MWG

Midwest Generation, LLC

Waukegan Generating Station

2024 Structural Stability Assessment for East Ash Pond & West Ash Pond

Revision 0

October 13, 2024

Issue Purpose: Use

Project No.: A12661.187

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EXECUTIVE SUMMARY

This report presents the 2024 annual structural stability assessment for the East Ash Pond and West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" 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 the East and West Ash Ponds are consistent with recognized and generally accepted engineering practices specified in 35 Ill. Adm. Code 845.450(a) for the ponds' storage capacities. To complete this assessment, S&L performed a visual surveillance of the ponds on September 11, 2024, facilitated discussions with MWG personnel, and reviewed recent annual inspections and historical documentation for the ponds.

Currently, the East and West Ash Ponds are out of service, and the Station has opened the Recycle Water Sump drain gates to lower and control the water levels in the ponds. As a result, the water level in each pond is limited to approximately one foot. Indeed, during S&L's site visit on September 11, 2024, no appreciable amount of surface water was observed in either pond. Closure construction activities will commence at both ponds upon receipt of closure construction permits from the Illinois EPA in accordance with Subpart B of the 35 Ill. Adm. Code Part 845.

The 2023 structural stability assessment recommended several corrective actions, including regular mowing of vegetation, removal of woody plants, and surveillance of hydraulic structures during closure construction. S&L noted that the Station had mowed the vegetation that was observed to be taller than 12 inches along the East and West Ash Ponds' dikes and along the crests of the interior berms during last year's structural stability assessment in accordance with the corrective measures recommended therein. S&L also noted that woody vegetation that had been present in these areas had also been removed in accordance with our recommendations. However, although the vegetation had been mowed since last year's assessment, vegetation along the ponds' north dikes and south dikes and along the crests of the interior berms was observed at heights taller than 12 inches during this year's assessment; some woody vegetation had also regrown.

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

Table ES-1 – 2024 Structural Stability Assessment Findings for the East Ash Pond and West Ash Pond at Waukegan Generating Station

Area	35 Ill. Adm. Code Ref.	Findings
Stable Foundations & Abutments	§ 845.450(a)(1)	• The soils supporting the East and West Ash Ponds' 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 ponds' downstream slopes against surface erosion, wave action, and adverse effects of sudden drawdown. • Vegetation along the ponds' north dikes and south dikes and along the crests of the interior berms was observed at heights taller than 12 inches during this year's assessment, and some woody vegetation had regrown.
Dike Compaction	§ 845.450(a)(3)	• The ponds' 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 ponds.
Spillways	§ 845.450(a)(5)	• The ponds do not have spillways.
Embedded Hydraulic Structures	§ 845.450(a)(6)	• No visual surveillance programs have been performed since the initial video camera inspection in June 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 the unnamed channel south of the ponds. • The ponds' downstream slopes are not considered to be susceptible to a sudden (rapid) drawdown loading condition.

Table ES-2 – 2024 Recommended Corrective Measures per 35 Ill. Adm. Code 845.450(b)(1) for the East Ash Pond and West Ash Pond at Waukegan Generating Station

Recommended Corrective Measure	Timeframe
Continue mowing vegetation taller than 12 inches and removing woody vegetation. Woody vegetation shall be removed in a manner that does not risk destabilizing the subject CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel removing the woody vegetation.	Now, and As Required to Maintain Vegetative Cover Under 12 Inches
Remove the hydraulic structures passing through the East and West Ash Ponds' northern dikes.	During Closure Construction

1.0 PURPOSE & SCOPE

1.1 PURPOSE

The East Ash Pond and West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are 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 the East and West Ash Ponds are consistent with recognized and generally accepted engineering practices for the CCR surface impoundments' storage capacities.

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 the East and West Ash Ponds at Waukegan.

1.2 SCOPE

In addition to being regulated under the Illinois CCR Rule, Waukegan's East and West Ash Ponds are 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, the East and West Ash Ponds 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 periodic assessment was completed (2021).

2.0 INPUTS, PREVIOUS RESULTS, & CURRENT OPERATIONS

2.1 INPUTS

The findings documented in this 2024 structural stability assessment for the East and West Ash Ponds are based on the following inputs:

- Observations made during a site visit by S&L on September 11, 2024.

- Discussions with MWG personnel.
- The history of construction for the East and West Ash Ponds (Ref. 12).
- The annual inspection reports prepared for the CCR surface impoundments in accordance with 40 CFR 257.83(b) and 35 Ill. Adm. Code 845.540(b) (Refs. 5 through 11).
- The weekly inspection reports prepared in accordance with 35 Ill. Adm. Code 845.540(a) since the 2023 structural stability assessment was issued (Ref.16).
- The initial federal structural stability assessment prepared for the CCR surface impoundments in accordance with 40 CFR 257.73(d) (Ref. 4).

The initial federal structural stability assessment for the East and West Ash Ponds, 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 the East and West Ash Ponds based on the findings documented in the 2023 structural stability assessment (Ref. 13).

Table 2-1 – 2023 Recommended Corrective Measures for East & West Ash Ponds

Recommended Corrective Measure	Timeframe
Continue mowing vegetation taller than 12 inches and removing woody vegetation. Woody vegetation shall be removed in a manner that does not risk destabilizing the subject CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel removing the woody vegetation.	Now, and As Required to Maintain Vegetative Cover Under 12 Inches
Conduct a visual surveillance program to verify that the hydraulic structures passing through the West Ash Pond's northern dike are in good, working condition and are free of significant material defects that could compromise the structures' integrities.	During Closure Construction
Remove the hydraulic structures passing through the East Ash Pond's northern dike.	During Closure Construction

2.3 CURRENT POND OPERATING CONDITIONS

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. In April 2021, MWG filed a notice of intent to close the West Ash Pond in accordance with the Federal CCR Rule's closure criteria (Ref. § 257.102). Following the retirements of Units 7 and 8 in June 2022, Waukegan ceased placing CCR wastestreams into the East Ash Pond but continued to use the pond to manage stormwater run-off from the Station property. After implementing modifications to its stormwater management system in May 2024, the Station ceased placing stormwater run-off into the East Ash Pond, and MWG filed a notice of intent to close

the East Ash Pond in June 2024. Closure construction activities will commence at both ponds upon receipt of closure construction permits from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule.

As a part of the modifications made in 2024 to the Station's stormwater management system, the Station opened the Recycle Water Sump drain gates to lower the water level in the East Ash Pond, and the Station continues to keep these gates open to limit water accumulation in the East and West Ash Ponds, essentially leaving the ponds in a constant dewatering state. Because these drain gates are situated one foot above the bottom of each pond, the normal water level in each pond will be limited to approximately one foot (Ref. 16). Indeed, S&L did not observe appreciable surface water in either pond during our site visit on September 11, 2024.

3.0 ASSESSMENT

3.1 STABLE FOUNDATIONS & ABUTMENTS

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

The East and West Ash Ponds are comprised of earthen dikes on all sides and do not have any abutments. Detailed information on the soils supporting the East and West Ash Ponds' dikes is provided in the ponds' initial federal structural stability assessment in Appendix A. Based on reviews of the ponds' annual inspection reports (Refs. 5 through 11) and Google Earth aerial images (Ref. 3), there have been no significant modifications to East and West Ash Ponds' geometries since their initial federal structural stability assessment was completed. Therefore, the details of the soils supporting the East and West Ash Ponds' dikes and corresponding conclusions documented in the ponds' initial federal structural stability assessment remain valid for this 2024 assessment (see Appendix A). Thus, the soils supporting the East and West Ash Ponds' 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 the East and West Ash Ponds are lined with high-density polyethylene (HDPE) geomembrane liners. This form of cover protects the upstream slopes of the ponds' dikes against surface erosion, wave action, and adverse effects of sudden (rapid) drawdown.

Slope protection for the downstream slopes of the East and West Ash Ponds consists of vegetative cover which provides protection against surface erosion. Because the ponds' downstream slopes are unlikely to be inundated by surface water of an adjacent water body, these slopes are not expected to be subject to wave

action or sudden (rapid) drawdown. However, the vegetative cover present on these slopes would provide protection against wave action and the adverse effects of sudden (rapid) drawdown in such conditions.

During our site visit on September 11, 2024, S&L noted that the Station had mowed the vegetation that was observed to be taller than 12 inches along the East and West Ash Ponds' dikes and along the crests of the interior berms during the 2023 structural stability assessment in accordance with the corrective measures recommended therein (see Section 2.2, Ref. 13). S&L also noted that woody vegetation that had been present in these areas had also been removed in accordance with our recommendations. However, although the vegetation had been mowed since last year's assessment, vegetation along the ponds' north dikes and south dikes and along the crests of the interior berms was observed at heights taller than 12 inches during this year's assessment; some woody vegetation had also regrown.

It is recommended that the Station continue mowing grassy vegetation and removing woody vegetation, increasing the frequency as needed to maintain vegetative cover less than 12 inches in accordance with the Illinois CCR Rule (Ref. 1, §§ 845.430(b)(4) and 845.430(b)(5)). Any woody vegetation that is removed shall be removed in a manner that does not risk destabilizing the subject CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel removing the woody vegetation.

3.3 DIKE COMPACTION

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

As documented in the East and West Ash Ponds' initial federal and 2024 safety factor assessments (Refs. 4 and 14), the ponds' 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 ponds due to the Station maintaining the Recycle Water Sump drain gates in an open position to limit the normal water levels in the ponds to about one foot.

3.4 SPILLWAYS

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

The East and West Ash Ponds do not have spillways. As documented in the ponds' 2024 inflow design flood control system plan (Ref. 15), each pond is capable of managing the design flood event (1000-year, 24-hour storm) without a spillway.

3.5 EMBEDDED HYDRAULIC STRUCTURES

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

The West Ash Pond has a reinforced concrete distribution trough along the upstream slope of its northern dike that, when the pond was operating, received wastewater from a reinforced concrete inlet trench that passes through the pond's northern dike. The East Ash Pond has a similar reinforced concrete distribution trough that, when the pond was operating, received wastewater from two reinforced concrete inlet trenches that pass through the pond's northern dike. Meanwhile, portions of three discharge pipes from the Recycle Water Sump located between the East and West Ash Ponds also pass through the ponds' northern dikes. The locations of these hydraulic structures are shown on Figure 2 of the ponds' initial federal structural stability assessment in Appendix A.

As documented in the initial federal structural stability assessment, visual surveillance of the hydraulic structures passing through the East and West Ash Ponds' northern dikes was performed in June 2016. No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that may negatively affect the ponds were identified during the surveillance program except for two isolated locations in two of the discharge pipes from the Recycle Water Sump (labeled Pipes 4E and 4W in Figure 2 of Appendix A). The Station subsequently repaired the deficient portions of these pipes that were identified by the surveillance program.

No similar visual surveillance programs have been performed since the initial video camera inspection in June 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. Moreover, since the East and West Ash Ponds have been taken out of service and the water levels in the ponds are being limited to about one foot, the hydraulic structures passing through the ponds' northern dikes are not expected to convey water again. Therefore, it is recommended that the Station remove the hydraulic structures passing through the East and West Ash Ponds' northern dikes as part of the ponds' closure construction activities.

3.6 LOW POOL & RAPID DRAWDOWN STABILITY

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

As documented in the East and West Ash Ponds' initial federal safety factor assessment (Ref. 4), the results of which were revalidated in their 2024 safety factor assessment (Ref. 14), the structural stabilities of the ponds' downstream slopes are maintained during low pool conditions in the unnamed channel south of the ponds. As previously mentioned, the ponds' downstream slopes are unlikely to be inundated by surface water of an adjacent water body, including the unnamed channel south of the ponds. Thus, the East and West Ash Ponds are not considered to be susceptible to a sudden (rapid) drawdown loading condition.

Based on reviews of the East and West Ash Ponds' annual inspection reports (Refs. 5 through 11) and Google Earth aerial images (Ref. 3), there have been no significant modifications to either pond since their initial federal structural stability assessment was completed. Therefore, the conclusions documented therein regarding the stability of the ponds' southern dikes during low pool conditions at the unnamed channel south of the ponds 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 the East and West Ash Ponds in accordance with the findings documented in this 2024 structural stability assessment.

Table 4-1 – Recommended Corrective Measures for East & West Ash Ponds

Recommended Corrective Measure	Timeframe
Continue mowing vegetation taller than 12 inches and removing woody vegetation. Woody vegetation shall be removed in a manner that does not risk destabilizing the subject CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel removing the woody vegetation.	Now, and As Required to Maintain Vegetative Cover Under 12 Inches
Remove the hydraulic structures passing through the East and West Ash Ponds' northern dikes.	During Closure Construction

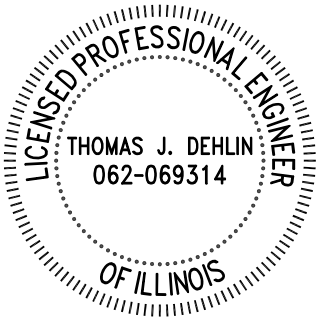
5.0 CERTIFICATION

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:



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6.0 REFERENCES

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14. Sargent & Lundy. “2024 Safety Factor Assessment for East Ash Pond & West Ash Pond.” S&L Project No. A12661.187. October 2024.
15. Sargent & Lundy. “2024 Inflow Design Flood Control System Plan for East Ash Pond & West Ash Pond.” S&L Project No. A12661.187. October 2024.
16. Midwest Generation, LLC. “IL Weekly and Monthly Inspection.” 2023 Week 42 through 2024 Week 39. Accessed via https://midwestgenerationllc.com/illinois-ccr-rule-compliance-data-and-information/.

APPENDIX A: 2016 FEDERAL STRUCTURAL STABILITY ASSESSMENT FOR EAST & WEST ASH PONDS

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STRUCTURAL STABILITY AND FACTOR OF SAFETY ASSESSMENT
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2016

This report presents the initial periodic structural stability and initial safety factor assessment of the East and West Ash Basins (the Basins) at the Waukegan Station (Site) in Waukegan, 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 Waukegan Station is owned and operated by Midwest Generation, LLC (Midwest Generation). Based on the results provided in this report, the East and West Ash Ponds meet 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. The East and West Ash Basins meet the minimum size and capacity criteria under §257.73(b) and are subject to the structural stability and safety factor assessments required.

2. Site Conditions

The Basins are co-located in the southeastern portion of the Waukegan Station. A divider berm extends north-south between the Basins. The Basins are irregular in shape, and each includes a finger berm extending from the northern boundary southward approximately 715 feet. The West Ash Basin is approximately 470 feet by 975 feet in plan dimensions with a total plan area of approximately 11.0 acres (including the finger berm and embankment crests). The East Ash Basin is approximately 470 feet by 1,030 feet in plan dimensions with a total plan area of approximately 11.8 acres (including the finger berm and embankment crests).

A retaining wall is located on the downstream side of the north embankment, north of the outlet structures for the Basins.

Based on available documentation and discussions with site personnel, the Basins, in their current configuration, were constructed in the late 1970s. A history of construction for the Basins

was prepared in accordance with §257.73(c) and describes the design of the Basins and their 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)

The East and West Ash Basins consist of fill embankments on all sides. The area west of the West Ash Basin includes fill graded to approximately the same elevation as the west embankment crest. Because no formational material provides lateral structural support for the embankments, there are no abutments associated with the Basins. The remainder of this section addresses the foundation materials for the East and West Ash Basins.

Previous subsurface investigations performed at the Site indicate the foundation materials underlying the embankments for the East and West Ash Basins generally consist of approximately 30 feet of dense, poorly graded sand with some gravel, and silt and silty sand associated with the Henry Formation (Geosyntec, 2016b). Due to the granular nature of the foundation soils (mostly sand and gravel), settlement associated with the construction and operation of the Basins is anticipated to be predominately elastic settlement, which would likely have occurred soon after construction in the late 1970s. Because of the age of the embankments (over 35 years old), the majority of potential consolidation and secondary compression settlement has likely already occurred. Further, the embankments of the Basins 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 the Basins 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 Basins' 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, laboratory data (Geosyntec, 2016b), and seismic data (Geosyntec, 2016d). The liquefaction triggering analyses shows a very low likelihood of liquefaction occurring in the foundation materials underlying the embankments (Geosyntec, 2016d).

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

The West and East Basins are lined with a 60-mil high density polyethylene (HDPE) geomembrane that protects the interior basin slopes from erosion, the effects of wave action, and mitigates potential effects of rapid drawdown.

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

Documentation of as-built construction conditions for the East and West Ash Basin embankments was not available at the time of this report. However, available construction drawings from 1977 indicated that embankment fill was to be compacted to a minimum of 95 percent relative compaction as determined by Modified Proctor testing. No recent quantitative evaluation of the degree of compaction of the embankments was performed on the embankments in their current state; however, slope stability analyses shows the embankments for the East and West Ash Basins are sufficient to withstand the range of loading conditions in the CCR units (Geosyntec, 2016e).

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

The northern and southern downstream slopes of the West and East Ash Basins are covered with established vegetation. The eastern downstream slope of the East Ash Basin has been recently covered in erosion control matting and seeded. Based on site observations, the existing surface conditions of the slopes provide adequate slope protection.

3.5 Spillway – §257.73(d)(1)(v)

The West and East Basins were designed and constructed, and are operated and maintained, without spillways. Inflows for the Basins consist solely of regulated flows from plant operations and precipitation that falls within the surface area of the Basins and embankment crests. There is no significant run-on to the Basins. Subsequently, surface water levels are maintained by regulating inflow from plant operations, regulating outflow quantities, and monitoring and maintaining freeboard to accommodate precipitation from the design storm event. An inflow design flood control system plan has been prepared to document that the Basins adequately manage flow from the design event (Geosyntec, 2016f).

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

Hydraulic structures passing through or beneath the embankments of the East and West Ash Basins consist of six pipes and conveyance structures associated with the inlet and outlet structures of the Basins. These structures and pipes were inspected between 1 June 2016 and 7 June 2016 by a company specializing in video camera pipe inspections. Inspections consisted

only of the length of the pipe or structure that passes through or beneath the Basins' embankments. The inspected structures and pipes related to the East and West Ash Basins are presented on Figure 2.

The video inspections showed no significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that would negatively affect the operation of Pipes 1, 2, 3, and 5. The video inspections identified isolated areas of deformation and deterioration of Pipes 4E and 4W, which are 24-inch diameter concrete pipes with invert locations at the bottom of the outlet structures for the East and West Ash Basins, respectively. These pipes are located under the north embankment and are utilized for dewatering the outlet structure. Repairs were made to Pipe 4E to mitigate the isolated areas of deformation and deterioration identified during the inspection. The valve for controlling flow into Pipe 4W has been closed by Site personnel, and Pipe 4W will not be used until a repair is completed. Pipe 4W is not required for normal operation of the West Ash Basin.

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

Water bodies near the East and West Ash Basins include a drainage channel located south of the Basins and marsh area east of the Basins. Stability analyses presented in Section 3 demonstrate structural stability with the water body at a "low pool" condition where there is little or no stabilizing force present on the downstream slope of the embankments.

Significant inundation of the downstream slopes of the East and West Ash Basins from the water body is unlikely, and the generally coarse-grained embankment fill materials that are relatively free-draining make a rapid drawdown analysis not applicable. Therefore, a rapid drawdown condition is not anticipated to impact structural stability of the impoundment embankments.

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

A structural stability deficiency associated Pipe 4W was identified in this initial structural stability assessment. Geosyntec suggests relining the interior of the deficient portions of the pipe as a eorrective action. The pipe will remain out of service until the repair is complete. Documentation detailing the corrective measures taken to repair the pipe will be prepared after the repair is complete.

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 the East and West Ash Basins during the 2016 calendar year. Deficiencies identified in the initial annual inspection for the East

and West Ash Basins were corrected as documented in the Notice of Remedy prepared in response to the initial annual inspection.

4. Safety Factor Assessment

This section describes the initial safety factor assessment for the East and West Ash Basins and the methodology used to perform the assessment in accordance with §257.73(e)(1). This assessment includes slope stability analyses of the critical embankment cross-sections for each basin, shown in Figure 3, and evaluation of stability of the retaining wall north of the Basins.

4.1 Slope Stability Methodology

Limit equilibrium slope stability analyses were performed to evaluate the stability of the embankments for the East and West Ash Basins. The process involved performing two-dimensional analyses on the critical cross-sections for each basin 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

As presented in Table 1, 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 the East and West Ash Basins, this condition included a pool elevation 2 feet below the lowest point of the embankment crest (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 lowest points of the embankment crest (Geosyntec, 2016e).

4.2.3 Seismic – §257.73(e)(1)(iii)

Pursuant to §257.73(e)(1)(iii), a seismic condition for East and West Ash Basins 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)(iv)

The majority of the embankment soils for the East and West Ash Basins are not considered susceptible to liquefaction because saturation of the embankment soils is unlikely based on the presence of a geomembrane liner system. Based on the design phreatic surface discussed in Geosyntec (2016b), a limited portion of the bottom of the embankments may become saturated from groundwater. Liquefaction triggering analyses of these saturated embankment soils indicate that liquefaction and associated post-liquefaction shear strength loss is unlikely for the seismic design event (Geosyntec, 2016d). Because the likelihood of liquefaction and associated shear strength loss of the embankment soils is very low, post-liquefaction conditions are represented by the static factor of safety analyses.

4.3 Results

The results of the slope stability analysis for the critical cross sections of the East and West Ash Basin embankments are summarized in Table 1 below and presented in Figures 4 through 9 (Geosyntec 2016e).

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	≥1.20
2	≥1.50	≥1.40	≥1.00	≥1.20

These results meet the factor of safety requirements presented in §257.73(e)(1)(i) through §257.73(e)(1)(iv).

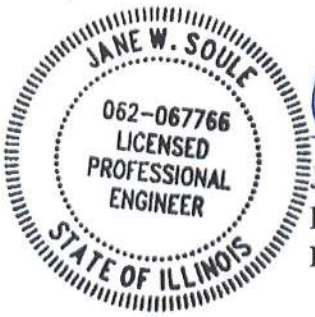
4.4 Retaining Wall Analyses

Stability of the retaining wall located north of the East and West Ash Basins was also evaluated (Geosyntec, 2016h). Construction drawings for the wall were not available, but Geosyntec personnel observed that the wall is a metal bin wall, a form of gravity retaining structure similar to a crib wall, built by combining "bins", or cells filled with soil. Inputs for the analyses were based on field observations and measurements of the wall the subsurface investigations at the

Site (Geosyntec, 2016h and Geosyntec, 2016b). Factors of safety for bearing capacity, overturning, and sliding were calculated for the wall based on methods for evaluating a cantilever retaining wall in Das (2007). Results show that the factors of safety for the wall 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.



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

6. References

Das, 2007. "Principles of Foundation Engineering," Sixth edition. Thomson Canada Limited.

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Geosyntec, 2016b. East and West Ash Basin – Soil Properties Calculation, Waukegan Station, October.

Geosyntec, 2016c. Annual Inspection Report, East and West Ash Basin, Waukegan Station, 18 January 2016.

Geosyntec, 2016d. East and West Ash Basin – Liquefaction Calculations, Waukegan Station, October.

Geosyntec, 2016e. East and West Ash Basin – Slope Stability Calculations, Waukegan Station, October.

Geosyntec, 2016f. Inflow Design Flood Control System Plan, West and East Ash Basins, Waukegan Generating Station, October.

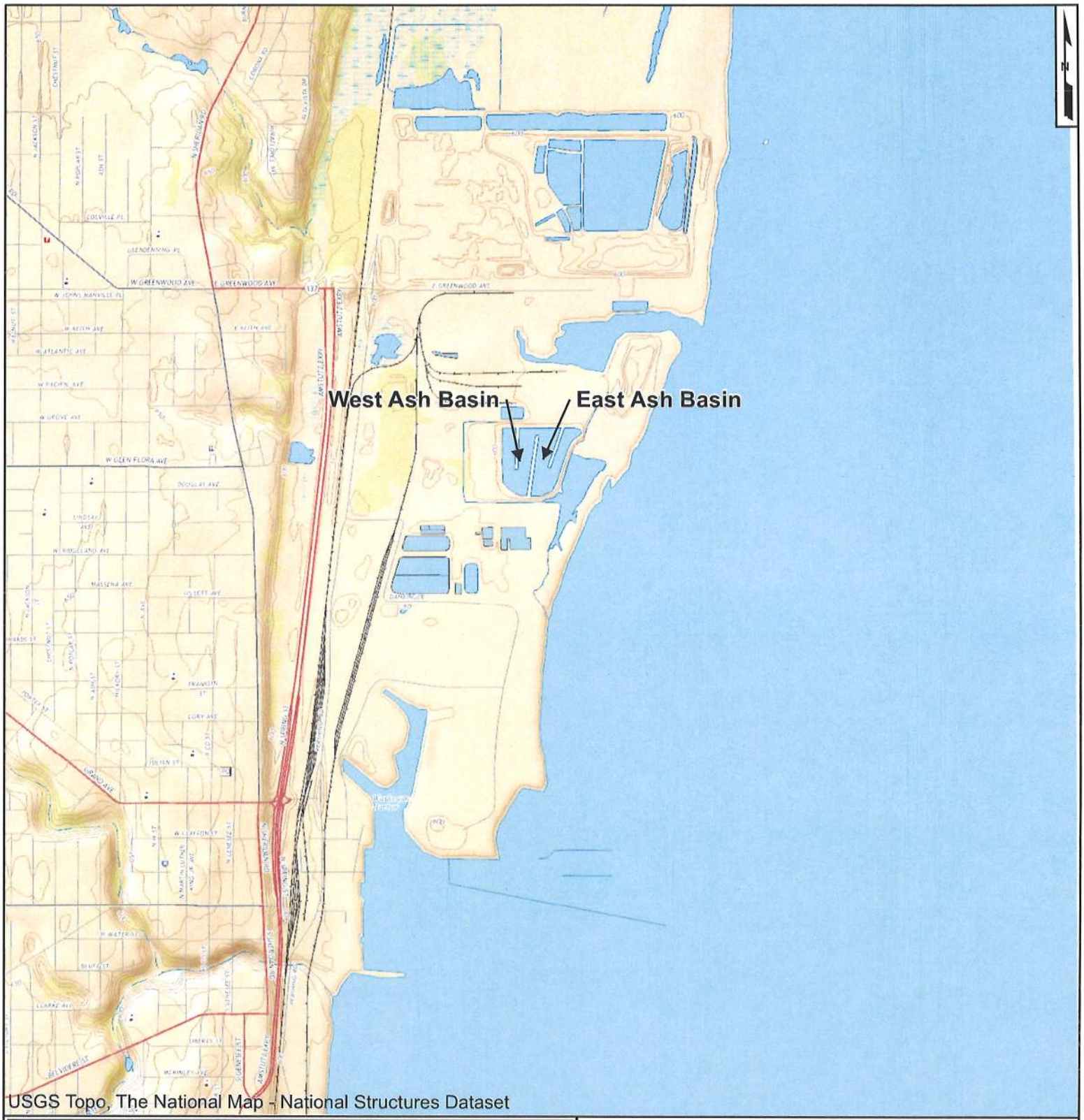
Geosyntec, 2016g. East and West Ash Basin – Seismic Coefficient Calculations, Waukegan Station, October.

Geosyntec, 2016h. East and West Ash Basin – Retaining Wall Calculations, Waukegan, October.

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

Attachments

Figure 1 – Site Location
Figure 2 – Pipe Locations
Figure 3 – Slope Stability Cross Sections
Figure 4 – Slope Stability Output, Section 1 - 257.73(e)(1)(i)
Figure 5 – Slope Stability Output, Section 1 - 257.73(e)(1)(ii)
Figure 6 – Slope Stability Output, Section 1 - 257.73(e)(1)(iii)
Figure 7 – Slope Stability Output, Section 2 - 257.73(e)(1)(i)
Figure 8 – Slope Stability Output, Section 2 - 257.73(e)(1)(ii)
Figure 9 – Slope Stability Output, Section 2 - 257.73(e)(1)(iii)



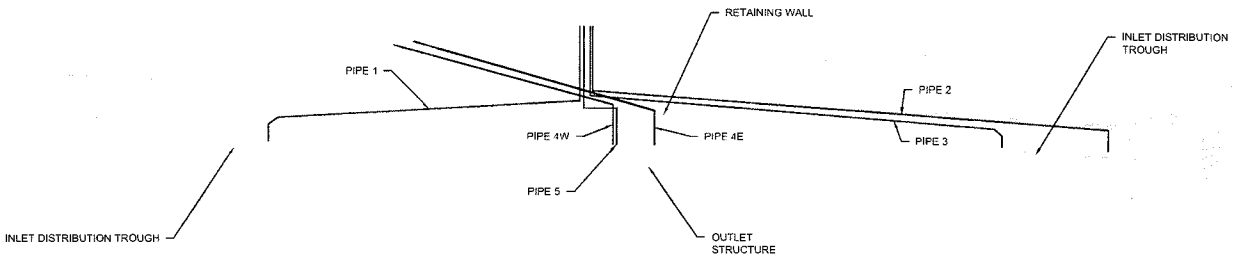
2,000 1,000 0 2,000 Feet

Site Location

East and West Ash Basins
Waukegan Station
Waukegan, Illinois

Geosyntec consultants

San Diego	October 2016	Figure 1



WEST BASIN EAST BASIN

ACCESS RAMP

ACCESS RAMP

LEGEND

EXISTING GROUND MAJOR CONTOUR (5')

EXISTING GROUND MINOR CONTOUR (1')

EXISTING FENCE

EXISTING PIPE

NOTES

1. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015. EAST EMBANKMENT GRADING BASED ON EAST ASH BASIN MODIFICATION CONSTRUCTION DRAWINGS BY GEOSYNTEC (2016).
2. ALL PIPE LOCATIONS ARE APPROXIMATE.
3. PIPES 4E AND 4W DISCHARGE TO THE COAL PILE RUNOFF BASIN. LOCATIONS OF THESE UNDERGROUND PIPES ARE ESTIMATED.

0 150' 300'

SCALE IN FEET

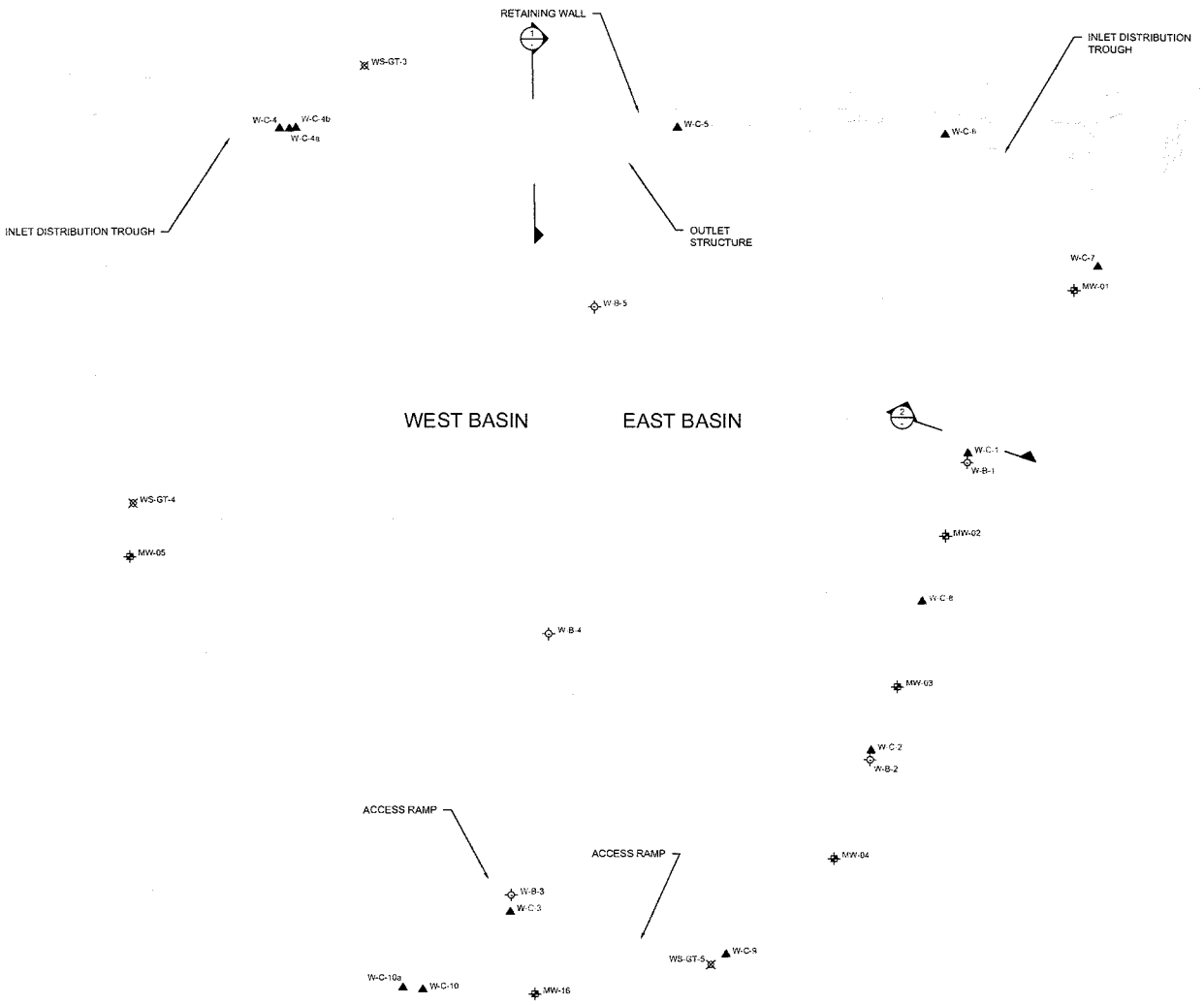
PIPE LOCATIONS
WEST AND EAST ASH BASINS
WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Geosyntec consultants

FIGURE 2

PROJECT NO: SW0251-08 | OCTOBER 2016

Z:\CADD\FIGURES\WAUKEGAN\SW0251-F02--PIPE LOCATIONS



LEGEND

- EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- EXISTING FENCE
- MONITORING WELL (PATRICK, 2011)
- BORINGS (KPRG, 2005, 2015)
- CPT SOUNDING (GEOSYNTEC, 2016)
- BORING (GEOSYNTEC, 2016)
- CROSS SECTION LOCATION

NOTES

1. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015. PROPOSED GRADING CONTOURS REFER TO DESIGN GRADES CONTAINED IN EAST ASH BASIN SLOPE MODIFICATION CONSTRUCTION DRAWINGS.
2. ALL EXPLORATION LOCATIONS ARE APPROXIMATE.

0 150' 300'

SCALE IN FEET

SLOPE STABILITY CROSS SECTIONS
WEST AND EAST ASH BASINS
WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Geosyntec consultants

PROJECT NO: SW0251-08 | OCTOBER 2016

FIGURE 3

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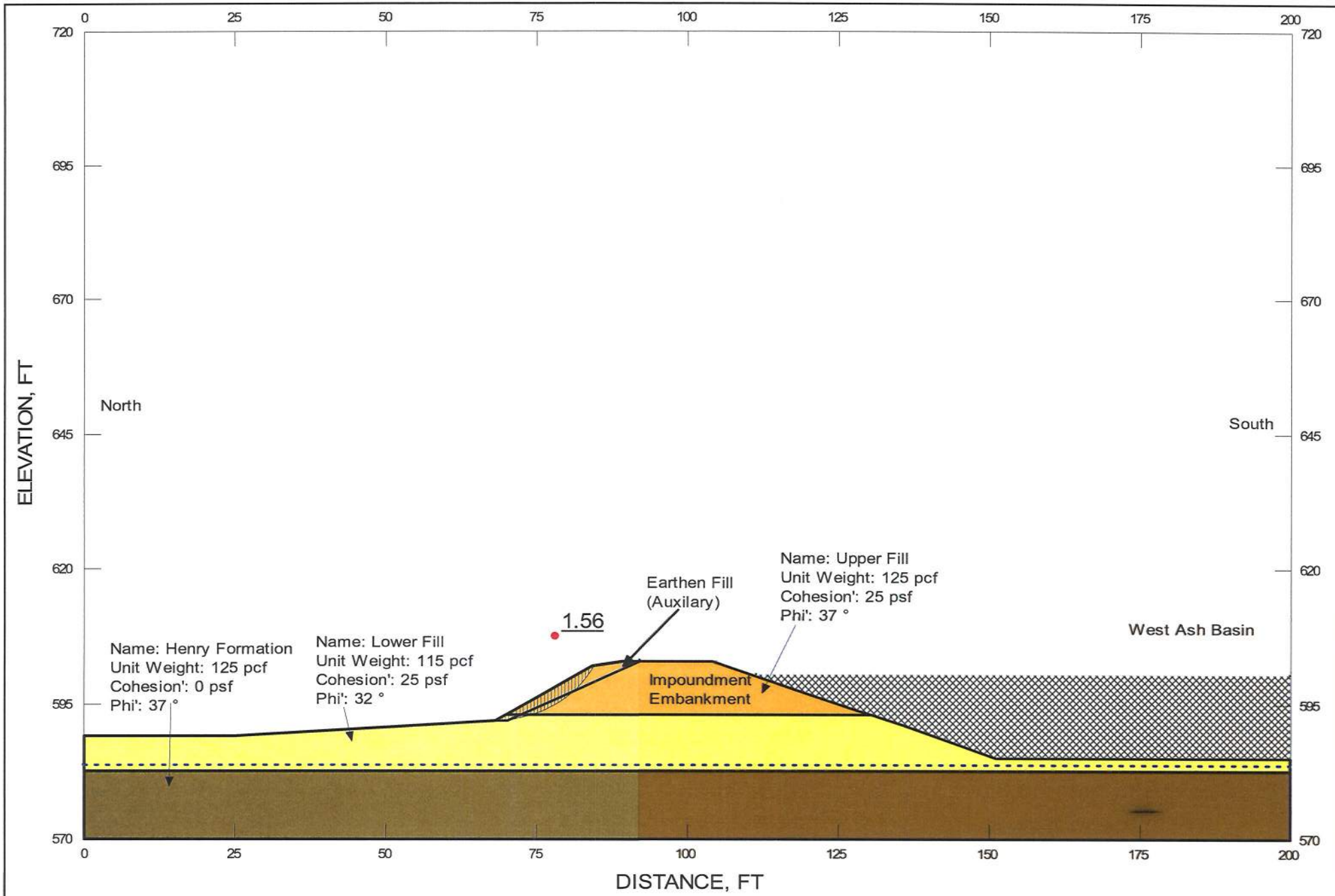
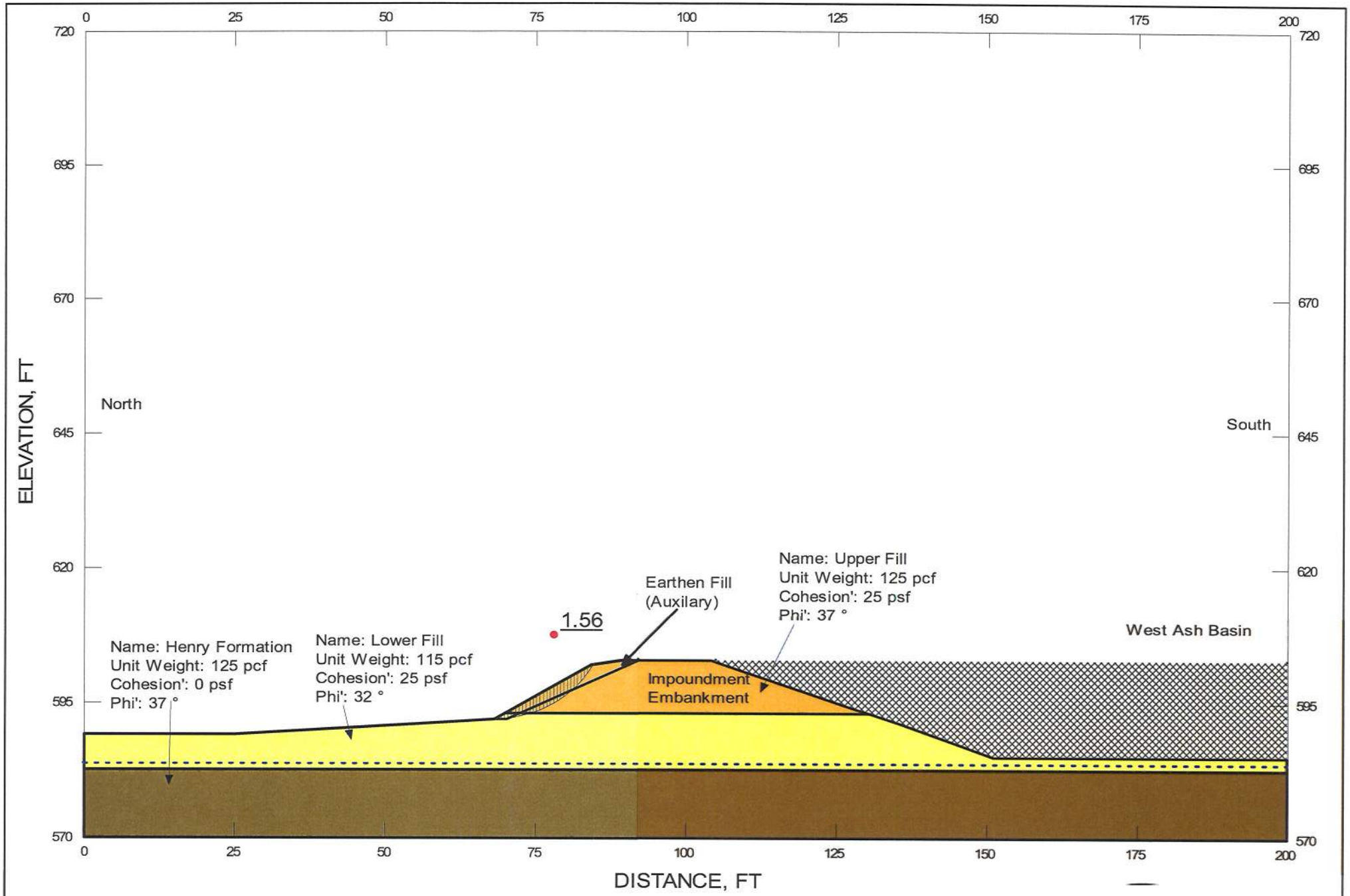
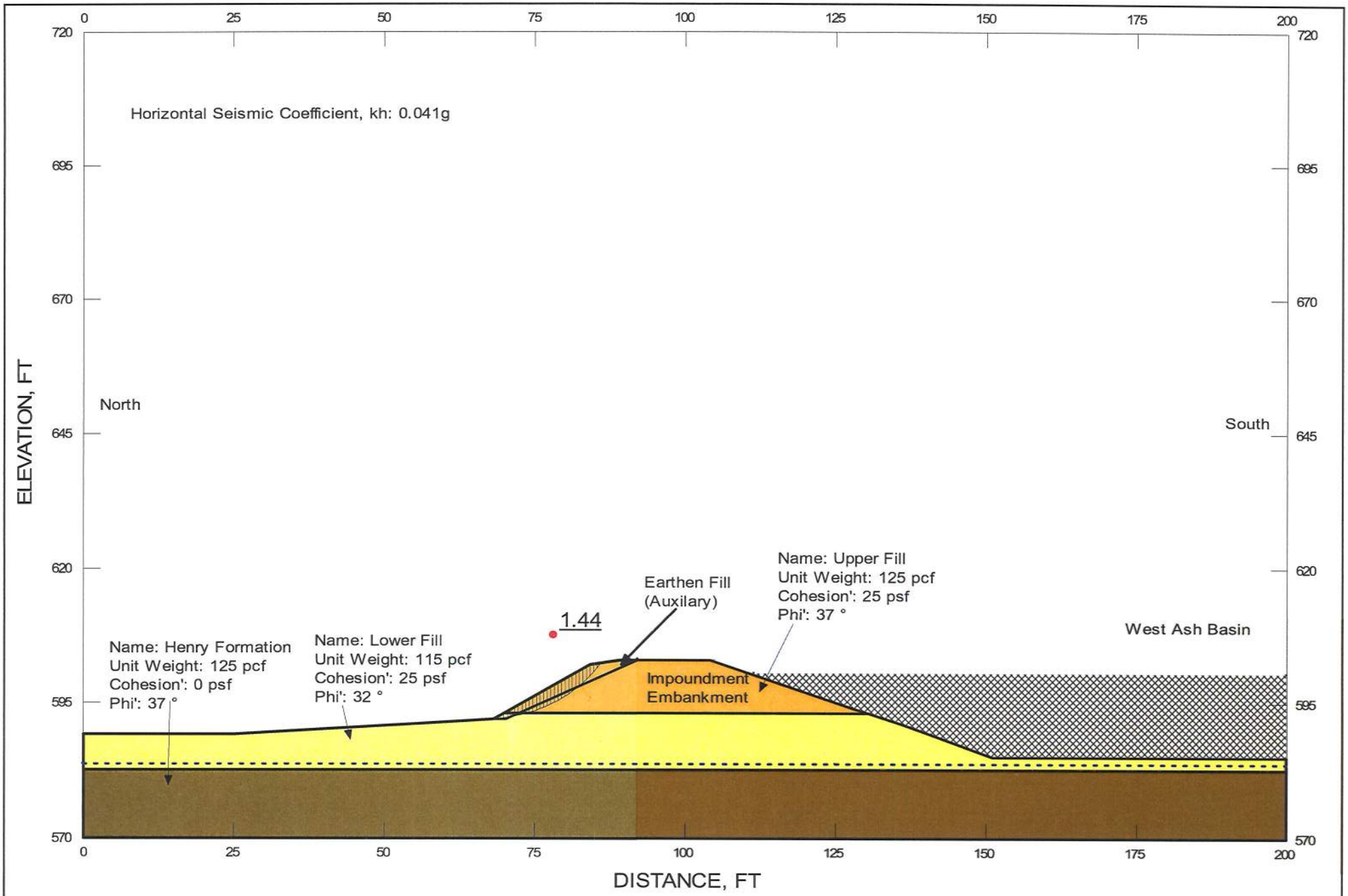


Geosyntec consultants	Analysis: Section 1 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading		FIGURE 4
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 1.gsz	Date: October 2016	

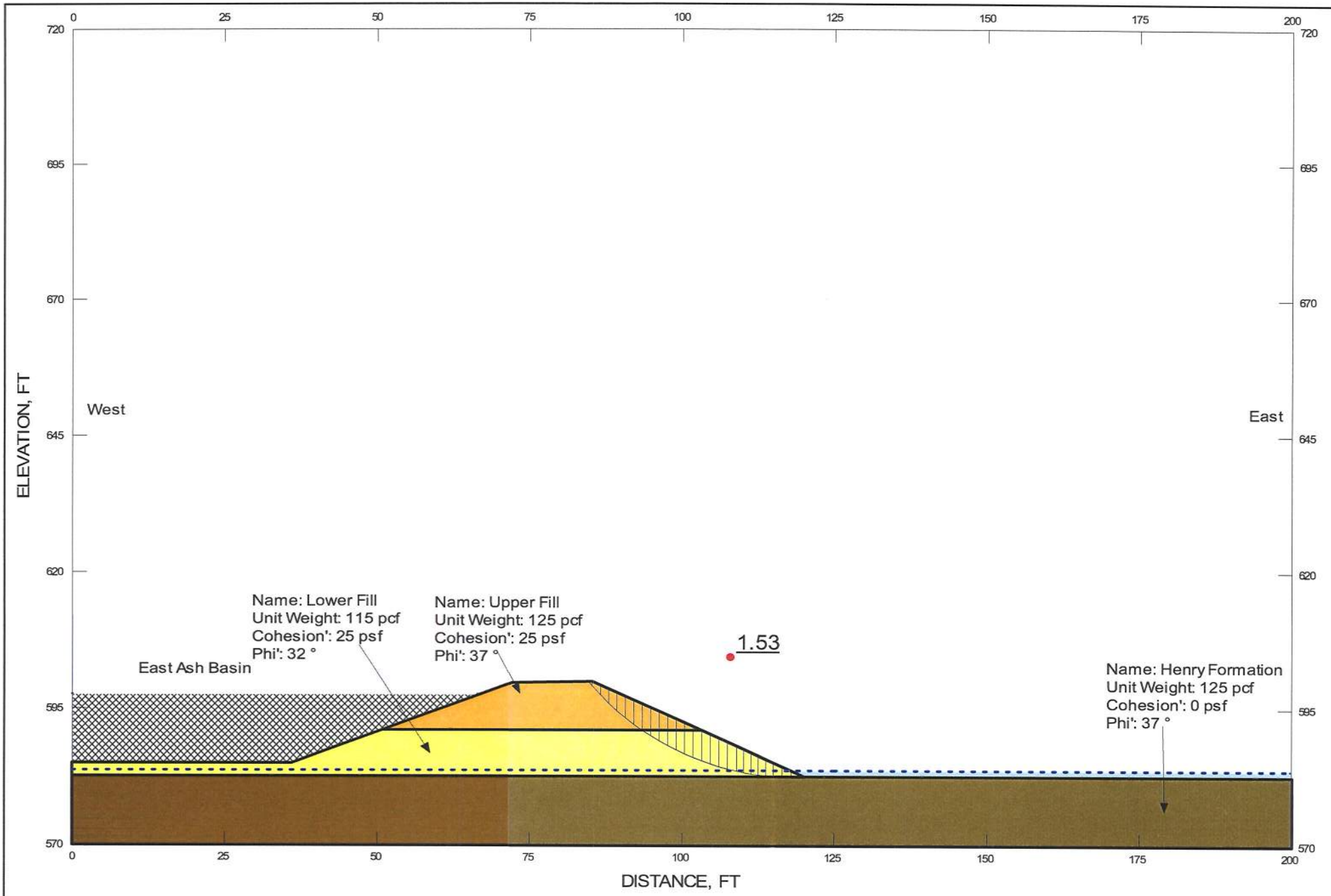


Geosyntec consultants

Analysis	Section 1 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading		FIGURE 5
Project	Waukegan East and West Ash Basins	Analysis By	Jay Griffin
File Name	Waukegan 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: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 1.gsz	Date: October 2016	



Geosyntec consultants	Analysis: Section 2 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading		FIGURE 7
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
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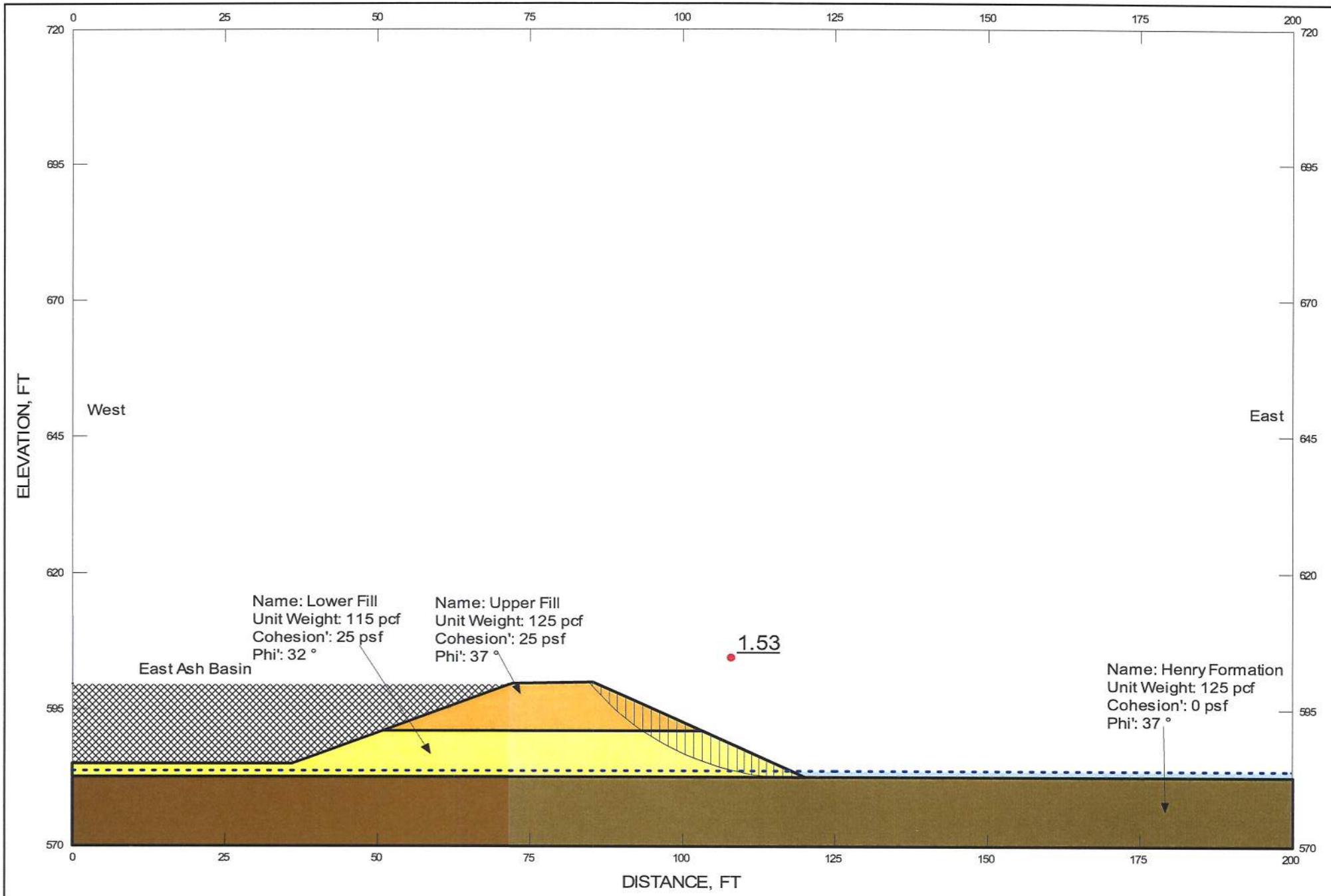
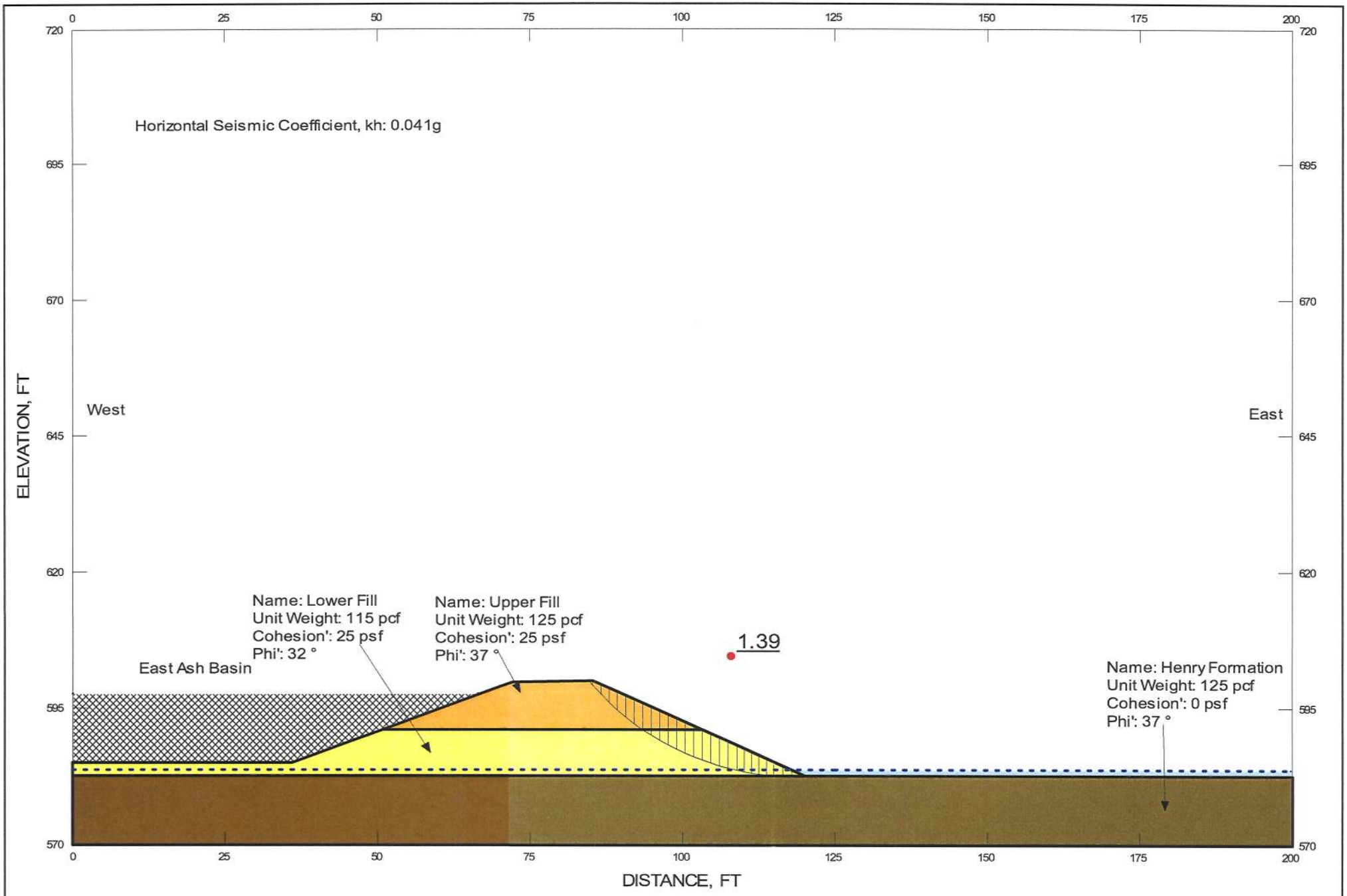


Geosyntec consultants

Analysis	Section 2 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading		
Project	Waukegan East and West Ash Basins	Analysis By	Jay Griffin
File Name	Waukegan Section 2.gsz	Date	October 2016

FIGURE 8



Geosyntec consultants	Analysis: Section 2 - §257.73(e)(1)(iii): Long Term, Maximum Storage Pool Loading with Seismic		FIGURE 9
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 2.gsz	Date: October 2016	