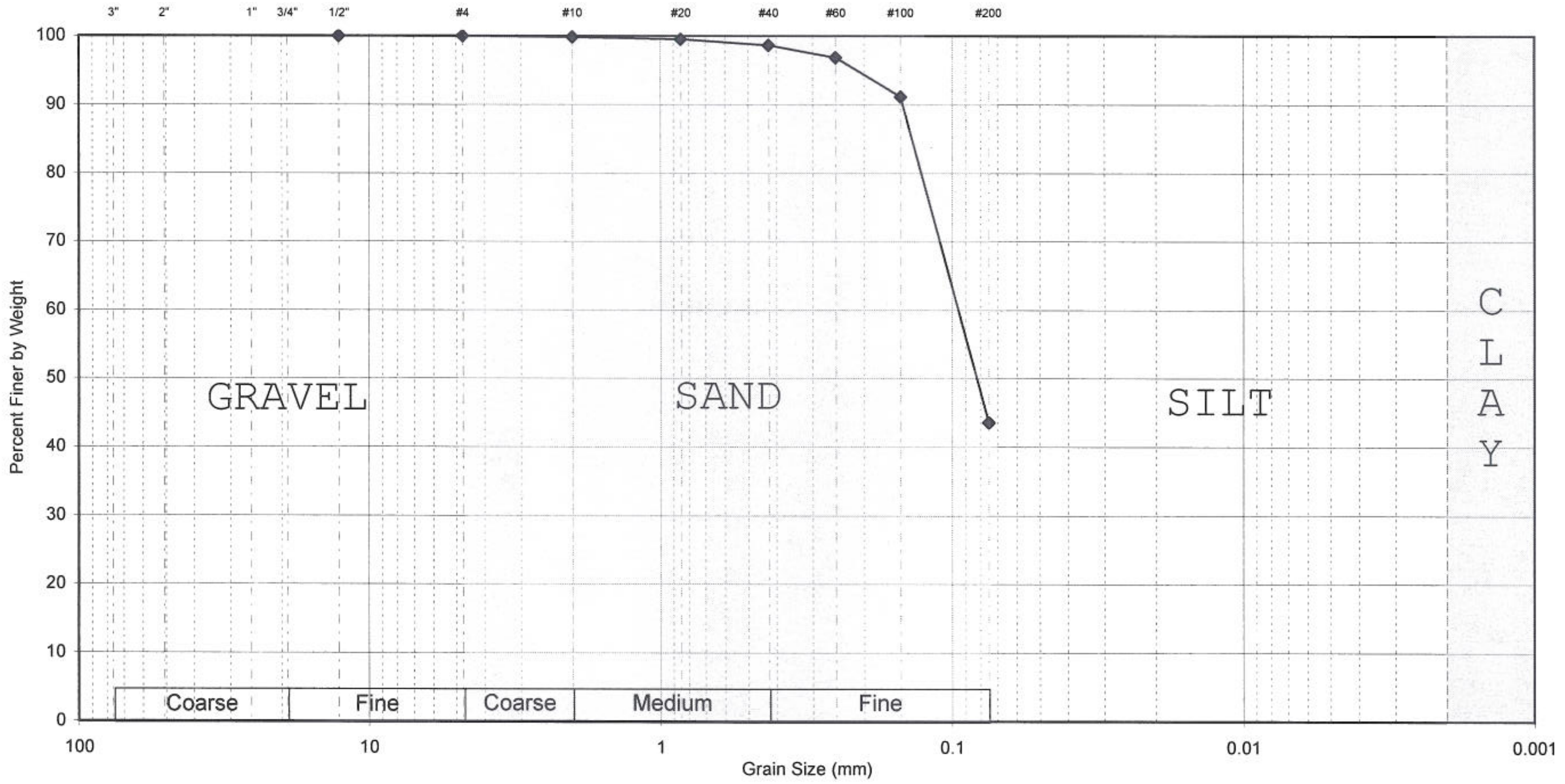
Fines
38.9%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
2.1.2	B-1	ST-1	14.8-15.3'	Gray fine SAND and SILT				

NRG Huntley Embankment Evaluation
Tonawanda, NY
GZA File # 21.0056497.00

Tested by:	PEC	Date:	5/18/09
Reviewed by:	MBP	Date:	5/19/09

U.S. STANDARD SIEVE AND HYDROMETER



Gravel
0.0%

Sand
56.4%

Fines
43.6%

Lab #	Exploration	Sample	Depth (ft)	Description	WC	LL	PL	PI
2.1.3	B-1	ST-1	15.4-15.8'	Gray fine SAND and SILT				

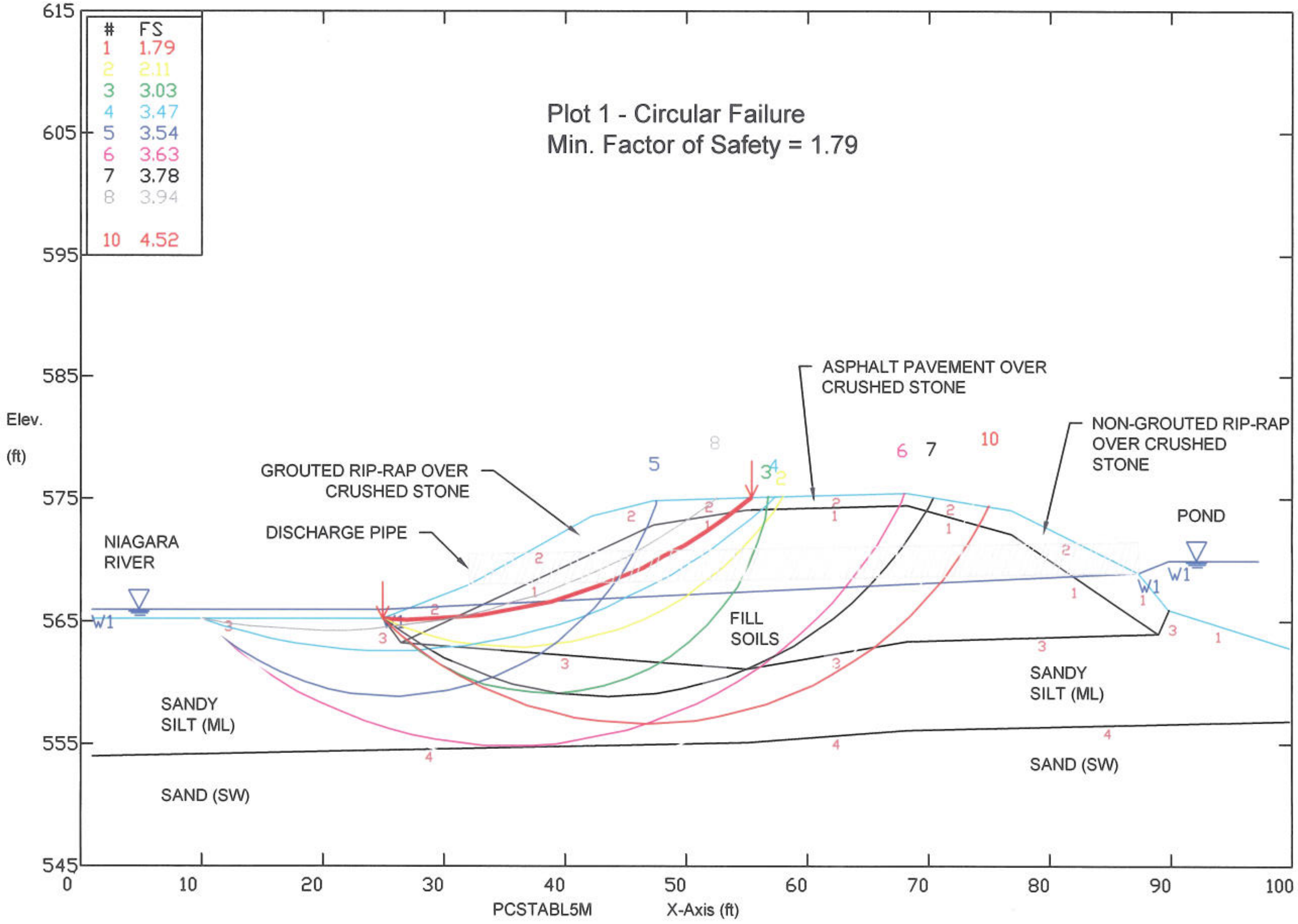
NRG Huntley Embankment Evaluation
Tonawanda, NY
GZA File # 21.0056497.00
Tested by: PEC Date: 5/18/09
Reviewed by: MBP Date: 5/19/09

ATTACHMENT 3

SLOPE STABILITY MODEL ANALYSIS

NRG Embankment Evaluation

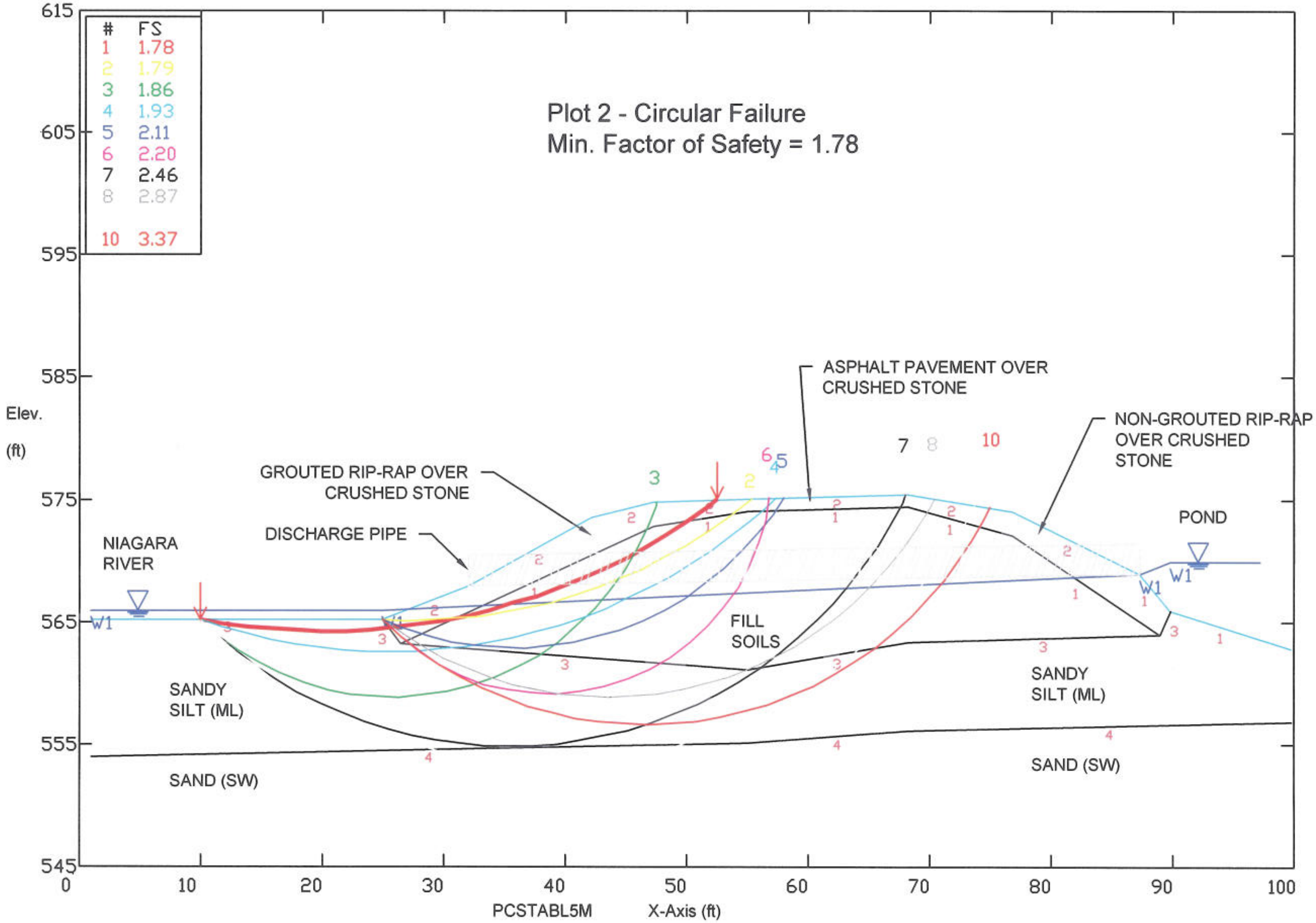
Ten Most Critical. C:NRG2.PLT By: djt 05-20-09 1:21pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1 FILL	128	130	0	30	0	0	0
2 RIP-RAP	140	140	0	40	0	0	0
3 SANDY SILT	120.5	124.5	560	19	0	0	0
4 SAND	130	132	0	32	0	0	0

NRG Embankment Evaluation

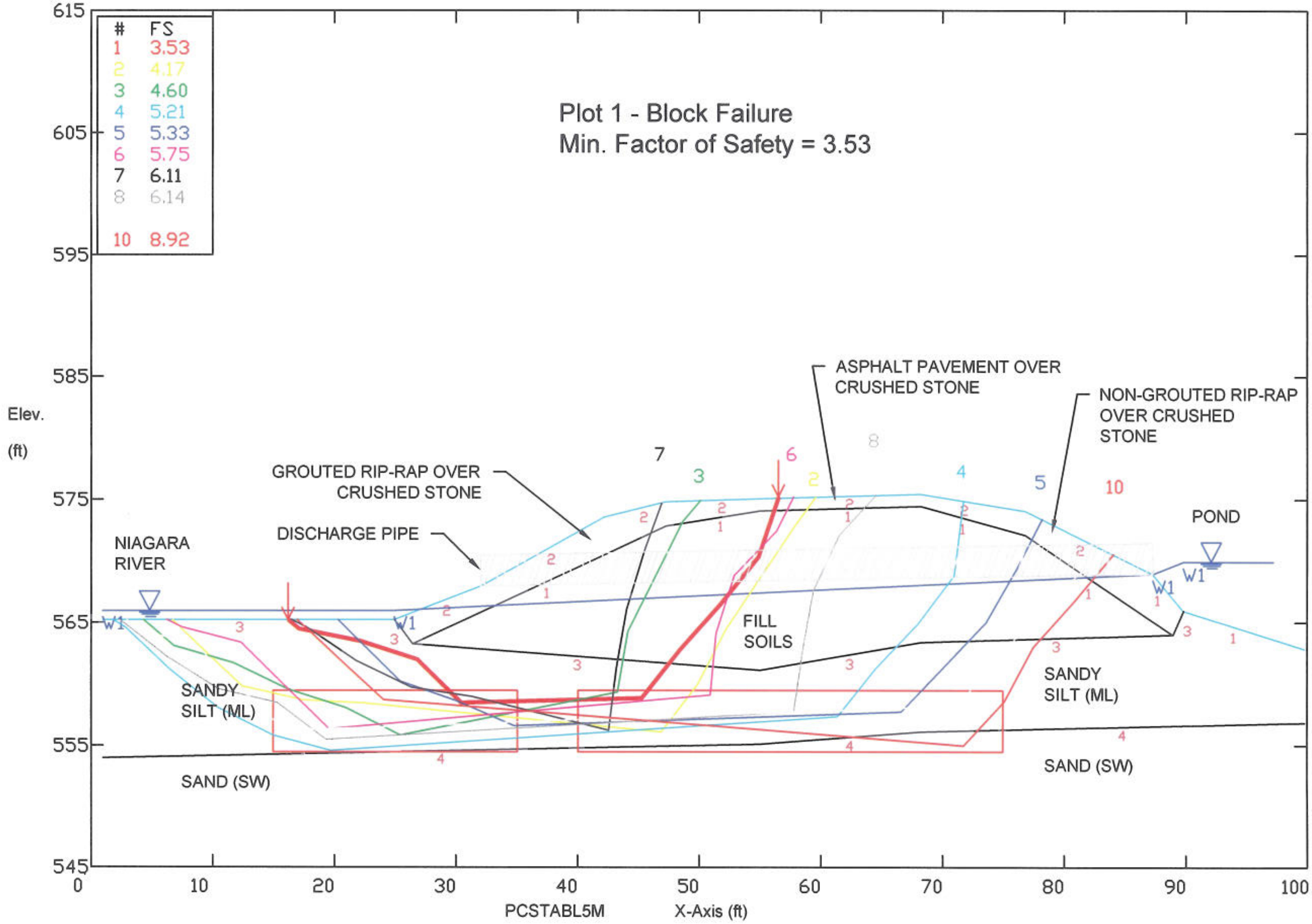
Ten Most Critical. C:NRG1.PLT By: djt 05-20-09 1:16pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1 FILL	128	130	0	30	0	0	0
2 RIP-RAP	140	140	0	40	0	0	0
3 SANDY SILT	120.5	124.5	0	25	0	0	0
4 SAND	130	132	0	32	0	0	0

NRG Embankment Evaluation

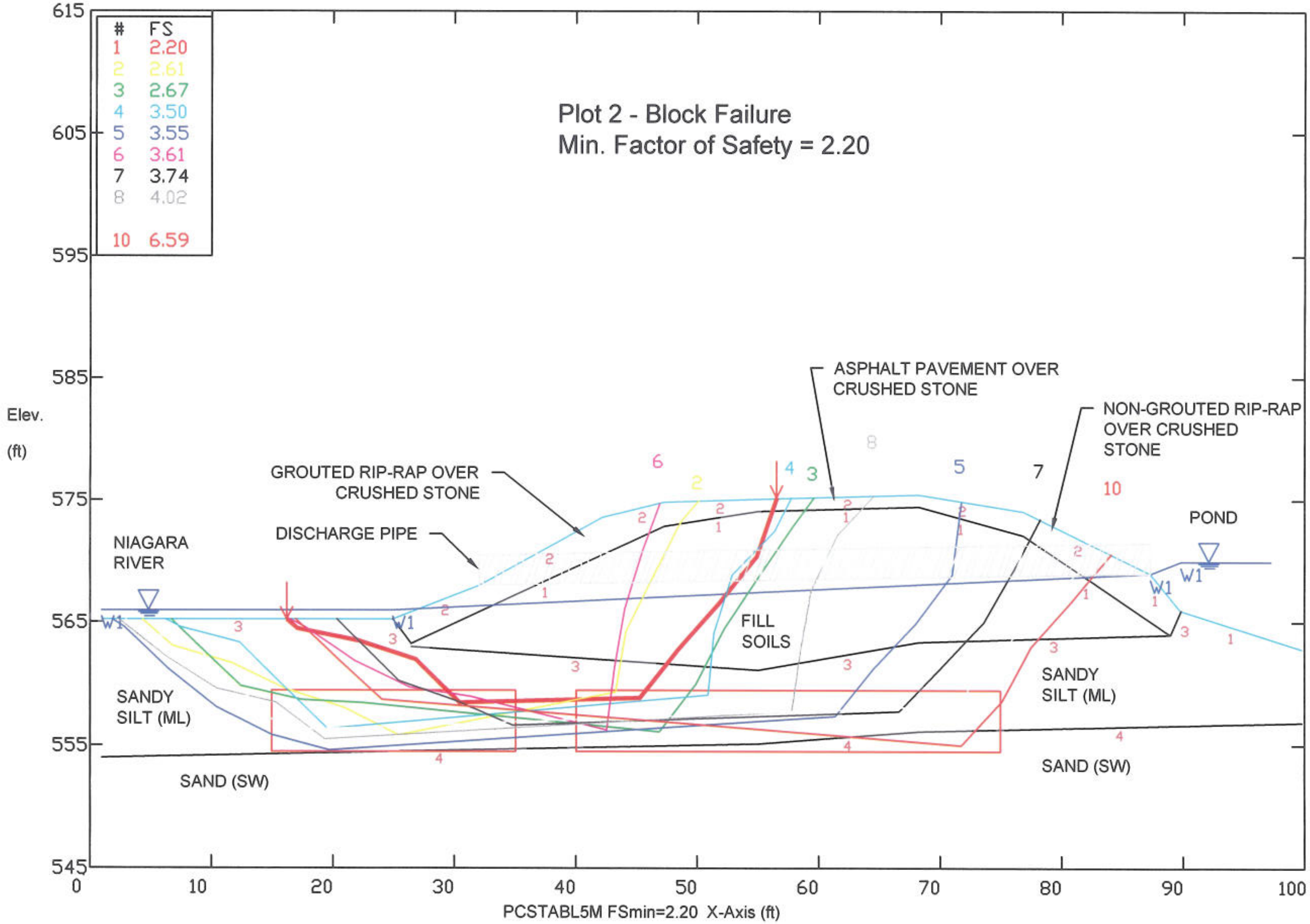
Ten Most Critical. C:NRG4.PLT By: djt 05-20-09 1:25pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1 FILL	128	130	0	30	0	0	0
2 RIP-RAP	140	140	0	40	0	0	0
3 SANDY SILT	120.5	124.5	560	19	0	0	0
4 SAND	130	132	0	32	0	0	0

NRG Embankment Evaluation

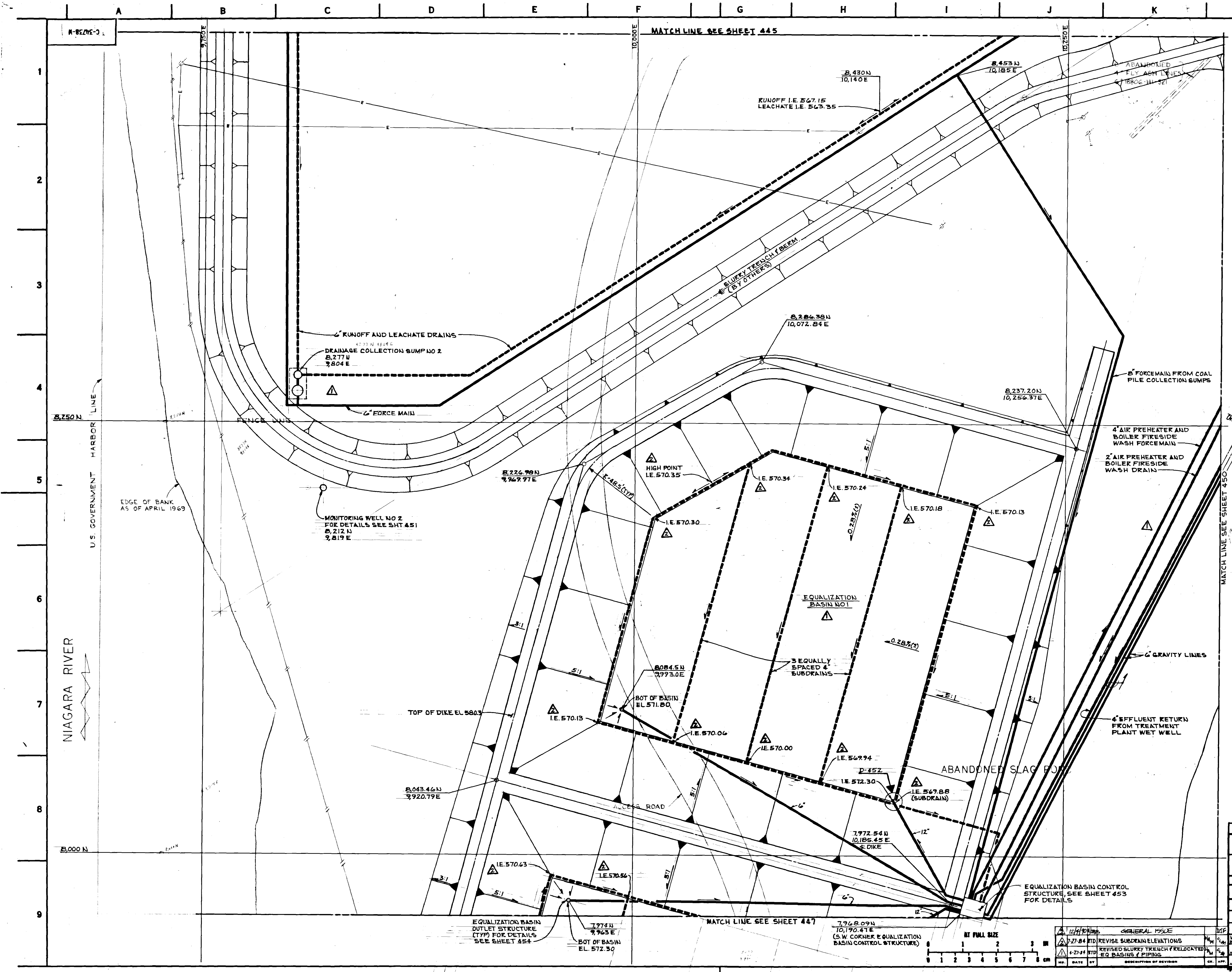
Ten Most Critical. C:NRG3.PLT By: djt 05-20-09 1:23pm

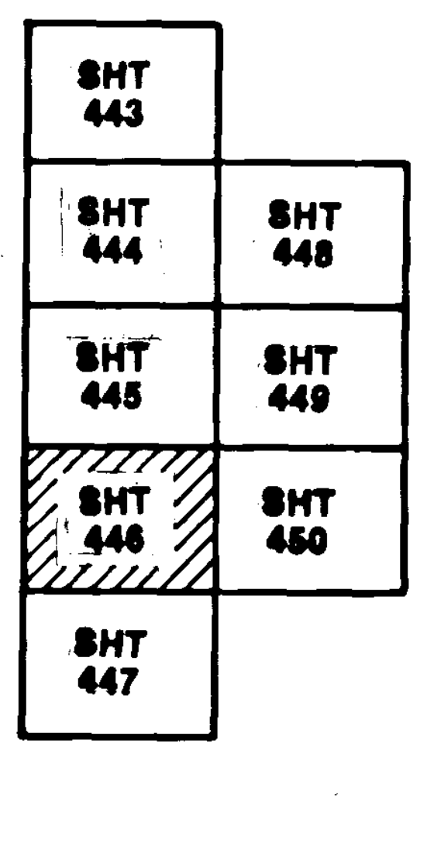


Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1 FILL	128	130	0	30	0	0	0
2 RIP-RAP	140	140	0	40	0	0	0
3 SANDY SILT	120.5	124.5	0	25	0	0	0
4 SAND	130	132	0	32	0	0	0

Add APPENDIX E

“DRAWING C-34738” with the C-34738-W Equalization Basins.pdf





KEY PLAN

NOTES:

1. THE SIZE, NUMBER AND LOCATION OF BURIED UTILITIES SHOWN ON THIS DRAWING ARE BASED ON THE BEST INFORMATION AVAILABLE; HOWEVER, EXTREME CARE SHOULD BE TAKEN DURING CONSTRUCTION SINCE LOCATION MAY NOT BE AS SHOWN, AND THERE IS THE POSSIBILITY THAT SOME UTILITIES MAY NOT BE SHOWN ON THIS DRAWING.
2. SCREENED LINES INDICATE ITEMS AND NOTES PERTAINING TO EXISTING FACILITIES AND ARE PROVIDED FOR INFORMATION ONLY. WORK TO BE PERFORMED BY THIS CONTRACT IS INDICATED BY SOLID LINES EXCEPT AS NOTED.
3. THE COORDINATE SYSTEM SHOWN ON THIS DRAWING IS BASED ON A EAST-WEST BASE LINE OF 10,000 EAST LOCATED AT STATION NO. 2 COLUMN ROW "C" AND A NORTH-SOUTH BASE LINE OF 10,000 NORTH LOCATED AT STATION NO. 2 COLUMN ROW "1".

ALTERATION OF THIS DOCUMENT EXCEPT BY A LICENSED PROFESSIONAL ENGINEER IS ILLEGAL.

CHARLES L. MEYER No. 049611

Charles L. Meyer
6/27/83

MK.	DATE	BY	DESCRIPTION OF REVISION	CK.	APP.
3	12/4/90	Jones	GENERAL ISSUE		DJF
2	7-27-84	RTD	REVISE SUBDRAIN ELEVATIONS	HAM	CLM
1	4-27-84	RTD	REVISED SLURRY TRENCH & RELOCATED EQ BASINS & PIPING	HAM	CLM

SC SHEET NO 446

NIAGARA MOHAWK RECORDED

NIAGARA MOHAWK POWER CORPORATION

C.R. HUNTLEY STEAM STATION
COAL PILE DRAINAGE COLLECTION SYSTEM
AND EQUALIZATION BASINS
ENLARGED SITE PLAN
SHEET 4 OF 8

DES. W. Thom CK. L.J.S. CK. H.A. Mann DATE 6-27-83 SCALE 1"= 20'
APP. APP. INDEX 3-HO-524
APP. APP. NO. C-34738-W

Add APPENDIX F

Huntley Inspection Report (GZA, September 13, 2012)

GZA
GeoEnvironmental
of New York

*Engineers and
Scientists*

535 Washington Street
11th Floor
Buffalo, New York
14203
716-685-2300
Fax: 716-685-3629
www.gza.com

September 13, 2012
File: 21.0056662.00

Mr. Joseph P. Schwab
NRG Energy
Joseph.Schwab@nrgenergy.com

Re: GZA Evaluation of Impoundment Embankments
Coal Combustion Surface Impoundments
NRG Energy Huntley Generating Station
Tonawanda, NY

Dear Mr. Schwab:

GZA GeoEnvironmental of New York (GZA) presents this letter report summarizing our evaluation of the coal combustion surface impoundment embankments at NRG's Huntley Generating Station in Tonawanda, New York (Site). We conducted a visual inspection of the embankments on Wednesday September 12, 2012 in general accordance with the New York State Department of Environmental Conservation (NYSDEC) "An Owners Guidance Manual for the Inspection and Maintenance of Dams in New York State".

GZA conducted this inspection in follow-up to a site reconnaissance conducted on July 6, 2012. The inspections were done on the following impoundments:

- North Basin Nos. 1, 2 and 3(vegetated embankments)
- South Equalization Basin (asphalt-lined bottom and embankments)
- North Equalization Basin (asphalt-lined bottom and embankments)
- South Ash Settling Basin (vegetated embankments)

NRG mowed down the heavy vegetation subsequent to July 6, to allow better inspection on September 16. NRG also patched distressed asphalt areas and applied asphalt sealant on the bottom liners and embankments of the South and North Equalization Basins.

Bart A. Klettke, P.E., of GZA, was accompanied by Joe Schwab, Regional Engineering and Construction Manager for NRG, and Joe Pietro, Environmental Coordinator at the Huntley Plant. Mr. Klettke observed and took photographs of the impoundments and their respective inlet and outlet flow structures. Photographs of the embankments are attached.

Our observance of the embankments showed the physical conditions to be in good to excellent condition, and in general conformance with their original design. The embankments generally had vegetative cover or hardscape protective cover (e.g. concrete matting, riprap, asphalt). We did not observe evidence of:

- ○ Sinkholes caused by internal erosion of embankment via piping.
- ○ Slide, Slump or Slip of the embankment slopes
- ○ Broken Down or Missing Slope Protection

- Erosion
- Rodent Activity and Animal Impact which could create holes, tunnels and caverns.

In our opinion the existing vegetative and/or hardscape cover is sufficient to maintain stability for the impoundment embankments at the Huntley facility. We recommend that the vertical-walled incised embankments located at the north end of the south ash settling basin be sloped back or reinforced with large-size riprap/concrete slabs to provide better stabilization. This recommendation is made mainly for safety purposes for the dredging operations performed there – we do not feel that these embankments pose an environmental concern.

We trust this information satisfies your needs for this project.

Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

Bart A. Klettke

Bart A. Klettke, P.E.
Associate Principal
(716) 844-7035
bart.klettke@gza.com

Attachments:

North Ponds

Attachment 1 – North Pond No. 1 Photographs
Attachment 2 – North Pond No. 2 Photographs
Attachment 3 – North Pond No. 3 Photographs

South Ponds

Attachment 4 – South Ash Settling Basin Photographs
Attachment 5 – North and South Equalization Basin Photographs

Add APPENDIX G

GZA Letter Response (September 13, 2012, Hydraulic and Stability Analyses)

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September 13, 2012
File: 21.0056662.00

Mr. Joseph P. Schwab
NRG Energy
Joseph.Schwab@nrgenergy.com

Re: GZA Letter Response to AMEC
Dam Safety Assessment Report of
Coal Combustion Surface Impoundments
NRG Energy Huntley Generating Station
Tonawanda, NY

Dear Mr. Schwab:

GZA GeoEnvironmental of New York (GZA) presents this letter response to the comments and recommendations presented in a recent Draft Report of Dam Safety Assessment of the coal combustion surface impoundments at NRGs Huntley Generating Station in Tonawanda, New York (Site). The report was issued by the United States Environmental Protection Agency (EPA) from a study conducted by AMEC Earth & Environmental, Inc. (AMEC).

BACKGROUND

The EPA has conducted nation-wide assessments of Coal Combustion Waste (CCW) impoundments at coal combustion energy producers. AMEC was hired by EPA to perform assessments of six (6) ponds at NRG's Huntley Site. AMEC's June 2011 assessment included a site visit to perform visual observations, inventory the CCW surface impoundments, assess the containment dikes, and to collect relevant historical impoundment documentation. Condition assessments, as accepted by the National Dam Safety Review Board (NDSRB), were ascribed by AMEC to each of the 6 impoundments, ranging from: "Satisfactory" – "Fair" – "Poor" – "Unsatisfactory" – "Not Rated" (ratings are defined below). AMEC completed EPA's Coal Combustion Dam Assessment Checklists and CCW Impoundment Assessment Forms. The Impoundment Inspection Forms include a section that assigned a "Hazard Potential" rating ranging from "Less than Low" – "Low" – "Significant" – "High". A summary of AMEC's assessments are presented below in our review of their report.

PURPOSE AND SCOPE OF WORK

NRG requested that GZA review the EPA/AMEC draft report[1] and assist NRG in preparing a response letter to their findings and recommendations, as NRG does not agree with some of EPA/AMEC's statements and conclusions in the report.

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[1] "Report of Dam Safety Assessment of Coal Combustion Surface Impoundments, NRG Energy Huntley Generating Station, Tonawanda, NY (AMEC Project No. 3-2106-0194)", prepared by AMEC for U.S. EPA, dated September 2011.

To accomplish NRG's objectives, we performed the following.

- Reviewed the draft EPA/AMEC report;
- Performed reconnaissance of the Site, on July 6, 2012, to check the physical conditions of the impoundments and contributing process inflows and approximate watershed areas to each. GZA also took photographs of the impoundments;
- Reviewed existing available design and/or as-built drawings of the 6 ponds and reports describing inflows and outflows;
- Conducted hydrologic/hydraulic analyses of the 6 ponds for the given inflows of process waters and contributing watersheds, and the possible impact from the flood tailwater on the adjacent Niagara River;
- Reviewed our July 2009 geotechnical evaluation[2] of the South Ash Settling Pond to address specific comments made by EPA/AMEC;
- Conducted slope stability analyses of the north ponds incorporating results of the hydrologic/hydraulic analyses; and
- Prepared this draft response letter summarizing our general engineering judgments given the current site conditions. We provide our opinion as to what the appropriate classification should be for the 6 impoundments, based on accepted EPA qualifiers or rankings.

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[2] "(South Ash) Settling Pond Outlet Embankment Evaluation", Huntley Generation Plant, Tonawanda, NY, by GZA GeoEnvironmental of New York, July 1, 2009.

REVIEW OF AMEC/EPA DRAFT REPORT

The following table summarizes AMEC's Condition Assessment and Hazard Potential for each pond/basin, and their rationale for the assigned Assessment and Hazard Rating. The Condition Assessment and Hazard Potential rating systems are defined in the sections presented below the table.

POND	NDSRB Condition Assessment	AMEC Rationale in Assigning Condition Assessment	EPA Hazard Potential Rating	AMEC Rationale in Assigning Hazard Potential
Pond 1	Poor	Lack of Hydrologic and Static and Stability Analysis Documentation	Low	Small pond where unlikely failure would have discharge with little impact to adjacent Ponds 2 and 3.
Pond 2	Poor	Lack of Hydrologic and Static and Stability Analysis Documentation	Significant	Release from Pond 2 outlet to ditch discharging to Niagara River would cause economic and/or environmental damage.
Pond 3	Poor	Lack of Hydrologic and Static and Stability Analysis Documentation	Significant	Release from Pond 3 outlet to ditch discharging to Niagara River would cause economic and/or environmental damage.
North Equalization Basin	Poor	Lack of Hydrologic and Static and Stability Analysis Documentation	Significant	Release from Basin would discharge to Niagara River causing economic and/or environmental damage.
South Equalization Basin	Poor	Lack of Hydrologic and Static and Stability Analysis Documentation	Significant	Release from Basin would discharge to Niagara River causing economic and/or environmental damage.
South Ash Settling Basin	Poor	Lack of Hydrologic and More Complete Stability Analysis Documentation*	Significant	Release from Basin would discharge directly to Niagara River causing economic and/or environmental damage.

*Specific to the South Ash Settling Pond, AMEC's review included a review of GZA's "Settling Pond Outlet Embankment Evaluation" report of July 2009, where our general opinion was that the embankment would have a hazard rating classification of low to remote. EPA/AMEC stated that the South Ash Settling Pond was rated "Poor" due to lack of a hydrologic/hydraulic study and a more complete stability analysis (seismic evaluation and re-consideration of friction angle parameters used in our study).

GZA reviewed the draft report prepared by AMEC. AMEC assigned a Condition Assessment of each pond using the following rating system acceptable by the NDSRB.

SATISFACTORY

No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.

FAIR

No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.

POOR

A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are necessary.

UNSATISFACTORY

A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

NOT RATED

The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

AMEC completed EPA's Coal Combustion Dam Assessment Checklists and CCW Impoundment Assessment Forms. The Impoundment Assessment Forms include a section that assigns a "Hazard Potential" that is used to indicate what would likely occur following failure of an impoundment. "Hazard Potential" definitions are as follows.

LESS THAN LOW HAZARD POTENTIAL

Failure or mis-operation of the dam results in no probable loss of human life or economic or environmental losses.

LOW HAZARD POTENTIAL

Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

SIGNIFICANT HAZARD POTENTIAL

Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of

> lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
>
> **LOW HAZARD POTENTIAL**
>
> Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

GZA SITE RECONNAISSANCE AND REVIEW OF EXISTING DRAWINGS AND REPORTS

GZA conducted a site reconnaissance on July 6, 2012. Bart A. Klettke, P.E., of GZA, was accompanied by Joe Schwab, Regional Engineering and Construction Manager for NRG. Mr. Klettke observed and took photographs of the impoundments, their respective inlet and outlet flow structures, and contributory watershed areas.
Available existing drawings and reports were provided by Mr. Schwab. The drawing and report information was used to develop the figures presented herein and to perform the hydrologic/hydraulic analyses described below.

General descriptions of the waste flows into the North and South Basins are as follows.

North Basins

The North Basins (Ponds 1, 2 and 3) no longer receive Coal Combustion Waste (CCW), but may contain residual ash from their former use. The ponds currently receive flows from drainage from the north wastewater collection system, which includes sub-basement sump pumps, roof and floor drains, auxiliary cooling system drains and de-mineralized water production wastes.

A plan view of the North Basins is presented on attached Figure 1. Basin and drainage pipe information is provided on the figure. Figure 2 shows cross-sections of the outlet drainage pipes from Ponds 2 and 3 draining into the adjacent drainage ditch.

South Basins

The North and South Equalization Basins receive flows from wastewater associated with the air pre-heater washes and coal pile runoff sump pumps. The North and South Equalization basins are treated by an on-site Wastewater Treatment Facility which discharges into the plant’s Low Level Waste Water Pit through internal SPDES Outfall 007A and ultimately to the Niagara River through the South Ash Settling Basin and SPDES Outfall 008. The South Ash Settling Pond receives flow from sluice waters and suspended solids from Unit 67 and Unit 68 bottom ash and economizer ash systems and discharge from the Low Level Waste Water Pit. The Low Level Pit discharge includes rain water from roadway drains, sub basement sump drains, boiler water releases, Huntley 1 roof and floor drains, auxiliary cooling systems drains and discharge from the Wastewater Treatment facility from treating the North and South Equalization basin water.

A plan view of the South Basins is presented on attached Figure 3. Basin and drainage pipe information is provided on the figure. Figure 4 presents a cross-sectional photograph of the southwest corner of the South Equalization Basin, showing dimensions for discussion purposes presented in our Conclusions section below.

HYDROLOGIC/HYDRAULIC ANALYSES

Pond 1, Pond 2, Pond 3, the North Equalization Basin, the South Equalization Basin and the South Ash Settling Pond have been rated to be in Poor condition primarily due to the lack of hydrologic and hydrologic documentation for the ponds. This condition rating was recommended by AMEC. AMEC, therefore, recommended that the design flood for these ponds be the ½ Probable Maximum Flood (½ PMF). The objective of our analysis was to calculate and document maximum water surface elevations under ½ PMF conditions.

The inputs for this analysis were based on the information gathered by GZA, upon reviewing historical drawings and other design documents made available to GZA by NRG Energy. The computer software of BOSS HMR52 (v.1.10) developed by BOSS International and HEC-HMS (v.3.5) developed by US Army Corps of Engineers Hydrologic Engineering Center were utilized for the analysis.

All elevations refer to the vertical datum of IGLD 1955 to be consistent with previous design drawings and documents, unless otherwise noted.

1/2 Probable Maximum Flood Analysis

The Probable Maximum Precipitation (PMP) for the project site was estimated using the BOSS HMR52 computer software, developed by BOSS International, based on National Oceanic and Atmospheric Administration (NOAA) Hydrometeorological Report Nos. 51 and 52 (Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, 1978 and 1982). We adjusted storm orientation, centroid, and temporal distribution of rainfall to optimize/maximize the total volume of the 72-hour PMP. The ten-square-mile PMP for the project site was calculated to be 33.0 inches over a 72-hour duration, 22.4 inches of which occurs within a 6-hour period. The temporal distribution of the PMP calculated by BOSS HMR52 was then applied to the stormwater contributory areas of North and South Ponds in the HEC-HMS models. The 10-minute incremental output data file is attached.

The ½ PMF was selected to be the design flood for North Ponds and South Ponds, based on the hazard potential of the ponds being significant/moderate, per Mine Safety and Health Administration (MSHA) Minimum Long Term Hydrologic Design Criteria. In HMS a ratio of 50 percent was applied to the calculated discharge from application of the full PMP to each watershed.

500-year Flood in Niagara River

The North and South Ponds ultimately discharge to the Niagara River. The analysis assumes a 500-year flood elevation in the river. The 500-year flood elevation between "Interstate Route 190" and "Limit of Detailed Study" was estimated to be approximately El.571.5 in NGVD 1929 Datum, based on "Flood Profiles / Niagara River – Tonawanda Channel" included in the FEMA Flood Insurance Study for Town of Tonawanda, New York, dated February 1981. The conversion between NGVD 1929 and IGLD 1955 for the site location was estimated to be:

IGLD 1955 (ft) = NGVD 1929 (ft) – 0.85 ft

Therefore, the 500-year flood elevation in Niagara River was calculated to be El.570.65 in the IGLD 1955 Datum, and represents the tailwater level from subsequent hydraulic routing computations from the basins.

HMS Analysis

The North Ponds and South Ponds were analyzed as two independent hydrologic systems in HEC-HMS. Setup schematics for the two basin models are attached. A summary of the hydrologic elements used for the analysis is given below.

Inputs for North Ponds

The North Ponds consist of three inter-connected ponds, Pond 1 through Pond 3. Pond 1 receives a maximum process inflow of about 1,950 gpm (4.34 cfs) at its southwest corner and discharges to Ponds 2 and 3 through two, 43-in by 27-in galvanized arched pipes to the north, while Ponds 2 and 3 each discharge to a drainage channel through a 24-in and 18-in diameter Corrugated Metal Pipe (CMP), respectively. The drainage channel conveys flow to the Niagara River through a 36-in diameter CMP.

Key elevations and dimensions are as follows:

	Dimension or Elevation (ft, IGLD 1955)
Pond 1	
Crest	579.0
In Invert of 43"x27" Outflow Pipe to Pond 2	576.1
Out Invert of 43"x27" Outflow Pipe to Pond 2	575.4
Length of 43"x27" Outflow Pipe to Pond 2	70
In Invert of 43"x27" Outflow Pipe to Pond 3	576.1
Out Invert of 43"x27" Outflow Pipe to Pond 3	575.7
Length of 43"x27" Outflow Pipe to Pond 3	40
Pond 2	
Crest	579.0
In Invert of 24"Ø Outflow Pipe to Drainage Channel	575.3
Out Invert of 24"Ø Outflow Pipe to Drainage Channel	575.0±
Length of 24"Ø Outflow Pipe to Drainage channel	50±

Pond 3

Crest	579.0
In Invert of 18"Ø Outflow Pipe to Drainage Channel	574.35
Out Invert of 18"Ø Outflow Pipe to Drainage Channel	573.4±
Length of 18"Ø Outflow Pipe to Drainage Channel	65±

The SCS (Soil Conservation Service, now known as Natural Resources Conservation Service, i.e. NRCS) Dimensionless Unit Hydrograph method was used in this analysis. Input parameters estimated by GZA for the watershed areas for North Ponds used in the HEC-HMS Model are summarized in **Table 1** below.

Table 1: HEC-HMS Watershed Input – North Ponds

HEC-HMS Model	Subbasin	Drainage Area		Runoff Potential (SCS Curve Number) *	Watershed Lag Time (min)
		(sq mi)	(sq ft)		
North Ponds	Pond 1	0.001159	32,300	94	6
	Pond 2	0.001865	52,000	99	6
	Pond 3	0.001998	55,700	95	6

*Note: Composite curve numbers with CN of 99 for water and 89 for land.

Tables 2 through **4** present the elevation-area and elevation-storage relationships that GZA developed for the subbasins for the North Ponds.

Table 2: Reservoir Elevation-Area Function for Pond 1

Elevation (ft, IGLD 1955)	Area		Storage (acre-ft)
	(sq ft)	(ac)	
575	8,000	0.184	0
576.1	17,500	0.402	0.3
579	32,300	0.742	1.9

Table 3: Reservoir Elevation-Area Function for Pond 2

Elevation (ft, IGLD 1955)	Area		Storage (acre-ft)
	(sq ft)	(ac)	
575	35,000	0.803	0
576.1	51,500	1.182	0.3
579	52,000	1.194	4.7

Table 4: Reservoir Elevation-Area Function for Pond 3

Elevation (ft, IGLD 1955)	Area		Storage
	(sq ft)	(ac)	(acre-ft)
574	16,300	0.374	0
574.35	35,300	0.810	0.2
579	55,700	1.279	5.0

Initial Water Surface Elevation

For North Ponds, the initial water surface elevations in the ponds were assumed to coincide with the invert elevations of the outflow structures, i.e. El.576.1, El.575.3 and El.574.35 for Ponds 1, 2 and 3, respectively.

Tailwater Conditions

Under the ½ PMF to the ponds, the water surface elevations are going to rise in all these ponds. Based on the invert elevations and pool elevations, the two 43'' by 27'' outflow pipes that convey flows from Pond 1 to Ponds 2 and 3 will be under the influence of the downstream water levels in Ponds 2 and 3. GZA adopted a simplified approach to the "pond in series" configuration and thus analyzed two separate cases. In Case A, the tailwater elevations were assumed not to affect discharge through the two pipe arches. Case A therefore assumes the highest capacity through the pipes between Pond 1 and Ponds 2 and 3 with no restrictions from tailwater. In Case B, the calculated peak water elevations in Ponds 2 and 3 from Case A were used as the tailwaters for the same outflow pipe arches above. Case B represents a lower pipe capacity per unit head.

The tailwater elevation at the drainage channel is assumed to be at El.570.65, representing the 500-year peak flood level in Niagara River. Tailwater for Ponds 2 and 3 was assumed to be constant at El.570.65, the 500-year flood elevation in the Niagara River and the elevation in the discharge channel.

Inputs for South Ponds

The South Ponds consist of three basins- the North and South EQ Basins and the South Ash Settling Basin. The North and South EQ Basins receive a maximum process inflow of 500 gpm (1.11 cfs) from the plant and share a 12-in diameter outflow pipe to the South Ash Settling Basin. Because the EQ basins share a single outflow pipe they were modeled as a single reservoir element in HEC-HMS. The water levels in the EQ basins are also controlled by an outflow pump. Pump specifics and operational rules were not available therefore the outflow pump was not included in the analysis. The South Ash Settling Basin receives a maximum inflow of about +-6,800 gpm (15.15 cfs) at the north end and discharges to the Niagara River through a 92-in by 65-in steel pipe arch at the southwest corner. The modeling effort included a sensitivity analysis to evaluate the impact of varying the process inflows.

Key elevations and dimensions are as follows:

	Dimension or Elevation (ft, IGLD 1955)
North & South EQ Basins	
Crest	580.3
In Invert of 12''Ø Outflow Pipe to South Settling Basin	579.3
Out Invert of 12''Ø Outflow Pipe to South Settling Basin	570±
Length of 12''Ø Outflow Pipe to South Settling Basin	120±
South Ash Settling Basin	
Crest	580.3
In Invert of 92"x65" Outflow Pipe to Niagara River	568.94
Out Invert of 92"x65" Outflow Pipe to Niagara River	568.04
Length of 92"x65" Outflow Pipe to Niagara River	55±

Key input parameters for the watershed areas in the HEC-HMS model are summarized in **Table 5** below:

Table 5: HEC-HMS Watershed Input – South Ponds

HEC-HMS Model	Subbasin	Drainage Area		Runoff Potential (SCS Curve Number) *	Watershed Lag Time (min)
		(sq mi)	(sq ft)		
South Ponds	North and South EQ Basin	0.00475	132,400	99	6
	South Ash Settling Basin	0.012329	343,700	95	6

*Note: Composite curve numbers with CN of 99 for water and 89 for land.

Tables 6 and **7** present the elevation-area and elevation-storage relationships that GZA developed for the subbasins for the South Ponds.

Table 6: Reservoir Elevation-Area Function for North & South EQ Basins (Combined)

Elevation (ft, IGLD 1955)	Area		Storage (acre-ft)
	(sq ft)	(ac)	
572	66,320	1.522	0
580.3	132,400	3.039	18.6

Table 7: Reservoir Elevation-Area Function for South Ash Settling Basin

Elevation	Area		Storage
(ft, IGLD 1955)	(sq ft)	(ac)	(acre-ft)
563	114,000	2.617	0
575	200,000	4.951	42.7

Initial Water Surface

The initial water surface elevation for the North and South EQ Basins are assumed to be at the elevation of the overflow structure, El.579.3. The EQ Basins are typically maintained at lower elevations by utilizing the outflow pump. A sensitivity study was performed to evaluate the influence of varying the initial water surface elevation.

The initial water surface elevation in the South Ash Settling Pond is assumed to be coincident with the Niagara River, El.570.65, because the invert of the outflow pipe is at El.568.94.

Tailwater Conditions

Tailwater for the pipe from the EQ Basins to the South Ash Settling Pond was set at El.571.5 for the runs for South Ponds. The tailwater for South Ash Settling Basin was constantly set at El.570.65, the 500-year flood in Niagara River.

RESULTS

North Ponds

The results for North Ponds are summarized in **Table 8** below. Case A assumes a low tailwater condition (i.e. outlet capacity is not impacted by the tailwater elevation). Case B assumes a high tailwater condition (i.e. outlet capacity is impacted by the tailwater elevation).

Table 8: HEC-HMS Results for North Ponds (1/2 PMF)

Case	Pond	Watershed Runoff (in)	Peak Inflow (cfs)	Peak Outflow (cfs)	**Max WSEL (ft)**	Min Freeboard[1] (ft)	Tailwater Elev. (ft)
A[2]	1	16.1	11	5	**576.8**	2.2	None / None[2]
	2	16.4	14	7	**576.8**	2.2	570.65
	3	16.2	15	7	**576.1**	2.9	570.65
B[3]	1	16.1	11	5	**576.9**	2.1	576.8 / 576.1[3]
	2	16.4	14	4	**576.4**	2.6	570.65
	3	16.2	17	8	**576.5**	2.5	570.65

Notes:

1. Assumed top of berm at El.579.0 for Ponds 1 through 3.
2. Tailwater elevations for Pond 1 assumed not to affect the discharges from the outflow pipes.
3. Tailwater elevations for Pond 1 assumed to be fixed at the peak water levels of Ponds 2 and 3 that was estimated for Case A.

The results indicate that the North Ponds have the ability to safely pass the ½ PMF. The calculated minimum freeboard ranges from 2.1 to 2.9 feet.

South Ponds

The results for South Ponds are summarized in **Table 9** below. The sensitivity analysis included evaluating the impact of varying the initial water surface elevations for the EQ Basins. The analysis also included evaluating the impact of both including the 500 gpm inflow to the EQ Basins and assuming no pumped inflows to the EQ Basins.

Table 9: HEC-HMS Results for South Ponds (1/2 PMF)

Case	Pond	Initial WSEL (ft)	Process Inflow (gpm)	Watershed Runoff (in)	Peak Inflow (cfs)	Peak Outflow (cfs)	Max WSEL (ft)	Freeboard[1] (ft)
C	N. EQ	579.3	500	16.4	27	27	580.3	**OT**[2]
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	106	72	571.5	**3.5**
D	N. EQ	578	500	16.4	27	27	580.3	**OT**[2]
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	81	58	571.3	**3.7**
E	N. EQ	576	500	16.4	27	2	580	**0.3**
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	81	58	571.3	**3.7**
F	N. EQ	579.3	0	16.4	26	21	580.3	**OT**[2]
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	87	63	571.4	**3.6**
G	N. EQ	578	0	16.4	26	1	579.7	**0.6**
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	81	58	571.3	**3.7**
H	N. EQ	576	0	16.4	26	0.0	577.9	**2.4**
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	81	58	571.2	**3.8**

Notes:

1. Assumed top of berm at El.580.3 for North and South EQ Basins; assumed top of berm at El. 575.0 for South Ash Settling Basin.
2. "OT" denotes overtopping.
3. To alleviate the overtopping of the equalization basins, GZA analyzed an alternate condition for the north and south equalization basins to determine a revised elevation for the top of the overflow pipe in the basin's outflow structure. The analysis was run with the top of overflow pipe elevation established at 578.3' (1.0' below the existing 579.3'), tabulated as follows.

Case	Pond	Initial WSEL (ft)	Process Inflow (gpm)	Watershed Runoff (in)	Peak Inflow (cfs)	Peak Outflow (cfs)	Max WSEL (ft)	Freeboard[1] (ft)
Alternate	N. EQ	578.3	500	16.4	26	4	580.1	**0.2**
	S. EQ			16.4				
	S. Set.	570.65	6,800	16.2	84	60	571.5	**3.7**

Based on the above alternate case, NRG can lower the top of the existing overflow pipe, and associated maximum operating level, from Elevation 579.3’ to 578.3’, to prevent over-topping of the equalization basins for the ½-PMF event.

The results of the analysis are as follows:

- If NRG lowers the top of the existing overflow pipe, and associated maximum operating level, from Elevation 579.3’ to 578.3’, that will prevent over-topping of the equalization basins for the ½-PMF event.

- The water level in the South Ash Settling Basin is fairly stable under various scenarios. The water level rises between 0.6 and 0.8 feet from its initial water level, El.570.65. The minimum freeboard for the settling basin is greater than 3 feet under the ½ PMF event.

Based on the results presented above, GZA presents the following conclusions concerning our hydrological study:

1. For North Ponds 1, 2 and 3, the ½ PMF does not cause overtopping in any of the ponds. The calculated freeboard of 2.1 to 2.9 feet is adequate, in our opinion, to protect the berms from wave run-up given the overall small area of the impoundments.
2. For the North and South EQ Basins, the dominant factor impacting the potential for overtopping is the initial water surface elevations (and thus available surcharge storage).
3. The North and South EQ Basins will be overtopped during the ½ PMF when the initial water surface is below El.578.7 with no process inflow or below El.577.7 with a maximum process inflow of 500 gpm) regardless of whether process inflows are discharged to the basins. However, the North and South EQ Basins will not be overtopped during the ½ PMF, under either condition, if NRG lowers the top of the existing overflow pipe, and associated maximum operating level, from Elevation 579.3’ to 578.3’.
4. The outflow pipe for South Ash Settling Basin can pass the ½ PMF with a freeboard greater than 3 feet, regardless of the conditions in the EQ Basins.

REVIEW OF GZA 2009 GEOTECHNICAL REPORT FOR SOUTH ASH SETTLING BASIN

In reviewing GZA's July 2009 geotechnical report, AMEC noted the following.

1. The friction angle used for the fill (30 degrees) may be high due to the presence of soft zones and debris noted in the boring.

2. Although the GZA report provided comments on liquefaction due to seismic activity, a seismic stability is not presented. AMEC recommends that the analysis be revised to include a seismic analysis. The analysis should be reviewed after completion of the recommended hydraulic study to evaluate elevated phreatic conditions and the need for a rapid drawdown analysis based on flood and receding waters of the Niagara River.

GZA assigned a friction of 30 degrees to the fill based upon the following.

- Typical range of internal friction angle values published for silty-sand fill by Joseph E. Bowles, "Physical and Geotechnical Properties of Soils", 1979: Loose Silty Sand: 25-35 degrees; Dense Silty Sand: 30 – 36 degrees.

- Due to the presence of gravel, slag, concrete, brick, cobbles and wood debris in the fill soils, plus the presence of the 65" x 92" steel arch pipe providing reinforcement, it is GZA's opinion that the debris and pipe gives greater interlocking and a higher shear strength that warranted assigning a mid-range friction angle of 30 degrees to the fill layer.

- We note that the critical failure surface, shown on the attached stability analyses, occurs at a shallow depth where denser soils exist. Less critical failure surfaces, having higher factors of safety, occur at greater depth through the loose fill soils.

To address AMEC's comments, GZA did additional evaluation of the South Ash Settling Basin embankment stability to:

- Conduct a seismic analysis; and
- Conduct a rapid drawdown analysis to evaluate the elevated phreatic conditions based on the hydrologic study completed.

The following factors of safety were calculated.

Loading Condition	Calculated F. S.	EPA Minimum Required F. S.
Long-Term Steady Seepage (Static)	1.8	1.5
Rapid Drawdown	1.8	1.3
Seismic Loading*	1.1	1.0

*For the seismic analysis, GZA applied a maximum horizontal acceleration (MHA) of 0.2g (90 percent probability of not being exceeded in 250 years), based on "Probabilistic

Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico", U.S. Geologic Survey, Map MF-2120. This is a conservative value based on published information. More recent published data, which has catalogued earthquake activity, indicates lower MHA values.

The calculated factors of safety exceed the EPA minimum required safety factors for the 3 loading conditions. GZA considers the South Ash Settling Basin embankment along the Niagara River to be stable for all conditions.

SLOPE STABILITY ANALYSES OF NORTH BASINS

GZA conducted slope stability analyses of the following North Basin impoundment embankments.

- Embankment between Pond 3 and the existing drainage channel to the north.
- Embankment between Pond 2 and the existing drainage channel to the north.
- Embankment between Pond 2 and the low lying area located between Ponds 2 and 3.

Analyses were done for static and seismic conditions assigning a conservative internal friction angle of 30 degrees for the general berm fill and a friction angle of 35 degrees for the surficial layer where concrete matting exists along the embankment slopes. The static analyses were done with a phreatic surface representing the ½-PMF rain event, and the seismic analyses were done with a phreatic surface representing normal pool elevations. Rapid drawdown analyses were not done since we consider the change in water level negligible for the given conditions.

The following factors of safety were calculated.

Loading Condition	Calculated F. S.	EPA Minimum Required F. S.
20-FT.+/- WIDE POND 3/DRAINAGE CHANNEL EMBANKMENT*		
Long-Term Steady Seepage (Static)	1.8	1.5
Seismic Loading	1.1	1.0
40-FT.+/- WIDE POND 2/DRAINAGE CHANNEL EMBANKMENT		
Long-Term Steady Seepage (Static)	2.1	1.5
Seismic Loading	1.2	1.0
POND 2/INTERNAL LOW-LYING AREA		
Long-Term Steady Seepage (Static)	2.7	1.5
Seismic Loading	1.4	1.0

*Stability analyses for the 20-ft. wide embankment between Pond 3 and the drainage channel embankment, did not incorporate the reinforcement effects of the 5 drainage pipes spanning the embankment, in addition to the 16-feet wide x 12-feet deep concrete retaining headwall.

CONCLUSIONS

The shallow embankments that partially surround the basins should not be considered "dams". NDSRB defines a dam as having an embankment height ≥ 25 feet in height, providing impoundment capacity ≥ 50 acre-feet. The highest embankment height of NRG Huntley's six basins is 6 feet at an isolated location at the southwest corner of the South Equalization Basin, and 10 feet at the outfall point of the South Ash Settling Basin. Otherwise, embankment heights are generally 2 to 3 feet above existing grade, or incised. The largest impoundment, the South Ash Settling Basin, has a capacity of about 43 acre-feet.

It is GZA's professional opinion that AMEC's Condition Assessment and Hazard Potential ratings assigned to each pond are overly conservative. In general, the NRG Huntley basins have functioned properly and as designed for the past 30+ years with widely varying loading conditions. Specific discussion for each basin follows.

North Basins

Pond 1 – This pond is small, covering an area less than ½-acre, with partial embankments (Top El. 579.0' ±) between itself and Ponds 2 and 3. The hydrologic analysis indicates that the ½ PMF event would result in a peak storm water elevation of 577.0' providing about 2.0 feet of freeboard height. The surrounding soils are coarse-grained coal ash. In the unlikely event of embankment failure, decant water would percolate into the site soils or drain into Ponds 2 or 3. Pond 1 does not require a stability analysis. Therefore, Pond 1 should have a NDSRB condition assessment of "Satisfactory" in that no existing or potential embankment safety deficiencies are recognized, and acceptable performance is expected under all loading conditions (static, hydrologic, seismic). We also believe that Pond 1 should have a "Less than Low Hazard Potential" since failure or mis-operation of the impoundment results in no probable loss of human life or economic or environmental losses; NRG would not experience economic or environmental loss on their property.

Pond 2 – This pond has a full surrounding embankment (Top El. 579.0' ±). The hydrologic analysis indicates that the ½ PMF event would result in a peak storm water elevation of 577.2' providing about 1.8 feet of freeboard height. The surrounding soils are coarse-grained coal ash. In the unlikely event of embankment failure along the south, east and west embankments, decant water would percolate into the site soils or drain into Pond 1. The stability analyses done for the Pond 2 north embankment, adjacent to the drainage ditch, shows stable conditions for static and seismic conditions, given the following:

- The analyses ascribed a conservative internal friction angle of 30 degrees for the berm fill.

- The analyses did not incorporate: the reinforcing elements of the 16-feet wide concrete retaining headwall with a depth of 12 feet (see cross-section on Figure 2); the 5 drainage pipes spanning the narrowest section (about 20 feet across the top) of the embankment, from the pond to the drainage ditch, providing additional reinforcement of the embankment.

A stability analyses, also done for the internal berm between Pond 2 and the low-lying area between Ponds 2 and 3, shows stable conditions for static and seismic conditions.

We believe Pond 2 should have a NDSRB condition assessment of “Fair” in that no existing embankment safety deficiencies are recognized for normal loading conditions, evidenced by 35 years of safe and stable operation. In the unlikely event of a rare or extreme hydrologic and/or seismic event resulting in an embankment deficiency, the resultant risk of uncontrolled flow to the adjacent drainage ditch could be quickly mitigated by the following procedure.

1. Shutting off the process water influent to upstream Pond 1.
2. Temporarily damming off the narrow ditch downstream of Pond 1 via a few tandem truck loads of clay readily available in the area.
3. Establishing a temporary process water bypass system (either diverting flow to Pond 3 or setting up a series of portable holding tanks) to decant the water to the drainage ditch downstream of temporary dam.
4. Repairing the embankment and restoring normal pond operations.

We also believe that Pond 2 should have a “Low Hazard Potential” since failure or mis-operation of the impoundment results in no probable loss of human life and low economic and/or environmental losses. NRG would experience only the economic loss of repairing the embankment deficiency; low environmental loss may be experienced for the short duration in shutting off the process water feeding upstream Pond 1 and establishing a temporary dam and bypass system described above.

Pond 3 - This pond has partial embankments (Top El. 579.0’ ±) along the west and north edges, with the east and south sides incised. The hydrologic analysis indicates that the ½ PMF would result in a peak storm water elevation of 577.4’ providing about 1.6 feet of freeboard height. The surrounding soils are coarse-grained coal ash. In the unlikely event of embankment failure along the west embankment, decant water would percolate into the site soils or drain into Pond 1 or Pond 2.

The stability analyses done for the Pond 3 north embankment, adjacent to the drainage ditch, shows stable conditions for static and seismic conditions.

In our opinion, Pond 3 should have a NDSRB condition assessment of “Fair” in that no existing embankment safety deficiencies are recognized for normal loading conditions, evidenced by 35 years of safe and stable operation. In the unlikely event of a rare or extreme hydrologic and/or seismic event resulting in an embankment deficiency, the resultant risk of uncontrolled flow to the adjacent drainage ditch could be quickly mitigated similar to the procedure described for Pond 2 above.

We also believe that Pond 3 should have a "Low Hazard Potential" since failure or mis-operation of the impoundment results in no probable loss of human life and low economic and/or environmental losses. NRG would experience only the economic loss of repairing the embankment deficiency; low environmental loss may be experienced for the short duration in shutting off the process water feeding upstream Pond 1 and establishing a temporary dam and bypass system described above.

South Basins

North and South Equalization Basins – Both basins are lined on the interior, as well as the exterior slopes of the embankments, with asphalt having 2 inches of binder course overlaid with 2 inches of surface course. The asphalt surface was observed by GZA to be in good to excellent condition, with some vegetation located mainly on the exterior slopes of the embankments, with isolated protrusions of vegetation on the interior slopes. The embankment interior slopes are at 5H:1V and the exterior slopes are at 3H:1V.

We do not believe that a stability analysis is required for these basins for the following reasons.

- The majority of the basins embankments are shallow ranging from about 0 to less than 5 feet high on the outside slopes, with the interior slopes having shallow 5H:1V slopes. The highest embankment, about 5 feet high, is located in the southwest corner of the South Eq. Basin, where the embankment is curved providing radial reinforcement. Attached Figure 4 shows a photograph of this corner with dimensions shown.

- NRG typically alternates filling these basins so that one of the basins is empty or near empty while the other basin is filled or partially filled. Given that water in each basin has a low occupancy period, and that the pond interior is constructed with highly impermeable asphalt, it is our opinion that an elevated phreatic condition is highly unlikely to occur through the embankment section.

In our opinion, the North and South Equalization Basins should have a NDSRB condition assessment of "Fair" in that no existing embankment safety deficiencies are recognized for normal loading conditions, evidenced by over 25 years of safe and stable operation. In the highly unlikely event of a rare or extreme hydrologic and/or seismic event resulting in an embankment deficiency, the resultant risk of uncontrolled flow to the adjacent Niagara River could be quickly mitigated by emptying out both ponds via pumps inside the outlet control structure and diverting pumped flow, from the plant, to the South Ash Settling Basin.

It is our opinion that the North and South Equalization Basins should have a "Low Hazard Potential" since unlikely failure or mis-operation of the impoundment results in no probable loss of human life and low economic and/or environmental losses. Low environmental loss may be experienced for the short duration in temporarily diverting the process water from the plant to the South Ash Settling Basin until the embankment is repaired.

South Ash Settling Basin –The static, hydrologic and seismic stability analyses discussed above, shows the south embankment, at the outfall to the Niagara River, to be stable for all 3 conditions. Therefore, we believe this basin should have a NDSRB condition assessment of "Fair" in that no existing embankment safety deficiencies are recognized for normal loading conditions, evidenced by 25+ years of safe and stable operation.

In the highly unlikely event of a rare or extreme hydrologic and/or seismic event resulting in an embankment deficiency, the resultant risk of uncontrolled flow to the Niagara River could be quickly mitigated by the following procedure.

1. Shutting off the process water influent to the Basin.
2. Temporarily damming off the narrow section (about 60 feet wide) of the Basin immediately upstream of the outlet pipe using clay readily available in the area.
3. Establishing a temporary process water bypass system to decant the water to the Niagara River downstream of the temporary dam.
4. Repairing the embankment and restoring normal Basin operations.

We also believe that the South Ash Settling Basin should have a "Low Hazard Potential" since an improbable failure or mis-operation of the impoundment results in no probable loss of human life and low economic and/or environmental losses. NRG would experience the economic loss of repairing the embankment deficiency; low environmental loss may be experienced for the short duration in shutting off the process water feeding the Basin and establishing a temporary dam and bypass system described above. Low environmental loss would also be attributed to the fact that NRG dredges the majority of CCW sediment at the north-side inlet end of the South Ash Settling Basin about 1,200 feet upstream of the Basin outlet to the Niagara River. Transport of significant amounts of CCW sediment over that distance is unlikely to take place when NRG would immediately implement process inflow shut-off, temporary damming and bypass operations described above.

We trust this information satisfies your needs for this project.

Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

Bart A. Klettke Dan Troy

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Attachments:

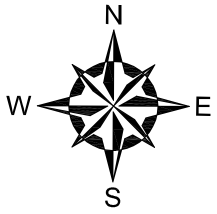
Figure 1 – North Ponds 1-3 Site Plan
Figure 2 – North Ponds 2 & 3 Cross Sections @ Pond Outlets
Figure 3 – South Ponds Plan
Figure 4 – South Equalization Basin Photographic Cross-Section

Slope Stability Analyses of South Ash Settling Basin

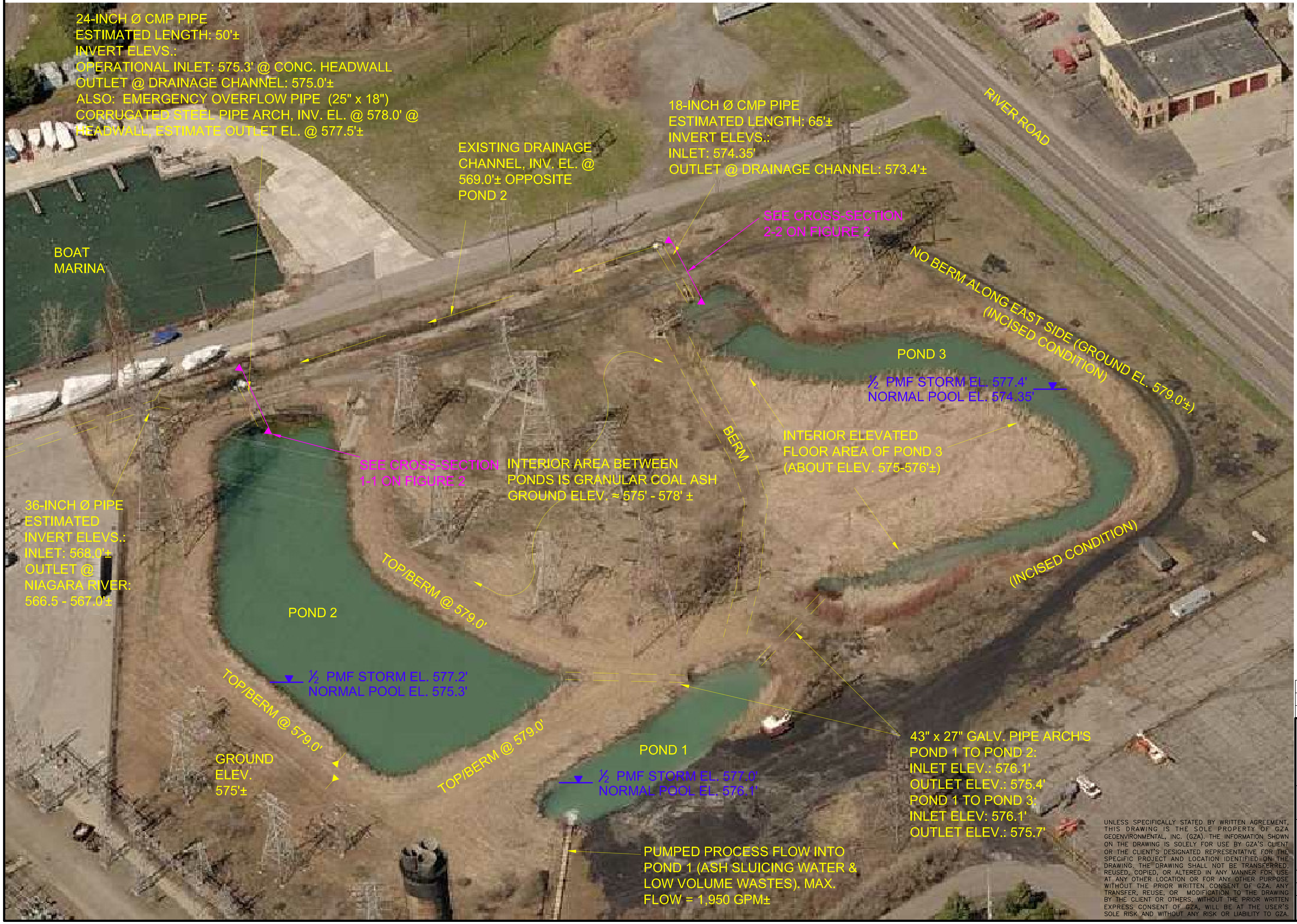
Slope Stability Analyses of North Basins

10-Minute Incremental Output Data File for ½ Probable Maximum Flood Analysis

Setup Schematics for Two Basin Models



LEGEND



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NO.	ISSUE/DESCRIPTION	BY	DATE

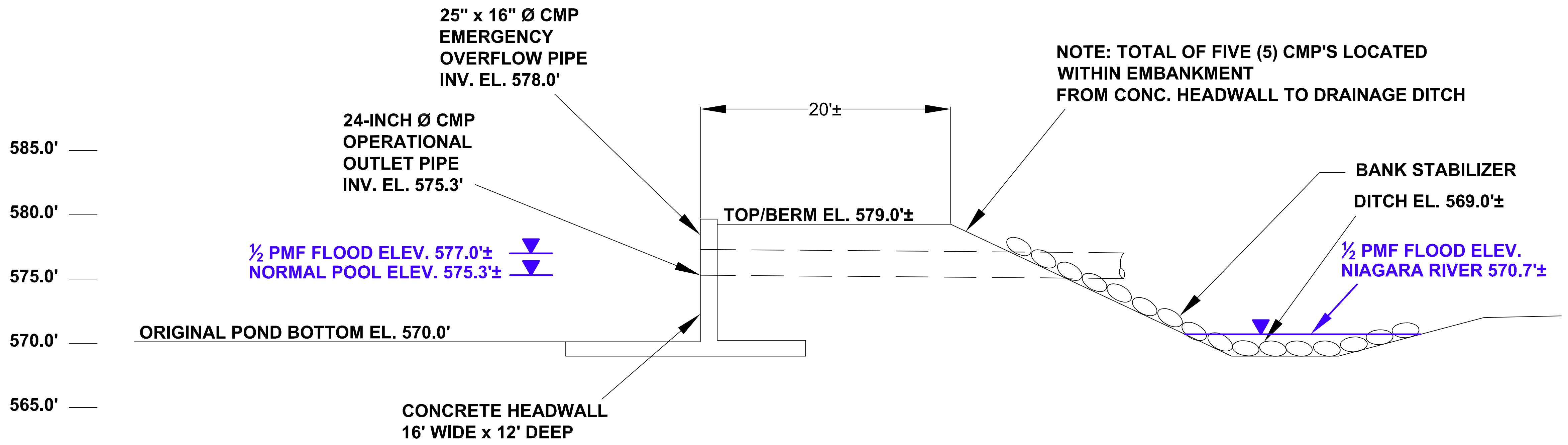
NRG RESPONSE TO EPA REPORT
NRG HUNTLEY PLANT
TONAWANDA, NEW YORK

NORTH PONDS 1-3
SITE PLAN

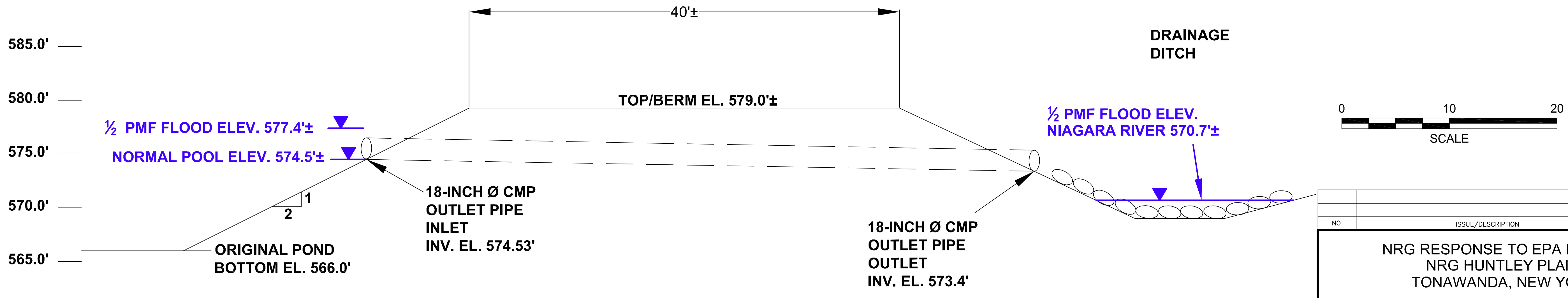
PREPARED BY:
GZA GeoEnvironmental Inc.
Engineers and Scientists
535 WASHINGTON STREET 11th FLOOR
BUFFALO, NEW YORK 14203
(716) 685-2300

PREPARED FOR:
NRG ENERGY

PROJ MGR: BAK
REVIEWED BY: BAK
CHECKED BY: DJT
DESIGNED BY:
DRAWN BY: DEW
SCALE: AS SHOWN
DATE SEPTEMBER 2012
PROJECT NO. 21.0056662.00
REVISION NO.
FIGURE 1



X-SECTION 1-1
THRU NORTH POND 2 OUTLET EMBANKMENT



X-SECTION 2-2
THRU NORTH POND 3 OUTLET EMBANKMENT

NO.	ISSUE/DESCRIPTION	BY	DATE

NRG RESPONSE TO EPA REPORT
NRG HUNTLEY PLANT
TONAWANDA, NEW YORK

NORTH PONDS 2 & 3
CROSS-SECTIONS @ POND OUTLETS

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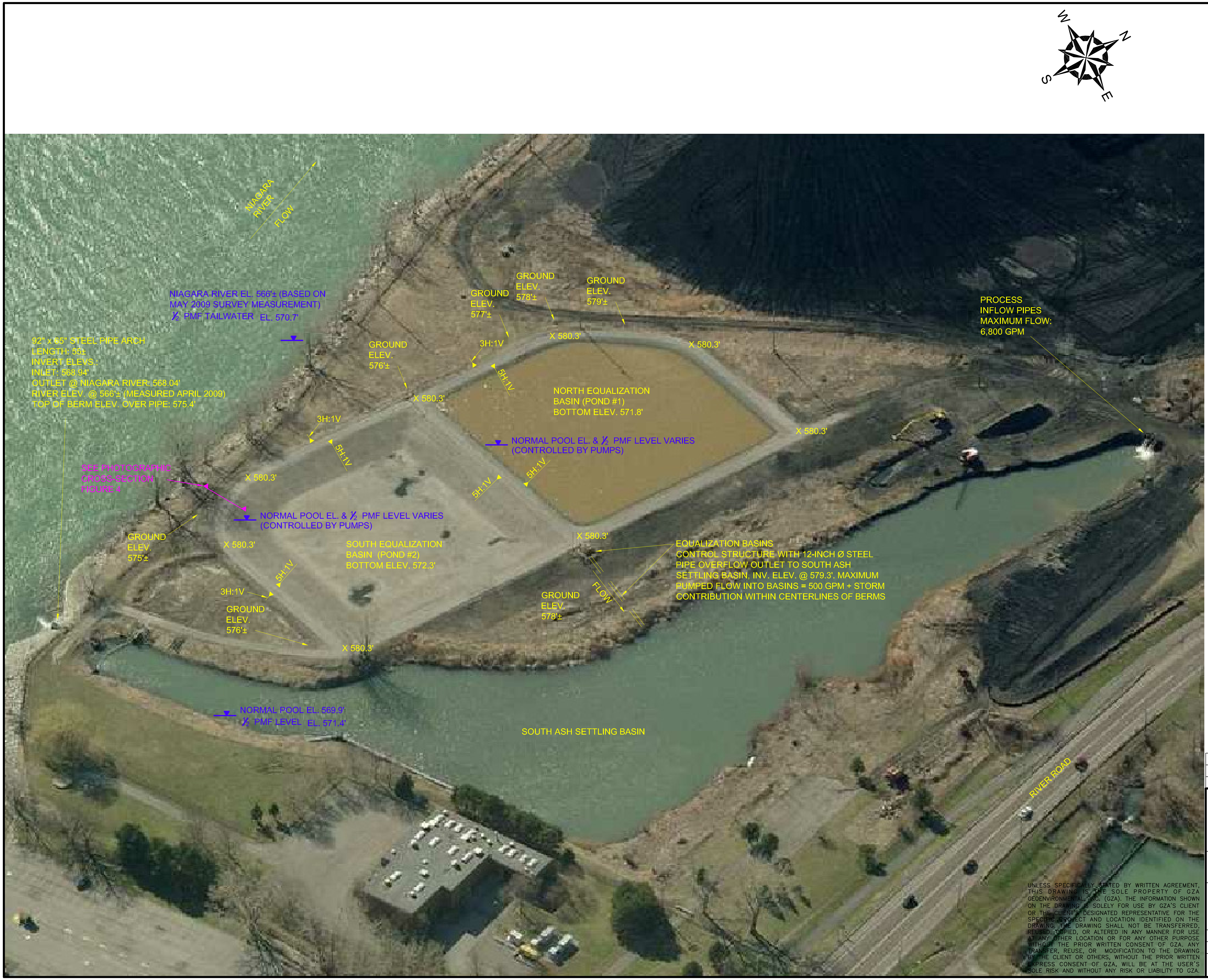
PREPARED FOR:
NRG ENERGY

PROJ MGR: BAK	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE 2
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE SEPTEMBER 2012	PROJECT NO. 21.0056662.00	REVISION NO.	



LEGEND

0 X X
NOT TO SCALE

NO.	ISSUE/DESCRIPTION	BY	DATE

NRG RESPONSE TO EPA REPORT
NRG HUNTLEY PLANT
TONAWANDA, NEW YORK

SOUTH PONDS
SITE PLAN

PREPARED BY:

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Engineers and Scientists
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BUFFALO, NEW YORK 14203
(716) 685-2300

PREPARED FOR:
NRG ENERGY

PROJ MGR: BAK	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE 3
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE SEPTEMBER 2012	PROJECT NO. 21.0056662.00	REVISION NO.	

LEGEND

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NOT TO SCALE

NO.	ISSUE/DESCRIPTION	BY	DATE

NRG RESPONSE TO EPA REPORT
NRG HUNTLEY PLANT
TONAWANDA, NEW YORK

SOUTH EQUALIZATION BASIN
PHOTOGRAPH CROSS-SECTION @ SW CORNER

PREPARED BY:

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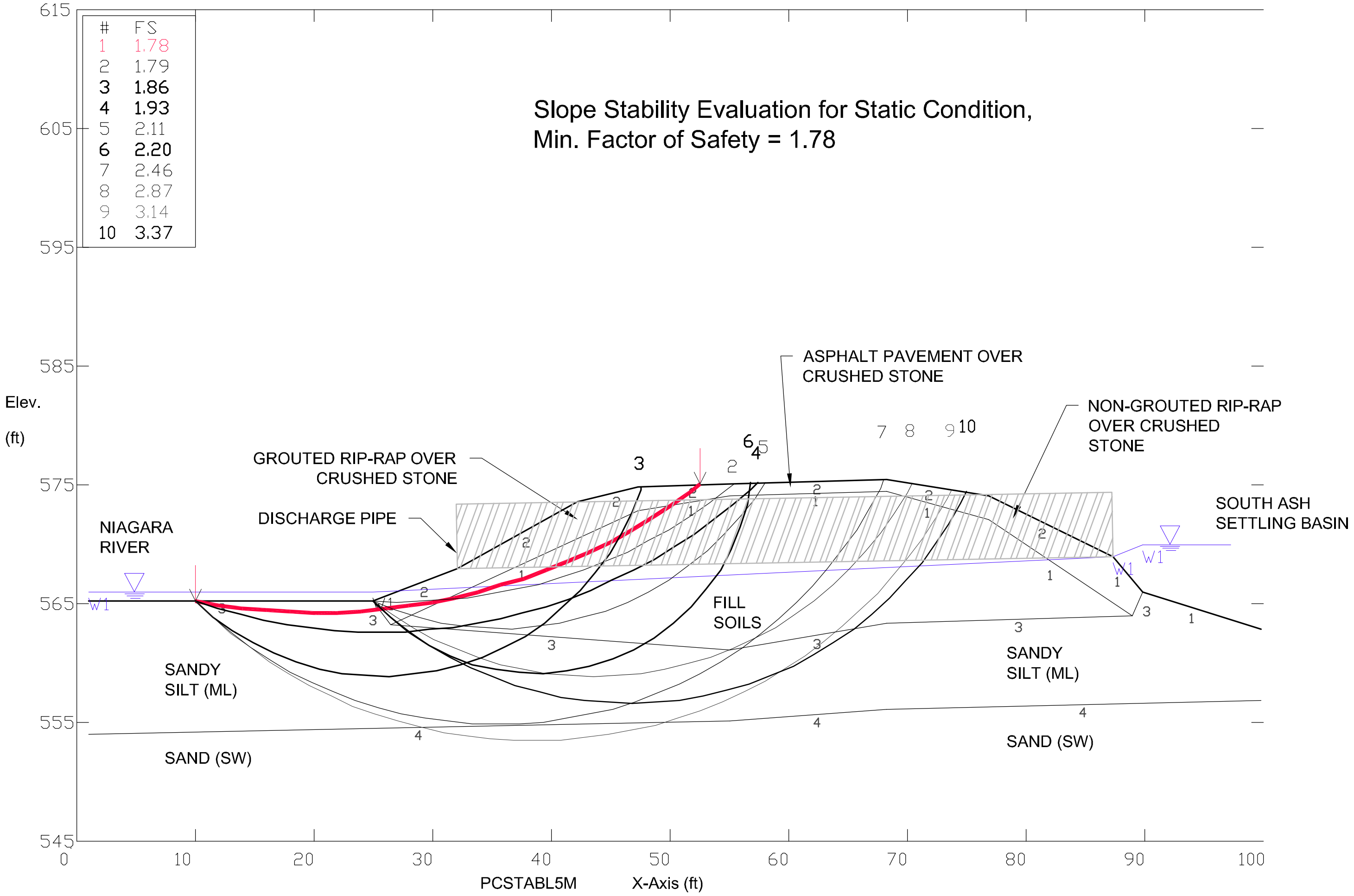
PREPARED FOR:
NRG ENERGY

PROJ MGR: BAK	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE 4
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE SEPTEMBER 2012	PROJECT NO. 21.0056662.00	REVISION NO.	

©2010– GZA GeoEnvironmental, Inc. GZA-T:\PROJECTS\56600s\56662 NRG Response to EPA Report\Birdseye aerials of NRG Huntley Ponds.dwg [South Pond Picture] September 13, 2012 – 2:59pm bart.klettke

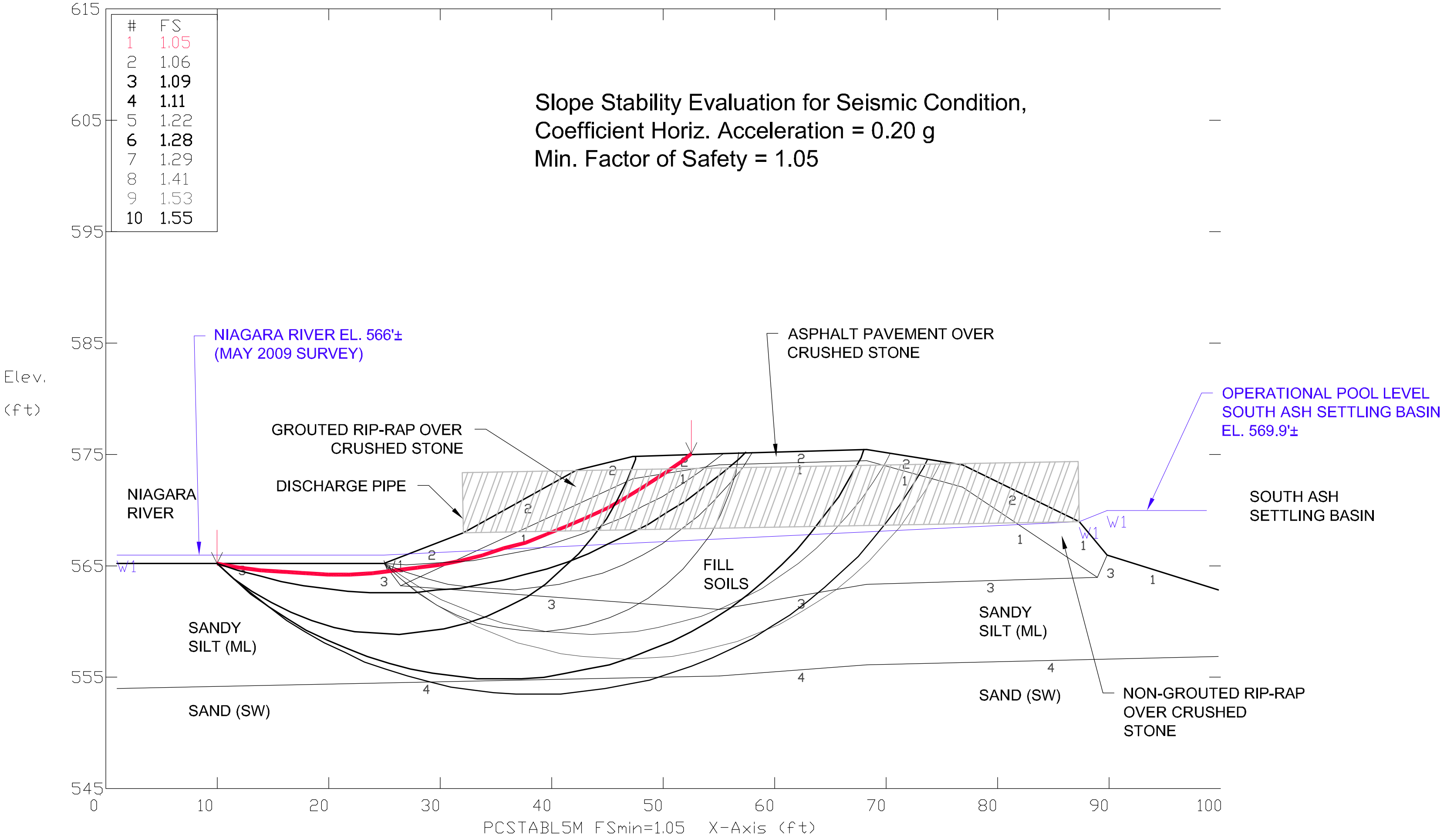
NRG Embankment Evaluation, Static Condition @ South Ash Settling Basin
Ten Most Critical. C:NRG1.PLT By: djt 07-19-12 1:16pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1 FILL	128	130	0	30	0	0	0
2 RIP-RAP	140	140	0	40	0	0	0
3 SANDY SILT	120.5	124.5	0	25	0	0	0
4 SAND	130	132	0	32	0	0	0

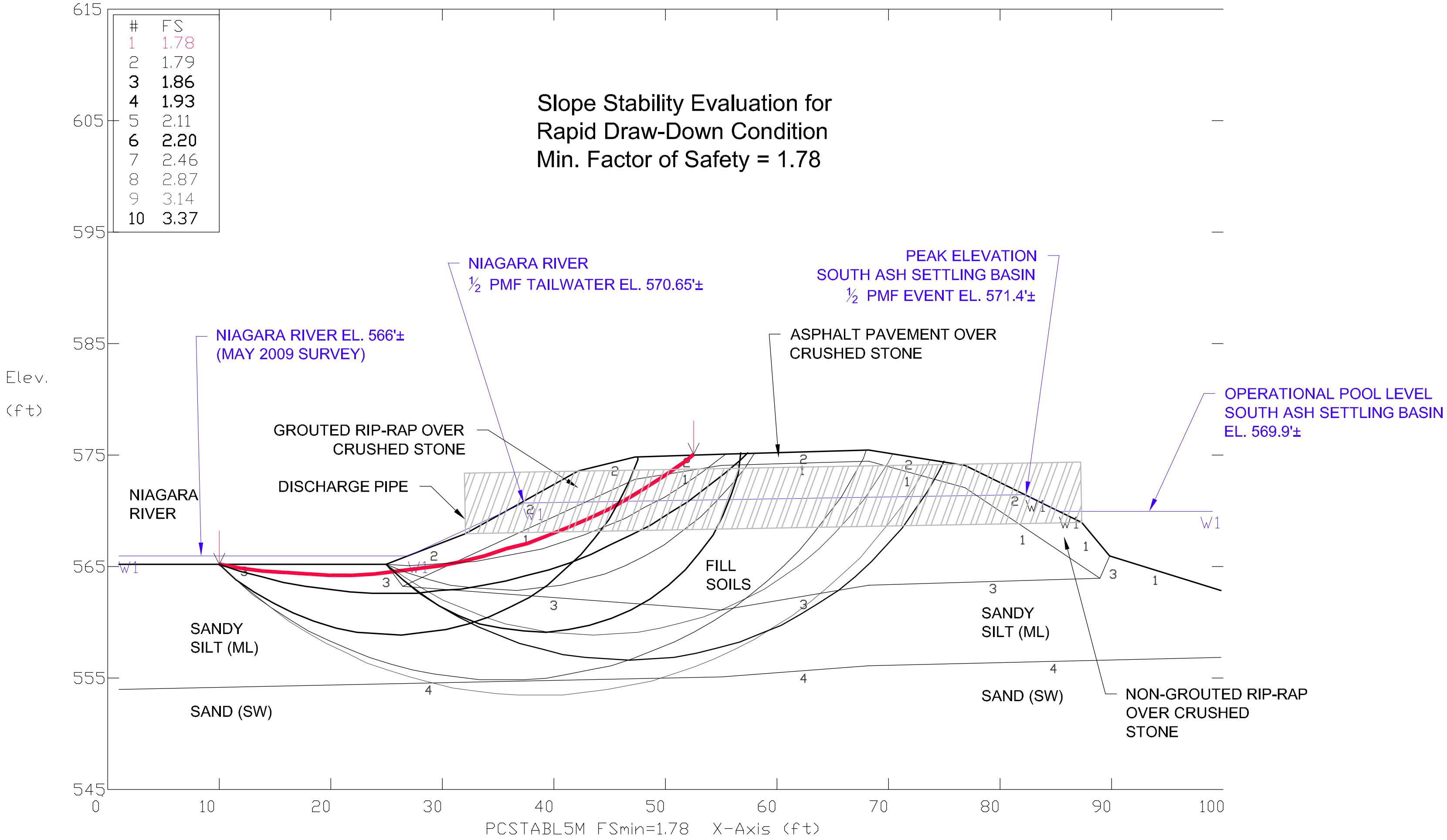
NRG Embankment Seismic Evaluation @ South Ash Settling Basin

Ten Most Critical. C:NRG1E.PLT   By: bak   07-20-12   7:51am



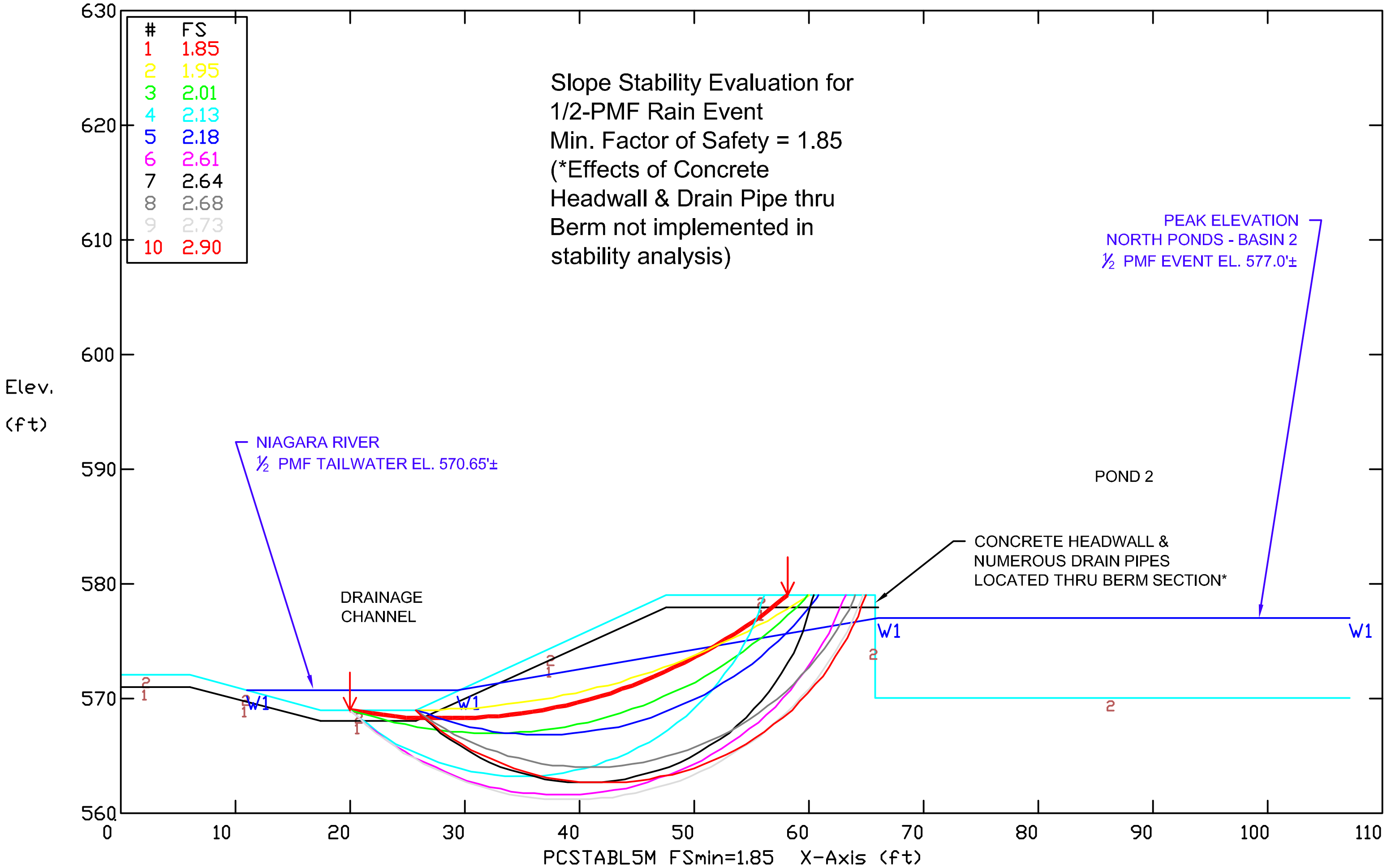
Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	0
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	0
4	130	132	0	32	0	0	0

NRG Embankment with One-Half PMF Event @ South Ash Settling Basin
Ten Most Critical. C:NRG1PMF.PLT By: bak 07-20-12 6:50am



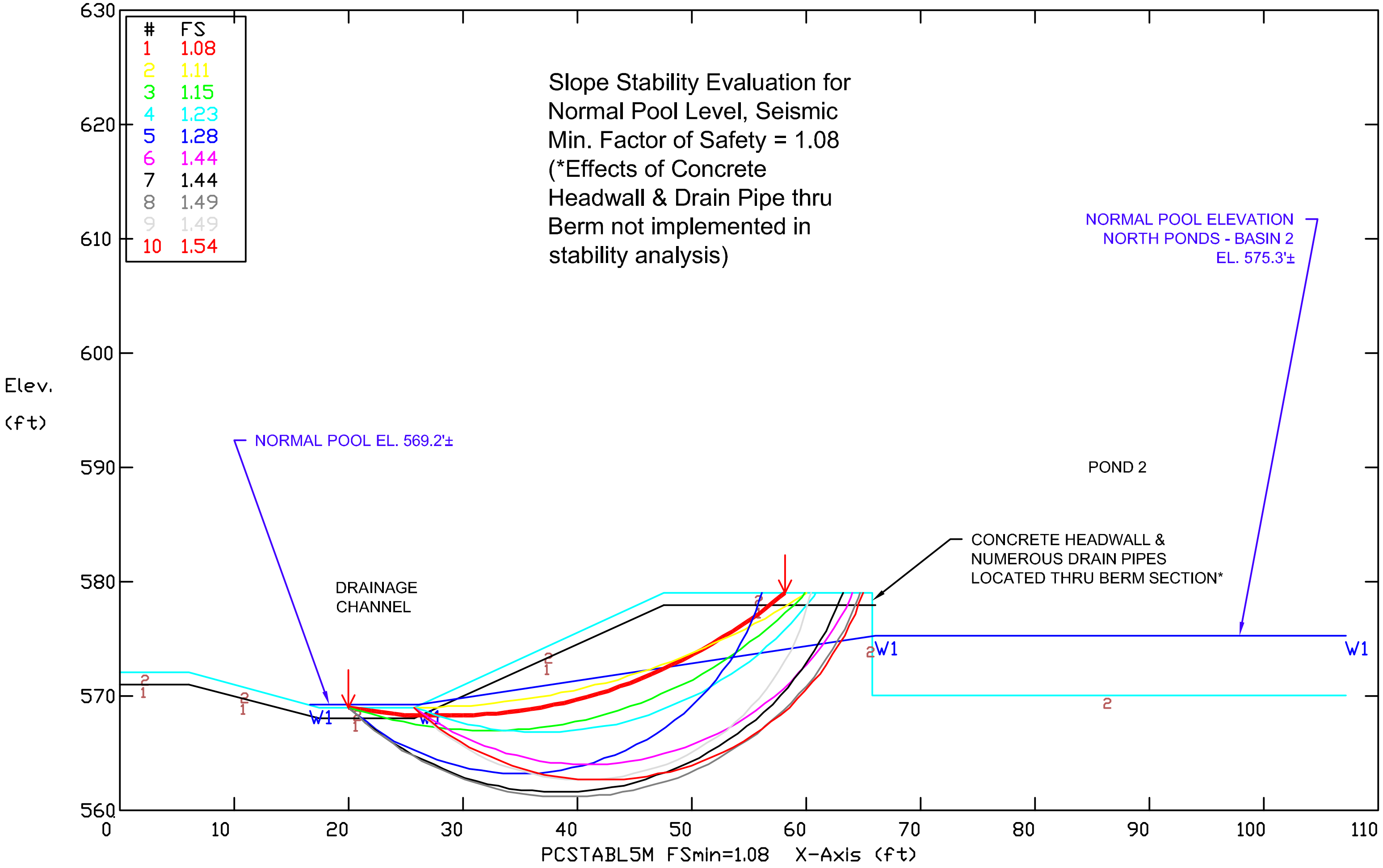
Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	0
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	0
4	130	132	0	32	0	0	0

NRG POND 2 EVALUATION AT OUTFALL
Ten Most Critical. C:NRG20FT.PLT



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125	130	0	30	0	0	0
2	130	135	0	35	0	0	0

NRG POND 2 EVALUATION AT OUTFALL (with Seismic)
Ten Most Critical. C:20FTSEIS.PLT

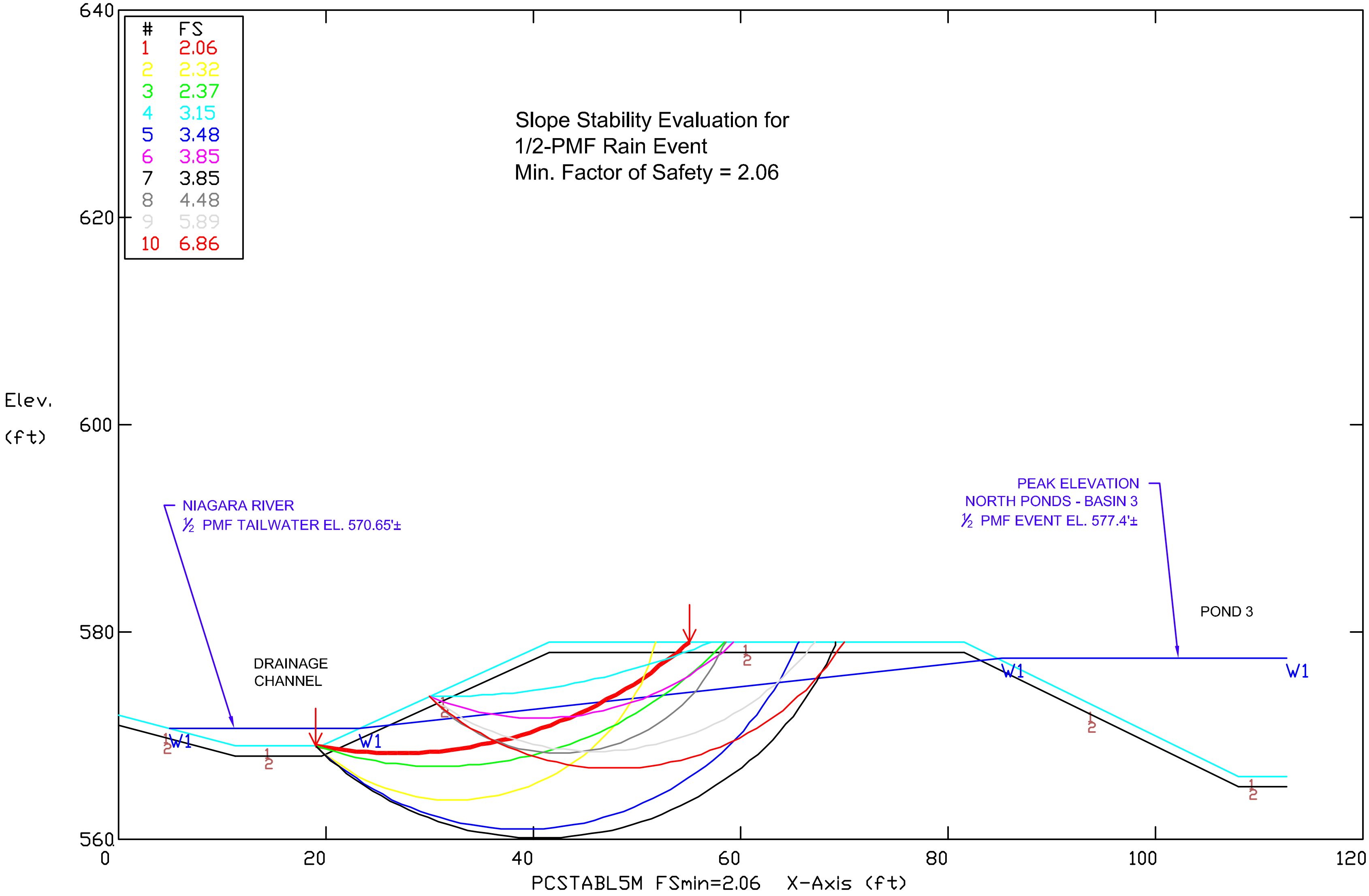


Slope Stability Evaluation for
Normal Pool Level, Seismic
Min. Factor of Safety = 1.08
(*Effects of Concrete
Headwall & Drain Pipe thru
Berm not implemented in
stability analysis)

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125	130	0	30	0	0	0
2	130	135	0	35	0	0	0

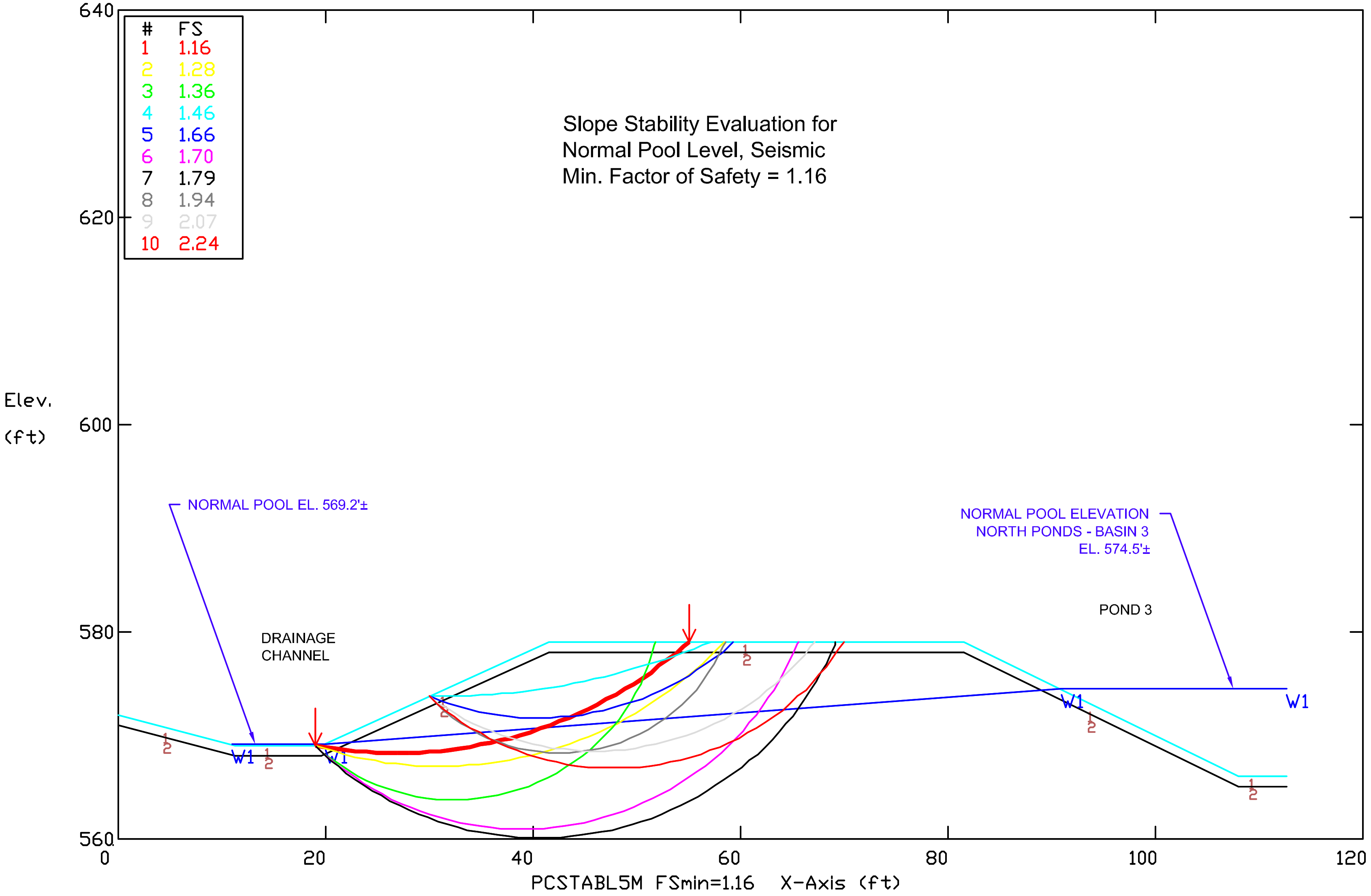
NRG IMPOUNDMENT EMBANKMENT EVALUATION POND 3 AT 1/2 PMF RAIN EVENT

Ten Most Critical. C:NRG40FT.PLT



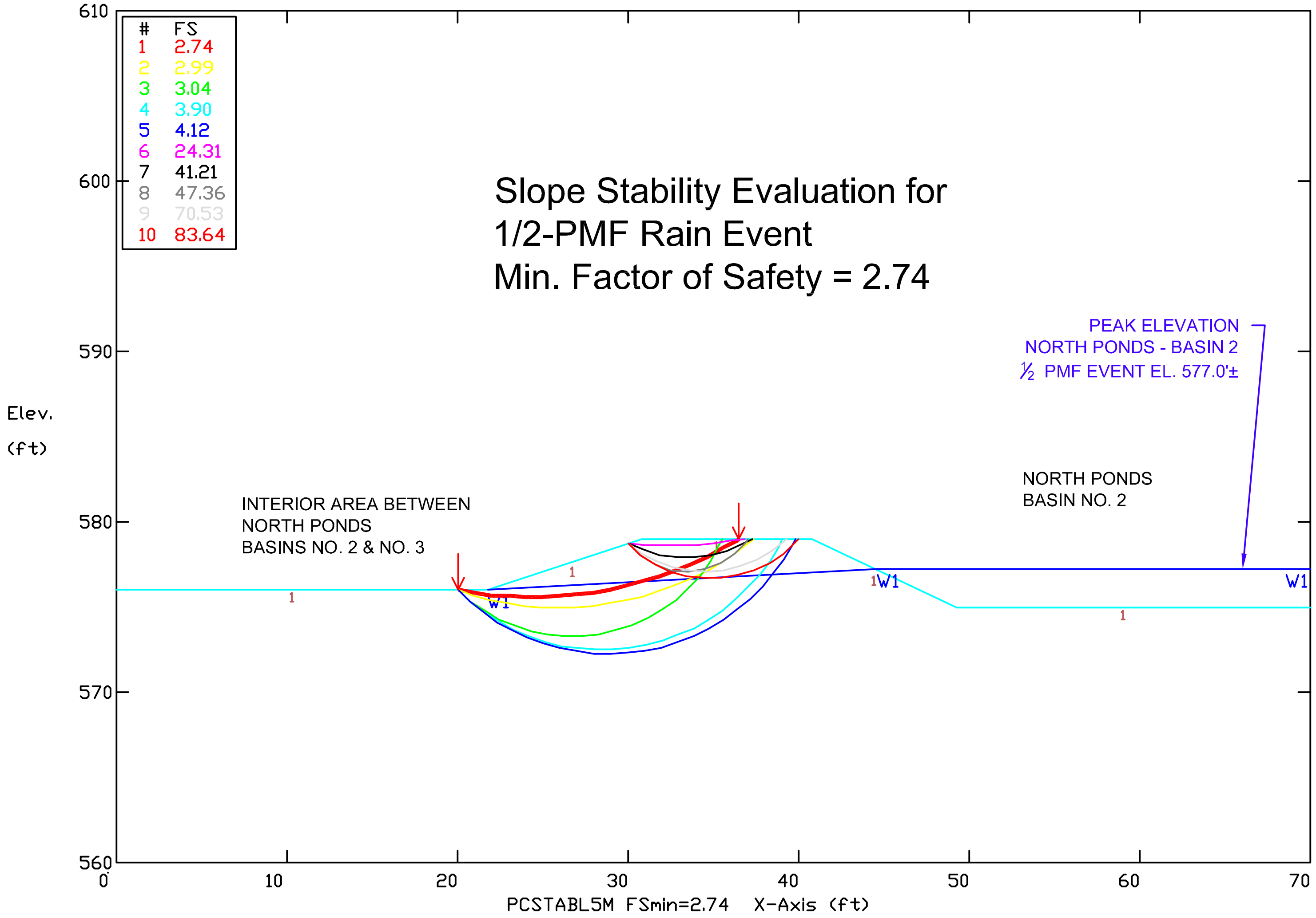
Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130	135	0	35	0	0	0
2	125	130	0	30	0	0	0

NRG IMPOUNDMENT EMBANKMENT EVALUATION POND 3 SEISMIC AT NORMAL POOL LEVEL
Ten Most Critical. C:40FTSEIS.PLT



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130	135	0	35	0	0	0
2	125	130	0	30	0	0	0

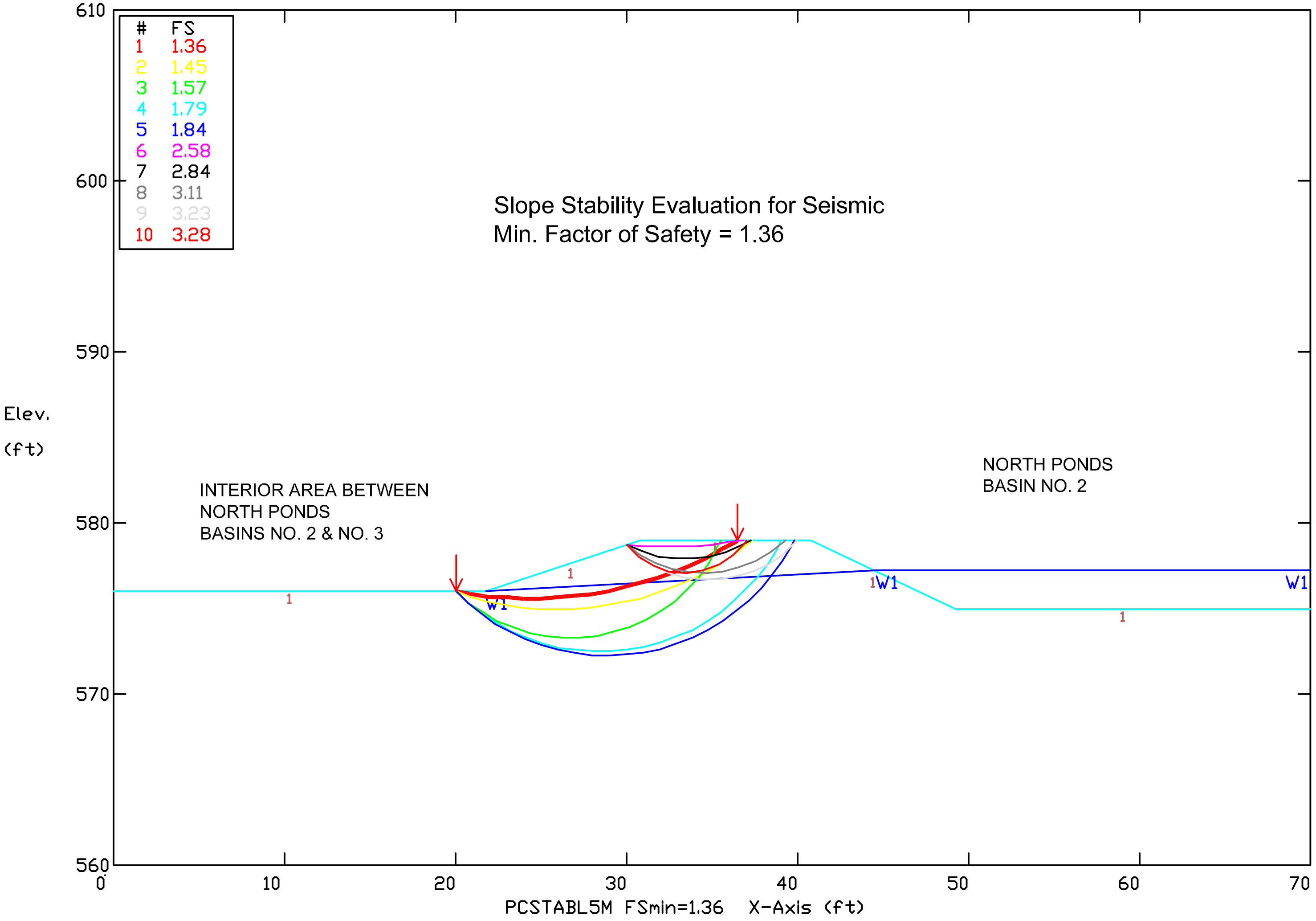
NRG IMPOUNDMENT EMBANKMENT EVALUATION POND 3 INTERNAL BERM
Ten Most Critical. C:NRGINT.PLT



Slope Stability Evaluation for
1/2-PMF Rain Event
Min. Factor of Safety = 2.74

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125	130	0	30	0	0	0

NRG IMPOUNDMENT EMBANKMENT EVALUATION POND 3 INTERNAL BERM SEISMIC
Ten Most Critical. C:INTSEIS.PLT



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125	130	0	30	0	0	0

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  NATURA         INTERVAL =   10 MIN
PI  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
PI  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
PI  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
PI  .007    .007    .007    .007    .007    .007    .009    .009    .009    .009
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PI  .009    .009    .009    .009    .009    .009    .009    .009    .009    .009
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PI  .031    .031    .032    .032    .033    .033    .033    .034    .034    .035
PI  .068    .072    .076    .080    .084    .088    .091    .095    .098    .102
PI  .105    .108    .112    .115    .118    .120    .123    .126    .129    .131
PI  .134    .136    .138    .141    .143    .145    .147    .149    .150    .152
PI  .154    .155    .157    .158    .160    .161    .167    .186    .205    .222
PI  .237    .251    .263    .274    .284    .310    .374    .412    .407    .415
PI  .555   1.132   1.960   2.813   2.837   2.535   1.700    .674    .469    .395
PI  .422    .396    .345    .288    .279    .269    .257    .244    .230    .213
PI  .196    .177    .066    .064    .062    .061    .059    .058    .056    .055
PI  .053    .052    .051    .050    .048    .047    .046    .045    .044    .043
PI  .042    .042    .041    .040    .039    .039    .038    .038    .037    .037
PI  .036    .036    .036    .036    .035    .035    .035    .035    .021    .021
PI  .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
PI  .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
PI  .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
PI  .021    .021    .021    .021    .014    .014    .014    .014    .014    .014
PI  .014    .014    .014    .014    .014    .014    .014    .014    .014    .014
PI  .014    .014    .014    .014    .014    .014    .014    .014    .014    .014
PI  .014    .014    .014    .014    .014    .014    .014    .014    .014    .014
PI  .010    .010    .010    .010    .010    .010    .010    .010    .010    .010
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PI  .010    .010    .010    .010    .010    .010    .010    .010    .010    .010
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PI  .008    .008    .008    .008    .008    .008    .008    .008    .008    .008
PI  .008    .008    .008    .008    .008    .008    .008    .008    .008    .008
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PI  .008    .008
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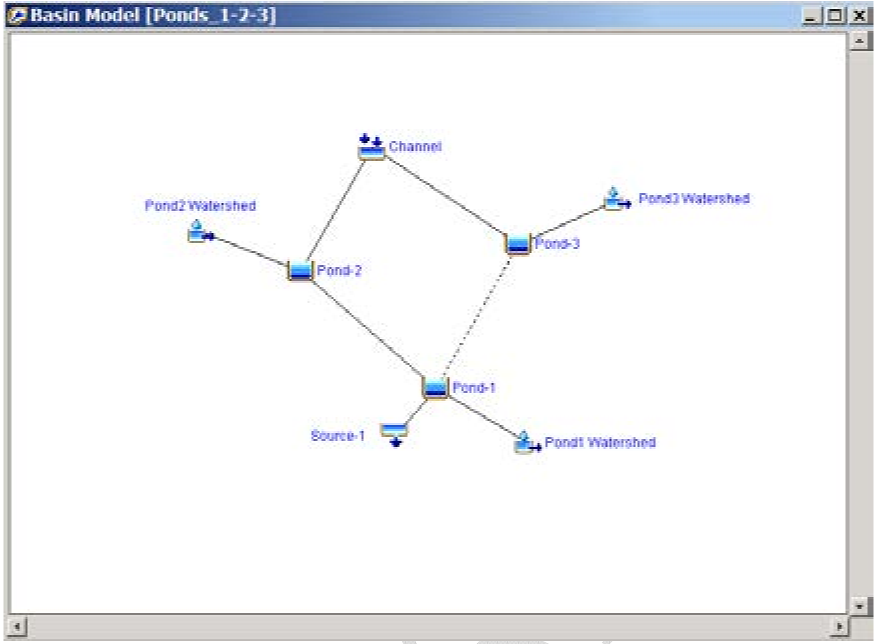
Basin Model for North Ponds 1, 2 & 3



Basin Model for South Ponds - N. & S. Eq. Basins & S. Ash Settling Basin