MWG
Midwest Generation, LLC

Joliet 29 Generating Station

2024 Structural Stability Assessment for Ash Pond 2

Revision 0

October 13, 2024

Issue Purpose: Use

Project No.: A12661.188

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EXECUTIVE SUMMARY

This report presents the 2024 annual structural stability assessment for Ash Pond 2 at Midwest Generation, LLC's (MWG) Joliet 29's Generating Station ("Joliet 29" or the "Station"). This annual assessment, prepared by Sargent & Lundy (S&L) on behalf of MWG, documents whether the design, construction, operation, and maintenance of Ash Pond 2 are consistent with recognized and generally accepted engineering practices specified in 35 Ill. Adm. Code 845.450(a) for the pond's storage capacity. To complete this assessment, S&L performed a visual surveillance of the pond on September 26, 2024, facilitated discussions with MWG personnel, and reviewed recent annual inspections and historical documentation for the pond.

Currently, Ash Pond 2 is out of service, and the Station is actively taking measures to limit the water level in the pond. Indeed, during S&L's site visit on September 26, 2024, less than two feet of water was observed in the pond. Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA in accordance with Subpart B of 35 Ill. Adm. Code Part 845.

The findings of the 2024 structural stability assessment for Ash Pond 2 are summarized in Table ES-1. Meanwhile, Table ES-2 presents the 2024 recommended corrective measures recommended for Ash Pond 2 in accordance with these findings.

Table ES-1 – 2024 Structural Stability Assessment Findings for Ash Pond 2 at the Joliet 29 Generating Station

Area	35 Ill. Adm. Code Ref.	Findings
Stable Foundations & Abutments	§ 845.450(a)(1)	• The soils supporting Ash Pond 2's dikes are considered to be stable for the maximum volume of CCR and CCR wastewater which can be impounded therein.
Slope Protection	§ 845.450(a)(2) & (4)	• High-density polyethylene (HDPE) geomembrane liners protect the ponds' upstream slopes against surface erosion, wave action, and adverse effects of sudden drawdown. • Vegetative cover protects the downstream slope of the pond's northern dike against surface erosion, wave action, and adverse effects of sudden drawdown. • Vegetative cover protects the downstream slopes of the ponds' eastern and southern dikes against surface erosion, wave action, and adverse effects of sudden drawdown.

Area	35 Ill. Adm. Code Ref.	Findings
Dike Compaction	§ 845.450(a)(3)	• The pond's dikes are sufficiently compacted to withstand the range of original design conditions in the CCR surface impoundments and the substantially lower loading conditions present in the pond.
Spillways	§ 845.450(a)(5)	• The pond does not have any spillways.
Embedded Hydraulic Structures	§ 845.450(a)(6)	• No visual surveillance programs have been performed since the initial video camera inspection in May 2016. • However, no visual signs of distress at the dike surfaces that could be indicative of deterioration, failure, deformation, etc. (e.g., soft spots caused by leaking water, distortions in dike alignment) were observed during S&L's September 2024 site visit.
Low Pool & Rapid Drawdown Stability	§ 845.450(a)(7)	• The ponds' downstream slopes are stable during low pool conditions in Pond 1. • The ponds' downstream slopes are not considered to be susceptible to a sudden (rapid) drawdown loading condition.

Table ES-2 – Recommended Corrective Measures for Ash Pond 2

Recommended Corrective Measure	Timeframe
Contact the USDA to assist in monitoring and mitigating the observed burrowing near the crest of the pond's southern dike. Continue to monitor embankments for signs of animal burrowing.	Now, and as Required to Maintain Slopes
Conduct a visual surveillance program to verify that the discharge pipes for Pond 1 and Ash Pond 2 are in good, working condition and are free of significant material defects that could compromise the pipes' integrities.	During Closure Construction

1.0 PURPOSE & SCOPE

1.1 PURPOSE

Ash Pond 2 at Midwest Generation, LLC's (MWG) Joliet 29 Generating Station ("Joliet 29" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.450(a), MWG must conduct and complete an annual structural stability assessment that documents whether the design, construction, operation, and maintenance of Ash Pond 2 are consistent with recognized and generally accepted engineering practices for the CCR surface impoundment's storage capacity.

This report documents the 2024 structural stability assessment conducted and completed in accordance with the Illinois CCR Rule by Sargent & Lundy (S&L) on behalf of MWG for Ash Pond 2 at Joliet 29.

1.2 SCOPE

In addition to being regulated under the Illinois CCR Rule, Joliet 29's Ash Pond 2 is also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, Ash Pond 2 will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program; the Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval. However, the scope of this 2024 structural stability assessment is strictly limited to demonstrating compliance with the Illinois CCR Rule. Pursuant to 40 CFR 257.73(f)(3), the next structural stability assessment for demonstrating compliance with the Federal CCR Rule is not required until 2026, five years after the last federal assessment was completed (2021).

2.0 INPUTS, PREVIOUS RESULTS, & CURRENT OPERATIONS

2.1 INPUTS

The findings documented in this 2024 structural stability assessment for Ash Pond 2 are based on visual observations made by S&L during a site visit on September 26, 2024; discussions with MWG personnel; historical and recent aerial images obtained from Google Earth Pro (Ref. 3); and the following documents:

- Initial federal structural stability assessment for Ash Pond 2 (Ref. 4),
- Annual inspection reports for Ash Pond 2 (Refs. 5 through 11), and
- History of construction for Ash Pond 2 (Ref. 13).

- The weekly inspection reports prepared in accordance with 35 Ill. Adm. Code 845.540(a) since the 2023 structural stability assessment was issued (Ref. 17).

The initial federal structural stability assessment for Ash Pond 2, which was completed in October 2016, is included in its entirety in Appendix A.

2.2 2023 RECOMMENDED CORRECTIVE MEASURES

Table 2-1 lists the corrective measures recommended for Ash Pond 2 based on the findings documented in the 2023 annual structural stability assessment (Ref. 14).

Table 2-1 – 2023 Recommended Corrective Measures for Ash Pond 2

Recommended Corrective Measure	Timeframe
Conduct a visual surveillance program to verify that the discharge pipes for Pond 1 and Ash Pond 2 are in good, working condition and are free of significant material defects that could compromise the pipes' integrities.	During Closure Construction

2.3 CURRENT POND OPERATING CONDITIONS

Ash Pond 2 was originally designed to manage CCR and miscellaneous non-CCR wastestreams from the Station. Following the conversion of Joliet 29's coal-fired units to natural gas, the pond was no longer used to manage CCR wastestreams and was eventually taken out of service. Accordingly, the station ceased sending all process and wastewater streams to Ash Pond 2, effectively isolating the pond. In accordance with the Station's ash pond maintenance practices, the Station then began dewatering and removing CCR from the pond. In July 2024, the Station manually dewatered the pond and plans to limit the water level in the pond by manually dewatering the pond on an annual basis henceforth. During S&L's site visit in September 2024, no CCR and approximately 1.8 feet of stormwater were visually observed in Ash Pond 2.

In April 2021, MWG filed a notice of intent to close Ash Pond 2 in accordance with the Federal CCR Rule's closure criteria (Ref. 2, § 257.102). In January 2022, MWG submitted the closure construction permit application for Ash Pond 2 to the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA.

3.0 ASSESSMENT

3.1 STABLE FOUNDATIONS & ABUTMENTS

(35 Ill. Adm. Code 845.450(a)(1))

Ash Pond 2 is comprised of three earthen dikes and does not have any abutments. Detailed information on the soils supporting Ash Pond 2’s dikes is provided in the pond’s initial federal structural stability assessment in Appendix A. Based on reviews of the pond’s annual inspection reports (Refs. 5 through 12) and Google Earth aerial images (Ref. 3), there have been no significant modifications to Ash Pond 2’s geometry since its initial federal structural stability assessment was completed. Therefore, the details of the soils supporting Ash Pond 2’s dikes and corresponding conclusions documented in the pond’s initial federal structural stability assessment remain valid for this 2024 assessment (see Appendix A). Thus, the soils supporting Ash Pond 2’s dikes are considered to be stable for the maximum volume of CCR and CCR wastewater which can be impounded therein.

3.2 SLOPE PROTECTION

(35 Ill. Adm. Code 845.450(a)(2) & (4))

The upstream slopes of Ash Pond 2 are lined with a high-density polyethylene (HDPE) geomembrane liner. This form of cover protects the upstream slopes of the pond’s dikes against surface erosion, wave action, and adverse effects of sudden (rapid) drawdown.

Slope protection for the downstream slopes of Ash Pond 2 consists of either the HDPE geomembrane liner of Pond 1 (western dike) or vegetative cover (eastern and southern dikes). The gravel, sand, and cobble surfacing noted in the pond’s initial federal structural stability assessment was also observed along the downstream slopes of the pond’s eastern and southern dikes during our September 2024 site visit. These forms of cover protect the downstream slopes of the pond’s dikes against surface erosion, wave action, and adverse effects of sudden (rapid) drawdown.

During our site visit on September 26, 2024, the vegetative cover present on the eastern and southern dikes was found to meet the performance standards promulgated by the Illinois CCR Rule (Ref. 1, § 845.430(b)(3)–(5)); no vegetation was found to be taller than 12 inches, and no woody vegetation was observed. However, one animal burrow was observed near the crest of Ash Pond 2’s southern dike. The observed hole does not suggest that the stability of the southern dike has been compromised, especially given its location on the slope and given that Ash Pond 2 is not currently in service. The Station was notified of the existence of the animal burrow upon completion of the site visit. It is recommended that the Station promptly contact the U.S. Department of Agriculture (USDA) to assist in monitoring and mitigating the observed burrowing. In addition, we recommend that the Station continue to monitor Ash Pond 2's embankments for signs of animal burrowing.

3.3 DIKE COMPACTION

(35 Ill. Adm. Code 845.450(a)(3))

As documented in Ash Pond 2's initial federal and 2024 safety factor assessments (Refs. 4 and 15), the pond's dikes are sufficiently compacted to withstand the range of loading conditions in the CCR surface impoundment and the substantially lower loading conditions present in the pond due to the Station manually dewatering the impoundment to limit the water level in the pond. Therefore, the loading conditions evaluated in the initial federal safety factor assessment are conservative considering the pond's current conditions.

3.4 SPILLWAYS

(35 Ill. Adm. Code 845.450(a)(5))

Ash Pond 2 does not have any spillways. As documented in the pond's 2024 inflow design flood control system plan (Ref. 16), the pond is capable of managing the design flood event (1,000-year, 24-hour storm) without a spillway.

3.5 EMBEDDED HYDRAULIC STRUCTURES

(35 Ill. Adm. Code 845.450(a)(6))

Portions of the discharge pipes from Pond 1 and from Ash Pond 2 underlie the latter's southern dike. The locations of these two pipes are shown on Figure 2 of the pond's initial federal structural stability assessment in Appendix A. As documented in the 2016 assessment, visual surveillance of these pipes was performed in May 2016 by a third party that specializes in video camera pipe inspections. No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that may negatively affect Ash Pond 2 were identified during this surveillance program. It is noted that a portion of Pond 1's discharge pipe passes under Ash Pond 2's northern crest, but this portion of Ash Pond 2 is effectively incised and, thus, is not considered to be at risk if the discharge pipe's integrity was to become compromised.

No similar pipe surveillance programs have been performed since the initial video camera inspection in May 2016. However, no visual signs of distress at the dike surfaces that could be indicative of pipe deterioration, failure, deformation, *etc*. were observed (*e.g.*, soft spots caused by leaking water, distortions in dike alignment) during S&L's September 2024 site visit. Moreover, since Ash Pond 2 has been taken out of service and has low levels of surface water remaining in it, the pond's discharge pipe will only be used when the Station manually dewaters the pond in continued efforts to limit water accumulation in the pond. Otherwise, Ash Pond 2's discharge pipe is not expected to regularly convey water again unless it is re-used as part of the pond's closure design. Therefore, it is recommended that the Station conduct a visual surveillance program to confirm the discharge pipes for Pond 1 and (the current) Ash Pond 2 are in good, working condition and are free of significant material defects that could impact the pipes' integrities as a part of the planned closure activities for Ash Pond 2.

3.6 LOW POOL & RAPID DRAWDOWN STABILITY

(35 Ill. Adm. Code 845.450(a)(7))

As documented in Ash Pond 2's initial federal safety factor assessment (Ref. 4), the results of which were revalidated in the 2024 safety factor assessment (Ref. 15), the structural stability of the pond's downstream slopes is maintained during a low pool condition in Pond 1. Because Pond 1 is lined with an HDPE geomembrane, a sudden (rapid) drawdown condition was determined to not be an applicable loading condition for Ash Pond 2 since Pond 1's liner precludes the infiltration of water into Ash Pond 2's western dike.

Based on reviews of Ash Pond 2's annual inspection reports (Refs. 5 through 12) and Google Earth aerial images (Ref. 3), there have been no significant modifications to Pond 1 since Ash Pond 2's initial federal structural stability assessment was completed. Therefore, the conclusions documented therein regarding the stability of Ash Pond 2's western dike during low pool and sudden (rapid) drawdown conditions at Pond 1 remain valid for this 2024 assessment (see Appendix A).

4.0 RECOMMENDED CORRECTIVE MEASURES

(35 Ill. Adm. Code 845.450(b)(1))

Table 4-1 lists the corrective measures recommended for Ash Pond 2 in accordance with the findings documented in this 2024 structural stability assessment.

Table 4-1 – Recommended Corrective Measures for Ash Pond 2

Recommended Corrective Measure	Timeframe
Contact the USDA to assist in monitoring and mitigating the observed burrowing near the crest of the pond's southern dike. Continue to monitor embankments for signs of animal burrowing.	Now, and as Required to Maintain Slopes
Conduct a visual surveillance program to verify that the discharge pipes for Pond 1 and Ash Pond 2 are in good, working condition and are free of significant material defects that could compromise the pipes' integrities.	During Closure Construction

5.0 CERTIFICATION

I certify that:

- This structural stability assessment was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.450.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: October 13, 2024

Seal:

Digitally signed by
Thomas Dehlin
Date: 2024.10.13
11:27:33-05'00'

6.0 REFERENCES

1. Illinois Pollution Control Board. “Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments.” 35 Ill. Adm. Code 845. Accessed October 11, 2024.
2. U.S. Environmental Protection Agency. “Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.” 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 11, 2024.
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4. Geosyntec Consultants. “Structural Stability and Factor of Safety Assessment, Ash Pond 2, Joliet 29 Station.” October 2016.
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12. Civil & Environmental Consultants, Inc. “Annual Inspection Report, Ash Pond 2, Joliet Station.” October 14, 2023.
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14. Sargent & Lundy. “2023 Structural Stability Assessment for Ash Pond 2.” S&L Project No. A12661.172. October 2023.
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16. Sargent & Lundy. “2024 Inflow Design Flood Control System Plan for Ash Pond 2.” S&L Project No. A12661.188. October 2024.
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APPENDIX A: 2016 FEDERAL STRUCTURAL STABILITY ASSESSMENT FOR ASH POND 2

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STRUCTURAL STABILITY AND FACTOR OF SAFETY ASSESSMENT
ASH POND 2
JOLIET 29 STATION
OCTOBER 2016

This report presents the initial periodic structural stability and initial safety factor assessment of the Ash Pond 2 at the Joliet 29 Station (Site) in Joliet, Illinois (Figure 1). This report addresses the initial structural stability and safety factor assessment requirements of the Coal Combustion Residuals (CCR) regulations, Code of Federal Regulations Title 40, Part 257, Subpart D (referred to as the CCR Rule). These regulations were published in the Federal Register on 17 April 2015 and became effective on 19 October 2015. The Joliet 29 Station is owned and operated by Midwest Generation, LLC (Midwest Generation). Based on the results provided in this report, Ash Pond 2 meets the requirements of §257.73(d) and §257.73(e) of the CCR Rule.

The work presented in this report was performed under the direction of Ms. Jane Soule, P.E., of Geosyntec Consultants, Inc. (Geosyntec) in accordance with §257.73(d) and §257.73(e). Mr. Robert White reviewed this report in accordance with Geosyntec's senior review policy.

1. Regulation Requirements - §257.73

Structural integrity criteria for existing CCR impoundments is described in §257.73 and includes structural stability and factor of safety assessments. Ash Pond 2 meets the minimum size and capacity criteria under §257.73(b) and is subject to the periodic structural stability and safety factor assessments required.

2. Site Conditions

Ash Pond 2 is approximately 500 feet by 280 feet in plan area and is located approximately 70 feet south of U.S. Route 6, east of Pond 1, west of the east entrance to the Joliet 29 Station, and north of the silo building at the Site. The pond is surrounded by embankments on the south, east, and west. There are no embankments on the north side of the pond where existing ground elevations generally increase to the north toward U.S. Route 6. Ash Pond 2 is currently lined with a 60-mil high density polyethylene (HDPE) geomembrane. A concrete retaining wall is located along the southern perimeter of Ash Pond 2, north of the silo building.

Based on available documentation and discussions with site personnel, Ash Pond 2, in its current configuration, was constructed in the late 1970s. A history of construction for the pond was prepared in accordance with §257.73(c) and describes the design of the Ash Pond 2 and its construction (Geosyntec, 2016a).

3. Structural Stability Assessment

The following subsections address the components of §257.73(d)(1).

3.1 Foundations and Abutments – §257.73(d)(1)(i)

Site observations and construction documents show Ash Pond 2 is surrounded by embankments on the south, east, and west. There are no embankments on the north side of the pond where existing ground elevations generally increase to the north; however, Site investigations indicate that fill material may be present along the northern boundary. For engineering purposes, material located along the northern embankment is considered consistent with embankment fill. Native materials do not provide lateral support for the embankments and therefore the pond does not include abutments. The remainder of this section addresses the foundation materials for the pond's embankments.

Previous subsurface investigations performed at the Site indicate that the foundation materials underlying the embankments for Ash Pond 2 generally consist of approximately 20 to 30 feet of medium dense to very dense sand and gravel (Geosyntec, 2016b). Due to the granular nature of the foundation soils (sand and gravel), foundation settlement associated with the construction and operation of Ash Pond 2 is anticipated to be predominately elastic settlement, which would have likely occurred soon after construction in the late 1970s. Because of the age of the embankments (over 35 years old), it is very likely that any potential consolidation and secondary compression settlement has also occurred. Further, the Ash Pond 2 embankments were not constructed with abutments or separate engineered zones that would be most susceptible to the adverse effects of differential settlement. During the initial annual inspection performed for Ash Pond 2 in accordance with §257.83(b), no visual evidence of adverse effects resulting from settlement was observed (Geosyntec, 2016c). There are no proposed changes in operation which would increase loading conditions on the foundation; therefore, no significant settlement of the foundation materials underlying the embankments is anticipated to occur in the future and the settlement of the foundation is not anticipated to impact the integrity of the impoundment embankments.

A factor of safety against the triggering of liquefaction was calculated for saturated foundation materials underlying the Ash Pond 2 embankments. The factor of safety was calculated based methods outlined in Idriss and Boulanger (2008) using information obtained from field explorations, including borings, Cone Penetration Test (CPT) soundings, and laboratory data (Geosyntec, 2016b) and seismic data (Geosyntec, 2016d). The triggering analysis indicated a very low likelihood of liquefaction occurring in the foundation materials underlying the embankments (Geosyntec, 2016d).

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3.2 Upstream Slope Protection – §257.73(d)(1)(ii)

Ash Pond 2 is lined with a 60-mil high density polyethylene (HDPE) geomembrane that protects the interior pond slopes from erosion, the effects of wave action, and mitigates effects of rapid drawdown.

3.3 Dike Compaction – §257.73(d)(1)(iii)

Because as-built construction documentation for Ash Pond 2 was not available at the time of this assessment, no quantitative evaluation of the degree of compaction of the embankments was performed. However, slope stability analyses show that the embankments for Ash Pond 2 are sufficient to withstand the range of loading conditions in the CCR unit (Geosyntec, 2016e).

3.4 Downstream Slope Protection – §257.73(d)(1)(iv)

The western downstream slope for Ash Pond 2 is the interior slope of Pond 1 and is lined with a geomembrane that provides erosion protection. Based on site observations in October 2015, the surfaces of eastern and southern downstream slopes for the Ash Pond 2 embankments consist of sandy gravel, gravelly sand, gravel, and some cobbles and include sparse vegetation. Based on site observations, the existing surface conditions of the slopes provide adequate slope protection.

3.5 Spillway – §257.73(d)(1)(v)

Ash Pond 2 was designed and constructed, and is operated and maintained, without an emergency spillway. Ash Pond 2 was constructed with elevated embankments on the south, east, and west perimeters. There are no embankments on the north side of the pond where existing ground elevations generally increase to the north. There is a 5-foot high, non-structural berm that exists between Ash Pond 2 and US route 6, which prevents run-on from US route 6. There is no significant run-on to the basins. Inflows for the pond consist solely of regulated flows from plant operations and precipitation that falls within the surface area of the pond and embankment crests. Surface water levels are maintained by regulating inflow from plant operations and maintaining operating levels. An inflow design flood control system plan has been prepared to document that the Basins adequately manage flow from the 1,000 year flood event (Geosyntec, 2016f).

3.6 Structural Integrity of Hydraulic Structures – §257.73(d)(1)(vi)

Hydraulic structures passing through or beneath the embankments of Ash Pond 2 consist of outlet pipes associated with Pond 1 and Ash Pond 2, as presented in Figure 2. These pipes were inspected on 9 June 2016 by a company specializing in video camera pipe inspections. No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that would negatively affect operation of the pipes was observed during inspection of these outlet pipes.

3.7 Downstream Slopes Adjacent to Water Bodies – §257.73(d)(1)(vii)

The only water body adjacent to Ash Pond 2 is Pond 1, located west of Ash Pond 2. When operated, Pond 1 will impound water against the western downstream slope of Ash Pond 2. The slope stability analyses presented in Geosyntec (2016e) consider a "low pool" condition for Pond 1 where no water is present in Pond 1 to provide a stabilizing force on the downstream face of the western slope of Ash Pond 2.

When Pond 1 is operated and water is impounded against the downstream face of the western slope of Ash Pond 2, the impounded water is unlikely to infiltrate into the embankment because Pond 1 is lined with a 60-mil HDPE geomembrane. Therefore, a rapid drawdown condition is not applicable to the western embankment of Ash Pond 2 and was not analyzed.

3.8 Structural Stability Assessment Deficiencies - §257.73(d)(2)

No structural stability deficiencies associated with Ash Pond 2 were identified in this initial structural stability assessment and no corrective measures are required.

3.9 Annual Inspection Requirement - §257.83(b)(4)(ii)

In accordance with §257.83(b)(4)(ii), submittal of this structural stability assessment precludes the requirement of an annual inspection under §257.83(b) for Ash Pond 2 during the 2016 calendar year.

4. Safety Factor Assessment

This section describes the initial safety factor assessment for Ash Pond 2 and the methodology used to perform the assessment in accordance with §257.73(e)(1). This assessment summarizes slope stability analyses of the critical embankment cross-section, shown in Figure 3, and evaluation of stability of the retaining wall southeast of the pond.

4.1 Slope Stability Methodology

Limit equilibrium slope stability analyses were performed to evaluate the stability of the embankments for Ash Pond 2. The process involved performing two-dimensional analyses on the critical cross-section for Ash Pond 2 using Spencer's Method as coded in the computer program SLOPE/W (Version 8.15.4.11512, www.geoslope.com) which satisfies vertical and horizontal force equilibrium and moment equilibrium (Geosyntec, 2016e). For each cross section analyzed, the program searches for the sliding surface that produces the lowest factor of safety

(FS). Factor of safety is defined as the ratio of the shear forces/moments resisting movement along a sliding surface to the forces/moments driving the instability.

Subsurface stratigraphy, groundwater conditions, and engineering parameters for the embankment and foundation materials were developed based on previous subsurface investigations performed at the Site (Geosyntec, 2016b and Geosyntec, 2016e).

4.2 Slope Stability Analyses

Four cases were analyzed to satisfy the safety factor assessment requirements in §257.73(e) (Geosyntec, 2016e).

4.2.1 Static, Long-Term Maximum Storage Pool Loading – §257.73(e)(1)(i)

Pursuant to §257.73(e)(1)(i) a static, long-term condition with the maximum operating pool loading on the embankments was evaluated. For Ash Pond 2, this condition included a pool elevation at 2 feet below the top of the embankments (Geosyntec, 2016e).

4.2.2 Static, Maximum Storage Pool Loading – §257.73(e)(1)(ii)

The conditions for §257.73(e)(1)(ii) are identical to §257.73(e)(1)(i) with the exception of the pool elevation, which is set at the top of the embankment (Geosyntec, 2016e).

4.2.3 Seismic – §257.73(e)(1)(iii)

Pursuant to §257.73(e)(1)(iii), a seismic condition for Ash Pond 2 was also analyzed. Seismic stability was evaluated with a pseudostatic analysis that uses constant horizontal accelerations to represent the effects of earthquake shaking. The horizontal accelerations are represented in SLOPE/W by a horizontal seismic coefficient. The horizontal seismic coefficient used for analysis was based on a peak ground acceleration with a 2 percent probability of exceedance in 50 years (Geosyntec, 2016g).

4.2.4 Liquefaction – §257.73(e)(1)(i)

The Ash Pond 2 embankment soils are assumed to be unsaturated. Based on quarterly groundwater monitoring in the vicinity of Ash Pond 2, groundwater is approximately 8 feet below the bottom of the pond. Further, the embankments are lined with an HDPE geomembrane liner that limits infiltration into the embankments and makes saturation of the embankments unlikely. Because the embankment soils are unlikely to be saturated and therefore are not considered susceptible to liquefaction, the calculation of a factor of safety for post-liquefaction slope stability is not required.

4.3 Results

The results of the slope stability analysis for the critical cross section of the Ash Pond 2 embankments are summarized in Table 1 below and presented in Figures 4 through 6 (Geosyntec 2016e).

Table 1: Safety Factor Results

Section	Safety Factor			
	257.73(e)(1)(i)	257.73(e)(1)(ii)	257.73(e)(1)(iii)	257.73(e)(1)(iv)
1	≥1.50	≥1.40	≥1.00	N/A

The results of the slope stability analyses meet the minimum safety factors requirements presented in §257.73(e)(1)(i) through §257.73(e)(1)(iii).

4.4 Retaining Wall Analyses

Stability of the retaining wall located on the southwest portion of the southern embankment of Ash Pond 2 was also evaluated (Geosyntec, 2016h). Construction drawings for the wall and site observations indicate that it is a reinforced concrete cantilever type wall. As-built construction documentation for the wall was not available. Inputs for the analyses were based on information provided in the construction drawings and developed from subsurface investigations at the Site (Geosyntec, 2016h and Geosyntec, 2016b). Factors of safety for bearing capacity, overturning, and sliding were calculated for the wall and results indicate that the factors of safety exceed minimum industry standard values (Geosyntec, 2016h).

5. Limitations and Certification

This initial periodic structural stability and safety factor assessment meets the requirements of §257.73(d) and §257.73(e) of the Code of Federal Regulations Title 40, Part 257, Subpart D, and was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

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Jane W. Soule

Jane W. Soule, P.E.
Illinois Professional Engineer No. 062-067766
Expiration Date: 11/30/2017

6. References

Geosyntec (2016a). History of Construction Report, Ash Pond 2, Joliet 29 Station, October.

Geosyntec (2016b). Soil Properties Calculations, Joliet 29 Station, October.

Geosyntec (2016c). Annual Inspection Report, Ash Pond 2, Joliet 29 Station, 18 January 2016.

Geosyntec (2016d). Liquefaction Calculations, Ash Pond 2, Joliet 29 Station, October.

Geosyntec (2016e). Slope Stability Calculations, Joliet 29 Station, October.

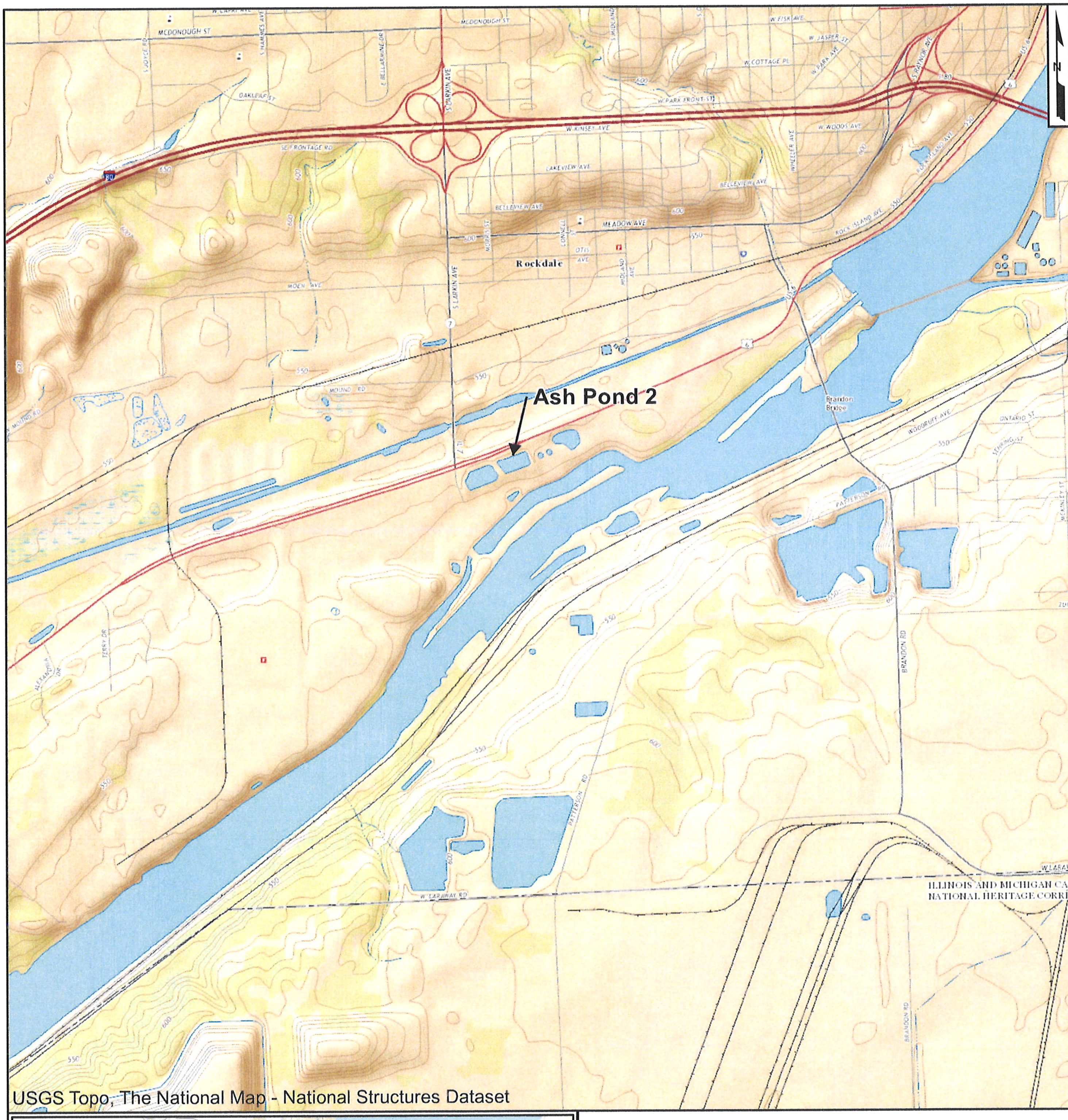
Geosyntec (2016f). Inflow Design Flood Control System Plan, Ash Pond 2, Joliet 29 Generating Station, October.

Geosyntec (2016g). Seismic Coefficient Calculations, Joliet 29 Station, October.

Geosyntec (2016h). Retaining Wall Calculations, Joliet 29 Station, October.

Idriss and Boulanger (2008). "Soil Liquefaction During Earthquakes". Earthquake Engineering Research Institute, MNO-12.

<u>Attachments</u>



2,000 1,000 0 2,000 Feet

Site Location

Ash Pond 2
Joliet 29 Station
Joliet, Illinois

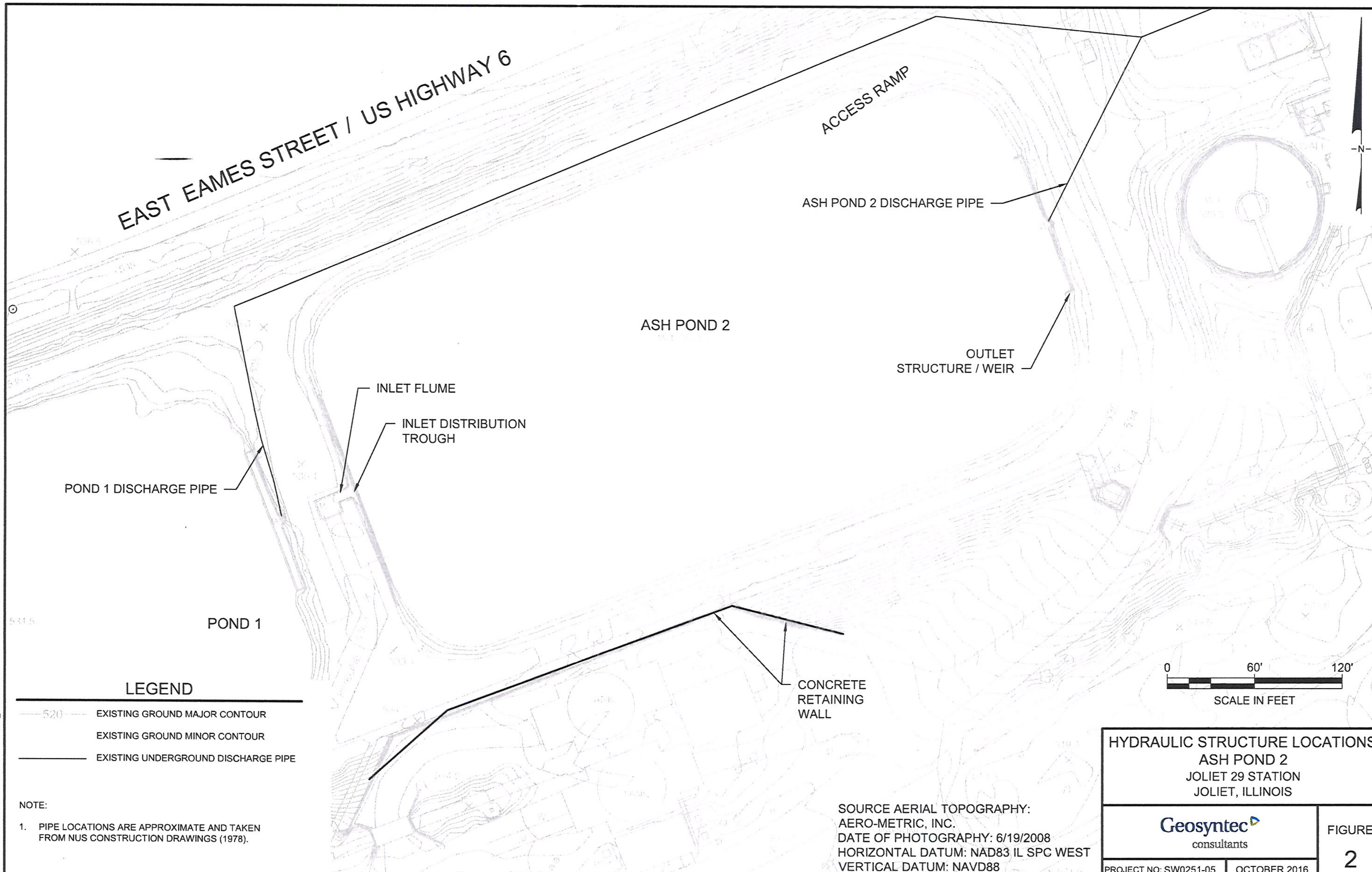
Geosyntec consultants

Figure

1

San Diego | October 2016

W:\GIS\JolietSiteLocation.mxd



LEGEND

520 EXISTING GROUND MAJOR CONTOUR

EXISTING GROUND MINOR CONTOUR

EXISTING UNDERGROUND DISCHARGE PIPE

NOTE:

1. PIPE LOCATIONS ARE APPROXIMATE AND TAKEN FROM NUS CONSTRUCTION DRAWINGS (1978).

SOURCE AERIAL TOPOGRAPHY:
AERO-METRIC, INC.
DATE OF PHOTOGRAPHY: 6/19/2008
HORIZONTAL DATUM: NAD83 IL SPC WEST
VERTICAL DATUM: NAVD88

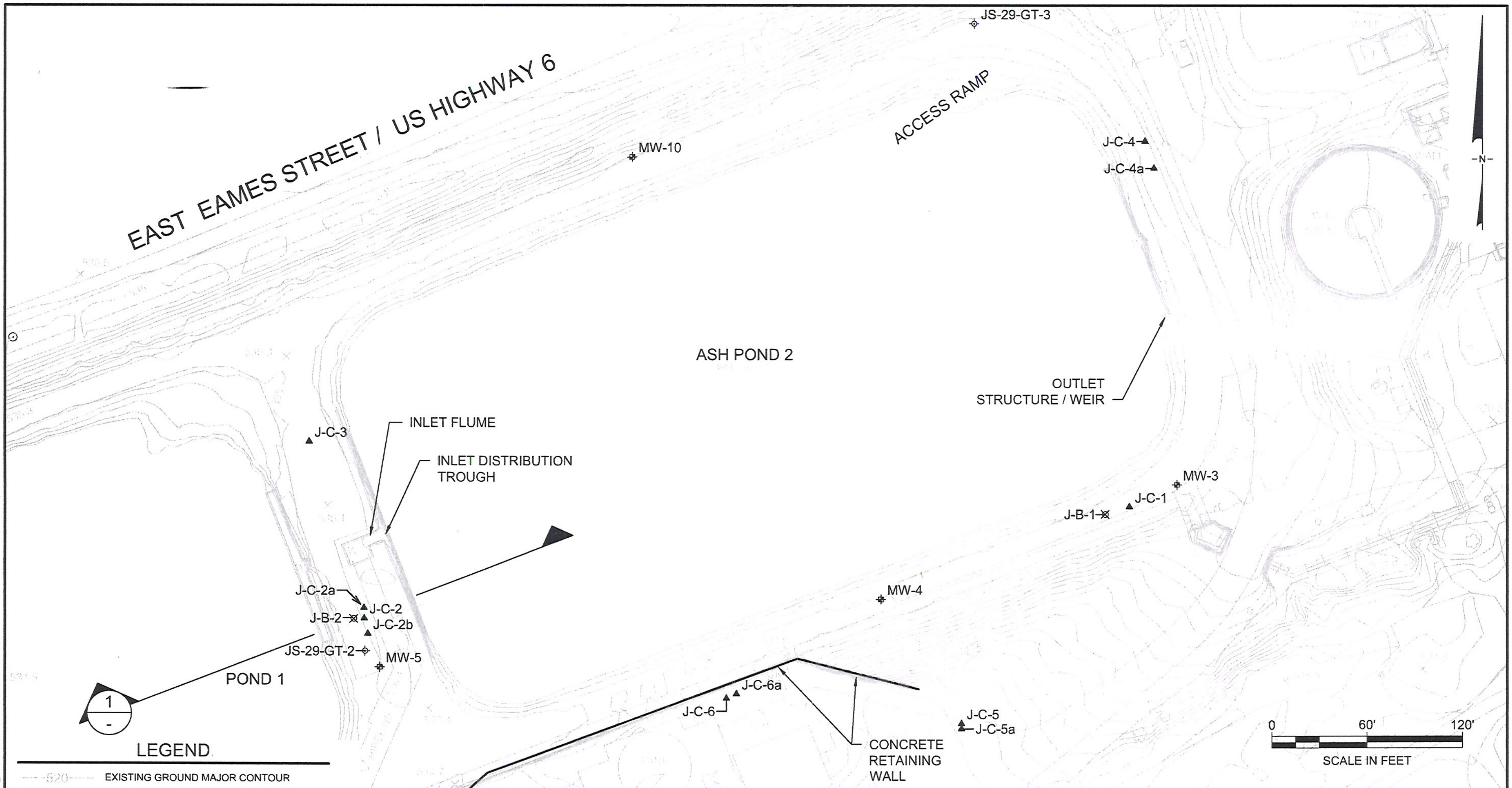
HYDRAULIC STRUCTURE LOCATIONS
ASH POND 2
JOLIET 29 STATION
JOLIET, ILLINOIS

Geosyntec consultants

PROJECT NO: SW0251-05 | OCTOBER 2016

FIGURE 2

Z:\CADD\FIGURES\JOLIET\SW0251-05 F02_HYDRAULIC STRUCTURES



LEGEND

520 EXISTING GROUND MAJOR CONTOUR

EXISTING GROUND MINOR CONTOUR

MW-03 MONITORING WELL (PATRICK, 2011)

J-B-1 BORING (GEOSYNTEC, 2016)

J-C-1 CPT SOUNDING (GEOSYNTEC, 2016)

JS-29-GT-2 BORING (KPRG, 2005)

CROSS SECTION LCOATION

NOTE:
1. ALL EXPLORATION LOCATIONS ARE APPROXIMATE.

SOURCE AERIAL TOPOGRAPHY:
AERO-METRIC, INC.
DATE OF PHOTOGRAPHY: 6/19/2008
HORIZONTAL DATUM: NAD83 IL SPC WEST
VERTICAL DATUM: NAVD88

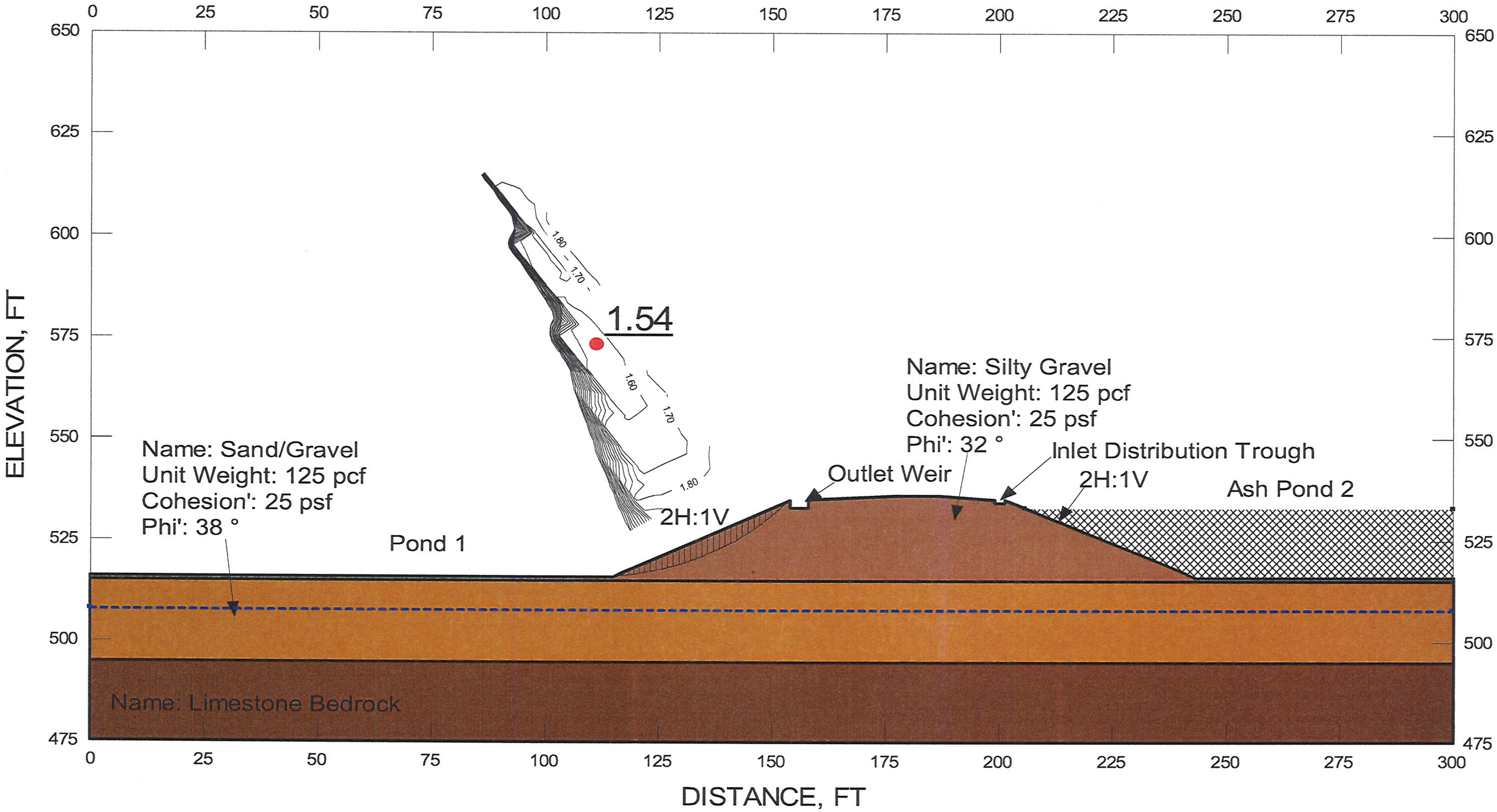
CRITICAL CROSS SECTION
ASH POND 2
JOLIET 29 STATION
JOLIET, ILLINOIS

Geosyntec consultants

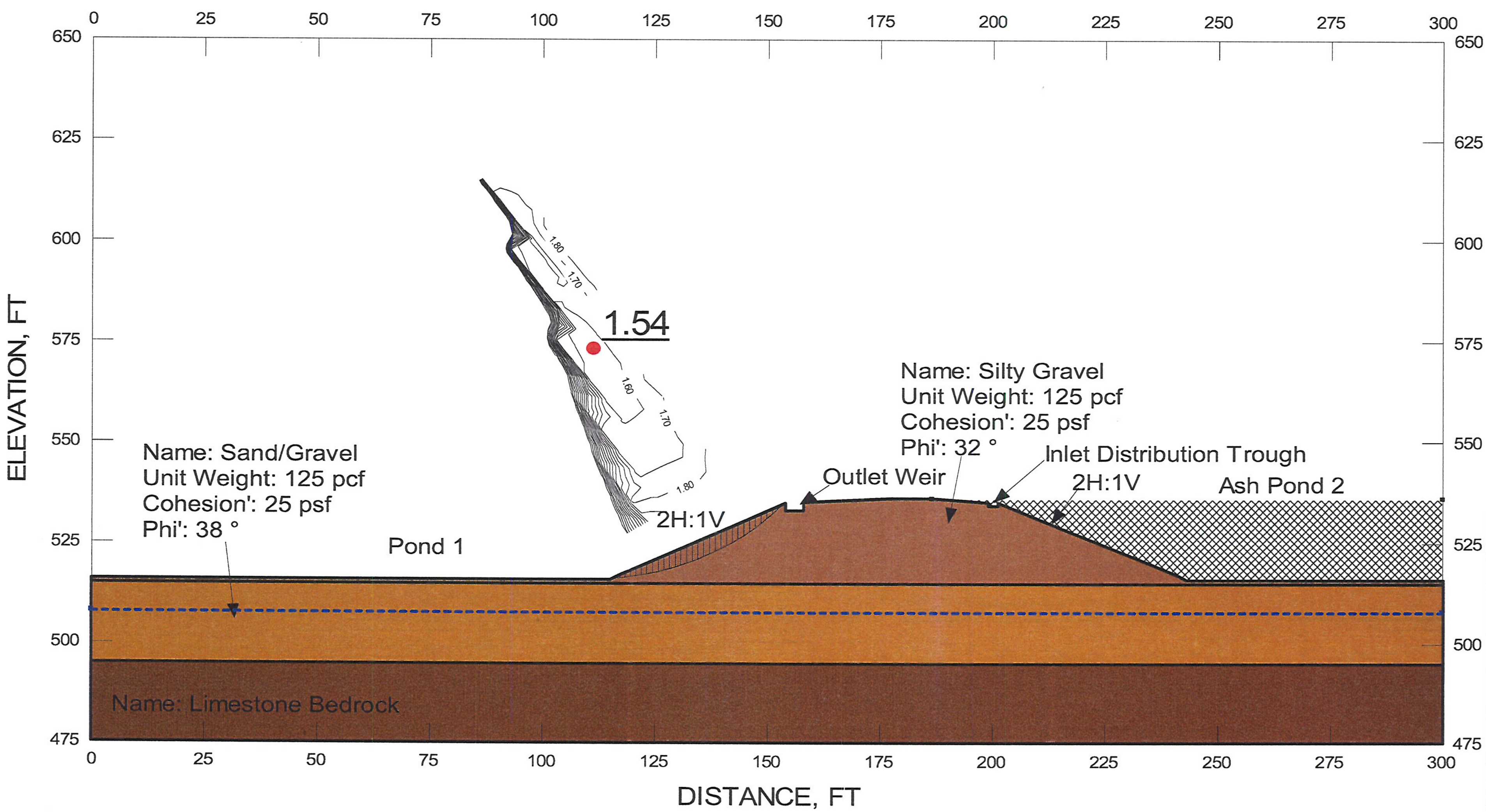
FIGURE 3

PROJECT NO: SW0251-05 | OCTOBER 2016

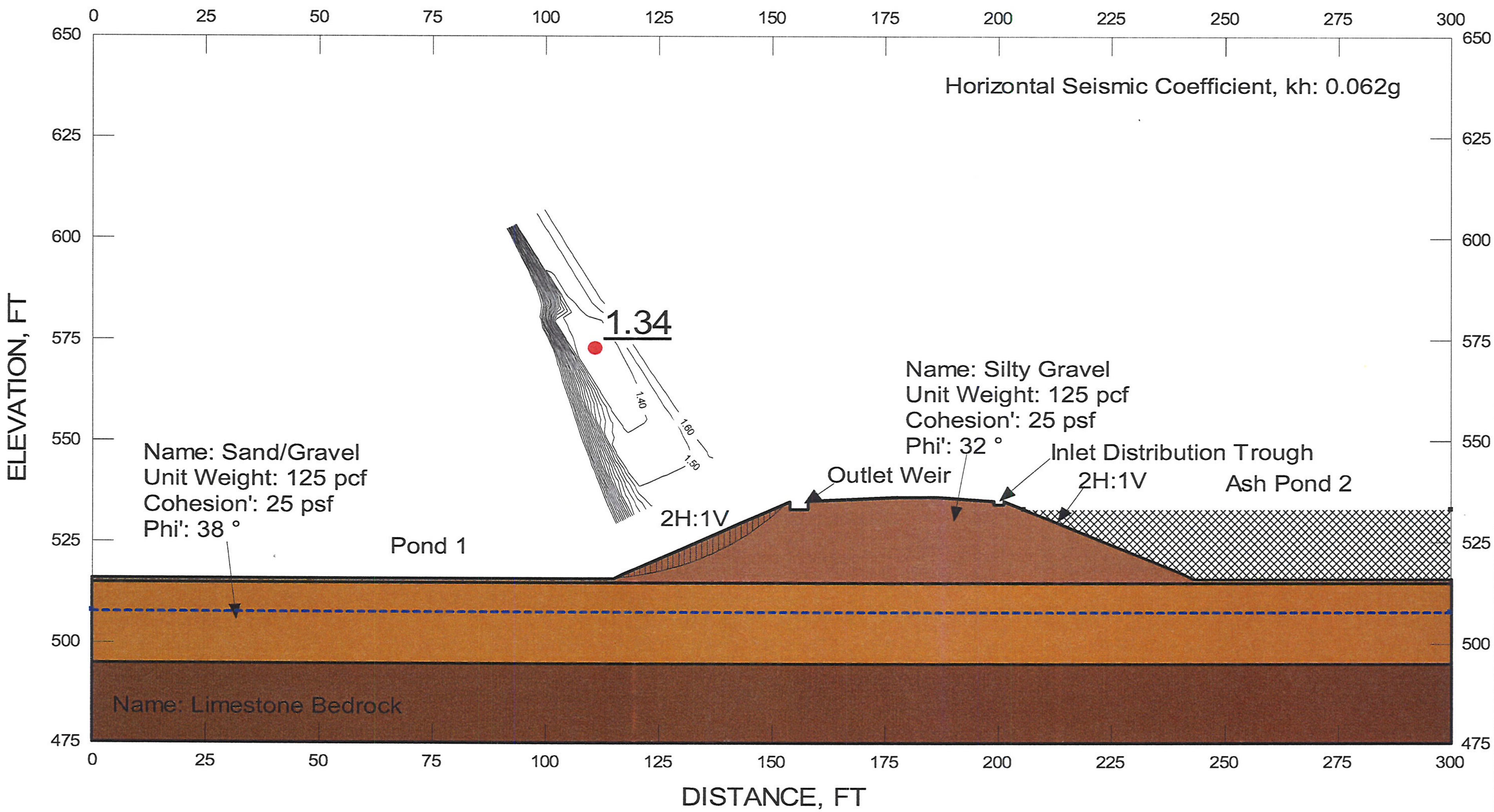
Z:\CADD\FIGURES\JOLIET\SW0251-05 F03_STABILITY SECTIONS (CRITICAL)



Geosyntec consultants	Analysis	Section 1 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading		FIGURE 4
	Project	Joliet Ash Pond 2	Analysis By: Cory Russell	
	File Name	Joliet Ash Pond 2.Section 1.gsz	Date: October 2016	



Geosyntec consultants	Analysis: Section 1 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading		FIGURE 5
	Project: Joliet Ash Pond 2	Analysis By: Cory Russell	
	File Name: Joliet Ash Pond 2.Section 1.gsz	Date: October 2016	



Geosyntec consultants	Analysis: Section 1 - §257.73(e)(1)(iii): Long Term, Maximum Storage Pool Loading with Seismic		FIGURE 6
	Project: Joliet Ash Pond 2	Analysis By: Cory Russell	
	File Name: Joliet Ash Pond 2.Section 1.gsz	Date: October 2016	