MWG

Midwest Generation, LLC

WAUKEGAN GENERATING STATION

SPECIFICATION W-7900

EAST & WEST ASH POND CLOSURES

S&L PROJECT NO.: 12661-098

REVISION 0B

ISSUE PURPOSE: PUBLIC COMMENT

ISSUE DATE: 11-15-2021

Sargent & Lundy

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SUMMARY OF WORK

PART 1 - GENERAL

101. PROJECT INFORMATION

101.1 Owner: Midwest Generation, LLC (MWG)

101.2 Design Engineer: Sargent & Lundy (S&L)

101.3 Project Name: East & West Ash Pond Closures

101.4 Project Location: Waukegan Generating Station
401 E. Greenwood Ave.
Waukegan, IL 60087

102. DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND

102.1 The purpose of this project is to close the East Ash Pond and the West Ash Pond at Midwest Generation, LLC's Waukegan Generating Station in accordance with the Illinois Pollution Control Board's Coal Combustion Residuals (CCR) Rule, 35 Ill. Adm. Code Part 845, and with the U.S. Environmental Protection Agency's (EPA) CCR Rule, 40 CFR Part 257 Subpart D.

102.2 The West Ash Pond will be closed by removing all CCR and CCR-mixed materials stored in the pond and decontaminating the pond's geomembrane liner and appurtenant concrete structures. The pond's existing geomembrane liner and appurtenant concrete structures will remain in place. Following removal of CCR and CCR-mixed material from the pond and decontamination of the pond's facilities remaining in-place, the West Ash Pond area will be repurposed as a new low-volume waste pond for the Waukegan Generating Station.

102.3 The East Ash Pond will be closed by leaving the CCR and CCR-mixed materials stored in the pond in-place and installing a final cover system over the pond.

103. SCOPE OF WORK

103.1 In general, this Specification covers the technical requirements for a General Work (GW) Contractor to close the East and West Ash Ponds. The Work includes the following activities:

a. Surveying the project area to verify the accuracy of the existing topographic data shown on the Design Drawings.

b. Establishing benchmark monuments for survey control throughout the project.

c. Furnishing and installing temporary erosion control best management practices prior to and during all phases of earth disturbance work.

d. Closing the West Ash Pond so that it may be repurposed as a new low volume waste pond by:

d1. Removing all CCR and CCR-mixed materials stored in the pond with offsite disposal of dry waste material in a permitted landfill approved by the Owner and disposal of liquid waste in the East Ash Pond.

d2. Decontaminating the pond's existing geomembrane liner and appurtenant concrete structures.

e. Closing the East Ash Pond by:

e1. Clearing, grubbing, and/or stripping topsoil from the East Ash Pond's perimeter dike and the dividing dike between the East and West Ash Ponds, with offsite disposal of material in a permitted landfill approved by the Owner.

e2. Dewatering, stabilizing, and preparing the CCR and CCR-mixed materials stored in the pond to receive Structural Fill.

e3. Placing, compacting, and grading Structural Fill to establish the lines and grades for the pond's final cover system as specified on the Design Drawings.

e4. Installing an engineered final cover system, ClosureTurf® (or Owner-approved equal), over the Structural Fill. ClosureTurf® is a multi-component final cover system design by Watershed Geo that consists of a structured geomembrane, a synthetic turf, and a ballast infill.

f. Restoring and cleaning the project area.

103.2 In addition, the Work shall include but not be limited to the following:

a. Engineering and construction services required to perform or install the Work.

b. Surveying to ensure the Work is located as indicated on the Design Drawings in accordance with the benchmark monuments established by the GW Contractor.

c. Furnishing all installation equipment and tools including any calibrated instruments required for monitoring and testing.

d. Maintaining the project site in a dry condition that includes dewatering of all excavations performed by the GW Contractor, redirecting any surface water as a result of rainfall or water generated by the installation Work. Any groundwater and/or surface water which requires removal from the area of work shall be disposed of in compliance with the Waukegan Generating Station's National Pollutant Discharge Elimination System (NPDES) discharge permit in effect at the time of the Work. The methods and proposed place of discharge shall be approved by the Owner prior to disposing of the water.

e. Excavated material and other construction related debris shall be disposed of offsite in a permitted landfill approved by the Owner.

f. Maintaining a record of the installation (i.e., as-built drawings) in accordance with the technical requirements of this Specification.

g. Furnishing the services of qualified personnel at the project site to perform the Work.

h. Progress reporting as specified in the Commercial Terms and Conditions.

i. Daily site cleanup and disposal of waste and debris.

j. Participation in the Owner's on-site safety program.

103.3 The Work shall conform to the requirements of this Specification and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The Work shall be performed exclusively by the GW Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of all people located on the work site, including the Contractor's personnel (or that of its subcontractor(s)) performing the Work.

103.4 Performance of the Work shall include all the labor, supervision, administration, management, material procurement, tools, installation and testing equipment, miscellaneous material, and consumables to perform the Work specified herein.

103.5 Provide all installation equipment and all incidental items not shown or specified but reasonably implied for successful completion of the Work and in strict accordance with Design Drawings and this Specification, including inspection, testing and quality standards.

103.6 Provide installation quality assurance and quality control submittals where required.

103.7 Prepare red-lined as-built drawings for review upon completion of the Work to document any variances between the construction issue of the Design Drawings and the actual installation. Finalize as-built drawings after the Owner and the Design Engineer review.

103.8 All other work, as indicated on the Design Drawings, as specified herein or as required to properly complete the Work.

104. MATERIAL AND SERVICES FURNISHED BY OTHERS

104.1 The following work has been, or will be, performed and/or provided by Others:

a. Initial dewatering and removal of CCR from the West Ash Pond. The GW Contractor shall be responsible for dewatering (if necessary) and removing all CCR and CCR-mixed materials remaining in the West Ash Pond after the GW Contractor mobilizes to the site. Estimated quantity of CCR to be removed from the pond will be provided by Owner during the bid period for the Work.

105. DEFINITIONS

105.1 The term "Design Drawing" means the Design Engineer's drawings indicating the Work to be performed.

105.2 The term "Work" means the material and services furnished to close the East and West Ash Ponds as identified on the Design Drawings and as specified herein.

105.3 The term "Owner-approved equal" means an acceptable equivalent to a specified material that has been accepted by the Owner.

106. INTENT OF DOCUMENTS

106.1 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is to include all labor, material, equipment, and transportation necessary for the proper execution of the Work.

106.2 Discrepancies between the Design Drawings and this Specification, or errors or omissions or mis-description in either the Design Drawings or in this Specification, shall be referred to the Design Engineer for interpretation and adjustment prior to beginning the Work. Do not proceed without the Design Engineer’s written acceptance.

107. PERFORMANCE OF THE WORK

107.1 The GW Contractor shall provide materials and employ construction practices that are sustainable to the greatest extent possible, including disposal of waste.

107.2 The GW Contractor shall provide a representative that will input and provide daily force reports and daily production reports.

107.3 The performance of the Work, as specified herein and as indicated on the Design Drawings, shall comply with the current safety and health standards authorized by the U.S. Department of Labor's Occupational Safety and Health Administration, as well as state and local jurisdictional requirements.

107.4 The GW Contractor shall take all appropriate precautions to ensure the safety of all people working on site.

107.5 The GW Contractor shall maintain the necessary skilled and qualified labor force for the Work to ensure the on time completion of the Work.

107.6 The GW Contractor's personnel shall be competent, capable, qualified, and able to perform the duties required to the satisfaction of the Owner. A supervisor vested with authority to make decisions binding on the GW Contractor shall be assigned to the task to resolve installation problems as they arise so as not to delay completion of the Work.

107.7 The GW Contractor shall be solely responsible for advising the Design Engineer in writing of any conflicts between this Specification and the Design Drawings and the GW Contractor's drawings, including performance and levels of quality. The Contractor agrees that its obligations, liabilities, and warranties shall not be diminished or extinguished due to its meeting the requirements of this Specification and the Design Drawings.

108. REGULATORY REQUIREMENTS

108.1 The GW Contractor shall at all times be solely responsible for complying with all applicable laws, ordinances, regulations, and codes, including those relating to safety of all persons, in connection with the Work. No obligation of the Design Engineer shall impose upon them any duty to review the GW Contractor's compliance with safety measures.

109. PROTECTION OF PROPERTY AND PERSONNEL SAFETY

109.1 The GW Contractor shall take adequate precautions to protect existing structures, fences, pavements, aboveground utilities and underground utilities and to avoid damage thereto. The GW Contractor shall, at its own expense, repair any damage caused by its operations.

109.2 The GW Contractor shall conduct safety training of all its personnel (including any subcontractors) in accordance with the Owner's safety requirements.

110. CLEAN-UP AND DISPOSAL OF DEBRIS

110.1 The Contractor shall be responsible for clean-up and disposal of all debris resulting from the installation work. All excavated material and other construction related debris shall be properly disposed of (i.e., in an environmentally responsible way) offsite in a permitted landfill approved by the Owner.

110.2 Clean up, disposal, and site restoration, if required, shall be in compliance with the applicable requirements of all access permits. If any additional permits are required for disposal of debris, these shall be the responsibility of the GW Contractor.

110.3 Work areas shall be kept clean and orderly at all times with as little disturbance as possible to existing conditions. Upon completion of work at each site, all tools, equipment, material, and debris shall be completely removed and the area left in a clean condition.

111. EXISTING SITE CONDITIONS

111.1 The Purchaser has prepared the project site by clearing and grubbing the area and providing a suitable grade level from which the Work can be performed and will provide suitable site access. The Contractor shall inspect the site and notify the Purchaser of any deficiencies that would prohibit proper completion of the Work for resolution.

111.2 Existing Underground Obstructions:

a. The GW Contractor shall be responsible for location underground utilities and obstructions prior to performance of the Work and shall promptly notify Owner of any potential interferences that may impact performance of the Work. Modifications to the design to resolve these interferences shall not be implemented until approved by the Owner.

b. If uncharted utilities or obstructions are encountered during the performance of the Work, the GW Contractor shall notify the Owner of any such uncharted utilities or obstructions that would prohibit proper completion of the Work for resolution.

111.3 Prior to performing any Work in any part of the project site, the GW Contractor shall make a thorough field check for the purposes of verifying existing conditions that may affect the Work. The GW Contractor shall include a thorough investigation of the potential interferences and difficulties that it may encounter in the proper and complete execution of the Work, including the field location and identification of underground and overhead utilities within and adjacent to the limits of the Work. The GW Contractor shall advise the Owner immediately of the discovery of any conditions, including the existence of underground and overhead utilities that may affect the timely and safe execution of the Work.

111.4 The GW Contractor further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface material and obstacles, including underground or embedded utilities, to be encountered insofar as this information is reasonably ascertainable from an inspection of the site (including field location and identification of underground utilities) and reference drawings made available by the Owner, as well as from information presented by the drawings and specifications that are a part of the Contract, the character and extent of existing work within or adjacent thereto and any other work being performed thereon at the time of the submission of bids.

111.5 Should the GW Contractor fail to perform any of the obligations set forth above, the GW Contractor's later plea of ignorance of existing or foreseeable conditions which create difficulties or hindrances in the execution of the Work will not be considered as an excuse for any failure on the part of the GW Contractor to fulfill in every detail the requirements of the Contract nor will such a plea be acceptable as the basis of a claim for additional compensation.

112. VERIFICATION OF DIMENSIONS ON DRAWINGS AND MEASUREMENTS AT SITE

112.1 The GW Contractor shall make a thorough field check for the purpose of verifying existing conditions that may affect the Work, such as existing topographic data shown on the Design Drawings, difficulties that might be encountered in the execution of the Work for any reason, and dimensions and other questions relating to interconnection of the Work with the existing ash pond construction.

112.2 The GW Contractor shall satisfy itself as to the accuracy of the dimensions of the existing ash pond construction as such dimensions relate to the dimensions given on any drawing issued by the Design Engineer. It shall be understood that neither the Design Engineer nor the Owner guarantee the exactness of such dimensions.

112.3 Should the GW Contractor discover any variation in the dimensions of existing conditions and the dimensions given on any drawings issued by the Design Engineer, the GW Contractor shall give immediate notice thereof to the Owner and the GW Contractor shall not proceed with the Work until such variation is resolved.

113. SOIL DATA

113.1 A structural stability and factor of safety assessment for the East and West Ash Ponds was prepared in October 2016. Site specific soil data and geotechnical recommendations are provided and referenced therein. The geotechnical information in and referenced by this assessment indicates the general character of the subsurface conditions at the site. This information is made available for the GW Contractor's information and for interpretation of soil and water conditions that may be encountered at the site. The logs and test data that are provided are not to be taken as a complete description of the site soil and water information, but only display what was found in borings at the indicated locations. The Owner and the Design Engineer take no responsibility for the accuracy of this information.

113.2 The GW Contractor may obtain additional subsurface information, as it deems necessary, for installation purposes.

114. LINES AND GRADES

114.1 The GW Contractor shall furnish and install a minimum of four (4) benchmark monuments as approved by the Owner to lay out lines and grades on the site during the lifetime of the project. All GW Contractor-installed benchmark monuments shall be shown on the red-lined as-built drawings. The GW Contractor is fully responsible for the correctness of such lines and grades and for proper execution of work to such lines and grades.

114.2 The Owner reserves the right to verify correctness of lines and grades during progress of the Work. Such verification by the Owner will not relieve the GW Contractor of responsibility as herein specified.

115. CONTROL AND CHARGE OF CONTRACTOR'S WORK

115.1 The Design Engineer shall have no authority to stop the Work by the GW Contractor for any reason.

115.2 The GW Contractor shall be responsible for the safety of its employees and subcontractors and for maintaining the safety of the job site.

115.3 The GW Contractor shall be solely responsible for construction means, methods, techniques, sequences, and procedures used in the construction of the Work. The Owner, however, reserves the right to request, and the Contractor shall supply, detailed information regarding the Work such as procedures or work methods.

115.4 Only the Owner (or its authorized representative) has the authority to stop the Work (in accordance with the Commercial Terms and Conditions) if such Work is determined to be not in accordance with this Specification, the Design Drawings, or the Contract documents.

116. DESIGN DRAWINGS

116.1 The Design Drawings prepared by the Design Engineer indicate the physical dimensions of the Work to be installed as defined by the Scope of Work and form a part hereof. Refer to Attachment 1 of this Specification for the applicable Design Drawings for this project.

117. REFERENCE DOCUMENTS

117.1 The reference documents assembled by the Design Engineer are for information only. Refer to Attachments 3 through 4 of this Specification for applicable reference documents for this project.

END OF SECTION 011100

SECTION 311522

ENGINEERED SYNTHETIC TURF FOR FINAL COVER SYSTEM

PART 1 - GENERAL

101. EXTENT

101.1 This section defines the minimum requirements for the material and installation of an engineered synthetic turf to be used in the ClosureTurf® final cover system (or Owner-approved equal) for the East Ash Pond, all in accordance with the Design Drawings and as specified herein.

101.2 The Work shall include, but not be limited to, the following items:

a. Manufacture, shipping, handling, and storage of synthetic turf materials.

b. Placement, splicing, and anchorage of synthetic turf.

c. Field testing of synthetic turf seams.

d. Repair of defects, holes, or tears in synthetic turf.

e. Visual inspection of the completed synthetic turf cover.

f. Placement of ballast infill between tufts of synthetic turf.

101.3 Definitions of Terms: The following definitions of terms shall apply throughout this section.

a. Earthwork Contractor: The contractor who works for the GW Contractor and is responsible for earthwork for the facility and for excavation and backfill of anchor trenches.

b. Geosynthetics Contractor: The contractor who works for the GW Contractor and is responsible for the supply and installation of all geomembrane and synthetic turf materials and the unloading and storage of the materials. The Geosynthetics Contractor may be the GW Contractor or a subcontractor to the GW Contractor.

c. Construction Quality Assurance (CQA) Contractor: The contractor who is independent of the GW Contractor and is responsible for all CQA work.

d. CQA Geosynthetics Inspector: An inspector who works for the CQA Contractor and is responsible for inspection of the Geosynthetic Contractor's work.

e. Synthetic Turf Manufacturer: The manufacturer who is responsible for manufacture of synthetic turf materials and for transporting synthetic turf materials to the site.

101.4 Qualifications:

a. Synthetic Turf Manufacturer:

a1. The Synthetic Turf Manufacturer shall be approved by the Owner.

b. Geosynthetics Contractor:

b1. The Geosynthetics Contractor shall meet the qualifications for the Geosynthetics Contractor specified in Section 319022.

b2. The Geosynthetics Contractor shall be approved by the Synthetic Turf Manufacturer for installation of the Synthetic Turf Manufacturer's products.

b3. Synthetic Turf Seamers:

b3.1 Master Synthetic Turf Seamer shall have installed at least 5,000,000 square feet of geotextile materials.

b3.2 All other synthetic turf seamers shall have installed at least 1,000,000 square feet of geotextile materials. Personnel who do not meet this criterion may be allowed to seam synthetic turf panels but only under the direct supervision of the Master Synthetic Turf Seamer.

b3.3 Personnel performing fusion welding of synthetic turf panels shall be factory trained by Demtech Services, Inc.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this section shall be coordinated with work specified in the following related sections:

a. GW Specification (W-7900):

a1. Section 319022 – High Density Polyethylene Geomembrane Liner for Final Cover System.

b. CQA Specification (W-7901):

b1. Section 014362 – Construction Quality Assurance for Closing a CCR Surface Impoundment.

103. REFERENCE DOCUMENTS

103.1 Standards, Specifications, manuals, codes and other publications of nationally recognized organizations and association are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Abbreviations listed indicate the form used to identify the reference documents in the Specification text.

103.4 ASTM – ASTM International:

a. C128 Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate.

b. C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

c. C1252 Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading).

d. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

e. D2256 Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method.

f. D4595 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

g. D4884 Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.

h. D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

i. D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.

j. D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50mm Probe.

k. D6459 Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion

l. G147 Standard Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests.

m. G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

104. SUBMITTALS

104.1 GW Contractor shall submit drawings and data as indicated below at least 30 days prior to use. GW Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into Owner's information systems specified by Owner.

104.2 Submittals with Bid Proposal:

a. Resumes of key Geosynthetics Contractor personnel demonstrating Geosynthetics Contractor meets qualifications specified in Paragraph 101.4.

b. Synthetic Turf Material:

b1. Synthetic Turf Manufacturer's literature providing specifications on the synthetic turf material that will be supplied.

b2. Synthetic Turf Manufacturer's certification that synthetic turf materials to be supplied comply with the requirements of this Specification.

b3. Manufacturer's Quality Control (MQC) and Construction Quality Control Plans. The MQC plan shall include inspection records of the tufting procedures and indicate the following material properties for every 300,000 square feet of synthetic turf manufactured:

b3.1 Tufting gauge.

b3.2 Pile height.

b3.3 Roll length and roll numbers.

b3.4 Total product weight.

b3.5 CBR puncture per ASTM D6241.

b3.6 Tensile strength product (lb. / ft, minimum average roll value) per ASTM D4595.

b3.7 Tensile strength of yarn (lbs., minimum average roll value) per ASTM D2256.

c. Ballast Infill Material:

c1. Proposed construction equipment and method(s) to be used to install Ballast Infill material.

104.3 Submittals After Award of the Contract:

a. Synthetic Turf Material:

a1. Synthetic turf material samples for conformance testing as specified in Specification W-7901, Section 014632.

b. Ballast Infill Material:

b1. GW Contractor shall submit a 10-pound sample of Ballast Infill material to the Synthetic Turf Manufacturer.

b2. Ballast infill material samples for conformance testing as specified in Specification W-7901, Section 014632.

105. QUALITY ASSURANCE

105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor employed by the Owner. Such inspections and tests will not relieve the GW Contractor of responsibility for providing materials and installation in compliance with specified requirements.

105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The GW Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.

105.3 CQA activities for installing the engineered synthetic turf shall be performed as described herein and in Specification W-7901.

PART 2 - PRODUCTS

201. SYNTHETIC TURF MATERIALS

201.1 Acceptable Manufacturers:

a. The products of the following manufacturers meeting the requirements for synthetic turf herein are acceptable:

a1. Shaw Industries, Inc., 616 E. Walnut Avenue, Dalton, GA 30720, Tel.: 800-720-7429.

a2. Owner-approved equal.

201.2 Material Requirements:

a. Synthetic turf materials shall meet the requirements of Table 311522-1.

TABLE 311522-1

MINIMUM REQUIREMENTS FOR SYNTHETIC TURF MATERIALS

Property	Test Method	Specified Value
Yarn Type	N/A	Polyethylene
Yarn Color	N/A	Olive Green
Yarn Weight	ASTM D5261	20 oz. / sq. yd (min.)
Total Synthetic Turf Weight	ASTM D5261	32 oz. / sq. yd (min.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. (min.)
CBR Puncture	ASTM D6241	1,500 lbs. (MARV)
Tensile Product:	ASTM D4595	
• Machine Direction		2,100 lb. / ft (MARV)
• Cross Direction		1,600 lb. / ft (MARV)
Interface Friction:	ASTM D5321	
• Between Synthetic Turf and 60 mil HDPE Textured Geomembrane		21° Peak (min.)
• Between Synthetic Turf and 60 mil HDPE Structured Geomembrane		35° Peak (min.)
Turf Fiber UV Stability	ASTM G147	60% (min.) retained tensile strength at 100 yrs (projected)
Geotextile Backing UV Stability (Exposed)	ASTM G154 Modified Cycle 1, UVA340	110 lb./ft retained tensile strength at 6,500 hrs (projected)
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb. / sq. ft
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.1% at 6 in./hr Rainfall

201.3 Packaging and Shipping Requirements:

a. Packaging and transportation shall be the responsibility of the Synthetic Turf Manufacturer, who shall retain responsibility until the synthetic turf is accepted at the site by the Geosynthetics Contractor.

b. Packaging:

b1. Deliver synthetic turf materials to the project site in rolls, each wrapped securely with a protective covering installed at the manufacturing facility. The covering shall prevent the entrance of water, vermin, and dirt, and shall be adequate for protection against ultraviolet exposure.

b2. The packaging shall not interfere with handling of the rolls either by slings or by using the central core upon which the synthetic turf is wound.

b3. A label shall be attached or adhered to each roll of synthetic turf identifying the following:

b3.1 Synthetic Turf Manufacturer's name.

b3.2 Product identification.

b3.3 Date of manufacture of the synthetic turf.

b3.4 Lot number.

b3.5 Roll identification number.

202. BALLAST INFILL MATERIALS

202.1 Acceptable Ballast Infill Material:

a. Material used as Ballast Infill between the tufts of the synthetic turf shall meet the final aggregate angularity, specific gravity, and grain size distribution specified in Table 311521-2.

TABLE 311522-2

REQUIREMENTS FOR BALLAST INFILL MATERIALS

Property	Test Method	Specified Value
Uncompacted Void Content	ASTM C1252 Method A	40% min.
Bulk Oven-Dry Specific Gravity	ASTM C128	2.40 min.
Grain Size Distribution	ASTM C136	Sieve Size / Percent Passing: 3/8" / 100; #4 / 90 – 100; #8 / 50 – 85; #16 / 25 – 65; #30 / 10 – 45; #50 / 0 – 30; #100 / 0 – 10; #200 / 0

PART 3 - EXECUTION

301. ONSITE HANDLING AND STORAGE

301.1 Receipt/Unloading:

a. Upon delivery of the materials to the project site, the unloading and other handling of synthetic turf materials shall be performed by the Synthetic Turf Manufacturer to ensure the material is handled with care and is not damaged.

b. Any protective covering that is accidentally damaged or stripped off of a roll shall be immediately repaired or the roll shall be moved to an enclosed facility until the repair can be made.

301.2 Storage:

a. The GW Contractor will provide temporary on-site storage space in a location near the area where the synthetic turf will be placed such that on-site transportation and handling are minimized. The GW Contractor shall be responsible for protecting the stored material from theft and vandalism.

b. Rolls of synthetic turf shall be placed on a smooth surface free of rocks and standing water.

c. Rolls of synthetic turf shall be stored in such a manner that cores are not crushed, the geotextile not damaged, and as required to provide protection from exposure to ultraviolet light, inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious condition. If stacked, the rolls shall be stacked per the Synthetic Turf Manufacturer's recommendations, but no more than three rolls high.

301.3 Inspection:

a. Upon delivery of the materials to the project site, the Synthetic Turf Contractor shall conduct a visual inspection of all rolls of synthetic turf for damage or defects. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.

b. Any damage or defects shall be noted and immediately reported to Owner, the Synthetic Turf Manufacturer, and the carrier that transported the material. Any roll, or portion thereof, which, in the judgment of Owner, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to Owner.

302. PRE-DEPLOYMENT OF SYNTHETIC TURF COVER

302.1 The geomembrane component of the ClosureTurf® final cover system shall be placed, seamed, tested, and approved in accordance with Section 319022 prior to deploying the synthetic turf component.

302.2 The geomembrane surface shall be substantially free of debris, large scraps, *etc*.

303. FIELD PLACEMENT OF SYNTHETIC TURF COVER

303.1 General Requirements:

a. The Synthetic Turf Contractor shall not remove the protective covering from the synthetic turf rolls to be deployed until immediately prior to deployment to ensure that synthetic turf panels are not excessively exposed to ultraviolet degradation.

b. During handling, the synthetic turf panels shall be handled in such a manner that the material is not damaged in any way. Damaged material shall not be used.

303.2 Panel Deployment:

a. All necessary precautions shall be taken to prevent damage to the underlying geomembrane upon which the synthetic turf is to be placed.

b. Deployment of synthetic turf panels on slopes shall proceed as follows:

b1. The synthetic turf shall be securely anchored at the top and then rolled down the slope in such a manner as to continually keep the panel in tension and keep the panel free of wrinkles and folds.

b2. The first synthetic turf panel deployed shall have the turf filaments facing upward.

b3. If the synthetic turf panels will be spliced by sewing, subsequent panels shall be deployed turf side down and on top of the previous panel. After sewing each panel, the panel shall be flipped onto the geomembrane surface with care to avoid pulling tufts in the drainage studs.

b4. The turf filaments in all synthetic turf panels shall be pointing upslope after deployment is complete.

c. Synthetic turf panels shall only be cut using an upward cutting hook blade. If synthetic turf panels are cut in place, special care shall be taken to protect the underlying geomembrane from damage which could be caused by cutting the synthetic turf panels.

d. During placement of synthetic turf panels, care shall be taken not to entrap, in or beneath the synthetic turf, stones, excessive dust, or moisture that could damage the synthetic turf or underlying geomembrane, or hamper subsequent splicing.

303.3 Precautions to Prevent Wind Damage:

a. If possible, work shall be oriented in the direction of the prevailing wind.

b. All deployed synthetic turf panels shall be weighted with sandbags, old tires, or the equivalent to provide resistance to wind uplift. Such weights shall be installed during deployment and shall remain until the sand infill is placed. Uplifted material can be reused only if approved by Owner.

303.4 Field Splicing:

a. Method of Splicing:

a1. Successive panels of synthetic turf shall be continuously sewn (i.e., spot seaming is not allowed) or continuously heat bonded in accordance with Synthetic Turf Manufacturer's recommendations on slopes flatter than 10H:1V (10 percent).

a2. On slopes steeper than 10H:1V (10 percent), all successive panels of synthetic turf shall be continuously sewn (i.e., spot sewing and heat bonding are not allowed). All seams shall be vertical (parallel with the flow line of the slope). No horizontal seams (across the slope) shall be permitted.

b. Sewing:

b1. Sewing procedures shall conform to the latest procedures recommended by the Synthetic Turf Manufacturer.

b2. Sewing shall be done using 207 polyester sewing thread.

b3. Seams shall be "prayer" seams constructed using a Newlong sewing machine or Owner-approved equal. Seams shall be formed by mating the edges of the synthetic turf panels and sewing the panels together with continuous stitches located between the first and second rows of tufts on both sides of the synthetic turf panels.

c. Heat Bonding:

c1. Fusion seaming (heat bonding) shall be performed using a Demtech VM-20/4/A fusion welder only.

c2. Fusion seams shall be made with at least 5 inches of overlap between the synthetic turf panels being welded.

c3. Frayed or loosed geotextile strands shall be cut off or otherwise removed.

c4. Prior to starting production seaming, trial seams shall be performed per Paragraph 303.4d.

c5. Mechanical or hot knife trimming and cutting devices shall be utilized for salvage trimming.

c6. Any damage that occurs due to production seaming shall be repaired in accordance with the Synthetic Turf Manufacturer's recommendations.

d. Trial Welds Prior to Beginning Heat Bonding:

d1. Trial welds are required for pre-qualification of personnel, equipment, and procedures for making seams on identical geotextile material under the same climatic conditions as the actual field production seams will be made.

d2. Trial welds shall be made as follows:

d2.1 Prior to each seaming period.

d2.2 Every 4 to 5 hours (*i.e.*, at the beginning of the work shift and after the lunch break).

d2.3 Whenever personnel or equipment are changed.

d2.4 When the welding apparatus has been turned off for longer than 30 minutes.

d2.5 When climatic conditions result in wide changes in geotextile temperature.

d2.6 When requested by the CQA Geosynthetic Inspector for any seaming crew or piece of welding equipment if problems are suspected.

d3. Once qualified by passing a trial weld, welding technicians shall not change parameters without performing another trial weld.

d4. A test strip shall be prepared by joining two pieces of synthetic turf. The test strip shall be at least 12 inches wide and 3 feet long, and the seam shall be centered lengthwise. The CQA Geosynthetic Inspector shall witness the fabrication of each test strip.

d5. Testing of a trial weld shall not commence until the seam cools to the ambient temperature.

d6. Trial Weld Testing Procedure and Pass/Fail Criteria:

d6.1 Trial welds shall comply with visual passing criteria, which is verified when manual peel/pull test is performed, and the top synthetic turf panel tufts transfer to the bottom synthetic turf panel.

d6.2 Passing Test: 75% or more of the tufts in the top synthetic turf panel transfer to the bottom synthetic turf panel.

d6.3 Failing Test: Less than approximately 75% of the tufts in the top synthetic turf panel transfer to the bottom synthetic turf panel.

d6.4 Two consecutive trial welds shall meet the visual passing criteria above prior to commencing production seaming.

304. REPAIR OF SYNTHETIC TURF

304.1 Repair of Holes or Tears:

a. All holes or tears in a synthetic turf panel shall be repaired by using a heat-bonded seam. A handheld heat gun with a pressure wheel shall be used in smaller, concentrated areas.

b. The patch material shall be the same synthetic turf material as the damaged synthetic turf panel.

c. Care shall be taken to remove any soil, object, and/or other material which penetrated or tore the synthetic turf.

d. Alternative patching techniques may be utilized by the Geosynthetics Contractor following a field demonstration and subsequent approval by Owner.

305. ANCHOR TRENCH BACKFILLING

305.1 Synthetic turf cover shall be anchored in an anchor trench at the bottom of the slope. See Section 319022 for anchor trench excavation and maintenance requirements.

305.2 Backfilling:

a. Anchor trench backfill shall be placed as shown on the Design Drawings.

b. Backfilling of the anchor trench shall occur during the morning or during extended periods of overcast skies when the liners are at their most contracted state.

c. Backfill shall be placed in layers not exceeding 4 inches loose thickness and compacted using hand compaction equipment to a minimum of 95% of the maximum dry density as determined by ASTM D1557.

306. INSPECTION OF SYNTHETIC TURF COVER AFTER INSTALLATION:

306.1 After installation is complete, a visual examination of the synthetic turf shall be carried out over the entire surface of the synthetic turf to verify that no potentially harmful foreign objects, such as broken needles, are present.

306.2 When sewing seams, the Geosynthetics Contractor shall perform continuous inspection during the seaming process using an in-line metal detector with an adequate sweep rate to determine the presence of broken needles. If the presence of broken needles is indicated, a needle removal system using magnets shall be implemented.

307. PLACEMENT OF BALLAST INFILL:

307.1 Placement of Ballast Infill between the tufts of the synthetic turf shall be done within the time limit specified by the Synthetic Turf Manufacturer.

307.2 Placement Procedures:

a. Ballast Infill shall be spread and placing using conveyor systems and/or express blowers using the method(s) presented to the Owner by the Ballast Infill Installer during the pre-construction meeting.

b. Ballast Infill shall not be deployed when snow and/or ice are present on the synthetic turf.

c. Ballast Infill shall be deployed in such a manner that excessive tensile stress is not placed on the synthetic turf.

d. Placement of the Ballast Infill shall be done in such a manner that the ClosureTurf® components are not shifted from their intended positions and are not exposed or damaged. On slopes, this requires deployment of Ballast Infill material to proceed from the bottom of the slope upward.

307.3 Final Thickness:

a. Ballast Infill placed between the tufts of the synthetic turf shall be at least 0.5-inch thick but no more than 0.75-inch thick.

END OF SECTION 311522

SECTION 312205

EARTHWORK FOR CCR SURFACE IMPOUNDMENT CLOSURE

PART 1 - GENERAL

101. EXTENT

101.1 This section defines the material and installation requirements for earthwork as part of closing the East and West Ash Ponds at the Waukegan Generating Station. This work shall be performed in accordance with the Design Drawings and as specified herein. This design is compliant with the Illinois and U.S. EPA Coal Combustion Residual (CCR) Rules.

101.2 The Work shall include, but not be limited to, the following items as indicated:

a. Surveying for alignment and grade.

b. Installation prior to construction and maintenance during construction of sediment and erosion control facilities.

c. Demolition and disposal of waste.

d. Clearing, grubbing and topsoil stripping as required for select areas of existing dikes and borrow site, along with offsite disposal of organic debris and waste.

e. Preparation of the subgrade (CCR) to receive fills,

f. Grading of CCR material along with placement and compaction of Structural Fill to support the final cover system.

g. All appropriate measures shall be taken to protect the existing HDPE geomembrane liner system.

h. Disposal of excess or unsuitable excavated material if required.

i. Installation of additional sediment and erosion control facilities during construction, if required.

j. Dust control.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:

a. Specification W-7900:

a1. Section 311010 – Temporary Sediment Control During Construction.

a2. Section 319022 – High Density Polyethylene Geomembrane for Final Cover System.

b. Specification W-7901 (Construction Quality Assurance for East & West Ash Pond Closures):

b1. Section 014362 – Construction Quality Assurance for Closing a CCR Impoundment.

103. REFERENCE DOCUMENTS

103.1 Standards, Specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.

103.4 Abbreviations listed below refer to the applicable organizations or documents.

103.5 ASTM - ASTM International:

a. D422 Standard Test Method for Particle-Size Analysis of Soils.

b. D1140 Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing.

c. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

d. D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

e. D4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

f. D4254 Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

g. D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

104. SUBMITTALS

104.1 The General Work (GW) Contractor shall submit drawings and data as specified. GW Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner's information systems specified by the Owner.

104.2 The GW Contractor shall submit with its bid, as a minimum, information requested including:

a. Complete Proposal Pricing (PP) and Proposal Data (PD) pages.

b. Company and key personnel experience on at least 20 similar projects in the last 10 years.

c. Project Work Plan to execute the work that includes at a minimum:

c1. Preliminary schedule,

c2. Construction equipment and manufacturer's specifications, and

c3. Names of key personnel.

104.3 After construction is complete the GW Contractor shall submit:

a. Final as-built drawings, documents and data prior to the Contract close out.

b. Final as-built drawings shall be in PDF file format and include native AutoCAD files. Drawing files shall be submitted with the project name, Project Identification Number (PIN), station name, drawing and revision numbers, and CAD file names identified in a separate electronic drawing list.

105. QUALITY ASSURANCE

105.1 The GW Contractor shall examine the areas and conditions under which earthwork is to be done and notify Owner in writing of conditions detrimental to the proper and timely completion of the Work.

105.2 Material, placing procedures and installations are subject to inspection and tests conducted by the CQA Contractor (see Specification W-7901, “Construction Quality Assurance for East & West Ash Pond Closures”). Tests shall be in accordance with Specification W-7901, Section 014362. Such inspections and tests shall not relieve the GW Contractor of responsibility for providing material and placement in compliance with this specification. Owner reserves the right, at any time before final acceptance, to reject material not complying with the specified requirements.

105.3 GW Contractor shall correct all deficiencies in earthwork which inspections and laboratory and field tests have indicated are not in compliance with this specification. The GW Contractor shall perform additional tests, at GW Contractor’s expense, as may be necessary to reconfirm any noncompliance of the original Work, and as may be necessary to show compliance of corrected Work.

105.4 The GW Contractor shall promptly correct errors or flaws in the Work or material identified during construction which may prevent proper installation. GW Contractor shall make immediate substitution of the noncomplying material or shall make field changes to make the noncomplying material acceptable. The correction or substitution shall be performed at no cost to Owner.

106. GEOTECHNICAL AND TOPOGRAPHICAL DATA

106.1 Geotechnical Data:

a. A structural stability and factor of safety assessment for the East and West Ash Ponds was prepared by Geosyntec Consultants in October 2016. Site specific soil data and geotechnical recommendations are provided and referenced therein.

b. The GW Contractor is allowed to make its own soil investigations. Any additional investigations shall be performed at no additional cost to Owner.

106.2 Topography:

106.3 A topographic survey of the project site was prepared in 2014. The design drawings indicate contour lines, elevations, and dimensions of existing ground. This information is furnished for GW Contractor's convenience and use. Owner assumes no responsibility for the accuracy of information provided.

a. It is noted that the volume of material stored in and topographic surface of the East and West Ash Ponds has been modified since the 2014 survey. Known changes are noted on the Design Drawings, but these notes are not considered to be an exhaustive representation of all differences between the 2014 survey and existing conditions.

b. The GW Contractor is allowed to make its own topographic assessment or check the existing survey data. Any additional surveying of the project site shall be at no additional cost to Owner.

107. CONSTRUCTION SURVEYING

107.1 The GW Contractor shall furnish and install a minimum of four (4) benchmark monuments as approved by the Owner to lay out lines and grades on the site during the lifetime of the project. The GW Contractor is fully responsible for the correctness of such lines and grades and for proper execution of work to such lines and grades.

107.2 Owner reserves the right to verify correctness of lines and grades during progress of the Work. Such verification by Owner shall not relieve the GW Contractor of responsibility as herein specified.

107.3 The GW Contractor shall notify Owner of any difference in location of existing construction and conditions from those indicated wherever such difference might affect its work.

PART 2 - PRODUCTS

201. MATERIALS FOR STRUCTURAL FILL

201.1 Acceptable Material for Structural Fill:

a. Poorly graded sand (SP per the Unified Soil Classification System, ASTM D2487) is stockpiled on site within ½ mile of the East Ash Pond and is available for the GW Contractor's use in establishing the specified lines and grades for the pond's final cover system. This fill will be provided by Owner to the GW Contractor at no cost to the GW Contractor.

201.2 Unsatisfactory Material for Structural Fill:

a. Material unsatisfactory for use as Structural Fill beneath final cover system is as follows:

a1. Soils classified as silt or organic soils in the Unified Soil Classification System, ASTM D2487. Classifications are ML, MH, PT, OL and OH.

a2. Soils classified as high liquid limit clay soils in the Unified Soil Classification System, ASTM D2487. Classification is CH.

a3. Rock material without a soil matrix in which nesting of rocks could occur.

201.3 CCR Fill:

a. The existing CCR stored in the East Ash Pond may be used as Structural Fill to support the pond's final cover system but is not permitted to be used as fill beyond the limits of the pond's existing HDPE geomembrane liner or used as fill offsite. No chemical characterization is required.

202. RESTRICTIONS ON THE USE OF MATERIAL FOR ANY PURPOSE

202.1 Any material, which is frozen, contains an excessive amount of organic material or trash, or contains rocks larger than ¾", shall be considered unsatisfactory for use as fill.

202.2 Fill and backfill soils placed by previous construction shall be considered unsatisfactory for use as fill unless they meet the requirements for satisfactory material.

202.3 For the East Ash Pond, since CCR is existing onsite material, it shall not be taken offsite and shall be graded solely for the purpose of establishing the proper slopes for drainage of the protective cover system and/or to support Structural Fill used to establish the lines and grades for the final cover system. There are no restrictions on use of the ash within the limits of the East Ash Pond's existing HDPE geomembrane liner.

PART 3 - EXECUTION

301. GENERAL

301.1 Work required is shown on the Design Drawings. No work shall be performed outside of the designated area without prior written approval of the Owner.

301.2 All Work that is incidental to excavation or fill may not be specifically indicated on the design drawings, but shall be performed as part of the Work.

302. CLEARING, GRUBBING, AND TOPSOIL STRIPPING

302.1 Areas designated for excavation or fill shall be cleared and grubbed prior to beginning earth-moving operations.

302.2 Clearing and grubbing shall be done to remove all vegetation and root systems that are in excess of 5 percent of the soil by mass or larger than 1 inch in diameter.

302.3 Extent of Stripping:

a. Areas designated for excavation or fill shall be stripped of all topsoil and all other organic material.

b. Weeds, small roots, heavy grass, and other vegetation remaining after clearing and grubbing operations shall be removed with the topsoil.

302.4 Disposal of stripped topsoil:

a. Stripped topsoil shall be hauled offsite at a permanent disposal facility approved by the Owner that is permitted to receive coal combustion residual (CCR) waste.

303. DEMOLITION

303.1 Demolition of any structure, if required, will be shown on the Design Drawings.

303.2 Demolition and removal of minor items which are incidental to the earthwork may be required. The GW Contractor shall identify any such items during its prebid walkdown. The GW Contractor shall demolish such items as required as part of the performance of the Work.

304. EXCAVATION

304.1 CCR Excavation:

a. The minor excavation within the limits of grading shall be performed to the lines and grades indicated on the Design Drawings.

b. Excavated material shall be used for fill unless it is classified as unsatisfactory.

c. CCR and CCR-mixed materials stored in the East Ash Pond shall be excavated and used as fill using proper placement and compaction methods specified herein. Under no

circumstances shall CCR and CCR-mixed materials be used as fill in areas outside of the limits of the East Ash Pond's existing geomembrane liner.

d. GW Contractor shall take all appropriate measures to protect the existing HDPE geomembrane liner systems during excavation activities. Any damage to the HDPE geomembrane liner systems shall be repaired by GW Contractor at no cost to Owner.

e. Excavations shall not be carried below grades indicated on the Design Drawings without approval of Owner. Overexcavations shall be refilled with compacted Structural Fill to the proper grade at no additional cost to Owner.

304.2 Borrow Site:

a. Excavation of the sand stockpile shall be performed in such a manner that stockpiled sand is prevented from entering Lake Michigan or the Waukegan Generating Station Intake Pond.

b. The excavation base where stockpiled soils are removed shall not extend below the elevation of the ground surrounding the stockpile.

c. Grading plans for the final stockpile are not included in the design. Instead, following the removal of the required sand to complete the work in the East Ash Pond, the GW Contractor shall grade the site to prevent erosion, pile instability, or ponding of water.

304.3 Excavation of Drainage Facilities:

a. Drainage ditches, swales, and channels shall be cut accurately to the cross section and grades indicated on the Design Drawings.

b. Roots, stumps, rocks and foreign material in the sides and bottom of drainage facilities shall be removed and the facility trimmed and dressed.

c. Care shall be taken not to excavate ditches and channels below the grades indicated. Excessive excavation shall be backfilled with compacted Structural Fill material.

d. Drainage facilities shall be maintained until final acceptance of the Work by the Owner.

e. Material excavated from the drainage facilities shall be used as fill or transported to the designated offsite disposal area.

305. DISPOSAL OF EXCESS MATERIAL

305.1 Disposal of Unsatisfactory Material:

a. Excavated material, which is unsatisfactory for use as Structural Fill, shall be disposed of in an offsite landfill permitted to receive CCR and approved by the Owner. Unsatisfactory fill material shall not be mixed with satisfactory fill material.

b. When transporting CCR and/or CCR-mixed materials offsite, the GW Contractor shall responsibly handle and transport the material in accordance with 35 Ill. Adm. Code 845.740(c)(1).

306. PREPARATION OF EXISTING SUBGRADE (CCR) TO RECEIVE FINAL COVER SYSTEM

306.1 Removal of Topsoil and Debris:

a. Areas to receive Structural Fill or any component of the East Ash Pond's final cover system shall be cleared and grubbed, stripped of topsoil, and cleared of any debris left by demolition Work and shall be inspected and approved by CQA Contractor prior to placement of Structural Fill or any component the final cover system.

306.2 Subgrade Compaction and Proofroll:

a. Where the existing HDPE geomembrane liner is at least 2 feet below subgrade, the subgrade beneath areas to receive fill shall be compacted and proofrolled prior to placing the fill. The subgrade shall be compacted to the minimum degree of compaction specified in Table 312205-1. Proofrolling shall consist of furnishing and operating compaction equipment for testing the stability of subgrade prior to receiving the fill. The intent is to locate any unstable areas. Proofrolling shall be performed in the presence of the CQA Contractor to allow for observation of unstable areas.

b. Where the existing HDPE geomembrane liner is less than 2 feet below subgrade, subgrade preparation and testing are not required.

c. Compact the surface of the subgrade to achieve the required density prior to performing proofroll.

d. Equipment such as a fully loaded water wagon having a gross weight of not less than 25 tons or loaded dump truck weighing at least 25 tons shall be used for proofrolling

e. Proofroll the surface by making a minimum of two coverages with the approved equipment at a speed no greater than 3 mph. Each succeeding trip of the proofroller shall be offset by not greater than one tire width. Make additional passes over areas of suspected instability.

f. Failure: The subgrade shall be considered failed if, under the action of proofrolling, the subgrade yields, pumps, or is otherwise unstable. Yielding is defined as rutting of more than 1 inch measured from the top of the construction grade to the bottom of the rut.

g. Remedial Action: Remove all failed areas a minimum depth of two feet or as directed by Purchaser and replace with satisfactory fill compacted as specified for Structural Fill.

307. PLACEMENT OF STRUCTURAL FILL

307.1 Structural Fill materials include sand material from the onsite stockpile and existing CCR or CCR-mixed materials within the East Ash Pond as described in Paragraphs 201.1 and 201.3, respectively.

307.2 Lift Thickness:

a. Fill shall be placed in horizontal layers.

b. Unless otherwise approved by Owner, the loose thickness shall not exceed the following:

b1. Eight inches maximum loose lift thickness for compaction by self-propelled equipment.

b2. Three inches maximum loose lift thickness for compaction by hand-operated equipment.

b3. These lift thicknesses may be increased if the results of a test section prove that a thicker loose lift can be compacted to the required specified densities. The maximum loose lift thickness shall be 12 inches.

307.3 Placement:

a. Where fill is placed with less than 2 feet of separation from the existing HDPE geomembrane liner, care shall be taken to avoid any damage to the existing liner system. This includes placing fill against the existing dikes from the bottom up while maintaining adequate fill thickness to prevent damage to the existing liner system.

b. Each layer of fill shall be evenly spread and moistened or aerated as required to achieve the required moisture content.

c. The top surface of each layer shall be approximately level but shall have sufficient crown or cross fall to provide adequate drainage of water at all times during the construction period. The crown or crossfall shall be at least 1 in 50 (two percent) but no greater than 1 in 20 (five percent).

d. Fill slopes steeper than 20 percent (i.e., five horizontal to one vertical) shall be overfilled a minimum of 6 inches beyond the face of the slope, measured horizontally, and then cut back and trimmed to the required line and grade to expose a smooth surface uniformly compacted to the required density. Installing the fill slope to lines and grades shown on the design drawings and then running over the surface with compaction equipment is not acceptable.

308. COMPACTING STRUCTURAL FILL

308.1 Equipment:

a. Each layer of fill shall be compacted by a smooth drum vibratory roller or other mechanical means acceptable to Owner that will produce the specified compaction.

b. At locations where it would be impractical because of inaccessibility to use self-propelled compacting equipment, fill layers shall be compacted using hand propelled compaction equipment.

308.2 Inspection and Testing:

a. All Work is subject to inspection and testing by the CQA Contractor. The CQA Contractor shall have access to the Work at all times. Testing shall be in accordance with the Contract. Refer to Specification W-7901 for inspection and testing requirements.

b. Each layer of compacted fill shall be tested and accepted before proceeding with the next layer.

c. It is the GW Contractor’s responsibility to request inspection prior to proceeding with further Work that would make parts of the Work inaccessible for inspection.

d. If the fill material fails to meet the required density, the material shall be removed and replaced or reworked, altering the construction method as necessary to obtain the required density and compaction. Sufficient time shall be allotted between lifts for the necessary testing of the soils.

309. COMPACTION DENSITIES

309.1 The degree of compaction shall be expressed as a percentage of the maximum laboratory dry density obtained at optimum moisture content in accordance with the standards listed in Table 312205-1.

309.2 The minimum degree of compaction for fills for different areas is presented in Table 312205-1. The GW Contractor shall use data from this table which are applicable to the project.

310. GRADING TOLERANCES

310.1 Lines and Grades: The acceptable deviation from lines and grades indicated on the Design Drawings shall be as shown in Table 312205-2. The GW Contractor shall use data from that table which is applicable to the project.

310.2 Slopes: Slopes shall be finished in conformance with the lines and grades shown on the Design Drawings. When completed, the average plane of a slope shall conform to the slope indicated on the Design Drawings and no point on the completed slope shall vary from the designated plane by more than 6 inches measured at right angles to the slope.

311. DUST CONTROL

311.1 The GW Contractor shall be responsible for controlling dust caused by the grading operation in compliance with the Fugitive Dust Plan in place for the facility and in accordance with 35 Ill. Adm. Code 845.740(c)(2). Water shall be applied uniformly and lightly to prevent muddy, slippery, or other hazardous conditions. The application shall be frequent enough to adequately control the dust nuisance. However, excessive application that would affect compacting operations shall be avoided.

312. TEMPORARY SEDIMENT CONTROL DURING CONSTRUCTION

312.1 The GW Contractor shall be responsible for providing temporary facilities for the control of sediment in site area runoff during construction.

312.2 Silt fences, straw bale dikes and other temporary facilities shall be provided as required and as specified on the design drawings and in Section 311010.

313. EROSION CONTROL

313.1 The GW Contractor shall be responsible for temporary protection of graded areas against erosion and for correction of erosion, which occurs.

313.2 Slopes, ditches, or other disturbed areas shall not be exposed for more than 21 days without a permanent cover.

TABLE 312205-1

AREA	ASTM D1557 (percent) (1)
Subgrade (CCR)	
Subgrade beneath fills	90
Structural Fills (Including Ash Fill)	
All structural fill	95

Notes:

(1) When granular material is used as fill the moisture content of the compacted material shall not be used as a criterion for acceptance of the fill.

TABLE 312205-2

ACCEPTABLE DEVIATION		
Type of Installation-Excavation or Fill	**Maximum Acceptable Deviation from Line Feet**	**Maximum Acceptable Deviation from Grade(1) Feet**
General Earthwork		
General Site Area	±0.3	±0.2
Drainage Facilities		
Permanent Drainage Channel	±0.3	+0.0 to -0.1
Slope Drainage Benches and Drainage Diversion Dikes	±0.5	±0.1

Notes:

(1) After initial settlement has taken place. Initial settlement is that settlement that will occur up to the time of determination and acceptance of final grade elevations by the Owner.

END OF SECTION 312205

SECTION 319022

HIGH DENSITY POLYETHYLENE GEOMEMBRANE FOR FINAL COVER SYSTEM

PART 1 - GENERAL

101. EXTENT

101.1 This section defines the minimum requirements for material and installation of non-textured, textured, and structured high density polyethylene (HDPE) geomembrane to be used in the ClosureTurf® final cover system (or Owner-approved equal) for the East Ash Pond, all in accordance with the Design Drawings and as specified herein.

101.2 The Work shall include, but not be limited to, the following items:

a. Manufacture, shipping, handling, and storage of geomembrane materials.

b. Inspection and approval of surfaces to be covered.

c. Placement and field seaming of geomembrane.

d. Anchorage of geomembrane in anchor trenches.

e. Attachment of geomembrane to structures and penetrations.

f. Non-destructive field testing of geomembrane seams.

g. Removal of samples of geomembrane seams and submittal to the CQA Contractor for destructive testing.

h. Repair of defective geomembrane seams.

i. Repair of defects in the geomembrane and locations where samples were taken.

j. Visual inspection of the completed geomembrane cover.

101.3 Definitions of Terms:

a. The following definitions of terms shall apply throughout this section.

a1. Earthwork Contractor: The contractor who works for the GW Contractor and is responsible for earthwork for the facility and for excavation and backfill of anchor trenches.

a2. Geosynthetics Contractor: The contractor who works for the GW Contractor and is responsible for the supply and installation of all geomembrane and synthetic turf materials and the unloading and storage of the materials. The Geosynthetics Contractor may be the GW Contractor or a subcontractor to the GW Contractor.

a3. Construction Quality Assurance (CQA) Contractor: The contractor who is independent of the GW Contractor and is responsible for all CQA work.

a4. CQA Geosynthetics Inspector: An inspector who works for the CQA Contractor and is responsible for inspection of the Geosynthetics Contractor's work.

a5. Geomembrane Manufacturer: The manufacturer who is responsible for manufacture of geomembrane materials and for transporting geomembrane materials to the site.

a6. Watershed Geo: A geosynthetic technology company and the designer of the ClosureTurf® final cover system.

101.4 Qualifications:

a. Geomembrane Manufacturer:

a1. The Geomembrane Manufacturer shall be approved by the Owner.

a2. The Geomembrane Manufacturer shall be approved by Watershed Geo for supplying the geomembrane component of the ClosureTurf® final cover system (or Owner-approved equal).

b. Geosynthetics Contractor:

b1. The Geosynthetics Contractor shall be approved by the Geomembrane Manufacturer for installation of the Geomembrane Manufacturer's products.

b2. The Geosynthetics Contractor shall be approved by the Owner.

b3. Geosynthetics Contractor personnel shall attend ClosureTurf® orientation provided by Watershed Geo prior to the start of the Work if this project is the Geosynthetics Contractor's first ClosureTurf® installation project.

b4. Geomembrane Seamers:

b4.1 Master Geomembrane Seamer shall have installed at least 5,000,000 square feet of geomembrane materials.

b4.2 All other geomembrane seamers shall have installed at least 1,000,000 square feet of geomembrane materials. Personnel who do not meet this criterion may be allowed to seam geomembrane materials but only under the direct supervision of the Master Geomembrane Seamer.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this section shall be coordinated with work specified in the following related sections and specifications:

a. GW Specification (Specification W-7900 – East & West Ash Pond Closures):

a1. Section 311522 – Engineered Synthetic Turf for Final Cover System.

a2. Section 312205 – Earthwork for CCR Surface Impoundment Closure.

b. CQA Specification (Specification W-7901 – Construction Quality Assurance for East & West Ash Pond Closures):

b1. Section 014362 – Quality Assurance for Closing a CCR Surface Impoundment.

103. REFERENCE DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local agencies having jurisdiction.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Abbreviations listed indicate the form used to identify the reference documents in the Specification Section text.

103.4 ASTM – ASTM International:

a. A276 Specification for Stainless Steel Bars and Shapes.

b. B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

c. D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

d. D1004 Test Method for Tear Resistance of Plastic Film and Sheeting.

e. D1505 Test Method for Density of Plastics by the Density-Gradient Technique.

f. D1603 Test Method for Carbon Black Content in Olefin Plastics.

g. D4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

h. D4833 Test Method for Index Puncture Resistance of Geomembranes and Related Products.

i. D5199 Test Method for Measuring Nominal Thickness of Geosynthetics.

j. D5397 Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.

k. D5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.

l. D5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

m. D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.

n. D5820 Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

o. D5885 Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.

p. D5994 Test Method for Measuring Core Thickness of Textured Geomembrane.

q. D6392 Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

r. D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.

s. D7466 Test Method for Measuring Asperity Height of Textured Geomembranes.

t. D8117 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry.

103.5 GRI – Geosynthetic Research Institute:

a. GM6 Practice for Pressurized Air Channel Test for Dual Seamed Geomembranes.

b. GM10 The Stress Crack Resistance of HDPE Geomembrane Sheet.

c. GM13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

d. GM14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes.

e. GM19a Seam Strength and Related Properties of Thermally Bonded Homogeneous Polyolefin Geomembranes/Barrier.

104. SUBMITTALS

104.1 GW Contractor shall submit the drawings and data as specified below within 30 days prior to use. Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Owner's information systems specified by the Owner.

104.2 Submittals with the Bid Proposal:

a. HDPE Geomembrane Material:

a1. Certification of Compliance from the Geomembrane Manufacturer signed by its authorized representative indicating that the HDPE geomembrane sheeting material meets the criteria specified herein.

a2. One representative sample of each type of HDPE geomembrane material.

a3. Geomembrane Manufacturer's Quality Control and Quality Assurance Policies and Procedures.

b. Warranty:

b1. Written warranties from the Geomembrane Manufacturer and the Geosynthetics Contractor covering the quality of the material and workmanship as specified.

b2. The minimum period of warranty for materials shall be 20 years with first year non-prorated. The minimum period of warranty for installation shall be 5 years with the first year non-prorated.

b3. Warranty conditions proposed, including limits of liability, will be evaluated by the Owner in approving the Geomembrane Manufacturer and the Geosynthetics Contractor.

c. Geosynthetics Contractor:

c1. Geosynthetics Contractor's name, address, and telephone number.

c2. Geosynthetics Contractor's qualifications.

c3. Installer's qualifications if the Geosynthetics Contractor is proposing to subcontract installation work.

104.3 Submittals After Award of the Contract:

a. Progress Reports:

a1. GW Contractor shall submit status reports at regular intervals as specified by the Owner. The reports shall indicate the status of the schedule.

b. Geomembrane Resin:

b1. Geomembrane Manufacturer's signed certificate that the resin meets the criteria specified herein.

b2. Geomembrane Manufacturer's signed certification of the origin of the resin and that all resin is from the same manufacturer (including Geomembrane Manufacturer's name, identification brand name, and number).

b3. Copies of Geomembrane Manufacturer and resin suppliers' QA/QC certificates. Certificates shall include a summary report of test results conducted to verify the quality of the resin used in each batch used to manufacture geomembrane for this project. As a minimum, the report shall include tests on specific gravity, melt flow index and percent carbon black.

c. Geomembrane Sheeting:

c1. Prior to material shipment to the site, the Geomembrane Manufacturer shall submit to the CQA Contractor representative samples of the geomembrane to be shipped to the site, along with chain of custody and certification that the samples submitted are from the geomembrane material to be delivered to the site. The number of samples shall be determined in accordance with the number of CQA conformance tests specified in Specification W-7901, Section 014362.

c2. Signed certification that the properties of the manufactured sheeting meet the criteria specified herein and are guaranteed by the Geomembrane Manufacturer.

c3. Statement certifying that no post consumer resin (PCR) has been added to the formulation.

c4. Copies of all of the Geomembrane Manufacturer's QA/QC certificates. The certificates shall include documents of test results.

d. Extrudate Resins or Rod for Seaming Geomembranes:

d1. Certification that all extrudate is the same resin type as the geomembrane and was obtained from the same resin supplier as the resin used to manufacture the geomembranes.

e. Installation Data:

e1. Geomembrane Manufacturer's proposed geomembrane panel layout for each installation.

e2. Geomembrane Manufacturer's recommended procedures for making and testing seams if different from those specified herein.

e3. Geomembrane Manufacturer's recommended procedures for repairing damaged geomembrane sections and seams if different from those specified herein.

e4. Geomembrane Manufacturer's details of geomembrane liner anchorage and attachment to structures and penetrations if different from those specified herein and the details shown on the Design Drawings.

104.4 Submittals After Construction is Complete:

a. Geosynthetics Contractor:

a1. As-built panel layout.

a2. Drawing showing location of repairs and type of repairs made.

a3. Location of destructive tests.

a4. Results of destructive tests.

a5. Results of non-destructive tests.

105. QUALITY ASSURANCE

105.1 Materials and construction procedures shall be subject to inspection and testing by the CQA Contractor. Such inspections and tests will not relieve the GW Contractor of responsibility for providing materials and installation in compliance with specified requirements.

105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The GW Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance with specified requirements.

105.3 CQA activities for installing geomembrane materials shall be performed as described herein and in Specification W-7901.

PART 2 - PRODUCTS

201. HIGH DENSITY POLYETHYLENE GEOMEMBRANE

201.1 Manufacturers of HDPE Geomembrane Products:

a. The products of the following manufacturers meeting the requirements herein are acceptable:

a1. AGRU America Manufacturing, Inc., 500 Garrison Road, Georgetown, SC 29440, Tel.: 800-373-2478.

a2. Owner-approved equal.

201.2 General Requirements:

a. All non-textured HDPE geomembrane shall be white. There is no color requirement for textured and structured HDPE geomembranes.

b. The HDPE geomembrane shall be manufactured from first quality, virgin resin. Blending of resins shall not be allowed. No recycled or reworked geomembrane may be used except edge trim generated during the manufacturing process (no more than 10%). No post-consumer resin (PCR) of any type shall be added to the formulation.

c. The resin used to produce the geomembrane shall be formulated to be resistant to chemical and ultraviolet degradation.

d. The geomembrane shall be free of plasticizers.

e. The geomembrane shall be free of leachable additives.

f. During manufacture, each roll of geomembrane shall be continuously monitored across the width to assure uniformity of thickness. Thickness measurements shall meet the requirements of Table 319022-1 for non-textured geomembrane, Table 319022-2 for textured geomembrane, and Table 319022-3 for structured geomembrane.

g. The geomembrane shall be free of factory seams.

h. The geomembrane shall be free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, blisters, pits, tears, holes, pores, pinholes, voids, undispersed raw material, any sign of contamination or other defects that may affect serviceability, and shall be uniform in color, thickness, and surface texture.

i. The geomembrane shall be capable of being seamed in the field to yield seams that are as resistant to waste liquids as the sheeting.

j. The geomembrane shall be manufactured in the United States or Canada.

201.3 Non-Textured HDPE Geomembrane:

a. Non-textured HDPE geomembrane shall meet the requirements of Table 319022-1.

b. The location of non-textured HDPE geomembrane to be used for each installation shall be as shown on the Design Drawings.

201.4 Textured and Structured HDPE Geomembranes:

a. Textured HDPE geomembrane shall meet the requirements of Table 319022-2.

b. Structured HDPE geomembrane shall meet the requirements of Table 319022-3.

c. The location of textured and structured HDPE geomembranes to be used for each installation shall be as shown on the Design Drawings.

d. Textured and structured geomembranes shall be manufactured using a co-extrusion process.

e. The textured/structured coating shall be applied to both sides of the base sheet.

f. Textured and structured geomembranes shall have uniform texturing appearance. The geomembrane shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

g. Each roll shall have 6-inch wide smooth edges (minimum) to provide suitable seaming surfaces. Textured and/or structured geomembrane without smooth edges may be provided if approved by the Owner.

TABLE 319022-1

HIGH DENSITY POLYETHYLENE NON-TEXTURED

GEOMEMBRANE REQUIREMENTS[1]

Property	Test Method	Polyethylene Base Compound	Geomembrane Minimum Average Roll Value		Testing Frequency
Nominal thickness, mil	--	--	60	100	---
Resin Properties					
Oxidative Induction Time (OIT), minimum average minutes Standard OIT or	D8117	100	--	--	200,000 lbs. of Resin
High Pressure OIT	D5885	400	--	--	200,000 lbs. of Resin
Oven Aging at 85° C	D5721	--	--	--	
Standard OIT (min avg), percent retained after 90 days or	D8117	55	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 90 days	D5885	80	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 1600 Hrs	D5885	50	--	--	one per formulation
Analytical Properties					
Density of base resin, g/cc minimum	D1505/D792	0.940	--	--	200,000 lbs. of Resin
Carbon black content, %	D1603 or D4218	2.0-3.0	--	--	20,000 lbs. of Resin
Carbon black dispersion for 10 different views	D5596	All 10 in Categories 1,2 & 3	--	--	45,000 lbs. .of Resin
Mechanical Properties					
Thickness, mils	D5199	--	--	--	One per roll
Average		--	60	100	
Lowest individual of 10 values		--	54	90	
Tensile properties, in each direction (minimum):	D6693 (Type IV Specimen at 2 ipm)				
Tensile stress at yield, ppi minimum		--	126	210	20,000 lbs. of Resin
Elongation at yield, % minimum		--	12	12	20,000 lbs. of Resin
Tensile stress at break, ppi minimum		--	228	380	20,000 lbs. of Resin
Elongation at break, % minimum 2" gage length		--	700	700	20,000 lbs. of Resin
Tear resistance, lb (minimum avg)	D1004	--	42	70	45,000 lbs. of Resin
Puncture resistance, lb. (minimum avg)	D4833	--	108	180	45,000 lbs. of Resin
Bonded seam strength[2]	D6392	--	--	--	
Shear strength, ppi		--	120	200	
Peel adhesion (fusion), ppi		--	91	151	
Peel adhesion (extrusion), ppi		--	78	130	
Environmental and Aging					
Effect on Properties					
Stress Crack Resistance, hours (min)	D5397	--	500	500	per GRI GM10

Notes:

1. Requirements shown in this table meet the minimum requirements of GRI Standard GM13, Revision 16 (March 17, 2021), except for bonded seam strength.
2. Seam requirements shown in this table meet the minimum requirements of GRI Standard GM19a, Revision 10 (March 18, 2021).

TABLE 319022-2

HIGH DENSITY POLYETHYLENE TEXTURED GEOMEMBRANE REQUIREMENTS[1]

Property	Test Method	Polyethylene Base Compound	Geomembrane Minimum Average Roll Value		Testing Frequency
Nominal thickness, mil	--	--	60	100	---
Resin Properties					
Oxidative Induction Time (OIT), minimum average minutes Standard OIT or	D8117	100	--	--	200,000 lbs. of Resin
High Pressure OIT	D5885	400	--	--	200,000 lbs. of Resin
Oven Aging at 85° C	D5721	--	--	--	
Standard OIT (min avg), percent retained after 90 days or	D8117	55	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 90 days	D5885	80	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 1600 hrs.	D5885	50	--	--	one per formulation
Analytical Properties					
Density of base resin, g/cc minimum	D1505/D792	0.940	--	--	200,000 lbs. of Resin
Carbon black content, %	D1603 or D4218	2.0-3.0	--	--	20,000 lbs. of Resin
Carbon black dispersion for 10 different views	D5596	All 10 in Categories 1,2 & 3	--	--	45,000 lbs. of Resin
Mechanical Properties					
Thickness, mils	D5994	--	--	--	One per roll
Minimum Average		--	57	95	
Lowest individual for 8 out of 10 values		--	54	90	
Lowest individual for 10 out of 10 values		--	51	85	
Asperity Height, mils (min avg)	D7466	--	16	16	Every second roll
Tensile properties, in each direction (minimum average)	D6693 (Type IV Specimen at 2 ipm)				
Tensile stress at yield, ppi minimum		--	126	210	20,000 lbs. of Resin
Elongation at yield, % minimum		--	12	12	20,000 lbs. of Resin
Tensile stress at break, ppi minimum		--	90	150	20,000 lbs. of Resin
Elongation at break, % minimum 2" gage length		--	100	100	20,000 lbs. of Resin
Tear resistance, lb. (minimum avg)	D1004	--	42	70	45,000 lbs. of Resin
Puncture resistance, lb. (minimum avg)	D4833	--	90	150	45,000 lbs. of Resin
Bonded seam strength[2]	D6392	--	--	--	
Shear strength, ppi		--	120	200	
Peel adhesion (fusion), ppi		--	91	151	
Peel adhesion (extrusion), ppi		--	78	130	
Environmental and Aging					
Effect on Properties					
Stress Crack Resistance, hours (min)	D5397	--	200	200	per GRI GM10

Notes:

1. Requirements shown in this table meet the minimum requirements of GRI Standard GM13, Revision 16 (March 17, 2021), except for bonded seam strength.
2. Seam requirements shown in this table meet the minimum requirements of GRI Standard GM19a, Revision 10 (March 18, 2021).

TABLE 319022-3

HIGH DENSITY POLYETHYLENE STRUCTURED GEOMEMBRANE REQUIREMENTS[1]

Property	Test Method	Polyethylene Base Compound	Geomembrane Minimum Average Roll Value		Testing Frequency
Nominal thickness, mil	--	--	60	100	---
Resin Properties					
Oxidative Induction Time (OIT), minimum average minutes Standard OIT or	D8117	100	--	--	200,000 lbs. of Resin
High Pressure OIT	D5885	400	--	--	200,000 lbs. of Resin
Oven Aging at 85° C	D5721	--	--	--	
Standard OIT (min avg), percent retained after 90 days or	D8117	55	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 90 days	D5885	80	--	--	one per formulation
High Pressure OIT (min avg), percent retained after 1600 hrs.	D5885	50	--	--	one per formulation
Analytical Properties					
Density of base resin, g/cc minimum	D1505/D792	0.940	--	--	200,000 lbs. of Resin
Carbon black content, %	D1603 or D4218	2.0-3.0	--	--	20,000 lbs. of Resin
Carbon black dispersion for 10 different views	D5596	All 10 in Categories 1,2 & 3	--	--	45,000 lbs. of Resin
Mechanical Properties					
Thickness, mils	D5994	--	--	--	One per roll
Minimum Average		--	57	95	
Lowest individual for 8 out of 10 values		--	54	90	
Lowest individual for 10 out of 10 values		--	51	85	
Drainage Stud Height, mils (min avg)	D7466	--	130	130	
Friction Spike Height, mils (min avg)	D7466	--	175	175	Every second roll
Tensile properties, in each direction (minimum average)	D6693 (Type IV Specimen at 2 ipm)				
Tensile stress at yield, ppi minimum		--	132	220	20,000 lbs. of Resin
Elongation at yield, % minimum		--	12	12	20,000 lbs. of Resin
Tensile stress at break, ppi minimum		--	132	220	20,000 lbs. of Resin
Elongation at break, % minimum 2" gage length		--	200	200	20,000 lbs. of Resin
Tear resistance, lb. (minimum avg)	D1004	--	42	70	45,000 lbs. of Resin
Puncture resistance, lb. (minimum avg)	D4833	--	90	150	45,000 lbs. of Resin
Bonded seam strength[2]	D6392	--	--	--	
Shear strength, ppi		--	120	200	
Peel adhesion (fusion), ppi		--	91	151	
Peel adhesion (extrusion), ppi		--	78	130	
Environmental and Aging					
Effect on Properties					
Stress Crack Resistance, hours (min)	D5397	--	500	500	per GRI GM10

Notes:

1. Requirements shown in this table meet the minimum requirements of GRI Standard GM13, Revision 16 (March 17, 2021), except for bonded seam strength.
2. Seam requirements shown in this table meet the minimum requirements of GRI Standard GM19a, Revision 10 (March 18, 2021).

201.5 Panel Layout:

a. Prior to manufacture of the geomembrane, a panel layout of the surface to be covered shall be made. Each panel to be used for the installation shall be given a numeric or alphanumeric identification number.

b. The panel identification number shall be related in writing to the manufacturing roll number that identifies the resin type, batch number, and date of manufacture.

c. The panel layout shall be made considering the following requirements:

c1. Panel lengths shall include slope gain and anchorage.

c2. Perpendicular tie-ins shall be made a minimum of 5 feet beyond the toe of the slope.

c3. A minimum of 6 inch overlap shall be allowed at double fusion welded seams.

c4. All field seams on slopes shall be oriented parallel to the slope (oriented along, not across the slope).

c5. The number of seams in corners or odd shaped geometric locations shall be minimized.

201.6 Packaging and Shipping:

a. The geomembrane shall be shipped to the project site in rolls. No material shall be folded.

b. A label shall be attached or adhered to each roll of the geomembrane identifying the following:

b1. Manufacturer.

b2. Product Identification, which can be traced back to the origin of the base material (resin supplier's name, resin production plant, resin brand name type, resin brand number, and production date of the resin).

b3. Date of manufacture of the geomembrane.

b4. Roll identification number.

b5. Geomembrane thickness and type.

b6. Roll dimensions (length and width).

b7. Batch number.

b8. Order number.

b9. Panel number.

201.7 Packaging and Transportation:

a. Packaging and transportation shall be the responsibility of the Geomembrane Manufacturer, who shall retain responsibility until the geomembrane is accepted at the site by the Geosynthetics Contractor.

202. MATERIALS FOR ATTACHMENT OF GEOMEMBRANE TO CONCRETE

202.1 Batten Strip:

a. Batten strip material shall be hot rolled, annealed, and pickled Type 306 L stainless steel in accordance with ASTM A276.

b. Strips shall be ¼ inch thick by 2 inches wide. Random lengths are acceptable.

202.2 Expansion Anchors:

a. Expansion anchors shall be stud type with a single piece three section wedge and zinc plated in accordance with ASTM B633. Wedges shall be manufactured from ANSI Type 304 stainless steel. Hilti Kwik Bolt 3 Expansion Anchors, or equal, are acceptable.

b. Minimum yield strength of 60,000 psi for wedge-type anchors and a minimum tensile strength of 65,000 psi for stud type anchors.

c. Anchors shall be 3/8 inch diameter by 3 1/2 inch long.

d. Washers for anchors shall be Type 18-8 stainless steel flat washers for 3/8 inch bolt size.

202.3 Neoprene Gasket:

a. Neoprene gaskets shall be 1/4 inch thick by 2 inches wide closed cell neoprene sponge sealing strips. Operating temperature range of neoprene shall be –40°F to +220°F.

b. Neoprene gaskets placed against concrete shall have a pressure sensitive adhesive on the side of the gasket placed against the concrete.

PART 3 - EXECUTION

301. ONSITE HANDLING AND STORAGE

301.1 Receipt/Unloading:

a. Unloading and storage of materials shall be the responsibility of the Geomembrane Manufacturer.

b. The unloading and other handling of materials shall be performed by the Geomembrane Manufacturer to ensure that the material is handled with care and not damaged.

301.2 Storage:

a. The GW Contractor shall provide temporary on-site storage space in a location near the area to be covered such that on-site transportation and handling are minimized. The GW Contractor shall be responsible for protecting stored material from theft and vandalism.

b. The rolls of geomembrane shall be placed on a smooth surface free of rocks and standing water.

301.3 Inspection:

a. Upon delivery of the material to the project site, the Geosynthetics Contractor shall conduct a visual inspection of all rolls of geomembrane for damage or defects. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.

b. Any damage or defects shall be noted and immediately reported to the Owner, the Geomembrane Manufacturer, and to the carrier that transported the material. Any roll or portion thereof, which, in the judgement of the Owner, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to the Owner.

302. PREPARATION OF SURFACES TO BE COVERED

302.1 General:

a. The Earthwork Contractor shall be responsible for preparing and maintaining the surfaces to be covered as specified in Section 312205 prior to placement of the geomembrane.

b. The Geosynthetics Contractor shall confirm the conditions of the finished surfaces to be covered prior to placement of the liner.

302.2 Grading Requirements:

a. The subgrade surface on which a lining is to be placed shall be graded to elevations shown on the Design Drawings. Tolerances shall be as specified in Section 312205.

302.3 Preparation of Concrete Surfaces:

a. All portions of concrete walls, curbs and foundations that will come in contact with a geomembrane shall be free of sharp edges or rough spots that can puncture or abrade the geomembrane. Where necessary, the concrete shall be ground smooth by the Earthwork Contractor. Where specified on the Design Drawings, one or more layers of geomembrane scuff strips shall be placed between the concrete and the geomembrane to act as a protective layer for the geomembrane cap.

302.4 Subgrade Acceptance:

a. See Section 312205 regarding inspection and acceptance of surfaces to be covered.

303. FIELD PLACEMENT OF THE GEOMEMBRANE COVER

303.1 General Requirements:

a. Placement Procedure: The placement procedure used for the geomembrane cover shall include the conditions listed below.

b. Weather:

b1. Geomembrane shall not be placed when the air temperature is above 104°F or below 41°F unless it can be demonstrated to the approval of the Owner by trial welds that acceptable welds can be made at the prevailing temperature. Trial welds shall be as described in Paragraph 303.2.c.

b2. Geomembrane shall not be placed when there is any rainfall or snowfall, in the presence of excessive moisture due to fog or dew, in ponded water, on a frozen subgrade, or during high winds.

c. Panel Layout:

c1. The panels shall be placed in accordance with the Geomembrane Manufacturer’s panel layout drawing to ensure that they are placed in the proper direction for seaming.

c2. If panels are installed in a location other than indicated on the Geomembrane Manufacturer's panel layout drawing, the revised location shall be indicated on an "as-built" layout drawing. The "as-built" record drawing shall be submitted to the Owner at the completion of the project.

d. Panel Deployment:

d1. Only the panels that can be anchored and seamed together in one shift shall be unrolled.

d2. Unroll and layout panels in as close to the final position as possible. Pulling geomembrane panels should be minimized to reduce the chance of permanent tension.

d3. The methods and equipment used to deploy the panels shall not damage the geomembrane or the supporting surface.

d4. Wrinkles shall be minimized. However, enough slack shall be provided in both directions so that there will be no tension in the geomembrane at the lowest expected operating temperature.

e. Precautions to Prevent Wind Damage:

e1. If possible, work shall be oriented in the direction of the prevailing wind.

e2. Provide adequate temporary loading and/or anchoring of the geomembrane by the use of sandbags, tires or other means which will not damage the geomembrane, to prevent uplift of the geomembrane by wind.

f. Other Precautions to Prevent Damage:

f1. Protection of the geomembrane from damage due to foot traffic on the slopes shall be provided.

f2. Provisions of facilities for safe entrance and egress of employees from sloped depressions is required.

g. Replacement of Damaged Geomembrane:

g1. Any area of a panel, which, in the judgement of the Owner, becomes seriously damaged (torn, twisted, or crimped permanently) shall be replaced at no additional cost to the Owner.

303.2 Field Seaming:

a. Method of Seaming:

a1. The primary welding procedure for seams shall be double wedge fusion welding.

a2. Extrusion welding shall be used only for repairs, detail work, and for seaming where double wedge fusion welding is not possible.

a3. The rods used for extrusion welding shall be the same type of resin as the geomembrane, unless otherwise approved by the Owner.

a4. The use of solvents or adhesives is not permitted.

b. General Requirements for Seaming:

b1. On slopes steeper than 10 horizontal to 1 vertical, seams shall be oriented parallel to the line of maximum slope (oriented up and down, not across the slope) when possible. No seams oriented across the slope shall be used unless approved by the Owner.

b2. Seams parallel to the toe of the slope shall be located a minimum of 5 feet from the toe.

b3. Seams parallel to the crest of the slope shall be located a minimum of 2 feet from the crest.

b4. Seams at the bottom of a slope shall be overlapped so that the upslope sheet is positioned above the downslope sheet.

b5. Seaming shall extend to the outside edge of panels to be placed in the anchor trench. Seams at sheet corners of three or four sheets shall be completed with a patch having a minimum dimension of 24 inches, and extrusion welded to the parent sheets.

b6. All cross seams between the two rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of geomembrane.

c. Trial Welds Prior to Beginning Seaming:

c1. Trial welds are required for pre-qualification of personnel, equipment, and procedures for making seams on identical geomembrane material under the same climatic conditions as the actual field production seams will be made.

c2. Trial welds shall be made as follows:

c2.1 Prior to each seaming period.

c2.2 Every 4 to 5 hours (i.e., at the beginning of the work shift and after the lunch break).

c2.3 Whenever personnel or equipment are changed.

c2.4 When climatic conditions result in wide changes in geomembrane temperature.

c2.5 When requested by the CQA Geomembrane Inspector for any seaming crew or piece of welding equipment if problems are suspected.

c3. Once qualified by passing a trial weld, welding technicians shall not change parameters without performing another trial weld.

c4. Trial welds shall be made on both double wedge fusion welds and on extrusion welds.

c5. A test strip shall be prepared by joining two pieces of geomembrane, each piece shall be at least 6 inches wide. The length of double wedge fusion welded seams shall be a minimum of 10 feet long. The length of an extrusion welded seam shall be a minimum of 4 feet long. The CQA Geomembrane Inspector shall witness the fabrication of each test strip.

c6. All test welds shall be tested by destructive testing. Testing can be done as soon as the seam cools.

c7. A minimum of three (3) one (1) inch wide sample strips shall be cut from each test strip, one from each end and one from the middle. The location of each sample shall be selected by the CQA Geomembrane Inspector. The test strips shall be tested in peel at

2 inches per minute using a field tensiometer. The CQA Geomembrane Inspector shall witness all tests.

c8. If any of the test specimens fail, a new test strip shall be fabricated and the tests repeated for the new strip. If additional specimens fail, the seaming apparatus and the seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and successful trial welds have been achieved.

c9. The trial weld is considered acceptable if, when tested for peel adhesion using the field tensiometer, all three specimens meet the criteria specified in Tables 319022-1 and 319022-2, respectively, for both the peel and shear under Bonded Seam Strength, or the three specimens exhibit Film Tear Bond (FTB) (yielding of the parent material before seam failure). In the case of double wedge fusion welded seams, both welds must pass in order to be considered acceptable.

c10. If the specimens pass the tests, production seaming operations can begin.

c11. The GW Contractor shall document all data on each trial weld, including:

c11.1 Date.

c11.2 Time.

c11.3 Operator.

c11.4 Machine number.

c11.5 Ambient temperature.

c11.6 Operating temperature.

c11.7 Speed setting.

c11.8 Pass/Fail designation.

d. Preparation for Seaming:

d1. Prior to seaming, the surface of the geomembrane shall be wiped with a clean cloth to ensure that it is clean and free from moisture, grease, dust, dirt, and debris of any kind before seam welding is started.

d2. The panels shall be adjusted so that the seams are aligned to eliminate wrinkles and fish mouths. Where necessary, fish mouths and wrinkles shall be cut to achieve flat overlap.

e. Seaming:

e1. Seaming shall be performed in accordance with the Geomembrane Manufacturer's accepted procedure.

e2. Double Wedge Fusion Welds:

e2.1 The panels shall be overlapped a minimum of 4 inches prior to welding.

e2.2 Vehicle mounted automated hot wedge welding apparatus shall be used to make the seam.

e3. Extrusion Fillet Welding:

e3.1 Geomembrane overlap shall be a minimum of 3 inches for extrusion welding.

e3.2 Geomembrane panels shall be temporarily bonded using a hot air device prior to extrusion welding.

e3.3 The edge of the geomembrane to be fillet welded shall be pre-beveled before heat-tacking the seam in place.

e3.4 The seam overlap shall be ground (abraded) no more than one hour prior to welding.

e3.5 Grinding shall be performed in accordance with the Geomembrane Manufacturer's instructions in a manner that does not damage the geomembrane.

e3.6 Grinding shall not extend more than 1/4 inch past the area to be covered with extrudate during welding.

e3.7 All grind marks shall be covered with extrudate.

e3.8 Geomembrane overlap shall be a minimum of 3 inches for extrusion welding.

303.3 Non-Destructive Field Testing:

a. General:

a1. All non-destructive field testing shall be performed and documented by the Geosynthetics Contractor.

a2. The CQA Geomembrane Inspector shall observe all non-destructive test procedures.

a3. One hundred (100) percent of the seam length shall be tested using non-destructive procedures to check the continuity of the field seams. Non-destructive testing is not meant to qualify seam strength.

a4. Air pressure testing shall be performed in accordance with ASTM D5820 and GRI GM6.

a5. Vacuum box testing shall be performed in accordance with ASTM D5641 and as specified herein.

a6. Continuity testing shall be performed as seaming progresses or as soon as a suitable length of seam is available, not at the completion of all field seaming.

b. Double Wedge Fusion Welded Seams:

b1. Double fusion welded seams shall be tested using air pressure testing.

b2. The procedure for testing shall be as specified in GRI GM6 for the type and thickness of geomembrane in use.

b3. The following test pressures are applicable to non-textured, textured, and structured HDPE geomembrane. After an initial 2 minute pressure stabilization period, the pressure shall be maintained between 27 and 30 psi for 60 mil HDPE and 30 and 35 psi for 100 mil HDPE. The pressure shall be sustained for a minimum of 5 minutes. The loss of pressure shall not exceed a maximum of 3 psi in 5 minutes. If the pressure does not stabilize in the first two minutes or the pressure loss exceeds the loss specified, the seam test shall be considered a failure.

b4. The leak or suspected leak shall be located and repaired.

b5. The repaired seam shall be re-tested as required until all leaks are identified, and repaired, and the seam passes a subsequent air pressure test.

b6. When the geometry of a double wedge fusion weld makes air testing impossible or impractical, vacuum testing may be used to test the seam.

c. Extrusion Welded Seams:

c1. Extrusion welded seams shall be tested using vacuum chamber testing in accordance with ASTM D5641.

c2. The completed seam shall exhibit no leakage when tested between 4 and 8 psi minimum vacuum for approximately 10 seconds.

c3. If leaks are discovered during testing, they shall be located, marked, and repaired.

c4. The repaired area shall be re-tested and exhibit no leakage.

d. Inaccessible Seams:

d1. Where extrusion welded seam, locations make use of vacuum box testing impractical, then the electric wire method of testing shall be used or the seam shall be cap stripped as approved by the Owner.

d2. If cap stripping is approved by the Owner, the seams shall be cap stripped as described in Paragraph 304.4, with strips of the same type and thickness of geomembrane being installed. The cap stripping shall be performed in the presence of the Owner.

d3. The electric wire test method shall consist of placing a 24 gauge copper wire 1/8 inch beneath the top sheet overlap of the two sheets prior to welding with the extruder. The wire shall be imbedded in the seam. After welding, a holiday spark detector, operating at 20,000 volts, shall be connected to one end of the wire, and slowly moved over the length of the seam. A seam defect between the probe and the embedded wire shall result in an audible alarm indicating where the defect is located.

e. Test Reports:

e1. Test reports for all air pressure tests shall contain all data specified in ASTM D5820 and GRI GM6.

e2. Test reports for vacuum box testing shall contain all the data specified in ASTM D5641.

e3. Test reports for other types of non-destructive tests shall contain as a minimum for each test:

e3.1 Location.

e3.2 Type of test.

e3.3 Test parameters.

e3.4 Test data.

e3.5 Test number.

e3.6 Name of tester.

e3.7 Outcome of the test.

303.4 Destructive Testing:

a. Testing:

a1. Destructive testing shall be performed by an independent third party laboratory employed by the CQA Contractor on samples cut from production welds in the field by the Geosynthetics Contractor.

a2. Samples shall be taken by the Geosynthetics Contractor to the third party laboratory and tested for shear strength and peel adhesion. For double wedge seam samples, both welds shall be tested for peel adhesion.

b. Location and Frequency:

b1. Test locations shall be determined after seaming. The location where the test samples shall be marked by the CQA Geomembrane Inspector. Locations may be prompted by the appearance of excessive heating, contaminations, offset welds, or a suspected defect. Destructive test samples shall be taken at a minimum average frequency of one per every 500 linear feet of seam length.

b2. The Method of Attributes described in GRI GM14 may be exercised to minimize the number of test samples taken if more than 100 destructive seam samples will be required based on the sampling strategy given in Paragraph 303.4.b1.

b3. Each sample location shall be numbered and marked with permanent identification and the location of the sample and the locations shall be indicated on a plan drawing prepared and maintained by the Geosynthetics Contractor. The following shall be recorded for each sample:

b3.1 Date and time.

b3.2 Ambient temperature.

b3.3 Seam number and location.

b3.4 Welding apparatus used.

b3.5 Name of Master Geomembrane Seamer.

b3.6 Reason for taking the sample.

b3.7 Size of sample.

b3.8 Test results.

b3.9 Name of tester.

b4. Samples shall be cut by the Geosynthetics Contractor. The CQA Geomembrane Inspector shall witness test sample cutting.

b5. Test samples shall be cut every shift and taken by the Geosynthetics Contractor to the third party laboratory the same day that the sample is prepared.

c. Sample Size:

c1. The minimum sample size shall be 12 inches wide with a seam 16 inches long centered length wise in the sample. As agreed, to with Owner, a sample may be increased in size to accommodate the requirements of the testing laboratory.

d. Field Testing:

d1. A one-inch wide specimen shall be cut from each end of each sample for field testing.

d2. Each one-inch wide specimen shall be tested with a field tensiometer for peel adhesion.

d3. The CQA Geomembrane Inspector shall witness each field test.

d4. A test is considered acceptable if a specimen meets the criteria specified in Tables 319022-1 and 319022-2, respectively, for both peel and shear under Bonded Seam Strength or, exhibits Film Tear Bond (FTB). For double wedge fusion welds, both welds must pass the test. If either sample fails the field test, it shall be assumed that the seam will not pass the specified laboratory testing and the sample shall be given a fail designation.

e. Laboratory Testing:

e1. Full size (12 inch minimum length) samples shall be taken to an independent third-party laboratory for testing.

e2. Samples shall be tested for shear strength and peel adhesion in accordance with ASTM D6392. Five specimens shall be tested for each test method. All samples shall meet minimum requirements for shear strength and peel adhesion given in Tables 319022-1 and 319022-2, respectively, under Bonded Seam Strength.

f. Test Results:

f1. Verbal test results shall be given to the Geosynthetics Contractor within 24 hours of receipt of the samples. Written results shall follow within one week.

f2. All test locations shall be marked with a pass/fail designation on the liner and on the drawings maintained by the Geosynthetics Contractor for submittal to the Owner after construction is complete.

g. Re-Testing if Failure Occurs:

g1. If a seam fails testing, one additional sample shall be taken 10 feet on each side of the location of the failed test. Additional samples shall continue to be taken at 10 foot intervals until tests show that seam strength is adequate and the zone in which the seam requires reconstruction is identified.

g2. All passing seams shall be bounded by two locations from which samples passing laboratory destructive tests have been taken.

g3. The entire seam length failing strength tests shall be reconstructed at no additional cost to the Owner.

g4. If the length of reconstructed seam exceeds 150 feet, a sample shall be taken of the reconstructed seam every 150 feet and shall pass destructive testing.

303.5 Inspection:

a. After seaming is complete, the Geosynthetics Contractor and the CQA Geomembrane Inspector shall conduct a detailed walk-down to visually check all seams and non-seam areas of the geomembrane.

b. All defects, holes, blisters, tears, signs of damage during installation, areas of undispersed carbon and holes from destructive or non-destructive testing shall be marked and repaired.

304. REPAIR OF DEFECTS AND SEAMS

304.1 Patching:

a. Patching shall be used to repair large holes, tears, and destructive sample locations.

b. All patches shall be round, oval, or shall have rounded corners.

c. All patches shall be made of the base geomembrane material and shall extend a minimum of 3 inches beyond the edges of the defect.

d. Patches shall be extrusion welded to the base sheet.

304.2 Grinding and Welding:

a. Grinding and welding shall be used to repair sections of extruded fillet seams with small defects.

304.3 Spot Welding:

a. Spot welding shall be used to repair small tears, pinholes, or other minor localized flaws.

304.4 Capping:

a. Capping shall be used to repair lengths of extrusion welded seams with large defects and to repair double wedge fusion welded seams.

b. Cap strips shall be made with strips of the same type and thickness of geomembrane being installed. Strips shall extend a minimum of 6 inches beyond the weld and shall have rounded corners.

c. Cap strips shall be extrusion welded to the base sheet.

304.5 Cut Out and Replacement:

a. When approved by the Owner, a length of defective seam may be cut out and replaced with a strip of new material seamed into place.

304.6 Verification of Repairs:

a. All repairs shall be non-destructive tested using one of the procedures described in Paragraph 303.3.

b. Repairs, which pass the non-destructive test, shall be deemed acceptable.

c. Repairs of a seam in excess of 150 feet in length shall have one destructive seam test per 150 feet in length.

305. ANCHOR TRENCH EXCAVATION AND BACKFILLING

305.1 Excavation and Shaping:

a. Unless specified otherwise on the Design Drawings, the geomembrane cover shall be anchored in an anchor trench at the bottom of the slope. The anchor trench shall be

excavated by the Earthwork Contractor to the lines and widths shown on the Design Drawings prior to placement of the geomembrane cover.

b. A slightly rounded corner shall be provided in the trench where the geomembrane adjoins the trench to avoid sharp bends in the geomembrane. No loose soil shall be allowed to underlie the geomembrane in the anchor trench.

c. The anchor trench shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open.

305.2 Backfilling:

a. See Section 311522 for anchor trench backfill requirements.

306. ATTACHMENT TO CONCRETE

306.1 Geomembrane shall be attached to concrete using batten strips in accordance with details on the Design Drawings.

307. ATTACHMENT TO PIPE PENETRATIONS

307.1 Geomembrane shall be attached to pipe penetrations through the cover in accordance with details on the Design Drawings.

307.2 Prefabricated or field fabricated HDPE sleeves (pipe boots) used for attaching the geomembrane to the pipe shall be supplied by the Geomembrane Manufacturer.

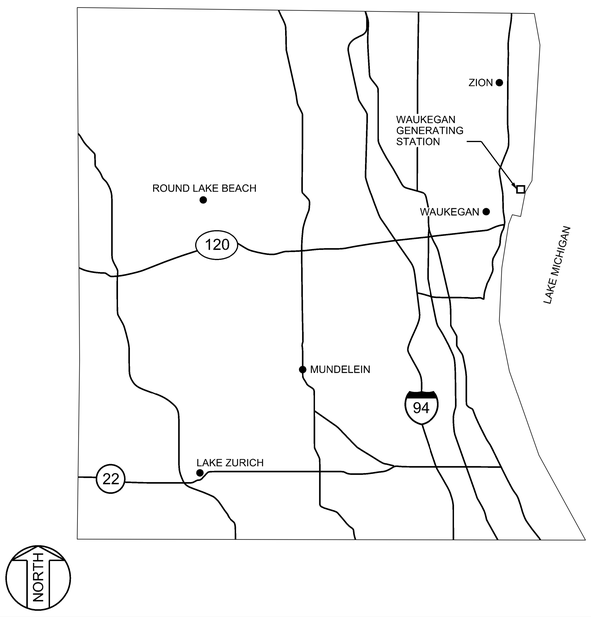
END OF SECTION 319022

ATTACHMENT 1

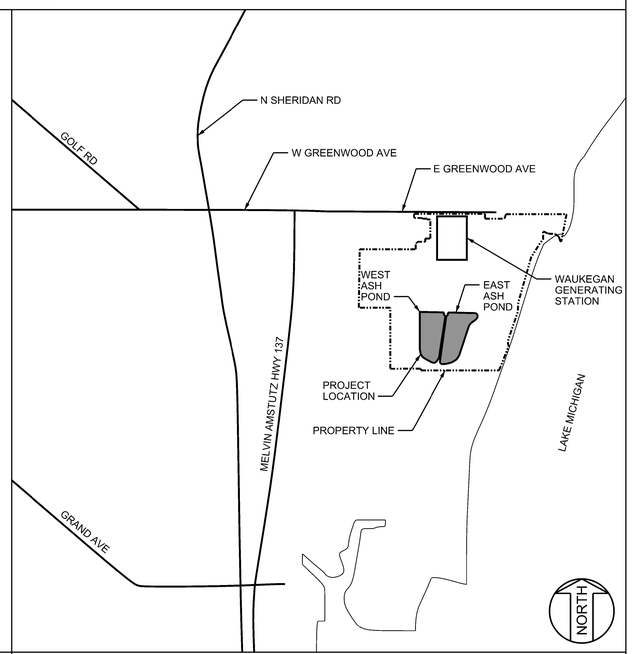
DESIGN DRAWINGS

MIDWEST GENERATION, LLC
WAUKEGAN GENERATING STATION
ASH POND CLOSURE PROJECT

VICINITY MAP



LAKE COUNTY MAP (N.T.S)



SITE LOCATION ENLARGED PLAN (N.T.S)

PREPARED FOR:
MIDWEST GENERATION, LLC
WAUKEGAN GENERATING STATION
401 E. GREENWOOD AVE.
WAUKEGAN, IL 60087

PREPARED BY:
SARGENT & LUNDY
55 E. MONROE ST.
CHICAGO, IL 60603

WAUKEGAN ASH POND CLOSURE DRAWING LIST	
DWG NO.	DRAWING TITLE
WKG-AP-CSK-001	ASH POND CLOSURE COVER SHEET
WKG-AP-CSK-002	ASH POND CLOSURE GENERAL NOTES
WKG-AP-CSK-003	WEST ASH POND EXISTING CONDITIONS
WKG-AP-CSK-004	WEST ASH POND EXCAVATION PLAN
WKG-AP-CSK-005	WEST ASH POND EXCAVATION SECTIONS & DETAILS
WKG-AP-CSK-006	EAST ASH POND EXISTING CONDITIONS
WKG-AP-CSK-007	EAST ASH POND DEMOLITION & REMOVAL PLAN
WKG-AP-CSK-008	EAST ASH POND FINAL COVER SYSTEM GRADING PLAN
WKG-AP-CSK-009	EAST ASH POND FINAL COVER SYSTEM SECTIONS & DETAILS

FOR PERMIT
NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

HOLD INFORMATION

NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

REV.	DATE	DESCRIPTION
A	11-02-2021	FOR CLIENT COMMENT
B	11-15-2021	FOR PUBLIC COMMENT

ISSUE PURPOSE: PUBLIC COMMENT
SPECIFICATION: W-7900
PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-001.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D.PACKARD
APPROVED BY: --

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

Sargent & Lundy LLC

SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

ASH POND CLOSURE
COVER SHEET

DRAWING NUMBER	REVISION
WKG-AP-CSK-001	B
SHEET 1 OF 1	

PL12793/OM1864/S:*#2-1
Form GDC-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A, Revision Date: 04-30-2010

11/15/2021 10:37:47 AM
...*#Drawings*WKG-AP-CSK-001.dgn

GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED ACCORDING TO THE REQUIREMENTS OF SPECIFICATION W-7900 UNLESS OTHERWISE NOTED ON THE DESIGN DRAWINGS.
2. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR AND HAVE CONTROL AND CHARGE OF CONSTRUCTION MEANS, METHODS, TECHNIQUES, WORK SEQUENCING, AND PROCEDURES IN CONNECTION WITH THE WORK. THE CONTRACTOR SHALL CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, COMPOSED OF THE DESIGN DRAWINGS AND SPECIFICATIONS.
3. ALL WORK DONE BY CONTRACTOR/INSTALLER PURSUANT TO THESE DRAWINGS SHALL: (A) CONFORM TO THE GOVERNING CONTRACT DOCUMENTS; (B) BE PERFORMED EXCLUSIVELY BY ITS TRAINED, COMPETENT PERSONNEL OR, WHERE PERMITTED, THAT OF ITS SUBCONTRACTOR(S); AND (C) COMPLY WITH ALL APPLICABLE SAFETY LAWS, REGULATIONS, PROGRAMS AND PRACTICES TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING THE CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.
4. THE CONTRACTOR SHALL PERFORM INSTALLATION AND REMOVAL WORK IN A NEAT AND SKILLFUL MANNER, CAREFULLY TERMINATING WORK NEAR MATERIAL TO REMAIN IN PLACE. PRECAUTIONS SHALL BE TAKEN NOT TO DAMAGE OR DEFACE WORK, EXISTING FACILITIES, AND/OR MATERIAL TO REMAIN IN PLACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY SUCH DAMAGE OR REPAIR THEREOF.
5. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF FEDERAL, STATE OR LOCAL CODES, STANDARDS AND SPECIFICATIONS.
6. COMPACTION:

   SEE SPECIFICATION W-7900 FOR COMPACTION AND EARTHWORK REQUIREMENTS UNLESS OTHERWISE NOTED.
7. SOIL EROSION AND SEDIMENTATION CONTROL:

   PROPER SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED TO MEET THE APPLICABLE REGULATORY CODES AND THE PERMIT REQUIREMENTS.
8. CONSTRUCTION QUALITY ASSURANCE:

   ANY WORK FOUND DEFECTIVE OR NOT IN COMPLIANCE WITH THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS OR THE DESIGN DRAWINGS SHALL BE REPLACED/FIXED AT NO ADDITIONAL COST TO THE OWNER.
9. TOPOGRAPHIC MAP & COORDINATES:
   A. THE TOPOGRAPHIC MAP OF THE PLANT SITE SHOWN ON THE DESIGN DRAWINGS WAS PREPARED IN 2014.
   B. THE PLANT COORDINATE SYSTEM SHOWN ON THE DESIGN DRAWINGS IS BASED ON THE ILLINOIS STATE PLANE, EAST ZONE, NORTH AMERICAN DATUM OF 1983 (2011) (NAD 83/2011), U.S. SURVEY FEET.
10. HORIZONTAL AND VERTICAL CONTROL:
    A. THE BASIS FOR HORIZONTAL CONTROL IS AS DESCRIBED IN NOTE 9.
    B. THE BASIS FOR VERTICAL CONTROL IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
    C. PRIOR TO BEGINNING ANY POND CLOSURE WORK, THE CONTRACTOR SHALL:
       I. MAKE A TOPOGRAPHICAL ASSESSMENT TO VERIFY THE ACCURACY OF THE EXISTING SURVEY DATA SHOWN ON THE DESIGN DRAWINGS. CONTRACTOR SHALL NOTIFY THE OWNER OF THE RESULTS OF THIS ASSESSMENT IN WRITING, AND SHALL IDENTIFY ANY DIFFERENCES BETWEEN THE 2014 SURVEY AND THE CONTRACTOR'S SURVEY THAT MIGHT AFFECT THE WORK SHOWN ON THE DESIGN DRAWINGS.
       II. FURNISH AND INSTALL A MINIMUM OF FOUR BENCHMARK MONUMENTS TO PERFORM THE WORK. CONTRACTOR SHALL PROVIDE A BENCHMARK PLAN IDENTIFYING THE LOCATIONS AND TYPES OF BENCHMARKS TO BE INSTALLED FOR OWNER REVIEW AND APPROVAL. CONTRACTOR SHALL LAY OUT LINES AND GRADES FROM THESE CONTRACTOR-FURNISHED BENCHMARKS.
11. GEOTECHNICAL WORK:

    A STRUCTURAL STABILITY AND FACTOR OF SAFETY ASSESSMENT FOR THE EAST AND WEST ASH PONDS WAS PREPARED BY GEOSYNTEC CONSULTANTS IN OCTOBER 2016. SITE SPECIFIC SOIL DATA AND GEOTECHNICAL RECOMMENDATIONS ARE PROVIDED AND REFERENCED THEREIN.
12. EXISTING CONDITIONS:
    A. DIMENSIONS OF EXISTING WORK SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO THE START OF WORK IN ACCORDANCE WITH THE SPECIFICATION AS FIELD CONDITIONS MAY VARY FROM INFORMATION SHOWN ON THE DESIGN DRAWINGS. DIMENSIONS NOTED FOR REFERENCE (REF) INDICATE NOMINAL DIMENSIONS FOR THE EXISTING STRUCTURE, UTILITY, ETC. NEW WORK SHALL NOT BE LOCATED BASED ON THE REFERENCE DIMENSIONS.
    B. PRIOR TO COMMENCING THE WORK, THE CONTRACTOR SHALL EXAMINE THE AREAS AND CONDITIONS UNDER WHICH THE CLOSURE WORK IS TO TAKE PLACE, AND NOTIFY THE OWNER IN WRITING OF CONDITIONS WHICH MAY IMPACT THE PROPER AND TIMELY COMPLETION OF THE WORK.
    C. UNDERGROUND OR EMBEDDED UTILITIES MAY EXIST WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK. THE LOCATION OR IDENTIFICATION OF SUCH UTILITIES HAS NOT BEEN VERIFIED BY THE OWNER OR BY S&L. CONTRACTOR/INSTALLER IS RESPONSIBLE FOR FIELD LOCATING AND IDENTIFYING UNDERGROUND OR EMBEDDED UTILITIES AND ANY OTHER UNDERGROUND OR EMBEDDED UTILITY DIMENSIONS.
    D. REFERENCES USED HAVE BEEN IDENTIFIED ON EXCAVATION/FOUNDATION/DEMOLITION DRAWINGS AND HAVE BEEN PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING EXISTING UTILITIES AND OTHER POTENTIAL UNDERGROUND OR EMBEDDED INTERFERENCES. THESE REFERENCES ONLY SHOW THE APPROXIMATE LOCATION OF POTENTIAL UNDERGROUND OR EMBEDDED UTILITIES AND MAY NOT INDICATE OR REFLECT ALL EXISTING UNDERGROUND OR EMBEDDED UTILITIES OR THEIR ACTUAL LOCATIONS.
    E. REFERENCES IDENTIFIED SHALL NOT SUBSTITUTE FOR THE CONTRACTOR'S/INSTALLER'S OBLIGATION TO FIELD LOCATE ANY UNDERGROUND OR EMBEDDED UTILITIES OR INTERFERENCES THAT MAY AFFECT THE WORK.
    F. DUE CAUTION SHALL BE TAKEN DURING ANY EXCAVATION/FOUNDATION/DEMOLITION WORK WITHIN THE AREA OF, AND ADJACENT TO THE LIMITS OF THE WORK DUE TO POSSIBLE INTERFERENCES THAT MAY NOT BE REFLECTED ON THE REFERENCES IDENTIFIED.
    G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PRESERVATION AND RESTORATION OF THE EXISTING UTILITIES IF DAMAGED DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.

ABBREVIATIONS

ROAD AND GRADING

T/RD	TOP OF ROAD ELEVATION
EL OR ELEV	GRADE ELEVATION
INV	INVERT ELEVATION
HP	HIGH POINT
LP	LOW POINT
HPFS	HIGH POINT FINISH SURFACING
BC	BEGINNING OF CURVE (HORIZONTAL CURVE)
EC	END OF CURVE (HORIZONTAL CURVE)
PI	POINT OF INTERSECTION (HORIZONTAL CURVE)
PT	POINT OF TANGENT
PC	POINT OF CURVE
STA	STATION
VC	VERTICAL CURVE
BVC	BEGINNING OF VERTICAL CURVE
EVC	END OF VERTICAL CURVE
PIVC	POINT OF INTERSECTION OF VERT. CURVE
PRC	POINT OF REVERSE CURVE
PCC	POINT OF COMPOUND CURVE
R	RADIUS
T	TANGENT
L	LENGTH OF CURVE
D	DEGREE OF CURVE
I	INTERIOR/DEFLECTION ANGLE OF CURVE
UN	UNLESS NOTED
ROW	RIGHT OF WAY
OHL	OVERHEAD LINE
OC	ON CENTER
WL	WATER LEVEL
HWL	HIGH WATER LEVEL
YR	YEAR
DS	DOWNSTREAM
US	UPSTREAM
CL	CENTERLINE
AC	ACRE
N.T.S.	NOT TO SCALE
LWL	LOW WATER LEVEL

SYMBOLS

- CENTERLINE OF NATURAL DRAINAGE PATTERN
- VALLEY LINE OR "V" DITCH
- SWALE
- CENTERLINE OF TRAPEZOIDAL DRAINAGE
- TRAPEZOIDAL DRAINAGE DITCH WITH BOTTOM WIDTH GREATER THAN 2'. BOTTOM WIDTH AND SIDE SLOPE SHOWN ON PLAN OR DETAIL
- RIPRAP EROSION PROTECTION
- C-1 — PIPE CULVERT, CULVERT NUMBER SHOWN
- DOWN — TOP OF EMBANKMENT SLOPE OR DITCH SIDE SLOPE AND DIRECTION OF SLOPE
- 3:1 — HORIZONTAL TO VERTICAL SLOPE WHEN SLOPE IS CONSTANT
- SLOPE VARIES — SLOPE IS NOT CONSTANT
- 1% — DIRECTION OF ROAD OR AREA SLOPE. PERCENT OF SLOPE SHOWN WHERE APPLICABLE
- TOP OF DIKE
- R=50' — RADIUS OF CURVATURE
- 1 — SECTION NUMBER (FIRST NUMBER=DRAWING SECOND NUMBER=SECTION NUMBER)
- CHAIN LINK FENCE
- PLAN SECTION — WATER LINE
- G — G — BURIED GAS LINE
- E — E — BURIED ELECTRICAL CABLE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 405 — ELEVATION CONTOUR
- EXISTING DEPRESSION
- x 408.8 — SPOT ELEVATION
- x — VERTICAL CONTROL POINT
- HORIZONTAL CONTROL POINT
- EXISTING FIRE HYDRANT
- EXISTING UTILITY POLE
- EXISTING UTILITY POLE WITH GUY
- WOOD OR BRUSH OUTLINE
- GRATING
- SINGLE SIGN ON POST
- DOUBLE SIGN ON POST
- GUARD POST

SYMBOLS & ABBREVIATIONS

EROSION CONTROL SYMBOLS

S	SILT FENCE
IP	INLET PROTECTION
	ROCK CHECK

SEWERS AND UNDERGROUND PIPE

CB	CATCH BASIN
C0	CLEANOUT
MH	MANHOLE
RE	RIM ELEVATION
℄	CENTERLINE
S	SLOPE
BOP	BOTTOM OF PIPE
PVC	POLY VINYL CHLORIDE PIPE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE
CHDPE	CORRUGATED HIGH DENSITY POLYETHYLENE PIPE
CISP	CAST IRON SOIL PIPE
DIWP	DUCTILE IRON WATER PIPE
STL	CARBON STEEL PIPE
IP	IN PLACE
SWS	STORM WATER SEWER
OWS	OILY WATER SEWER
SAN	SANITARY SEWER
PWS	PROCESS WASTE SEWER
C.S.	CARBON STEEL

ROAD, PAVEMENT AND SURFACING SYMBOLS

- ASPHALT OR CONCRETE PAVED ROAD. OUTER LINES SHOW OVERALL WIDTH. INTERIOR LINES SHOW EDGES OF PAVEMENT.
- ROCK SURFACED ROAD
- I — ISOLATION JOINT
- IT — THICKENED EDGE ISOLATION JOINT
- TE — THICKENED EDGE EXPANSION JOINT
- T — PAVEMENT THICKENED EDGE
- C — CONTRACTION JOINT
- CONCRETE PAVING
- CRUSHED ROCK SURFACING
- ASPHALT PAVEMENT
- 6" THICK CRUSHED STONE GROUND COVER SURFACING
- 4" THICK SEEDED TOPSOIL

FOR PERMIT
NOT FOR CONSTRUCTION

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HOLD INFORMATION

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RELEASE INFORMATION

REV.	DATE	DESCRIPTION
A	11-02-2021	FOR CLIENT COMMENT
B	11-15-2021	FOR PUBLIC COMMENT

ISSUE PURPOSE: PUBLIC COMMENT
SPECIFICATION: W-7900
PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-002.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D.PACKARD
APPROVED BY: --

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MWG
Midwest Generation, LLC

PROJECT

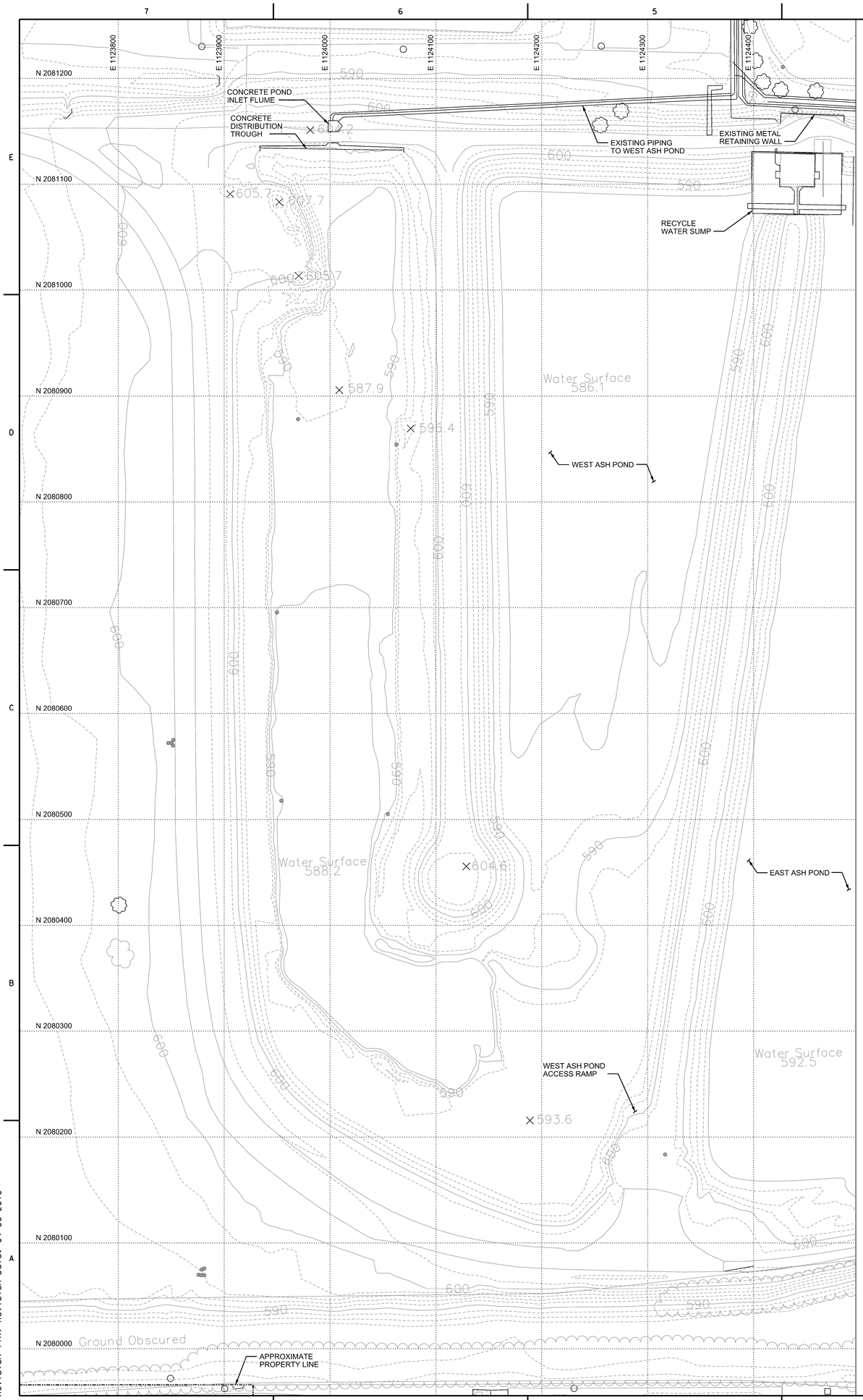
MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

ASH POND CLOSURE
GENERAL NOTES

DRAWING NUMBER	REVISION
WKG-AP-CSK-002	B

SHEET 1 OF 1



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PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-003.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D.PACKARD
APPROVED BY: --

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WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

WEST ASH POND
EXISTING CONDITIONS

DRAWING NUMBER	REVISION
WKG-AP-CSK-003	B
SHEET 1 OF 1	

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION W-7900 UNLESS NOTED OTHERWISE.
2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. EXISTING CONDITIONS FOR THE WEST ASH POND ARE BASED ON TOPOGRAPHIC DATA COLLECTED IN 2014. PRIOR TO BEGINNING ANY POND CLOSURE WORK, THE CONTRACTOR SHALL MAKE A TOPOGRAPHIC ASSESSMENT TO VERIFY THE ACCURACY OF THE EXISTING CONDITIONS SHOWN PER NOTE 10 ON DRAWING WKG-AP-CSK-002.

REFERENCE DRAWINGS

5082-C-5006	ASH POND DETAIL PLAN
5082-C-5007	ASH POND SECTIONS AND DETAILS
5082-C-5001	WASTE WATER TREATMENT FACILITIES ASH POND SUMP PLAN, SECTIONS AND DETAILS
5082-C-5502	ASH POND SUMP WEIR PLAN, SECTIONS & DETAILS
5082-C-5503	ASH POND SUMP AND WEIR MISCELLANEOUS SECTIONS AND DETAILS
5082-C-5507	ASH POND INLET FLUME & DISTRIBUTION TROUGH DETAILS
B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS

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NORTH

40' 0' 40' 80'
GRAPHIC SCALE

PL12793/OM1864/S:#2-1
Form GDC-0401-01-08. ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A. Revision Date: 04-30-2010

11/15/2021 10:40:56 AM
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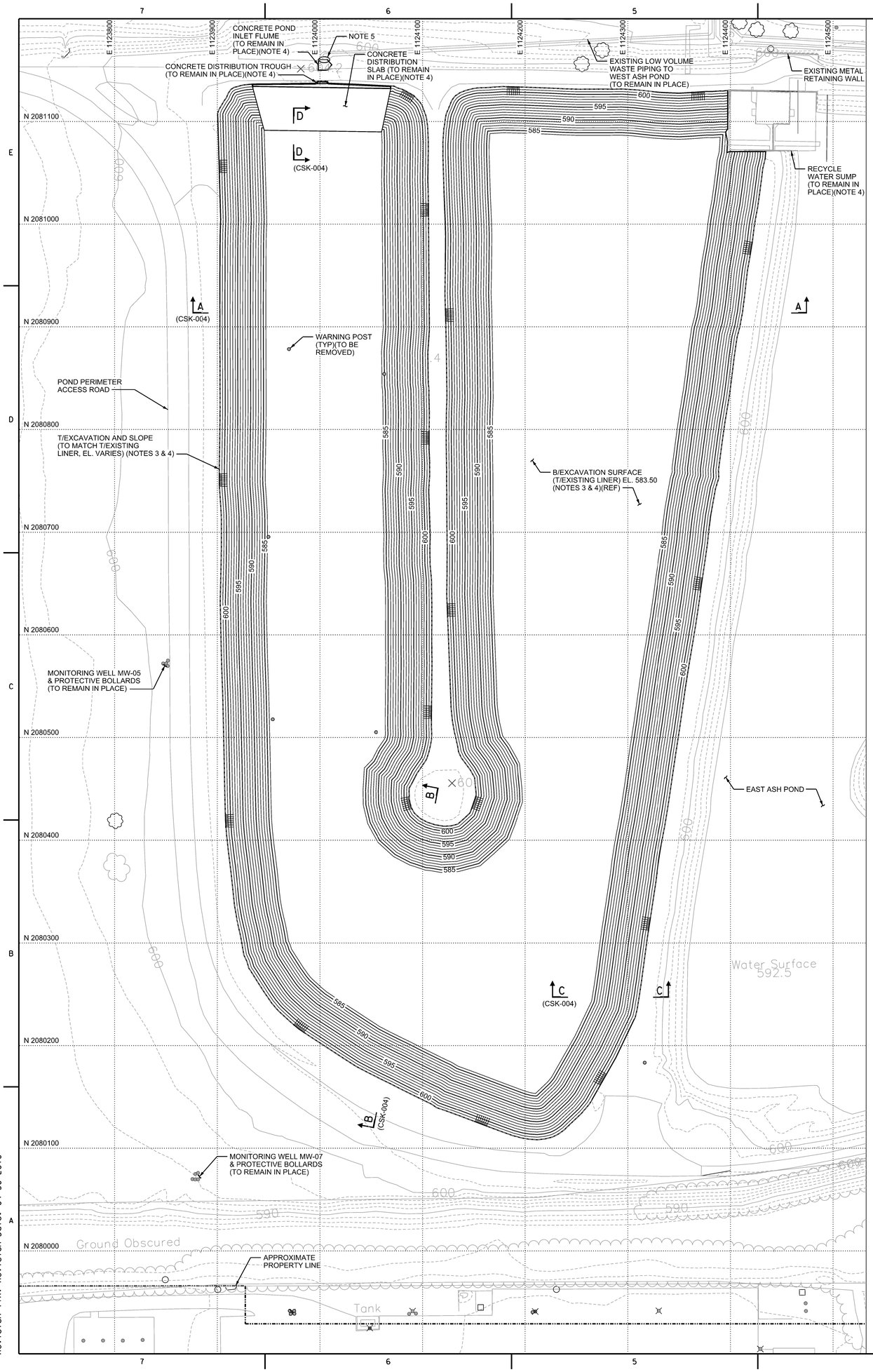

FOR PERMIT
NOT FOR CONSTRUCTION

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED IN ACCORDANCE WITH SPECIFICATION W-7900 UNLESS NOTED OTHERWISE.
2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. MATERIAL REMOVAL / EXCAVATION:
   A. ALL MATERIAL ABOVE THE EXISTING GEOMEMBRANE LINER SHALL BE REMOVED. BOTTOM-OF-EXCAVATION (I.E., TOP-OF-EXISTING LINER SURFACE) SHOWN ON THIS DRAWING IS APPROXIMATE AND REPRESENTS THE FLOOR AND SIDE SURFACES OF THE POND THAT ARE ASSUMED TO HAVE BEEN INSTALLED BASED ON THE WEST ASH POND'S HISTORY OF CONSTRUCTION (GEOSYNTEC, 2016).
   B. DURING REMOVAL OF MATERIAL FROM / DEMOLITION WORK WITHIN THE WEST ASH POND, GW CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO AVOID DAMAGING THE POND'S EXISTING GEOMEMBRANE LINER. GW CONTRACTOR SHALL PROVIDE ADEQUATE TEMPORARY LOADING AS NECESSARY TO PREVENT UPLIFT OF THE GEOMEMBRANE BY WIND BY THE USE OF SANDBAGS AND/OR OTHER MEANS WHICH WILL NOT DAMAGE THE GEOMEMBRANE. FOR ALL AREAS OF EXISTING LINER THAT ARE DAMAGED, THE GW CONTRACTOR SHALL:
      I. TAKE APPROPRIATE MEASURES TO PREVENT ANY FLUID OR SOLID MATERIALS FROM ENTERING THE SUBGRADE BELOW THE LINER.
      II. NOTIFY THE OWNER IMMEDIATELY.
      III. INSPECT THE EXPOSED SOILS BELOW THE LINER TO DETERMINE WHETHER ANY FLUIDS, CCR CONSTITUENTS, OR CCR-MIXED SOILS HAVE BEEN RELEASED INTO THE POND SUBGRADE. IF SUCH MATERIAL HAS BEEN RELEASED INTO THE POND SUBGRADE, THE GW CONTRACTOR SHALL REMOVE THE IMPACTED SOILS UNTIL THE AFFECTED AREA HAS BEEN DECONTAMINATED. CONTAMINATED SOILS REMOVED FROM THE POND SUBGRADE SHALL BE REPLACED WITH STRUCTURAL FILL IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
      IV. REPAIR THE DAMAGED LINER AREA IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
   C. MATERIAL REMOVED FROM THE WEST ASH POND AREA SHALL BE DISPOSED OF AS FOLLOWS:
      I. ALL DRY WASTE SHALL BE DISPOSED OF IN AN OFF-SITE DISPOSAL FACILITY PERMITTED TO RECEIVE CCR WASTE. ALL OFF SITE TRANSPORTATION OF MATERIAL REMOVED FROM THE WEST ASH POND SHALL BE PERFORMED IN ACCORDANCE WITH 35 ILL. ADM. CODE 845.740(C)(1).
      II. ALL LIQUID WASTE SHALL BE DISPOSED OF IN THE EAST ASH POND.
   D. GW CONTRACTOR SHALL DEVELOP AND IMPLEMENT FUGITIVE DUST CONTROLS DURING MATERIAL REMOVAL AND DEMOLITION WORK WITHIN THE WEST ASH POND AREA IN ACCORDANCE WITH 35 ILL. ADM. CODE 845.740(C)(2).
   E. GW CONTRACTOR SHALL DEVELOP AND IMPLEMENT MEASURES TO PREVENT CONTAMINATION OF SURFACE WATER, GROUNDWATER, SOIL, AND SEDIMENTS DURING MATERIAL REMOVAL AND DEMOLITION WORK WITHIN THE WEST ASH POND AREA IN ACCORDANCE WITH 35 ILL. ADM. CODE 845.740(C)(4).
   F. AT THE END OF EACH MONTH DURING WHICH MATERIAL REMOVAL AND DEMOLITION WORK IS PERFORMED WITHIN THE WEST ASH POND AREA, GW CONTRACTOR SHALL PREPARE A REPORT DOCUMENTING THE GW CONTRACTOR'S PROGRESS IN REMOVING CCR AND CCR-MIXED SOILS FROM THE AREA. THE MONTHLY REPORT SHALL BE PREPARED IN ACCANCE WITH THE RECORDKEEPING REQUIREMENTS STIPULATED IN 35 ILL. ADM. CODE 845.740(D).
4. LINER & CONCRETE DECONTAMINATION :
   A. AFTER REMOVAL OF MATERIAL ABOVE THE EXISTING GEOMEMBRANE LINER AND REPAIR OF ANY DAMAGED AREAS, THE GW CONTRACTOR SHALL DECONTAMINATE THE LINER AND POND APPURTENANT STRUCTURES REMAINING IN PLACE. AT A MINIMUM, THE EXPOSED GEOMEMBRANE SHALL BE PRESSURE WASHED IN A SYSTEMATIC MANNER TO REMOVE ALL CCR AND RESIDUALS OF CCR. WASH AND RINE WATER SHALL BE COLLECTED AND DISPOSED OF IN THE EAST ASH POND OR AS OTHERWISE DIRECTED BY THE OWNER.
   B. DURING REMOVAL OF MATERIAL FROM / DEMOLITION WORK WITHIN THE WEST ASH POND, GW CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO AVOID DAMAGING THE POND'S EXISTING GEOMEMBRANE LINER. GW CONTRACTOR SHALL PROVIDE ADEQUATE TEMPORARY LOADING AS NECESSARY TO PREVENT UPLIFT OF THE GEOMEMBRANE BY WIND BY THE USE OF SANDBAGS AND/OR OTHER MEANS WHICH WILL NOT DAMAGE THE GEOMEMBRANE. FOR ALL AREAS OF EXISTING LINER THAT ARE DAMAGED, THE GW CONTRACTOR SHALL:
   C. UPON COMPLETION OF DECONTAMINATION ACTIVITIES FOR A GIVEN AREA OF EXISTING GEOMEMBRANE LINER BY THE GW CONTRACTOR, THE CQA CONTRACTOR (W-7901) SHALL:
      I. PERFORM AN ELECTRICAL LEAK LOCATION SURVEY OVER THE DECONTAMINATED LINER AREA IN ACCORDANCE WITH ASTM D7953. IF THE SURVEY LOCATES A BREACH (HOLE, PUNCTURE, TEAR, DEFECT, ETC.) IN THE GEOMEMBRANE, THE CQA CONTRACTOR SHALL NOTIFY THE OWNER AND GW CONTRACTOR IMMEDIATELY, AND THE GW CONTRACTOR SHALL ADDRESS THE BREACH IN ACCORDANCE WITH NOTE 3.B.
      II. CUT-OUT AND REMOVE SAMPLES OF THE DECONTAMINATED GEOMEMBRANE LINER AT A MINIMUM FREQUENCY OF ONE PER ACRE OF LINER. THE GW CONTRACTOR SHALL REPAIR THE GEOMEMBRANE LINER AT ALL SAMPLE LOCATIONS IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
      III. ALL SAMPLES SHALL BE ANALYZED BY A CERTIFIED LABORATORY IN ACCORDANCE WITH EPA SW-846 TEST METHOD 1311: TOXICITY CHARACTERISTIC LEACHING PROCEDURE. IF THE CONCENTRATIONS OF CCR CONSTITUENTS MEASURED BY THIS TEST METHOD MEET THE GROUNDWATER PROTECTION STANDARDS SPECIFIED IN 35 ILL. ADM. CODE 845.600(A)(1), THEN THE AREA OF EXISTING GEOMEMBRANE LINER REPRESENTATED BY THAT SAMPLE IS CONSIDERED TO BE DECONTAMINATED. OTHERWISE, THAT AREA OF EXISTING GEOMEMBRANE LINER IS NOT CONSIDERED TO BE DECONTAMINATED.
   D. GW CONTRACTOR SHALL RECLEAN ANY AREAS THAT ANALYTICAL TESTING INDICATES ARE NOT DECONTAMINATED (I.E., ANALYTICAL TESTING OF A COLLECTED SAMPLE DETECTS AT LEAST ONE CCR CONSTITUENT EXCEEDS THE CONSTITUENT'S GROUNDWATER PROTECTION STANDARD LISTED IN 35 ILL. ADM. CODE 845.600(A)(1)). AFTER RECLEANING A GIVEN AREA, THE CQA CONTRACTOR (W-7901) SHALL COLLECT AND TEST ONE ADDITIONAL SAMPLE FROM THE AREA PER NOTE 4.C.
   E. LINER DECONTAMINATION IS CONSIDERED COMPLETE WHEN ALL COLLECTED LINER SAMPLES MEET THE DECONTAMINATION CRITERIA IN NOTE 4.C.III.

REFERENCE DRAWINGS

B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS

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NORTH

40' 0' 40' 80'
GRAPHIC SCALE

HOLD INFORMATION

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SPECIFICATION: W-7900

PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-004.DGN

PREPARED BY: J. CHAVEZ

REVIEWED BY: T. DEHLIN / D. PACKARD

APPROVED BY: --

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MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

WEST ASH POND
EXCAVATION PLAN

DRAWING NUMBER	REVISION
WKG-AP-CSK-004	B

SHEET 1 OF 1

PL12793/OM18&4/S:#2-1
Form GDC-0401-01-08. ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A. Revision Date: 04-30-2010

11/15/2021 10:41:55 AM
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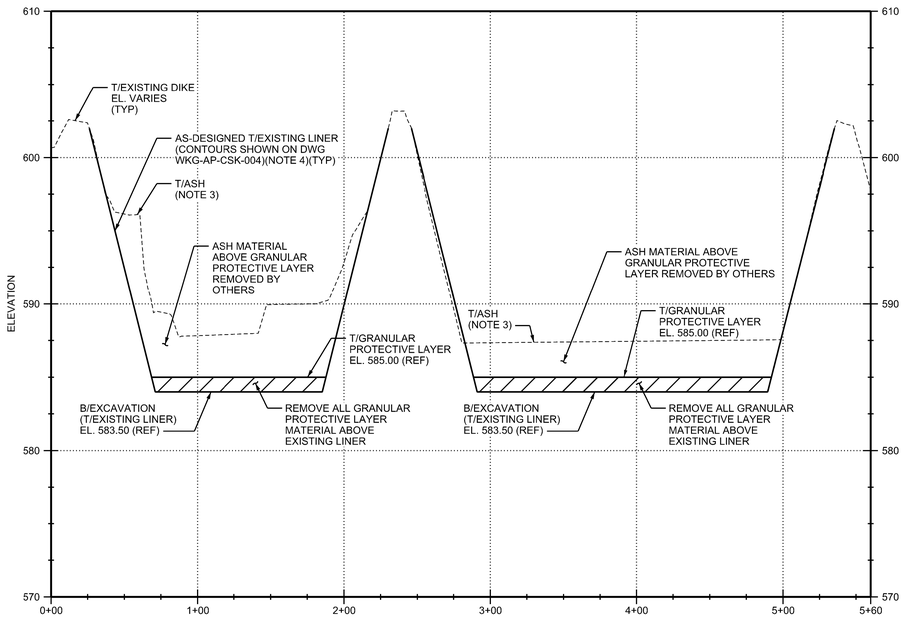
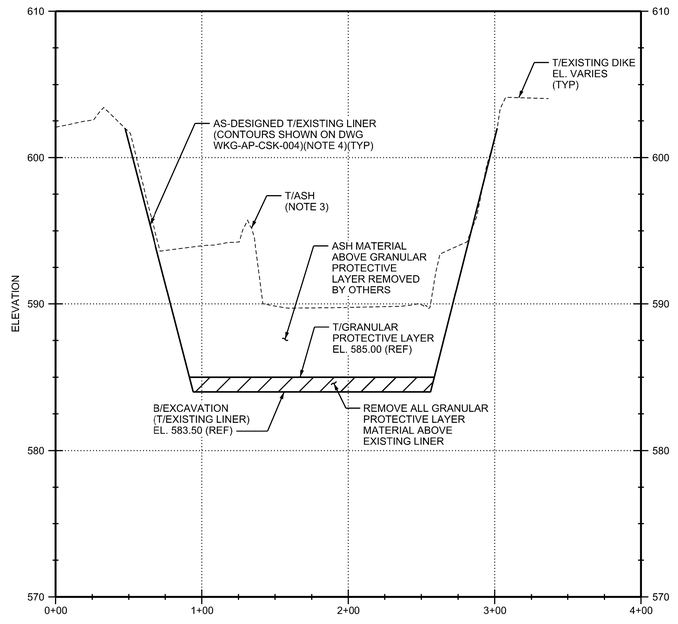


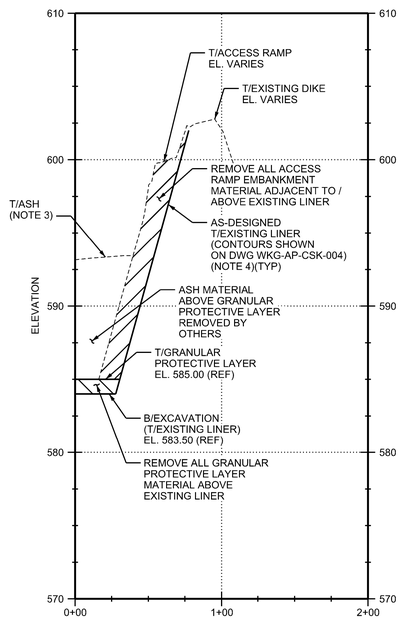
SECTION A

HORIZONTIAL SCALE 1"=40'
VERTICAL SCALE 1"=4'
(CSK-004)



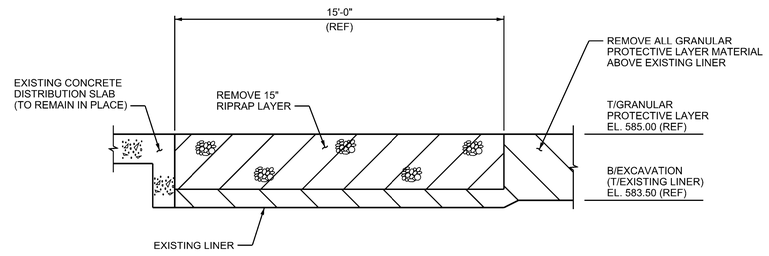
SECTION B

HORIZONTIAL SCALE 1"=40'
VERTICAL SCALE 1"=4'
(CSK-004)



SECTION C

HORIZONTIAL SCALE 1"=40'
VERTICAL SCALE 1"=4'
(CSK-004)



SECTION D

SCALE: N.T.S.
(CSK-004)

FOR PERMIT
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NOTES

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2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. TOP-OF-ASH SURFACE SHOWN REPRESENTS THE ASH STORED IN THE POND DURING THE 2014 SURVEY OF THE SITE AND MAY NOT BE REPRESENTATIVE OF CURRENT CONDITIONS.
4. THE AS-DESIGNED TOP-OF-EXISTING LINER SURFACE REPRESENTS THE FLOOR AND SIDE SURFACES OF THE POND THAT ARE ASSUMED TO HAVE BEEN INSTALLED BASED ON THE WEST ASH POND'S HISTORY OF CONSTRUCTION (GEOSYNTEC, 2016).

REFERENCE DRAWINGS

B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS
CSK-004	WEST ASH POND EXCAVATION PLAN

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PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D. PACKARD
APPROVED BY: --

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MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

WEST ASH POND
EXCAVATION SECTIONS & DETAILS

DRAWING NUMBER	REVISION
WKG-AP-CSK-005	B

SHEET 1 OF 1

PL12793/DM1864/S:#2-1
Form 00G-0401-01-08. ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A. Revision Date: 04-30-2010
11/15/2021 10:43:11 AM
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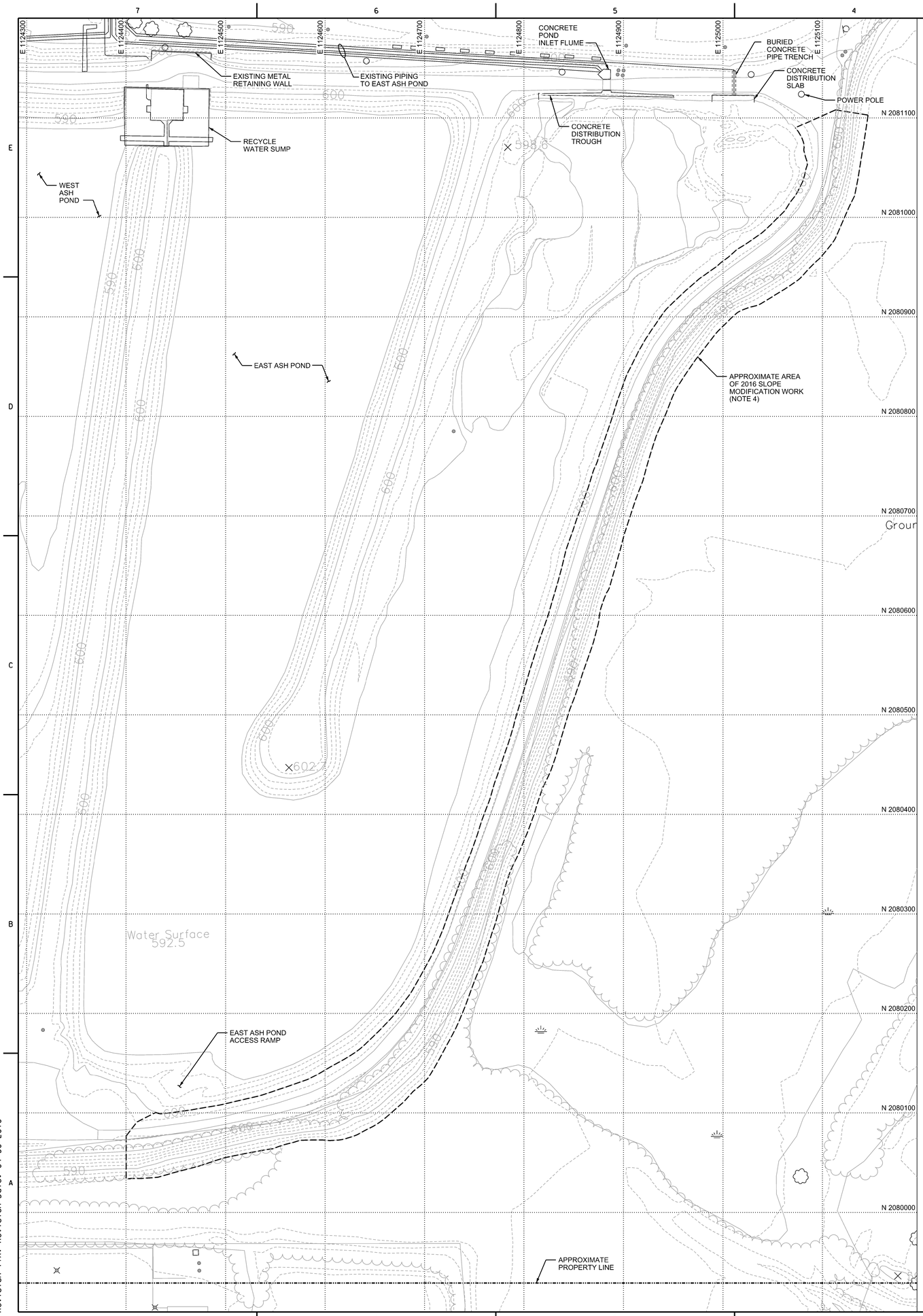

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CAD FILE NAME: WKG-AP-CSK-006.DGN
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REVIEWED BY: T. DEHLIN / D. NIELSON
APPROVED BY: --

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4. IN 2016, THE DOWNSTREAM SLOPE OF THE EAST ASH POND'S EAST DIKE WAS LOWERED TO AN APPROXIMATE CREST ELEVATION OF 600 FEET AND REGRADED TO A FLATTER GRADE THAN SHOWN. SEE GEOSYNTEC DRAWINGS SW0251-11-01 - 07 FOR THE 2016 SLOPE MODIFICATION DESIGN PLANS, SECTIONS, AND DETAILS.

REFERENCE DRAWINGS

5082-C-5006	ASH POND DETAIL PLAN
5082-C-5007	ASH POND SECTIONS AND DETAILS
5082-C-5001	WASTE WATER TREATMENT FACILITIES ASH POND SUMP PLAN, SECTIONS AND DETAILS
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5082-C-5507	ASH POND INLET FLUME & DISTRIBUTION TROUGH DETAILS
B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS
SW0251-11-01 - 07	EAST ASH BASIN SLOPE MODIFICATION

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NORTH

40' 0' 40' 80'
GRAPHIC SCALE

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

EAST ASH POND
EXISTING CONDITIONS

DRAWING NUMBER	REVISION
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SHEET 1 OF 1	

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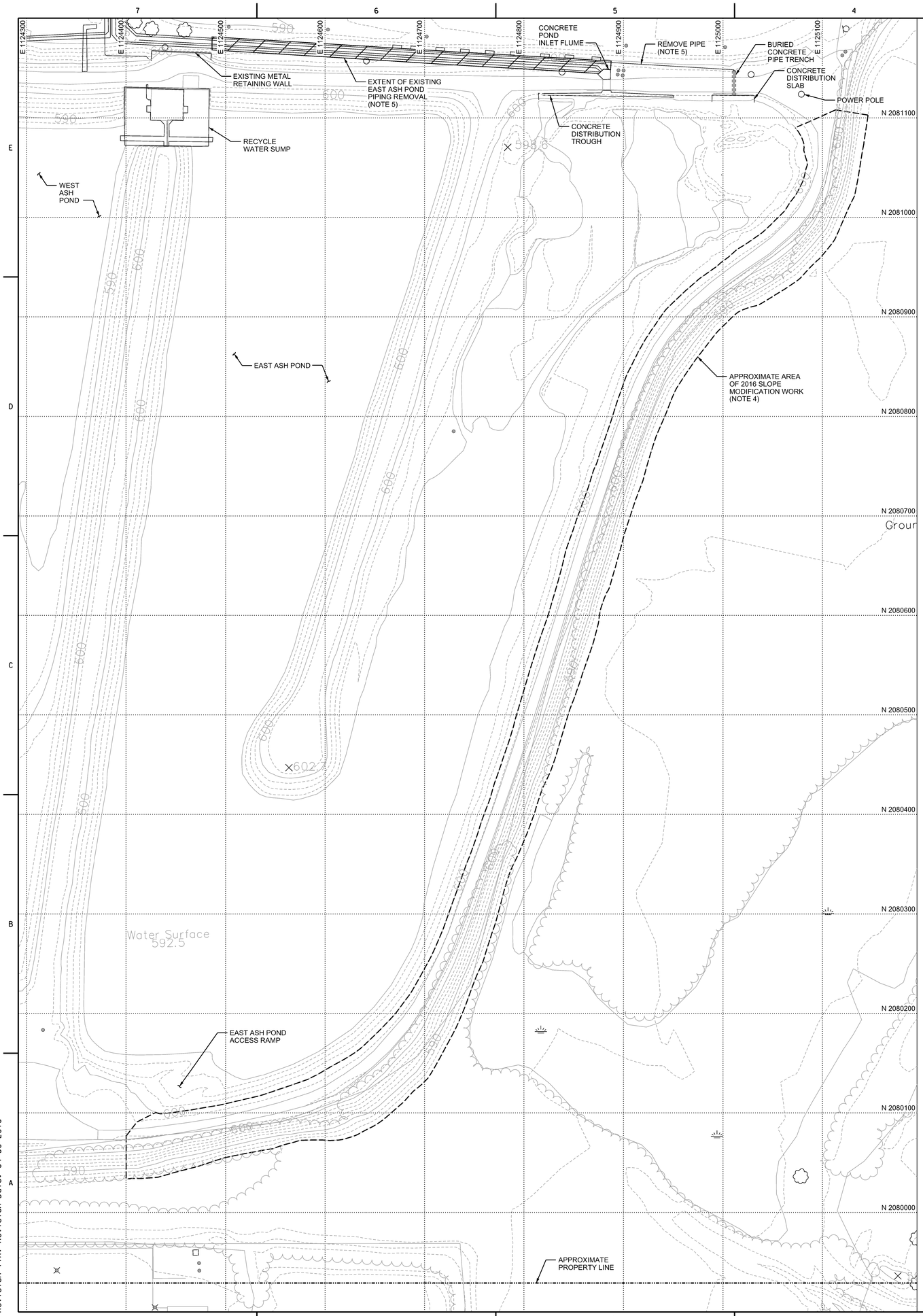

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PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-007.DGN

PREPARED BY: J. CHAVEZ

REVIEWED BY: T. DEHLIN / D. NIELSON

APPROVED BY: --

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY, IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED BY SPECIFICATION W-7900 UNLESS NOTED OTHERWISE.
2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. EXISTING CONDITIONS FOR THE EAST ASH POND ARE BASED ON TOPOGRAPHIC DATA COLLECTED IN 2014. PRIOR TO BEGINNING ANY POND CLOSURE WORK, THE CONTRACTOR SHALL MAKE A TOPOGRAPHIC ASSESSMENT TO VERIFY THE ACCURACY OF THE EXISTING CONDITIONS SHOWN PER NOTE 10 ON DRAWING WKG-AP-CSK-002.
4. IN 2016, THE DOWNSTREAM SLOPE OF THE EAST ASH POND'S EAST DIKE WAS LOWERED TO AN APPROXIMATE CREST ELEVATION OF 600 FEET AND REGRADED TO A FLATTER GRADE THAN SHOWN. SEE GEOSYNTEC DRAWINGS SW0251-11-01 - 07 FOR THE 2016 SLOPE MODIFICATION DESIGN PLANS, SECTIONS, AND DETAILS.
5. DISCONNECT ALL PIPES FROM INLET FLUME, REMOVE PIPE SLEEVES, AND REMOVE PIPES TO LIMITS OF FINAL COVER SYSTEM SHOWN ON DRAWING WKG-AP-CSK-008. CAP ENDS OF PIPES REMAINING IN PLACE. PLACE REMOVED PIPE SLEEVES AND PIPE SECTIONS IN ONSITE STOCKPILE AREA DESIGNATED BY OWNER.

REFERENCE DRAWINGS

5082-C-5006	ASH POND DETAIL PLAN
5082-C-5007	ASH POND SECTIONS AND DETAILS
5082-C-5001	WASTE WATER TREATMENT FACILITIES ASH POND SUMP PLAN, SECTIONS AND DETAILS
5082-C-5502	ASH POND SUMP WEIR PLAN, SECTIONS & DETAILS
5082-C-5503	ASH POND SUMP AND WEIR MISCELLANEOUS SECTIONS AND DETAILS
5082-C-5507	ASH POND INLET FLUME & DISTRIBUTION TROUGH DETAILS
B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS
SW0251-11-01 - 07	EAST ASH BASIN SLOPE MODIFICATION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

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THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

NORTH

40' 0' 40' 80'
GRAPHIC SCALE

Sargent & Lundy LLC
SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

EAST ASH POND
DEMOLITION & REMOVAL PLAN

DRAWING NUMBER	REVISION
WKG-AP-CSK-007	B

SHEET 1 OF 1

PL12793/OM1864/S:#2-1
Form 00C-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A, Revision Date: 04-30-2010

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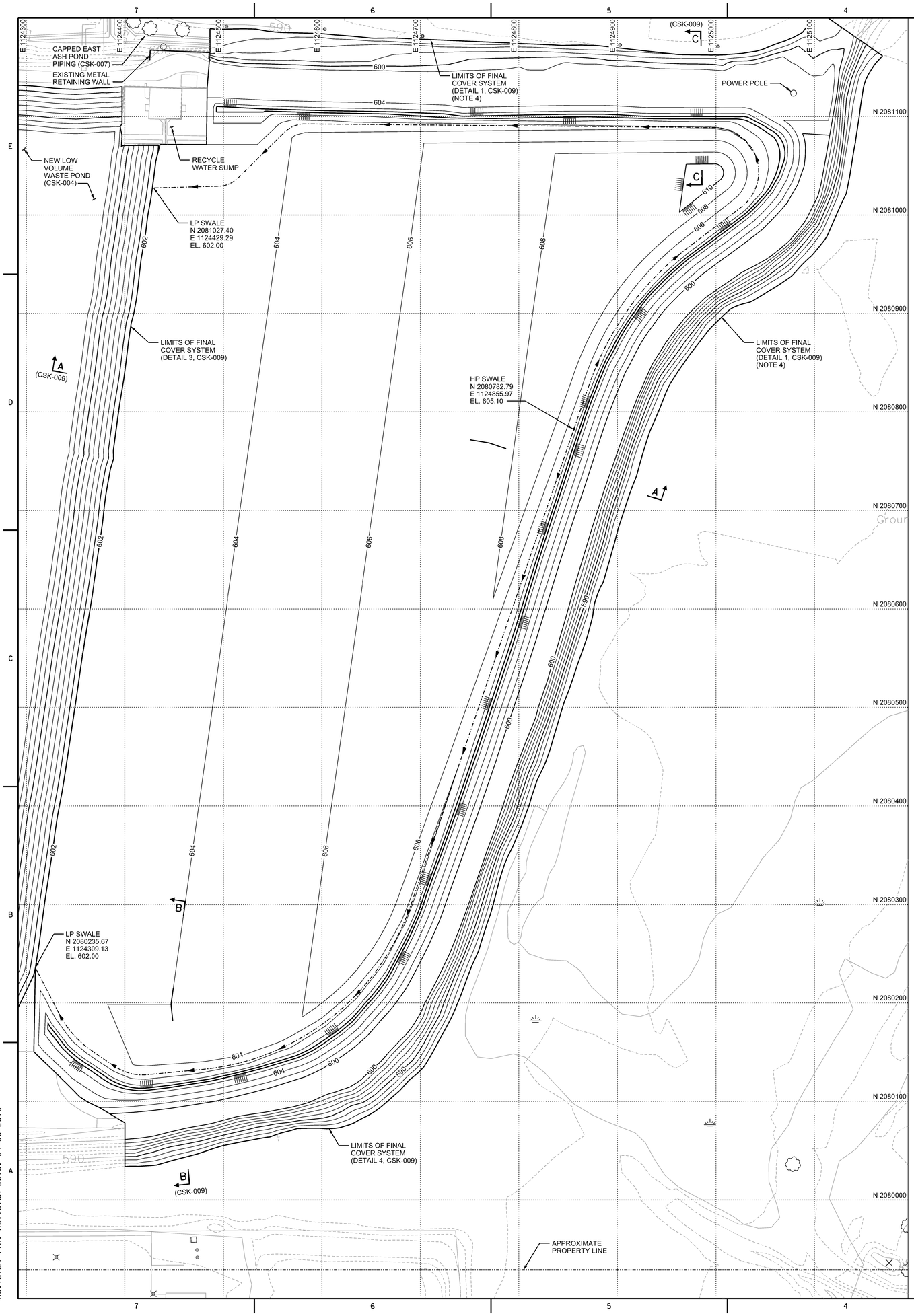

FOR PERMIT
NOT FOR CONSTRUCTION

HOLD INFORMATION	
NO.	DESCRIPTION

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RELEASE INFORMATION

REV.	DATE	DESCRIPTION
A	11-11-2021	FOR CLIENT COMMENT
B	11-15-2021	FOR PUBLIC COMMENT

ISSUE PURPOSE: PUBLIC COMMENT
SPECIFICATION: W-7900
PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-008.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D. NIELSON
APPROVED BY: --

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LEGEND

- 610 — MAJOR CONTOUR (10')
- 608 — MINOR CONTOUR (2')
- DRAINAGE PATH

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED IN ACCORDANCE WITH SPECIFICATION W-7900 UNLESS NOTED OTHERWISE.
2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. INSTALL FINAL COVER SYSTEM OVER EAST ASH POND PER DETAIL 1 ON DRAWING WKG-AP-CSK-009.
4. AT TOES OF EAST ASH POND DIKES, FINAL COVER SYSTEM COMPONENTS SHALL BE ANCHORED IN ANCHOR TRENCHES PER DETAIL 2 ON DRAWING WKG-AP-CSK-009.

REFERENCE DRAWINGS

B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS
CSK-004	WEST ASH POND EXCAVATION PLAN
CSK-009	EAST ASH POND FINAL COVER SYSTEM SECTIONS & DETAILS

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NORTH
40' 0' 40' 80'
GRAPHIC SCALE

Sargent & Lundy LLC
SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

EAST ASH POND
FINAL COVER SYSTEM
GRADING PLAN

DRAWING NUMBER	REVISION
WKG-AP-CSK-008	B
SHEET 1 OF 1	

PL12793/OM1864/S:#2-1
Form GDG-0401-01-08. ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A. Revision Date: 04-30-2010
11/15/2021 10:46:32 AM
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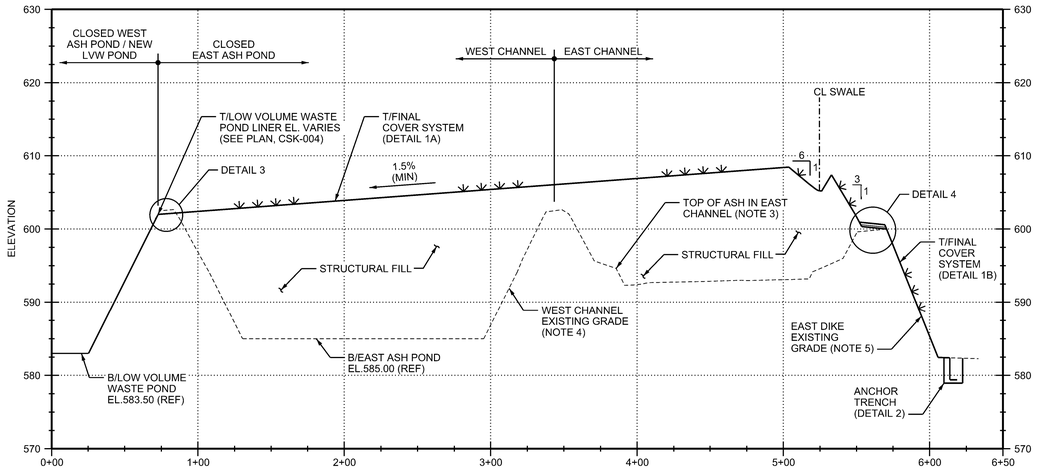
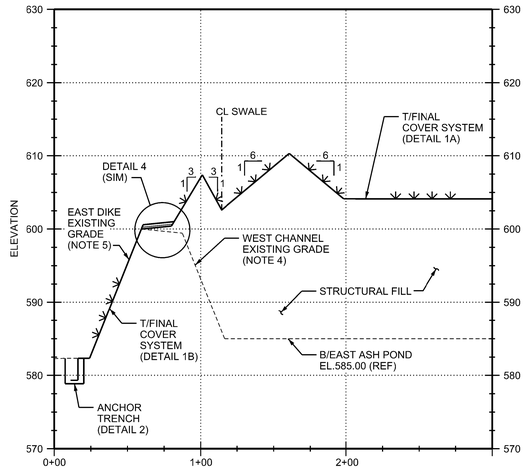


SECTION A
HORIZONTIAL SCALE 1"=40'
VERTICAL SCALE 1"=5'
(CSK-008)



SECTION B
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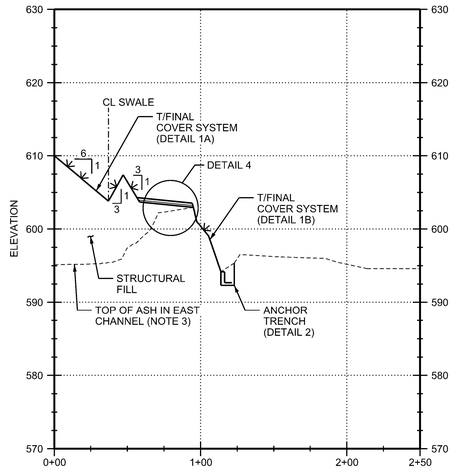
VERTICAL SCALE 1"=5'
(CSK-008)



SECTION C
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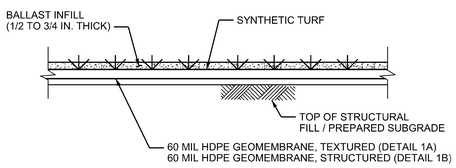
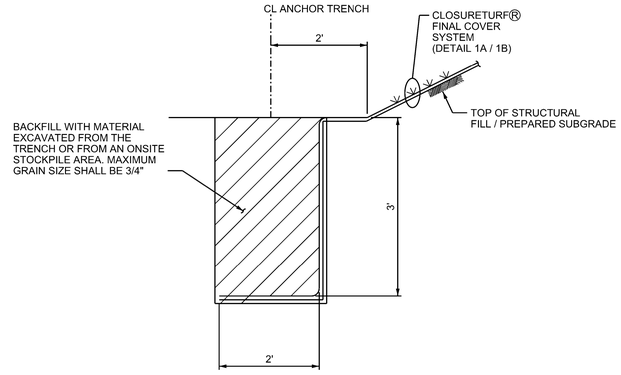
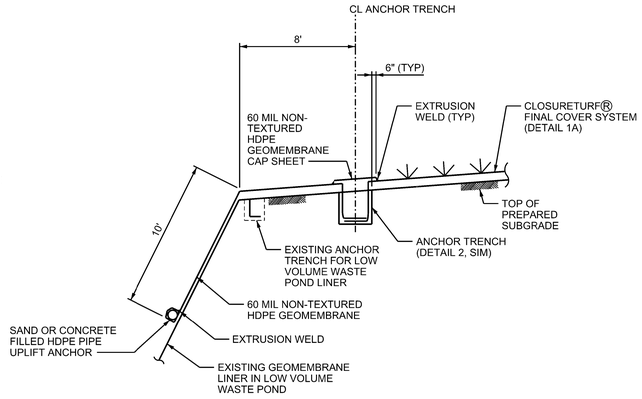
(CSK-008)



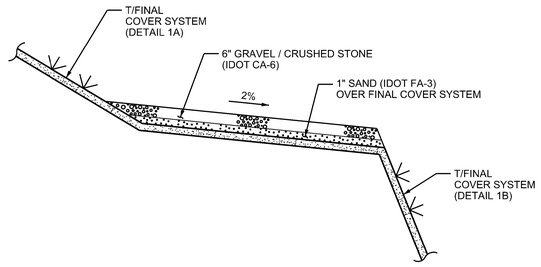
CLOSURETURF® FINAL COVER SYSTEM DETAIL 1
N.T.S.



TYPICAL ANCHOR TRENCH DETAIL 2
N.T.S.



GEOMEMBRANE LINER TRANSITION AT NEW LOW VOLUME WASTE POND DETAIL 3
N.T.S.



FINAL COVER ACCESS ROAD DETAIL 4
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED IN ACCORDANCE WITH SPECIFICATION W-7900 UNLESS NOTED OTHERWISE.
2. FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, SEE DRAWING WKG-AP-CSK-002.
3. TOP-OF-ASH SURFACE SHOWN IN THE EAST CHANNEL REPRESENTS THE ASH STORED IN THE POND DURING THE 2014 SURVEY OF THE SITE AND MAY NOT BE REPRESENTATIVE OF CURRENT CONDITIONS.
4. EXISTING GRADE SHOWN IN THE WEST CHANNEL REPRESENTS THE FLOOR AND SIDE SURFACES OF THE WEST CHANNEL THAT ARE ASSUMED TO HAVE BEEN INSTALLED BASED ON THE EAST ASH POND'S HISTORY OF CONSTRUCTION (GEOSYNTEC, 2016).
5. EXISTING GRADE SHOWN FOR THE DOWNSTREAM SLOPE OF THE EAST ASH POND'S EAST DIKE REPRESENTS THE SIDE SURFACE ASSUMED TO HAVE BEEN INSTALLED IN ACCORDANCE WITH THE SLOPE MODIFICATION WORK DONE IN 2016 (REF. DWGS. SW0251-11-01 THROUGH -07).

REFERENCE DRAWINGS

B739	EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS
CSK-008	EAST ASH POND FINAL COVER SYSTEM GRADING PLAN
SW0251-11-01 - 07	EAST ASH BASIN SLOPE MODIFICATION

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FOR PERMIT
NOT FOR CONSTRUCTION

HOLD INFORMATION

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ISSUE PURPOSE: PUBLIC COMMENT
SPECIFICATION: W-7900
PROJECT NO.: 12661-098

CAD FILE NAME: WKG-AP-CSK-009.DGN
PREPARED BY: J. CHAVEZ
REVIEWED BY: T. DEHLIN / D. NIELSON
APPROVED BY: --

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Sargent & Lundy LLC
SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

MWG
Midwest Generation, LLC

PROJECT

MIDWEST GENERATION, LLC
WAUKEGAN
GENERATING STATION
ASH POND CLOSURE PROJECT

DRAWING TITLE

EAST ASH POND
FINAL COVER SYSTEM
SECTIONS & DETAILS

DRAWING NUMBER	REVISION
WKG-AP-CSK-009	B

SHEET 1 OF 1

PL12793/OM1864/S:*2-1
Form GDC-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 11A, Revision Date: 04-30-2010
11/15/2021 10:47:47 AM
...*Drawings*WKG-AP-CSK-009.dgn

ATTACHMENT 2

SPECIFICATION W-7901 – CONSTRUCTION QUALITY ASSURANCE FOR EAST & WEST ASH POND CLOSURES

MWG

Midwest Generation, LLC

WAUKEGAN GENERATING STATION

SPECIFICATION W-7901

CONSTRUCTION QUALITY ASSURANCE FOR EAST & WEST ASH POND CLOSURES

S&L PROJECT NO.: 12661-098

REVISION 0B

ISSUE PURPOSE: PUBLIC COMMENT

ISSUE DATE: 11-15-2021

Sargent & Lundy

SECTION 000110

TABLE OF CONTENTS

END OF SECTION 000110

SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

101. PROJECT INFORMATION

101.1 Owner: Midwest Generation, LLC (MWG)

101.2 Design Engineer: Sargent & Lundy (S&L)

101.3 Project Name: Construction Quality Assurance for East & West Ash Pond Closures

101.4 Project Location: Waukegan Generating Station
401 E. Greenwood Ave.
Waukegan, IL 60087

102. DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND

102.1 The purpose of this project is to close the East Ash Pond and the West Ash Pond at Midwest Generation, LLC's Waukegan Generating Station in accordance with the Illinois Pollution Control Board's Coal Combustion Residuals (CCR) Rule, 35 Ill. Adm. Code Part 845, and with the U.S. Environmental Protection Agency's (EPA) CCR Rule, 40 CFR Part 257 Subpart D.

102.2 The West Ash Pond will be closed by removing all CCR and CCR-mixed materials stored in the pond and decontaminating the pond's geomembrane liner and appurtenant concrete structures. The pond's existing geomembrane liner and appurtenant concrete structures will remain in-place. Following removal of CCR and CCR-mixed materials from the pond and decontamination of the pond facilities remaining in-place, the West Ash Pond area will be repurposed as a new low-volume waste pond for the Waukegan Generating Station.

102.3 The East Ash Pond will be closed by leaving the CCR and CCR-mixed materials stored in the pond in-place and installing a final cover system over the pond.

103. SCOPE OF WORK

103.1 In general, this Specification covers the field and laboratory activities for a Construction Quality Assurance (CQA) Contractor to perform to provide assurance and documentation that the East and West Ash Ponds are closed in accordance with the General Work (GW) Specification (W-7900), the Design Drawings, and permit requirements.

103.2 The CQA Work shall include but not be limited to the following:

a. Prepare a CQA Plan that provides a detailed description of the activities that will be performed by the CQA Contractor in accordance with the Design Drawings and this Specification.

b. Perform earthwork inspection and testing work specified in Section 014362 to:

b1. Verify compliance of materials with the GW Specification and Design Drawings.

b2. Perform field material and installation tests.

b3. Obtain samples and perform laboratory tests and/or contract to have laboratory tests performed and audit laboratory test results.

b4. Perform inspections during construction.

c. Perform geosynthetics inspection and testing work specified in Section 014362 to:

c1. Verify compliance of materials with the GW Specification and Design Drawings.

c2. Perform field material and installation tests.

c3. Obtain samples and perform laboratory tests and/or contract to have laboratory tests performed and audit laboratory test results.

c4. Witness field testing and audit laboratory test results.

c5. Perform inspections during construction.

d. Identify non-conforming work.

e. Meetings, Documentation, and Reports:

e1. Participate in project meetings.

e2. Prepare CQA records and documents.

e3. Prepare CQA reports, including:

e3.1 Maintaining an Acceptance Report throughout the project.

e3.2 Preparing and certifying weekly Summary Reports until the end of the project.

e3.3 Preparing and certifying a Final Report at the end of the project.

103.3 The CQA Work shall conform to the requirements of this Specification and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The CQA Work shall be performed exclusively by the CQA Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of those located on the work site and associated laboratories, including the CQA Contractor's personnel (or that of its subcontractor(s)) performing the CQA Work.

103.4 Performance of the CQA Work shall include all the labor, supervision, administration, management, tools, testing equipment, and consumables to execute the CQA Work identified herein.

103.5 Inspection and tests specified in this Specification shall be performed by personnel qualified to perform such inspections and tests.

104. RESPONSIBILITY AND AUTHORITY

104.1 The responsibilities and authority are described below for the organizations that will be involved in the design, permitting, and construction activities associated with the project.

a. Permitting Authority – Illinois EPA:

a1. The Illinois EPA is the Permitting Authority and is responsible for reviewing the permit applications for closing the East and West Ash Ponds to assure compliance with state regulations and for granting permits for the project.

a2. The Permitting Authority may review any design revisions during construction and any requests for variance submitted by the Owner. The Permitting Authority has the authority to review and approve all CQA documentation and reports and to confirm the East and West Ash Ponds were closed as specified in Project Specifications and the Design Drawings.

b. Owner – MWG:

b1. MWG is the Owner of the facility and has the authority to accept or reject materials and workmanship of the GW Contractor or reports and recommendations of the CQA Contractor.

b2. The Owner will ultimately be responsible for the closure construction for the East and West Ash Ponds and for assuring the Permitting Authority that the construction meets or exceeds the requirements specified in state regulations, permits, Project Specifications, and the Design Drawings. The Owner will accomplish this by retaining a CQA Contractor for the project.

c. Design Engineer: S&L:

c1. S&L is the Design Engineer and is responsible for designing the closures for the East and West Ash Ponds.

c2. The Design Engineer will assure that the design meets the construction requirements of the Owner and meets or exceeds the requirements of the Permitting Authority.

c3. The Design Engineer shall resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes to the permitted design shall require approval of the Owner and Design Engineer to ensure that the original design objectives are still maintained. All changes shall meet state regulatory requirements and the rules promulgated thereunder and may include Permitting Authority-approved variances to the rules.

d. GW Contractor:

d1. The GW Contractor shall be responsible for constructing the facility in accordance with the GW Specification (W-7900) and the Design Drawings and shall implement additional quality control and quality assurance procedures and techniques as necessary during construction.

d2. The GW Contractor will consist of an Earthwork Contractor performing the earthwork and a Geosynthetics Contractor installing the geosynthetic materials for the East Ash Pond's final cover system.

e. CQA Contractor:

e1. The CQA Contractor shall be the company employed by the Owner who is responsible for performing the CQA Work. The CQA Contractor shall be objective, competent, and independent from the GW Contractor whose work is being inspected. The CQA Contractor shall remain independent throughout the duration of the project.

e2. The CQA Contractor's team shall include the CQA Officer and one or more CQA Inspectors.

f. CQA Officer:

f1. The CQA Officer shall be a professional engineer licensed in the State of Illinois who shall be responsible for implementation of the CQA Work. The CQA Officer shall be responsible to the Owner.

f2. The CQA Officer shall be responsible for the performance of activities specified herein such as auditing, inspecting, sampling, testing, documenting, and preparing and certifying the Final Report. In addition, the CQA Officer and/or its inspectors shall have the responsibility of daily coordination with CQA Inspectors, the GW Contractor and its subcontractors, and the Owner to discuss daily progress, review completed work, perform visual inspections, review test results, and discuss and assist in resolving any current or potential construction problems.

f3. Except as provided by Paragraph 104.1f4, the CQA Officer shall be present to provide supervision and assume responsibility for performing all inspections of the following activities, when applicable:

f3.1 Compaction of subgrade materials.

f3.2 Installation of the final cover system, including installation of the geomembrane cover.

f4. If the CQA Officer is unable to be present as required by Paragraph 104.1f3, the CQA Officer shall provide the following in writing:

f4.1 The reasons for the CQA Officer's absence.

f4.2 A designation of a person who must exercise professional judgment in carrying out the duties of the CQA Officer-in-Absentia.

f4.3 A signed statement that the CQA Officer assumes full responsibility for all inspections performed and reports prepared by the designated CQA Officer-in-Absentia during the absence of the CQA Officer.

g. CQA Inspectors:

g1. The CQA Inspectors shall be responsible for performing visual examinations and for performing or obtaining field and laboratory tests. The CQA Inspectors shall be under the direct supervision of the CQA Officer.

g2. The CQA Inspectors shall be responsible for reporting to the CQA Officer the results of any inspections or tests indicating materials or installed work are of unacceptable quality or do not meet specified design requirements.

g3. The work will be divided so that two or more CQA Inspectors, each with specialized knowledge and training, will be involved in inspection work.

105. QUALIFICATIONS

105.1 CQA Officer:

a. The CQA Officer shall be a registered professional engineer in the State of Illinois with at least 10 years of experience in design/construction/permitting/licensing, at least 5 years of which is CQA experience as a certifying engineer on landfills or ponds with geomembrane liner systems.

b. The CQA Officer shall be qualified by education, technical knowledge, and experience to complete the technical certifications required by this Specification.

105.2 CQA Inspectors:

a. The CQA Inspectors shall have adequate formal academic training and sufficient practical and technical experience needed to execute and record auditing and inspection activities conducted at the site and perform all required laboratory and field testing. This includes a demonstrated knowledge of the various aspects of the type of work being conducted.

b. As required, different CQA Inspectors, each with specialized knowledge and experience, shall be employed for different portions of the work.

c. CQA Earthwork Inspectors:

c1. The lead CQA field inspector for earthwork (Lead CQA Earthwork Inspector) shall have at least 5 years of experience as an earthwork inspector.

c2. All CQA Earthwork Inspectors shall be knowledgeable in:

c2.1 Field practices relating to construction techniques used for the type of earthwork being performed.

c2.2 Construction and compaction equipment.

c2.3 All codes and regulations concerning material installation.

c2.4 Observation procedures for earthwork construction.

c2.5 Sampling and earthwork testing procedures.

c2.6 Testing equipment.

c2.7 Documentation procedures.

c2.8 Site safety.

d. CQA Geosynthetics Inspectors:

d1. The lead CQA field inspector for geosynthetics (Lead CQA Geosynthetics Inspector) shall have at least 5 years of CQA experience as a field inspector on projects with a geomembrane lining system including two years as a CQA inspector.

d2. All CQA Geosynthetics Inspectors shall be knowledgeable in:

d2.1 Field practice relating to techniques used for the installation of high density polyethylene (HDPE) geomembranes and geotextiles.

d2.2 HDEP geomembrane welding equipment and the correct operating procedures for seaming HDPE.

d2.3 Geotextile seaming equipment and the correct procedures for splicing geotextiles.

d2.4 All codes and regulations concerning material installation.

d2.5 Non-destructive seam testing procedures and failure criteria.

d2.6 Sampling for destructive testing of samples of seams and laboratory testing procedures.

d2.7 Testing equipment.

d2.8 Documentation procedures for field and laboratory tests.

d2.9 Site safety.

106. DEFINITIONS

106.1 The term "Design Drawing" means the Design Engineer's drawings indicating the Work to be performed.

106.2 The term "Work" means the services furnished to complete the CQA activities specified herein.

106.3 The term "Owner-approved equal" means an acceptable equivalent to a specified material or equipment that has been accepted by the Owner.

107. PROJECT MEETINGS

107.1 Project meetings will be held on a periodic basis during the lifetime of the project. The meetings will include:

a. A preconstruction meeting.

b. Progress meetings.

c. Additional meetings as required to discuss problems or work deficiencies.

107.2 Preconstruction Meeting:

a. The preconstruction meeting will be organized by the Owner. In addition to the Owner, the GW Contractor (including representatives of the Earthwork Contractor and Geosynthetics Contractor), the CQA Officer (or CQA Officer-in-Absentia), the Lead CQA Inspectors, and any other interested party designated by the Owner shall attend the preconstruction meeting.

b. The preconstruction meeting shall be used to discuss:

b1. Site specific safety requirements.

b2. Requirements of the Design Drawings, GW Specification, and CQA Specification.

b3. The CQA Contractor’s CQA Plan and the responsibilities of each party.

b4. The lines of authority and communication.

b5. Procedure for submittal of manufacturer QA/QC documents for audit.

b6. Procedures for examination of materials delivered to the site.

b7. Location of material storage area(s).

b8. Field and laboratory test requirements and sample sizes.

b9. Procedures for observance of field tests.

b10. Coordination between each contractor and the CQA Inspector to obtain timely field samples and tests.

b11. Procedure for handling construction deficiencies, repairs, and retesting.

b12. Work area security and safety protocol.

b13. Coordination with other contractors or trades.

b14. Site visits.

107.3 Weekly Progress Meetings:

a. Weekly progress meetings will be scheduled by the Owner. In addition to the Owner, the meetings shall be attended by the GW Contractor (including representatives of the Earthwork Contractor and the Geosynthetics Contractor), the CQA Officer (or CQA Officer-in-Absentia), and the Lead CQA Inspectors.

b. If needed, daily meetings shall be held each day to review the work schedule, work completed, results of tests, and to discuss potential construction problems.

c. The Owner or its designee will document each meeting and distribute copies of meeting minutes to all responsible parties.

107.4 Additional Meetings:

a. Additional meetings between one or more contractors, the Lead CQA Inspector(s), and the CQA Officer (or the CQA Officer-in-Absentia) shall be held immediately after a work deficiency is identified or a problem arises. These meetings shall be used to define and resolve the problem.

b. Any supervisor/superintendent can request such a meeting through their line of authority.

c. Possible solutions to the problem shall be discussed, and an acceptable solution shall be selected. This solution shall be implemented provided it does not conflict with or require a change to the Design Drawings, in which case the solution shall be submitted to the Design Engineer for review.

d. The Design Engineer shall resolve unexpected conditions or unanticipated problems during construction, which may require changes to the permitted design. Changes from the permitted design shall require approval by the Owner and Design Engineer to ensure that the original design objectives are maintained. All changes shall meet the requirements of the Permitting Authority and may include regulations approved by the Permitting Authority.

e. The CQA Contractor shall document each special meeting and distribute copies of minutes to all responsible parties.

108. PERFORMANCE AUDITS AND DOCUMENTATION

108.1 As a minimum, the CQA Officer shall conduct the following reviews and performance audits:

a. Full review and audit of results of preconstruction testing or GW Contractor's material certificates used to qualify earthwork materials for construction use.

b. Full review and audit of manufacturer certificates that qualify geosynthetic materials for use in the final cover system (including geomembrane and synthetic turf).

c. Weekly audit of reports and test data sheets during and after construction of the earthwork until completion of work.

d. Weekly audit of reports and test data sheets during and after installation of geosynthetic materials (including geomembrane and synthetic turf) until completion of the work.

108.2 CQA documentation shall be well-documented and include at least the following:

a. Daily records, which shall include:

a1. Inspection data sheets.

a2. Data sheets listing the number and types of construction equipment used by the GW Contractor and construction equipment data.

a3. Problem identification reports and corrective action reports. Problem identification reports and corrective action reports shall include detailed descriptions of materials and/or workmanship that do not meet a specified design and shall be cross-referenced to specific inspection data sheets where the problem was identified and corrected.

b. Testing records, which shall include:

b1. Material shipping and manufacturer QA/QC data sheets.

b2. Data sheets describing field samples taken.

b3. Laboratory data sheets.

b4. Field test data sheets.

b5. Notes, charts, drawings, or sketches identifying the location and elevation of field tests, location of failures and repairs or retests, and where samples were obtained.

b6. Non-destructive test reports including location of failures, records of repairs, and results of retests.

c. Photographic records, which shall include:

c1. Digital photographs, each with a unique identifying number.

c2. Figure indicating the location from which each photograph was taken.

c3. Summary list giving the date and time of each photograph.

108.3 All records shall, at a minimum, bear the following:

a. Unique identifying sheet number.

b. The date.

c. Project name, project number, and location.

d. Descriptive remarks.

e. Data sheets for tests.

f. Written text descriptions for visual observations

g. Signature of the preparer of designated authority.

END OF SECTION 011100

SECTION 014362

CONSTRUCTION QUALITY ASSURANCE FOR CLOSING A CCR SURFACE IMPOUNDMENT

PART 1 – GENERAL

101. EXTENT

101.1 The intent of this section is to define the requirements for Construction Quality Assurance (CQA) activities to ensure that the quality of materials and installation procedures used to close the East and West Ash Ponds are in accordance with the General Work (GW) Specification W-7900, Design Drawings, permit requirements, and as specified herein.

101.2 The Work within this Specification is the responsibility of the CQA Contractor and shall include, but not be limited to, the following items:

a. Attend project meetings and site visits as scheduled by the GW Contractor for coordination between the Owner, GW Contractor, subcontractors, and CQA Contractor.

b. Perform pre-construction material certification activities to ensure materials meet or exceed GW Specification requirements that include but are not limited to:

b1. Testing for suitability of material prior to use.

b2. Performing pre-construction audits of material certifications prior to material use.

c. Perform CQA activities during construction to ensure materials meet or exceed GW Specification requirements:

c1. Perform audits of material certifications.

c2. Perform observations, inspections, and tests.

c3. Review laboratory test data.

c4. Material sampling.

d. Documentation of all observations, samples, certifications, test results, and conformance of work to the GW Specification that will be submitted by the Owner to the Permitting Authority.

e. Prepare a weekly report at the end of each week of construction, until construction is complete.

f. Prepare a report that demonstrates that the ash ponds were closed in conformance with the GW Specification and the Design Drawings. This report shall include all test data, observations, audits, material certificates, and any other relevant documentation.

g. Submit a draft version of the report to the Owner and Design Engineer for their review and comment. Upon resolution of all comments, submit a final version of the report to the Owner and Design Engineer.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 CQA Specification (Specification W-7901):

a. Section 011100 – Summary of Work

102.2 GW Specification (Specification W-7900):

a. Section 311522 – Engineered Synthetic Turf for Final Cover System

b. Section 312205 – Earthwork for CCR Surface Impoundment Closure

c. Section 319022 – High Density Polyethylene Geomembrane Liner for Final Cover System

103. REFERENCE DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

103.3 Abbreviations listed indicate the form used to identify the reference documents in the specification text.

103.4 ASTM – ASTM International:

a. C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

b. D422 Standard Test Method for Particle-Size Analysis of Soils (Withdrawn 2016).

c. D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

d. D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

e. D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.

f. D1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

g. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

h. D1603 Standard Test Method for Carbon Black Content in Olefin Plastics.

i. D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

j. D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

k. D2256 Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method.

l. D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

m. D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

n. D2974 Standard Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils.

o. D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

p. D4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

q. D4254 Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

r. D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

s. D4643 Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.

t. D4595 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

u. D4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

v. D4959 Standard Test Method for Determination of Water Content of Soil By Direct Heating.

w. D5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.

x. D5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes.

y. D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

z. D6241 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

aa. D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.

bb. D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

104. SUBMITTALS

104.1 Submittals with Bid Proposal:

a. Documentation to substantiate that the CQA Contractor's and its laboratory's Accreditation Certifications are current.

b. Detailed resumes on all CQA laboratory and field personnel proposed for the Work, including a complete description of their qualifications and previous experience in the same type of work and documentation of certification to perform required testing.

104.2 Submittals During the Course of the Work:

a. Certifications and submittals as specified herein.

b. Quality Reports shall be submitted on a weekly basis while performing the work.

c. Index Report:

c1. An Index Report shall be prepared listing all records and reports.

c2. The Index Report shall be assembled in chronological framework for recording and identifying all reports.

d. Acceptance Report:

d1. All reports and data sheets shall be assembled and summarized into an Acceptance Report in order to verify that the materials and construction procedures comply with the specified design. As a minimum, this report shall contain all inspection reports, inspection data sheets, problem identification reports and corrective action reports.

d2. The Acceptance Report shall be prepared by the CQA Inspectors and updated on a daily basis.

e. Weekly Summary Report:

e1. At the end of each week of construction, until construction is complete, a Summary Report must be prepared by either the CQA Officer or under the supervision of the CQA Officer and submitted to the Owner. The CQA Officer must review and approve the Summary Report.

e2. The Summary Report shall contain descriptions of the weather, locations where construction occurred during the previous week, materials used, results of testing, inspection reports, and procedures used to perform the inspections.

f. Final Report:

f1. A Final Report for the earthwork and the installation of the geosynthetic materials shall be prepared by the CQA Officer. The Final Report shall contain all data sheets, testing records, manufacturer data sheets, reports and photographs concerning items which were installed and tested. This report shall contain documentation that construction proceeded in accordance with the Design Drawings, Project Specifications, and permit requirements. The report shall also include a certification (sealed by the CQA Officer) that the GW Contractor's work is in compliance with the Design Drawings, Project Specifications, and permit requirements.

f2. The Final Report shall be submitted within 2 weeks after completion of CQA Work.

105. CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

105.1 General:

a. This section describes the CQA activities that shall be performed to assure the quality of materials and construction procedures used to close the East and West Ash Ponds. These activities are intended to ensure that the materials and construction procedures used to close the East and West Ash Ponds meet the GW Specification requirements and to provide assurance that the ash ponds have been closed in manners that meet or exceed the requirements stated on the Design Drawings and in the GW Specification.

105.2 Organizations Involved:

a. The organizations involved in the design, permitting, and construction activities associated with the Work are defined in Section 011100.

b. The responsibilities and authority of the organizations and personnel associated with the Work are defined in Section 011100.

105.3 Qualifications:

a. The qualifications of the CQA Contractor personnel are described in Section 011100.

105.4 Project Meetings and Audits:

a. The requirements for project meetings and audits are described in Section 011100.

105.5 Performance Audits and CQA Documentation:

a. The requirements for performance audits and CQA documentation are described in Section 011100.

PART 2 – PRODUCTS

201. PRODUCTS

201.1 The requirements for the various products used for the construction of the impoundment are specified in their respective technical specification sections in the GW Specification.

201.2 All permanent materials to be used in the Work are supplied by the GW Contractor. The GW Contractor and CQA Contractor shall coordinate obtaining materials for testing by the CQA Contractor.

PART 3 – EXECUTION

301. GENERAL CQA TESTING AND INSPECTION REQUIREMENTS

301.1 Record daily atmospheric conditions.

301.2 Field tests shall document the elevation and coordinate location for each test. The locations may be determined by survey, taping, or pacing off distances unless otherwise noted.

301.3 Material Source Testing: Material source testing activities include visual observations and laboratory and field testing at the material source to control material quality and material preparation prior to transport of the material to the facility.

302. CQA TESTING AND INSPECTION REQUIREMENTS FOR SUBGRADE (CCR) TO RECEIVE STRUCTURAL FILL

302.1 Testing During Construction:

a. CQA activities during subgrade preparation work shall include visual observations and field testing to ensure that subgrade (CCR) preparation for Structural Fill is in accordance with GW Specification requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-1 and the following paragraphs.

b. Visual Observations:

b1. Record type and size of compaction equipment in use:

b1.1 For rubber-tired rollers, record the tire inflation pressure, spacing of tires, and empty and ballasted wheel loads.

b1.2 For vibratory rollers, record the static weight, imparted dynamic force, operating frequency of vibration, and drum diameter and length.

b1.3 For hand tampers, record make, model number, size and compactive effort.

b2. Observe and record compactive effort, uniformity of compaction and scarification and connection between compacted lifts. Record number of passes of a roller by type, size, and weight of roller.

b3. For proofrolling, record the type, size, and weight of compaction equipment or other vehicles used for proofrolling.

b4. Observe removal of all organic and undesirable material.

b5. Observe that there are no moisture seeps, puddling, or ponding.

b6. Observe proofrolling to identify soft spots, and observe removal of material in soft spots.

b7. Observe compaction of the subgrade prior to placement of the proceeding layer of material. Inspect for any large, protruding, or sharp material that could puncture a geomembrane.

b8. Verify measurements and determine that the depth and slope of all excavations meet design requirements and that there are no sidewall failures from moisture seeps or other causes.

c. Laboratory and Field Tests:

c1. Laboratory testing and field testing for subgrade shall be performed in accordance with the requirements specified in Table 014362-1.

d. Test Acceptance Criteria:

e. Acceptance criteria for subgrade approval shall be as specified in GW Specification Section 312205.

303. CQA TESTING AND INSPECTION REQUIREMENTS FOR STRUCTURAL FILL MATERIAL

303.1 Initial Material Certification:

a. Prior to shipment of any materials, the CQA Contractor shall assemble, document the receipt of, and audit the material supplier's test results and certification(s) that the properties of the material(s) meet GW Specification requirements.

303.2 Testing During Construction:

a. CQA activities during placement of Structural Fill shall include visual observations and field testing to ensure that Structural Fill is installed in accordance with GW Specification requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-2 and the following paragraphs.

b. Visual Observation of the Material Source for Structural Fill Material During Construction:

b1. Inspect materials to ensure that they are uniform.

b2. Visually inspect the material in accordance with ASTM D2488.

b3. Inspect to ensure that only suitable material is transported to the site or obtained from onsite cuts or borrow areas, observe segregation operations when unsuitable materials are present, and observe removal of organic soils, roots, stumps, and stones.

b4. Observe changes in color or texture that can be indicative of a change in material type or moisture content.

b5. Observe moisture conditioning activities to ensure that any required substantial changes in moisture content are made at the source.

c. Visual Observation of Fill Placement:

c1. Record type and size of compaction equipment in use:

c1.1 For rubber-tired rollers, record the tire inflation pressure, spacing of tires, and empty and ballasted wheel loads.

c1.2 For vibratory rollers, record the static weight, imparted dynamic force, operating frequency of vibration, and drum diameter and length.

c1.3 For hand tampers, record make, model number, size and compactive effort.

c1.4 Observe and record compactive effort, uniformity of compaction and scarification and connection between compacted lifts. Record number of passes of a roller by type, size, and weight of roller.

c1.5 For proofrolling, record the type, size, and weight of compaction equipment or other vehicles used for proofrolling.

c2. Observe removal of roots, rocks, rubbish, or out-of-specification soil from the borrow material.

c3. Observe and record changes in soil characteristics necessitating a change in construction procedures.

c4. Observe fill placement and procedures for proper fill thickness.

c5. Observe procedures to be followed to adjust the soil moisture content to obtain uniform moisture content.

c6. Observe and record final finishing procedures.

c7. Observe and record that final grade is consistent with the design grade specified on the Design Drawings in the GW Specification.

c8. Observe that there is proper placement and compaction of any backfill around recessed areas, pipes, or sumps.

d. Laboratory and Field Tests:

d1. Laboratory and field testing shall be performed in accordance with the requirements specified in Table 014362-2.

e. Test Acceptance Criteria:

e1. Acceptance criteria shall be as specified in GW Specification Section 312205.

304. CQA TESTING AND INSPECTION REQUIREMENTS FOR GEOMEMBRANE COMPONENT OF FINAL COVER SYSTEM

304.1 Initial Material Certification:

a. Prior to shipment of any geomembrane materials, the CQA Contractor shall assemble and document the receipt of and audit the Geomembrane Manufacturer submittals listed below for conformance with the GW Specification.

a1. Geomembrane Resin:

a1.1 Certificate that the resin meets GW Specification requirements.

a1.2 Certificate of the origin of the resin and that all resin is from the same manufacturer (name, identification brand name and number).

a1.3 Copies of the Geomembrane Manufacturer's QA/QC certificates for the geomembrane resin. Certificates shall include a summary report of test results conducted to verify the quality of the resin used in each batch to manufacture geomembrane for this project. As a minimum, the report shall include tests on specific gravity, melt flow index and percent carbon black.

a2. Geomembrane Sheeting:

a2.1 Certification that the properties of the manufactured sheeting meet GW Specification requirements and are guaranteed by the Geomembrane Manufacturer.

a2.2 Statement certifying that no post consumer resin (PCR) has been added to the formulation.

a2.3 Copies of all of the Geomembrane Manufacturer's QA/QC certificates for the geomembrane sheeting. The certificates shall include test results.

a3. Extrudate Resins or Rod for Seaming Geomembrane:

a3.1 Certification from the Geomembrane Manufacturer that all extrudate is the same resin type as the geomembrane and was obtained from the same resin supplier as the resin used to manufacture the geomembrane.

b. Geomembrane Field Installation Quality Assurance Plan:

b1. Document receipt of the GW Contractor's QA plan for installing geomembrane.

b2. Review the plan for compliance with the GW Specification and document where the plan is not in compliance.

c. Geomembrane Panel Layout:

c1. Document receipt of the GW Contractor's panel layout for geomembrane.

304.2 Transportation, Handling, and Storage:

a. Documentation of Delivery:

a1. Document arrival of rolls of geomembrane.

a2. Document that each roll is marked with the following information:

a2.1 Name of Geomembrane Manufacturer.

a2.2 Product identification, which can be traced back to the origin of the base material (resin supplier's name, resin production plant, resin brand name type, resin brand number, and production date of the resin).

a2.3 Date of manufacture of the geomembrane.

a2.4 Roll identification number.

a2.5 Geomembrane thickness and type.

a2.6 Roll dimensions (length and width).

a2.7 Batch number.

a2.8 Order number.

a2.9 Panel number.

a3. Check the Quality Control certificates on each roll to verify that the rolls received onsite meet the GW Specification. Take the identifying labels from each roll or pallet and save them for future reference.

a4. Recommend rejection of rolls which do not have the required documentation and ensure that the rolls are removed from the site.

b. Inspection of Manufactured Rolls:

b1. Inspect all manufactured rolls upon delivery to the site.

b2. Ensure that packaging is secure and that no damage has occurred.

b3. If damage to packaging has occurred, inspect exposed roll surfaces, and note and identify any damage or repairable flaws. Note: This visual observation shall be conducted without unrolling rolls unless the extent of surface damage indicates that internal damage may be present.

b4. If damage to just the packaging has occurred, document repair of the packaging.

b5. If damage to the product has occurred, document that the damage or flaws are repaired or that the damaged material is wasted and removed from the site.

b6. Report all damage to the Owner.

c. Handling:

c1. Inspect the onsite handling equipment being used to move materials to ensure that it is adequate to minimize the risk of damage to materials.

c2. Inspect the handling of materials by installing personnel to ensure that care is used.

d. Storage:

d1. Inspect the storage facility.

d2. Inspect the ground surface to ensure that it is dry, relatively level, smooth and free of rocks, holes, and debris.

d3. Document unsafe or improper storage conditions.

304.3 Preconstruction Testing:

a. Prior to material shipment to the site, the Geomembrane Manufacturer shall submit to the CQA Contractor representative samples of the geomembrane to be shipped to the site, along with chain of custody and certification that the samples submitted are from the geomembrane material to be delivered to the site. The CQA Geosynthetics Inspector shall perform conformance testing of the received geomembrane samples in accordance with Table 014362-5. The laboratory tests shall be performed at least at the corresponding minimum frequencies specified in Table 014362-5.

b. Test acceptance criteria shall be as specified in GW Specification Section 319022. If the results from any of the tests in Table 014362-5 do not meet the respective pass/fail thresholds, then the CQA Officer shall reject all geomembrane material from the resin batch corresponding to the failed test(s) for use in the project.

304.4 Testing During Construction:

a. CQA activities during placement of the geomembrane component of the ClosureTurf® final cover system shall include visual observations and field testing to ensure that the geomembrane cover is installed in accordance with GW Specification requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-5 and the following paragraphs.

b. Weather Conditions for Placement:

b1. Observe and document the weather conditions (i.e., temperature, humidity, precipitation, and wind) to ensure that they are acceptable for geosynthetic material placement and seaming. The GW Specification describes acceptable weather conditions.

b2. If the weather becomes unacceptable for installation of the geosynthetic materials, recommend stopping the installation until conditions again become favorable, thus minimizing the potential for unacceptable installation.

c. Geomembrane Placement:

c1. Prior to placement of the geomembrane cover, visually inspect the surface to be covered to ensure that it meets the requirements of the GW Specification. Confirm that it is compacted, free from clods of soil, rocks larger than specified, roots, sudden or sharp changes in grade and standing water. Field observations shall be performed in accordance with the requirements specified in Table 014362-3.

c2. Provide documentation of daily inspection of the surface to be covered for the area of geomembrane to be placed that day.

c3. Observe and document that the GW Contractor's geomembrane placement plan is being followed. Note where the plan is not being followed and document the GW Contractor's reasons for not following the plan. As each panel is placed, visually inspect the geomembrane for tears, punctures, and thin spots. The CQA Geosynthetics Inspector shall traverse the panels in such a way that the entire surface is inspected. Any defects shall be documented on a drawing and marked on the geomembrane for repair.

c4. Document that the locations of geomembrane seams meet the general requirements for seaming contained in GW Specification Section 319022.

c5. At the time of placement, make measurements to confirm that required overlap of adjacent geomembrane sheets has been achieved, that proper temporary anchorage is

being used (e.g., sand bags or tires), and that the geomembrane is being placed in a relaxed (nonstressed) state.

c6. Document any liner damage from adverse weather conditions, equipment, inadequate temporary anchoring, or rough handling. Mark the location of damage on the geomembrane for repair and on a drawing.

c7. Document improper liner placement (if the placement plan is not followed) and, as a result, inadequate coverage with the available materials or an excess number of field seams.

c8. Document inadequate sheet overlap resulting in poor quality seams.

c9. Document nonwelded or cut panels.

c10. Document repair of damage. Documentation shall include location, type, and method of repair.

d. Geomembrane Seaming and Seam Repair:

d1. Trial Welds Prior to Beginning Seaming:

d1.1 Observe that trial welds are being made at the frequency specified in GW Specification Section 319022.

d1.2 Observe fabrication of test strips and note that test strips are fabricated correctly.

d1.3 Specify where samples are to be cut from the test strips and witness all destructive tests.

d1.4 Observe documentation of results of the destructive tests by the GW Contractor.

d1.5 Audit documentation of each trial weld received from the GW Contractor.

d2. Seaming and Seam Repair: Activities that shall be documented during field seaming operations include:

d2.1 Observe that the geomembrane is free from dirt, dust, and moisture.

d2.2 Observe that the seaming materials and seam welding equipment are as specified.

d2.3 Observe that a firm foundation is available for seaming.

d2.4 Observe that geomembrane overlap and panel adjustment are correct prior to seaming.

d2.5 For extrusion welding, observe that the geomembrane is pre-beveled and the geomembrane is properly abraded and that the panels are temporarily bonded.

d2.6 Observe that grind marks are covered with extrudite.

d2.7 Observe weather conditions (e.g., temperature, humidity, wind) to ensure that they are acceptable for seaming.

d2.8 Measurements of temperatures, pressures, and speed of seaming to ensure that they are as specified. Gages and dials on seaming equipment shall be checked and readings recorded.

d2.9 Observe that the geomembrane is not damaged by equipment or personnel during the seaming process.

d2.10 Observe that no solvents or adhesives are used.

e. Anchor Trench:

e1. Field measurements, observations, and testing shall be performed in accordance with the requirements specified in Table 014362-4.

e2. Measurements:

e2.1 Perform measurements of the anchor trench to ensure that the trench width, depth, and location is as specified on the Design Drawings.

e3. Observations:

e3.1 Observe that the trench corners are rounded as specified.

e3.2 Observe that good housekeeping practices are followed in the trenching operation by not allowing soil to fall back into the trench or down the slope and not allowing water to pond in the trench.

e3.3 Observe that the trench is backfilled as soon as possible and compacted such that the geomembrane (both geomembranes and the geonet) are not damaged.

f. Anchorage at Penetrations:

f1. Where the Design Drawings specify penetrations (e.g., structures and pipes) in the geomembrane, CQA Geosynthetics Inspectors shall ensure that the seals around such penetrations are of sufficient strength and are impermeable. Specific inspections that shall be made on all seals and anchors include:

f2. Observations and tests to ensure that the sealing systems (i.e., pipe boots) have been installed as specified (are leak free) and in the proper location(s).

f3. Observations to ensure that all objects that are placed adjacent to the geomembrane (i.e., batten bars, soil in an anchor trench) are smooth and free of objects or conditions that may damage the membrane.

f4. Observations to ensure that all seals and anchors are complete:

f4.1 No gaps or areas of uncompacted backfill.

f4.2 Batten bars of the specified material, width, and thickness and prepunched at the specified spacing.

f4.3 Anchor bolts of the specified size and material.

f4.4 Anchor bolts spaced as specified.

f5. Observations to confirm that all liner penetrations and liner connections are installed as specified. Liner penetrations shall be verified for appropriate clamp and caulking use, for appropriate material, for good seaming, and for good housekeeping practices. No sharp bends on foundations (concrete pads) shall be allowed. Soil compaction adjacent to concrete pads shall be performed as specified to prevent differential settlement.

g. Geomembrane Production Seam Testing:

g1. Non-Destructive: Activities to be observed and documented include the following:

g1.1 Observe that 100 percent of the seam lengths are tested using non-destructive procedures.

g1.2 Observe that testing is performed as seaming progresses.

g1.3 Observe that the correct procedures are used for testing each type of seam.

g1.4 Observe all non-destructive test procedures.

g1.5 For air pressure testing, observe that the equipment, procedures, and air pressure meet specified requirements. Observe that all testing is properly documented.

g1.6 For vacuum box testing, observe that testing is being performed correctly.

g1.7 For inaccessible seams, observe that a procedure acceptable to the Owner is used to test the seams.

g1.8 Observe that all leaks are marked, recorded as to location, and repaired.

g1.9 Observe that repairs are made in accordance with approved techniques.

g1.10 Observe that all repairs are re-tested and that no leakage is present.

g1.11 Review leakage data for possible patterns. Make suggestions to the GW Contractor if data shows a consistent pattern of failure of a particular machine or crew.

g1.12 Audit documentation of testing prepared by the GW Contractor to make sure that the location of leaks is identified on the drawings.

g2. Destructive:

g2.1 Destructive seam testing shall be performed at specific frequencies.

g2.2 The CQA Geosynthetics Inspector shall specify the location where each sample shall be taken and record data for each sample.

g2.3 The CQA Geosynthetics Inspector shall designate any additional test locations that may be necessary. These locations may be based on the suspicion of contamination by dirt or moisture, change in seaming materials, increase in failed nondestructive tests, and other causes that could result in unacceptable seams.

g2.4 Laboratory testing shall be performed in accordance with the GW Specification Section 319022. Predetermined pass/fail values are specified in that section.

g2.5 Audit and document the results of laboratory testing on seam samples. Note any sample that does not pass and identify the location on the geomembrane for repair in the field and on the drawings.

g3. Repair of Failed Seams:

g3.1 For field seams that fail, the seam can either be reconstructed between the failed and any previous passed seam location or the installer can go on either side of the failed seam location (10-foot minimum), take another sample, test it and if it passes, reconstruct the seam between the two locations. If it fails, the process shall be continued. In all

cases, acceptable seams must be bounded by two passed test locations. The CQA Geosynthetics Inspector shall document the procedure used and results of tests.

g3.2 Document that repairs are made. Documentation shall include location, type, and method of repair.

305. CQA TESTING AND INSPECTION REQUIREMENTS FOR ENGINEERED SYNTHETIC TURF COMPONENT OF FINAL COVER SYSTEM

305.1 Initial Material Certification:

a. Prior to shipment of any synthetic turf materials, the CQA Contractor shall assemble and document the receipt of and audit the Synthetic Turf Manufacturer submittals listed below for conformance with the GW Specification:

a1.1 Certification that the properties of the synthetic turf panels meet GW Specification requirements and are guaranteed by the Synthetic Turf Manufacturer.

a1.2 Copies of the Synthetic Turf Manufacturer's Quality Control and Construction Quality Control Plans. The plans shall include the inspection records and test results required by the GW Specification.

305.2 Transportation, Handling, and Storage:

a. Documentation of Delivery:

a1. Document arrival of rolls of synthetic turf.

a2. Document that each roll is marked with the following information:

a2.1 Name of Synthetic Turf Manufacturer.

a2.2 Product identification.

a2.3 Date of manufacture of synthetic turf.

a2.4 Lot number.

a2.5 Roll identification number.

a3. Check the Quality Control certificates on each roll to verify that the rolls received onsite meet the GW Specification. Take the identifying labels from each roll or pallet and save them for future reference.

a4. Recommend rejection of rolls which do not have the required documentation and ensure that the rolls are removed from the site.

b. Inspection of Manufactured Rolls:

b1. Inspect all manufactured rolls upon delivery to the site.

b2. Ensure that packaging is secure and that no damage has occurred.

b3. If damage to packaging has occurred, inspect exposed roll surfaces, and note and identify any damage or repairable flaws. Note: This visual observation shall be conducted without unrolling rolls unless the extent of surface damage indicates that internal damage may be present.

b4. If damage to just the packaging has occurred, document repair of the packaging.

b5. If damage to the product has occurred, document that the damage or flaws are repaired or that the damaged material is wasted and removed from the project site.

b6. Report all damage to the Owner.

c. Handling:

c1. Inspect the onsite handling equipment being used to move materials to ensure that it is adequate to minimize the risk of damage to materials.

c2. Inspect the handling of materials by installing personnel to ensure that care is used.

d. Storage:

d1. Inspect the storage facility.

d2. Inspect the ground surface to ensure that it is dry, relatively level, smooth and free of rocks, holes, and debris.

d3. Document unsafe or improper storage conditions.

305.3 Preconstruction Testing:

a. Prior to material shipment to the site, the Synthetic Turf Manufacturer shall submit to the CQA Contractor representative samples of the synthetic turf material to be shipped to the site, along with chain of custody and certification that the samples submitted are from the synthetic turf material to be delivered to the site. The CQA Geosynthetics Inspector shall perform conformance testing of the received synthetic turf samples in accordance with Table 014362-6. The laboratory tests shall be performed at least at the corresponding minimum frequencies specified in Table 014362-6.

b. Test acceptance criteria shall be as specified in GW Specification Section 311522. If the results from any of the tests in Table 014362-6 do not meet the respective pass/fail thresholds, then the CQA Officer shall reject all synthetic turf material from the lot corresponding to the failed test(s) for use in the project.

305.4 Testing During Construction:

a. CQA activities during installation of the synthetic turf component of the ClosureTurf® final cover system shall include visual observations and field testing to ensure that the synthetic turf is installed in accordance with GW Specification requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-6 and the following paragraphs.

b. Weather Conditions for Placement:

b1. Observe and document the weather conditions (i.e., temperature, humidity, precipitation, and wind) to ensure that they are acceptable for geosynthetic material placement and seaming. The GW Specification describes acceptable weather conditions.

b2. If the weather becomes unacceptable for installation of the geosynthetic materials, recommend stopping the installation until conditions again become favorable, thus minimizing the potential for unacceptable installation.

c. Synthetic Turf Placement:

c1. Prior to placement of the synthetic turf cover, visually inspect the geomembrane surface to be covered to ensure that it meets the requirements of the GW Specification (i.e., has

been seamed, tested, and approved for further ClosureTurf® component deployment). Confirm that it is substantially free of debris and/or large scraps. Field observations shall be performed in accordance with the requirements specified in Table 014362-6.

c2. Provide documentation of daily inspection of the surface to be covered for the area of synthetic turf to be placed that day.

c3. As each synthetic turf panel is placed, visually inspect the panel for tears, punctures, and thin spots. The CQA Geosynthetics Inspector shall traverse the panels in such a way that the entire surface is inspected. Any defects shall be documented on a drawing and marked on the synthetic turf for repair.

c4. Document that the locations of synthetic turf splices meet the general requirements for seaming contained in GW Specification Section 311522.

c5. During placement:

c5.1 Make measurements to confirm that required overlap of adjacent synthetic turf sheets has been achieved, that proper temporary anchorage is being used (e.g., sand bags or tires), and that the synthetic turf is being placed in a relaxed (nonstressed) state.

c5.2 Observe and verify that tufts in the synthetic turf are not excessively pulled out by the installation process.

c5.3 Observe and verify that the first synthetic turf panel deployed on a slope has the turf filaments facing upward.

c5.4 Observe and verify that the turf filaments in all synthetic turf panels are point upslope after deployment is complete.

c5.5 Observe and verify that equipment being used to place the synthetic turf panels does not damage the synthetic turf or underlying geomembrane.

c6. Document any panel damage from adverse weather conditions, equipment, inadequate temporary anchoring, or rough handling. Mark the location of damage on the synthetic turf for repair and on a drawing.

c7. Document improper synthetic turf panel placement and, as a result, inadequate coverage with the available materials or an excess number of field seams.

c8. Document inadequate sheet overlap resulting in poor quality seams.

c9. Document nonwelded or cut panels.

c10. Document repair of damage. Documentation shall include location, type, and method of repair.

d. Synthetic Turf Splicing and Seam Repair:

d1. Trial Welds Prior to Beginning Seaming:

d1.1 If successive synthetic turf panels are to be spliced by welding, observe that trial welds are being made at the frequency specified in GW Specification Section 311522.

d1.2 Observe fabrication of test strips and note that test strips are fabricated correctly.

d1.3 Specify where samples are to be cut from the test strips and witness all peel/pull tests.

d1.4 Observe documentation of results of the peel/pull tests by the GW Contractor.

d1.5 Audit documentation of each trial weld received from the GW Contractor.

d1.6 Document the following information for each trial weld:

d1.6.1 Names of the seaming personnel.

d1.6.2 Name of the fusion seaming technician.

d1.6.3 The welding apparatus number and temperature.

d1.6.4 Date, time, and ambient air temperature.

d2. Splicing and Seam Repair. Activities that shall be documented during field splicing operations include:

d2.1 Observe that the synthetic turf is free from dirt, dust, and moisture.

d2.2 Observe that synthetic turf panel overlap and adjustment are correct prior to splicing.

d2.3 Observe that the synthetic turf is not damaged by equipment or personnel during the splicing process. Observe that any damages or defects are repaired in accordance with the GW Specification and/or the Synthetic Turf Manufacturer's recommendations.

d2.4 For synthetic turf panels spliced by sewing:

d2.4.1 Observe that the sewing materials and equipment are as specified in GW Specification Section 311522.

d2.4.2 Observe that seams are sewn as specified in GW Specification Section 311522.

d2.5 For synthetic turf panels spliced by fusion welding (heat bonding):

d2.5.1 Observe that the seaming materials and seam welding equipment are as specified.

d2.5.2 Observe weather conditions (e.g., temperature, humidity, wind) to ensure that they are acceptable for seaming.

d2.5.3 Measurements of temperatures, pressures, and speed of seaming to ensure that they are as specified. Gages and dials on seaming equipment shall be checked and readings recorded.

d2.5.4 Observe that no solvents or adhesives are used.

306. CQA TESTING AND INSPECTION REQUIREMENTS FOR BALLAST INFILL MATERIAL

306.1 Initial Material Certification:

a. Prior to shipment of any materials, the CQA Contractor shall assemble, document the receipt of, and audit the material supplier's test results and certification(s) that the properties of the material(s) meet GW Specification requirements.

306.2 Testing During Construction:

a. CQA activities during placement of Ballast Infill shall include visual observations and field testing to ensure that Ballast Infill is installed in accordance with GW Specification requirements. Field observations and tests shall be performed in accordance with the requirements specified in Table 014362-7 and the following paragraphs.

b. Visual Observation of Infill Placement:

b1. Record type of equipment in use.

b2. Observe installation method(s) are consistent with the method(s) presented to the Owner by the Ballast Infill Installer during the pre-construction meeting.

b3. Observe the Ballast Infill material is worked into the synthetic turf between the synthetic yarn blades.

b4. Observe that the underlying geomembrane and synthetic turf components are not displaced or damaged.

b5. Observe that Ballast Infill material is not placed when snow and/or ice are present on the synthetic turf.

c. Laboratory and Field Tests:

c1. Laboratory and field testing shall be performed in accordance with the requirements specified in Table 014362-7.

d. Test Acceptance Criteria:

d1. Acceptance criteria shall be as specified in GW Specification Section 311522.

307. SAMPLING PATTERN

307.1 The CQA Officer shall establish a completely random sampling pattern for determining the choice of sampling points for field tests. Each block of work shall be subdivided into a sampling grid with at least 10 times as many grids as samples or tests to be taken or as directed by the Owner. The grid shall have a numeric identification system devised to distinguish each set of tests for a specific area from all other sets of tests. Each lift shall have a separate grid.

307.2 Sampling points shall be chosen by a random number generator or other acceptable method to obtain uniform coverage. Tests shall be numbered beginning with test number one (1) and no numbers shall be skipped. In areas where a test of any type fails to meet specification criteria and a retest is performed, the retest shall have the same test number as the original test except that an “R” shall follow the test designation.

308. VERIFICATION AND CALIBRATION

308.1 Verification of Selected Field Tests:

a. The following tests shall be verified at the following frequency:

Test Requiring Verification	Frequency of Verification Test
Nuclear In-Place Density and Nuclear In-Place Moisture Content, ASTM D 6938	Note 1
"Quick" Moisture Content Test Using Microwave, (ASTM D4643) or Gas Stove, Frying Pan, or Infrared Oven, (ASTM D4959), etc.	One standard oven-dry moisture content (ASTM D2216) test per 20 quick tests.
Lift Thickness Measured Using a Shaft or Shovel	One lift thickness verified by surveying every two acre-lifts.

Notes:

1 – A standard block test as required by ASTM D6938 shall be performed at the start of each day on each Nuclear apparatus that will be used that day. At the start of earthwork construction, a series of five Nuclear tests and five sand cone or rubber balloon tests shall be performed in the borrow area, or area to be excavated, on a compacted test strip to calibrate the Nuclear apparatus. During construction, one of the last Nuclear readings performed at the end of each day shall be verified using a sand cone (ASTM D1556) or rubber balloon (ASTM D2167) density and moisture content test for each apparatus used that day. The average wet density and moisture content for each apparatus shall be computed for every ten tests. If variations greater than those permitted by the ASTM's occur, corrections shall be applied to all future tests for the apparatus until the next set of 10 tests is performed.

308.2 Calibration:

a. Procedures for calibration of field and laboratory testing equipment shall be submitted by the CQA Contractor prior to the start of testing. These procedures shall meet ASTM requirements.

309. CORRECTIVE ACTION PROCEDURES

309.1 Failure of Material Quality Tests:

a. The GW Contractor and the Owner shall be notified immediately if gradation or Atterberg limits tests do not meet acceptance criteria. Failure to meet acceptance criteria of one or more of these groups of tests may indicate problems with the quality of soil materials. The GW Contractor shall cease all construction activities until the source of the problem or "out-of-specification" materials is identified.

309.2 Failure of Field Density or Moisture Content Tests:

a. If the results of field density or moisture content tests fail to meet acceptance criteria, those tests shall be re-run after recompaction. Judgment shall be used to select re-test locations suspected of having lower than specified density or moisture content. If the results of the re-test meet specification requirements, the compaction can be considered acceptable. If the results of the re-tests show out-of-specification densities or moisture contents, the CQA Officer shall immediately inform the Owner of the extent of the defective area. The defective area shall be removed and reconstructed or recompacted by the GW Contractor.

TABLE 014362-1

CQA FOR SUBGRADE (CCR)

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Proofrolling of subgrade	Observation		Continuous
2	Field Density / Soil Compaction	Nuclear Density Gauge, Sand Cone or Rubber Balloon Method	ASTM D6938, ASTM D2167, or ASTM D1556	Four per acre of compacted subgrade. Four additional tests per lift per acre of any regrading or fill. One per 500 cubic yards.
3	Field Moisture content	Nuclear Density Gauge or Direct Heat Method	ASTM D6938 or ASTM D4959	At each field density test location
4	Lift thickness, uncompacted	Direct Measurement		Four times per acre per lift
5	Moisture-density curve	Proctor or Index Density	ASTM D1557, ASTM D4253, or ASTM D4254, and ASTM D2216	One per 2 acres of compacted subgrade. One per 2 acres per lift fill and when changes in material are observed.

TABLE 014362-2

CQA FOR STRUCTURAL FILL MATERIAL

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Moisture Density Curve	Proctor	ASTM D1557, ASTM D4253, or ASTM D4254	One per 50,000 cubic yards, and for all changes in material.
2	Soil Index Properties	Atterberg Limits	ASTM D4318	One per 50,000 cubic yards, and for each moisture density curve sample.
3	Soil Index Properties	Grain Size	ASTM D422	One per 50,000 cubic yards, and for each moisture density curve sample.
4	Field Density / Soil Compaction	Nuclear Density Gauge, Sand Cone or Rubber Balloon Method	ASTM D6938, ASTM D2167, or ASTM D1556	Four per acre per lift.
5	Field Moisture content	Nuclear Density Gauge or Direct Heat Method	ASTM D6938, ASTM D4959, or ASTM D2978	At each field density test location.
6	Uncompacted and Compacted Thickness of Each Lift	Direct measurement		Four per acre per lift.
7	Fill Lines and Grades	Surveying		One per 100-foot grid spacing and at grade breaks.

TABLE 014362-3

CQA FOR AREAS TO RECEIVE GEOMEMBRANE

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Certification of Surface Elevation Prior to Geomembrane	Surveying		One per 100 ft grid and at grade breaks (toe and top of slopes).
2	Subgrade Firm and Unyielding	Observe and Document Proofroll		Continuous on Impoundment Floor
3	Slope Condition	Observe and document absence of erosion, slope failures, loose material or other non-conforming conditions on slopes		Continuous on slopes
4	Subgrade Free of Deleterious Conditions	Observe and document exposed subgrade is free from • Irregularities • Protrusions • Loose soil or soft spots • Abrupt changes in grade • Debris • Clods • Stones • Roots • Organic material • Moisture seeps, puddling, or ponding • Frozen material		Continuous

TABLE 014362-4

CQA FOR ANCHOR TRENCHES

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Trench Geometry	Measurement		1 location per 100 ft of trench
2	Trench Condition	Observe and Document • Trench free of sloughed material • Trench free from ponded water • Absence of loose material below geosynthetics		Continuous
3	Trench Backfill	Observe and document prompt backfill of trenches		Continuous
4	Field Density / Soil Compaction	Nuclear Density Gauge, Sand Cone or Rubber Balloon Method	ASTM D6938 ASTM D2167 or ASTM D1556	One per 200 ft of trench per lift

TABLE 014362-5

CQA FOR HDPE GEOMEMBRANE

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Receipt of Delivery	Observe and document: • Name of Geomembrane Manufacturer • Product identification • Date of manufacture of the geomembrane • Roll identification number • Geomembrane thickness and type • Roll dimensions (length and width) • Batch number • Order number • Panel number (where applicable)	Visual	Each Roll
2	Inspection of Rolls	Lack of uniformity	Visual	Each Roll
		Damage, Tears, Punctures	Visual	Each Roll
		Imperfections, Blisters, Excessive Folding	Visual	Each Roll
3	Geomembrane Properties	Thickness	ASTM D5994 or ASTM D5199	5 per roll of geomembrane delivered at locations evenly distributed throughout roll

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
		Density	ASTM D1505/D792	Per resin batch, but not less than once per 50,000 SF of geomembrane
		Tensile properties (strength and elongation at yield and at break)	ASTM D6693	Per resin batch, but not less than once per 50,000 SF of geomembrane
		Tear resistance	ASTM D1004	Per resin batch, but not less than once per 50,000 SF of geomembrane
		Puncture resistance	ASTM D4833	Per resin batch, but not less than once per 50,000 SF of geomembrane
		Carbon black content	ASTM D4218 ASTM D1603 is acceptable if an appropriate correlation to D4218 has been established	Per resin batch, but not less than once per 50,000 SF of geomembrane
		Carbon black dispersion	ASTM D5596	Per resin batch, but not less than once per 50,000 SF of geomembrane
4	Weather and site conditions at time of HDPE deployment and seaming	Observe and document: • Visual and weather measurements		Continuous

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
5	Panel Deployment	Observe and document: • Relaxed deployment • Damage prevention • Wrinkles minimized • Temporary anchorage • Protected from damage • Proper overlap • Seam location	Visual	Continuous
6	Trial Welds	Observe and document Construction Contractor staff performing and testing trial welds		• Prior to each seaming period. • Every 4 hours of continuous seaming. • Whenever personnel or equipment are changed. • When climatic conditions result in wide changes in geomembrane temperature. When requested by the CQA Geosynthetics Inspector(s) for any seaming crew or piece of welding equipment if problems are suspected.

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
7	Preparation for Seaming	Observe and document: • HDPE is clean • Minimum wrinkles and fish mouths • Fish mouths cut as necessary to lay flat • Firm surface for seaming	Visual	Continuous
8	Seaming	Observe and document: • Materials, • Equipment • Staff • Acceptable procedures • Weather • Pressure • Speed • Damage • Absence of solvents	Visual	Continuous
9	Non-Destructive seam tests	Observe and document: • Equipment • Methods • Pressures • Leaks marked • Repairs made • Repairs retested	Various as applicable to seam type	100 percent of seam lengths shall be tested.

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
10	Destructive Samples and Testing	Observe and document • Removal of all destructive test samples • Repair of sampled areas • Testing of repairs Label all samples	Shear strength and peel adhesion	• One test per every 500 linear feet of seam length if the seam is welded with a fusion weld. • One test per every 400 linear feet of seam length if the seam is welded with an extrusion weld. • One test for each seaming machine

TABLE 014362-6

CQA FOR SYNTHETIC TURF

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Receipt of Delivery	Observe and document: • Name of Synthetic Turf Manufacturer • Product identification • Date of manufacture of the synthetic turf • Lot number • Roll identification number	Visual	Each Roll
2	Inspection of Rolls	Lack of uniformity	Visual	Each Roll
		Damage, Tears, Punctures	Visual	Each Roll
		Imperfections, Blisters, Excessive Folding	Visual	Each Roll
3	Synthetic Turf Properties	Total Product Weight	ASTM D5261	Per 200,000 SF of synthetic turf
		CBR Puncture	ASTM D6241	Per 200,000 SF of synthetic turf
		Tensile Strength Product	ASTM D4595	Per 200,000 SF of synthetic turf
		Tensile Strength of Yarn	ASTM D2256	Per 200,000 SF of synthetic turf

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
4	Weather and Site Conditions at Time of Synthetic Turf Deployment and Seaming	Observe and document: • Visual and weather measurements		Continuous
5	Panel Deployment	Observe and document: • Geomembrane surface has been seamed, tested, and approved and is substantially free of debris and/or large scraps • Relaxed deployment • Damage prevention • Wrinkles minimized • Temporary anchorage • Protected from damage • Proper overlap • Seam location • First synthetic turf panel on a slope has the turf filaments facing upward • Turf filaments point upslope • Equipment does not damage synthetic turf or underlying geomembrane	Visual	Continuous

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
6	Trial Welds	Observe and document Geosynthetics Contractor personnel performing and testing trial welds.	Visual	• Prior to each seaming period. • Every 4 to 5 hours of continuous seaming (i.e., at the beginning of the work shift and after the lunch break). • Whenever personnel or equipment are changed. • When the welding apparatus has been turned off for longer than 30 minutes. • When climatic conditions result in wide changes in geotextile temperature. • When requested by the CQA Geosynthetics Inspector for any seaming crew or piece of welding equipment if problems are suspected.

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
7	Seaming	Observe and document: • Seaming method • Seaming materials and equipment • For sewn seams: stitching type and length • For welded seams: weather, pressure, speed, and absence of solvents • Damage and repairs	Visual	Continuous
8	Repairs	Identify areas to be patched. Document patching method and location.	Visual	Continuous

TABLE 014362-7

CQA FOR BALLAST INFILL MATERIAL

No.	Characteristic to be Monitored	Test		
		Monitoring/Testing Method	Test Method Reference	Minimum Test Frequency
1	Soil Index Properties	Grain Size	ASTM C136	One per 175 cubic yards.
2	Thickness	Direct measurement using digital caliper or Owner-approved alternate		Twenty (20) per acre.

END OF SECTION 014362

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HISTORY OF CONSTRUCTION
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2016

Geosyntec Consultants (Geosyntec) prepared this history of construction report for the East and West Ash Basins located at the Waukegan Station (Site) in Waukegan, Illinois, which is owned and operated by Midwest Generation, LLC (Midwest Generation). This history of construction report addresses the requirements of the Coal Combustion Residuals (CCR) Rule codified in the Code of Federal Regulations Title 40, Part 257, Subpart D. These regulations were published in the Federal Register on 17 April 2015 and became effective on 19 October 2015. This report identifies and addresses the specific requirements of §257.73(c) of the CCR Rule regarding preparing a history of construction report for CCR surface impoundments. Specifically, this report provides the history of construction through 17 October 2016 for the East and West Ash Basins.

This report was prepared under the direction of Ms. Jane Soule, P.E., and was reviewed in accordance with Geosyntec's internal review policy by Mr. Robert White of Geosyntec.

1. CCR Rule Requirements for History of Construction

History of construction requirements for existing CCR surface impoundments are included in the structural integrity criteria presented in §257.73 of the CCR Rule. The preamble of the CCR Rule (Page 21380) states that the history of construction for an existing CCR impoundment (in this case, the East and West Ash Basins) is required to include information only to the extent available and that only factual documentation, not anecdotal or speculative information, is to be included. Additionally, the preamble states that no new information should be generated to satisfy the requirements of §257.73(c).

2. History of Construction

2.1 Owner and Unit Identification - §257.73 (c)(1)(i)

Owner and unit identification for the East and West Ash Basins are presented in Table 1 below.

Table 1: Owner and Unit Identification

UNIT NAME	OWNER/OPERATOR	IDENTIFICATION NUMBER
East Ash Basin	Midwest Generation 804 Carnegie Center Princeton, NJ 08540	IL0002259
West Ash Basin	Midwest Generation 804 Carnegie Center Princeton, NJ 08540	IL0002259

2.2 Unit Location on USGS Map – §257.73 (c)(1)(ii)

The Site is located west of Lake Michigan in Waukegan, Illinois. Figure 1 presents the location of the East and West Ash Basins on a 7.5-minute United States Geological Survey (USGS) topographic quadrangle map.

2.3 Purpose of the CCR Units – §257.73 (c)(1)(iii)

The East and West Ash Basins serve as settling ponds for sluiced CCR and other process waters related to electrical power generation at the Site.

2.4 Name and Size of the Watershed – §257.73 (c)(1)(iv)

The East and West Ash Basins are located in the Waukegan River – Frontal Lake Michigan watershed (HUC12 040400020501), which is approximately 31,245 acres in size (USGS, 2015). However, surface water run-on to the Basins is limited to the area within the embankment crests because the basins are constructed with elevated embankments or run-on diversion berms surrounding them.

2.5 Description of Foundation– §257.73 (c)(1)(v)

The East and West Ash Basins consist of fill embankments on all sides. Because no formational materials provide lateral structural support for the embankments, the basins do not contain abutments. The area west of the West Ash Basin is at approximately the same elevation as the west embankment crest, such that there is not a downstream slope of the west embankment. A divider berm separates the two basins and acts as the west embankment for the East Ash Basin and the east embankment for the West Ash Basin. The remainder of this section addresses the foundation materials for the basins' embankments.

2.5.1 Physical Properties of Foundation Materials

Information on the physical properties of the foundation materials for the East and West Ash Basins is based on published geologic information and field investigations performed at the Site by KPRG in 2005 and 2015, Patrick Engineering in 2011, and Geosyntec in 2015. Detailed descriptions of these investigations and the regional geology at the Site are included in the Geosyntec (2016a).

The East and West Ash Basins are directly underlain by the Henry Formation which generally consists of approximately 30 feet of dense poorly graded sand with some gravel and silt and silty sand. The Henry Formation is underlain by the Wadsworth Formation which consists of very hard low plasticity clay in the vicinity of the Site.

2.5.2 Engineering Properties of Foundation

Table 2 presents engineering properties for the foundation materials at the Site developed for the safety factor assessment (Geosyntec, 2016a). These engineering properties are based on previous investigations performed at the Site, published correlations, and laboratory testing of samples collected from foundation soils during the Site investigations. Based on the observed very hard consistency of the Wadsworth Formation and its depth below the base of the embankments, the material is not considered in the safety factor assessment and engineering properties were not developed.

Table 2: Foundation Material Engineering Properties

MATERIAL	UNIT WEIGHT (PCF)	DRAINED FRICTION ANGLE (DEGREES)	EFFECTIVE COHESION (PSF)
Henry Formation	125	37	0

2.6 Description of the Materials, Methods, and Dates of Construction - §257.73 (c)(1)(vi)

The following sections describe the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the East and West Ash Basins, the method of site preparation and construction of each zone of the unit, and the approximate dates of construction of each successive stage of construction of the unit, to the extent the information is available.

Information presented in the following sections is based on available construction drawings (NUS, 1977 and 1978) and subsequent investigations at the Site. No as-built construction

drawings or construction completion reports detailing the actual materials and methods used for the construction of the basins were available for this report.

Based on the available construction drawings (NUS, 1977), dikes existed in the area of the East and West Ash Basins prior to their construction. Cross sections show areas where existing dikes were widened and raised during construction with compacted fill. Surface impoundment embankments were designed with typical crest widths ranging from 12 to 16 feet. Additional earthen structures overlay the downstream embankment slope to provide for auxiliary uses such as vehicular traffic and pipe support. These additional earthen structures are not required for structural support of the impoundment. The construction drawings indicate that compacted fill for dikes was required to be placed at 95% relative compaction and that the existing foundation areas should be stripped of unsuitable materials (NUS, 1977).

Interior slopes were designed at an inclination of 2H:1V (horizontal:vertical) and exterior slopes were designed at 2H:1V or flatter (NUS, 1977). The interior slopes and basin floor were originally lined with a geomembrane (Hypalon) liner. According to site personnel, in 2003 (East Ash Basin) and 2005 (West Ash Basin), the Hypalon liner was removed and replaced with the existing 60-mil smooth high-density polyethylene (HDPE) geomembrane liner. During this construction process, the interior slopes of the basins were flattened to 2.5H:1V (Midwest Generation, 2002). Based on 2015 aerial topography, existing exterior (or downstream) slopes range from approximately 1.4H:1V to 3H:1V or flatter (GeoTerra, 2015). Exterior slopes along the eastern and southeastern side of the East Ash Basin were flattened to 2H:1V in 2016.

2.6.1 Engineering Properties

Engineering properties used for the design and construction of the East and West Ash Basins were not available at the time of this report. However, engineering properties were estimated for use in the factor of safety assessment performed for the basins in accordance with the CCR Rule. The estimated engineering properties were based on investigations performed at the Site, published correlations, and laboratory testing of embankment materials and are presented in Geosyntec (2016a) and reproduced in Table 3. For engineering analyses, the embankments were divided into two different materials: Upper Fill located from the embankment surface to approximately 10 to 12 feet below the top of the embankment along its centerline and Lower Fill from the bottom of the Upper Fill to the foundation material.

Table 3: Embankment Fill Engineering Properties

MATERIAL	UNIT WEIGHT (PCF)	DRAINED FRICTION ANGLE (DEGREES)	EFFECTIVE COHESION (PSF)
Upper Fill	125	37	25
Lower Fill	115	32	25

2.6.2 Construction Dates

Construction dates for the East and West Ash Basin embankments, original liner system, and appurtenant structures are unknown; however, construction drawings were approved for construction in August 1977 (NUS, 1977). Replacement of the original liner systems were completed in 2003 and 2005 for the East and West Ash Basins, respectively. Modification of the eastern and southeastern slopes of the East Ash Basin was completed in September 2016.

2.7 Drawings - §257.73 (c)(1)(vii)

Available drawings relevant to the design, construction, operation, and maintenance of the East and West Ash Basin are included in Appendix A. Appendix A-1 includes construction drawings[1] (NUS, 1977 and 1978), Appendix A-2 includes a drawing from the liner replacement performed in 2003 (Midwest Generation, 2002) and Appendix A-3 includes construction drawings from the eastern and southeastern slope modifications completed in 2016 (Geosyntec, 2016b).

2.8 Instrumentation - §257.73 (c)(1)(viii)

Water level monitoring instrumentation was installed along the outboard (basin) side of the concrete weir walls within both the East and West Ash Basins in October 2016. This instrumentation includes ultrasonic level detectors with automated remote sensors that provide notification to station operators of basin water level conditions (high level, low level or no signal).

2.9 Area-Capacity Curve - §257.73 (c)(1)(ix)

Area-capacity curves for the East and West Ash Basins are included as Figure 2.

[1] The available construction drawings (NUS, 1977 and 1978) are based on a site specific vertical datum. Slope modification drawings (Geosyntec 2016) are based on the North American Vertical Datum of 1988 (NAVD88). The 1977 and 1978 construction drawings referred to the West Ash Basin as Pond I and the East Ash Basin as Pond II.

2.10 Spillway Description and Calculations - §257.73 (c)(1)(x)

The East and West Ash Basins do not contain spillways.

2.11 Construction Specifications and Provisions for Surveillance, Maintenance and Repair - §257.73 (c)(1)(xi)

Earthwork, HDPE geomembrane, and specifications from requests for proposals solicited by Midwest Generation for the liner replacement projects constructed in 2003 and 2005, for the East and West Ash Basins, respectively, are included in Appendix B-1 and B-2. Technical specifications for the 2016 slope modification project for the East Ash Basin, including specifications for earthwork and geosynthetics (Geosyntec, 2016c), are included in Appendix B-3.

As part of the 2003 and 2005 liner replacement projects, warning posts were installed at the toe of interior basin slopes above the geomembrane liner system. These posts are utilized as a visual guide to identify the toe of slope during CCR removal operations to limit potential damage to the liner system.

2.12 Record of Any Structural Instability - §257.73 (c)(1)(xii)

Midwest Generation retained Raymond Professional Group, Inc. (RPG) to prepare a Report of Engineering Study to propose repairs to instability observed in the interior embankments of the basins in January 2002 (RPG, 2002a). The recommendations included flattening the interior slopes of the basins to 2.5H:1V, which was completed during the liner replacement projects in 2003 and 2005.

Inspections of the east and south embankments for the East Ash Basin were also performed by RPG in 2002 and 2003. These inspections indicated areas of undercutting and soft soil at the downstream toe of the embankment, observations of some seepage from the embankment and localized erosion of the perimeter access road east of the East Ash Basin (RPG, 2002b and RPG, 2003). These inspections were performed before the liner replacement project for the East Ash Basin was completed. The eastern and southeastern slopes of the East Ash Basin, including the areas generally referenced in these inspections, were re-graded in 2016 (see Appendix A-2 and B-3).

Midwest Generation also retained Valdes Engineering to perform inspections of the East and West Ash Basins in 2009, 2014, and 2015. Inspection reports from these years did not document structural instability of the CCR units (Valdes, 2009, Valdes, 2014, and Valdes, 2015).

3. References

Geosyntec, 2016a. Soil Properties Calculations, Waukegan Station, October.

Geosyntec, 2016b. Plans for the Construction of: East Ash Basin Slope Modification, Waukegan Generating Station, Lake County, Illinois, July, 2016.

Geosyntec, 2016c. Technical Specification Sections 02200 and 02770 for the Construction of: East Ash Basin Slope Modification, Waukegan Generating Station, Lake County, Illinois, July, 2016.

KPRG and Associates, Inc., 2005. Geotechnical Analysis of Soil Surrounding Settling Basins/Ponds, KPRG Project No. 15805, October.

Midwest Generation, 2002. East and West Ash Pond Liner Replacement Plans, Sections, and Details, Sheet B739

NUS Corporation, 1977. Waste Water Treatment Facilities Waukegan:
Ash Pond – Location and Plot Plan, Sheet No. 5082-C-5000.
Ash Pond – Detail Plan, Sheet No. 5082-C-5006.
Ash Pond – Sections & Details, Sheet No. 5082-C-5007.

NUS Corporation, 1978. Waste Water Treatment Facilities Waukegan:
Ash Pond Sump – Plan, Sections and Details, Sheet No. 5082 C 5501
Ash Pond Sump Weir – Plan, Sections & Details, Sheet No. 5082 C 5502
Ash Pond Sump and Weir – Miscellaneous Sections and Details, Sheet No. 5082 C 5503
Ash Pond Inlet Flume & Distribution – Trough Details, Sheet No. 5082 C 5507

Patrick Engineering, 2011. Hydrogeological Assessment Report, Waukegan Generating Station, Waukegan, Illinois, Patrick Project No. 21053.070, February.

RPG, 2002a. “Report of Engineering Study on Waukegan Generating Station #16 Ash Pond Repairs,” 25 January 2002.

RPG, 2002b. “Ash Pond Berm Inspection Report,” Letter to Chris Lux, 2 May 2002.

RPG, 2003b. “Ash Pond Berm Inspection Report,” Letter to Chris Lux, 12 June 2003.

USGS, 2015. “Watershed Boundary Dataset,” accessed via The National Map, http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd, accessed 1 February 2016.

Valdes Engineering, 2009. “Ash Ponds Berm Inspection,” Letter to Chris Lux, 29 June 2009.

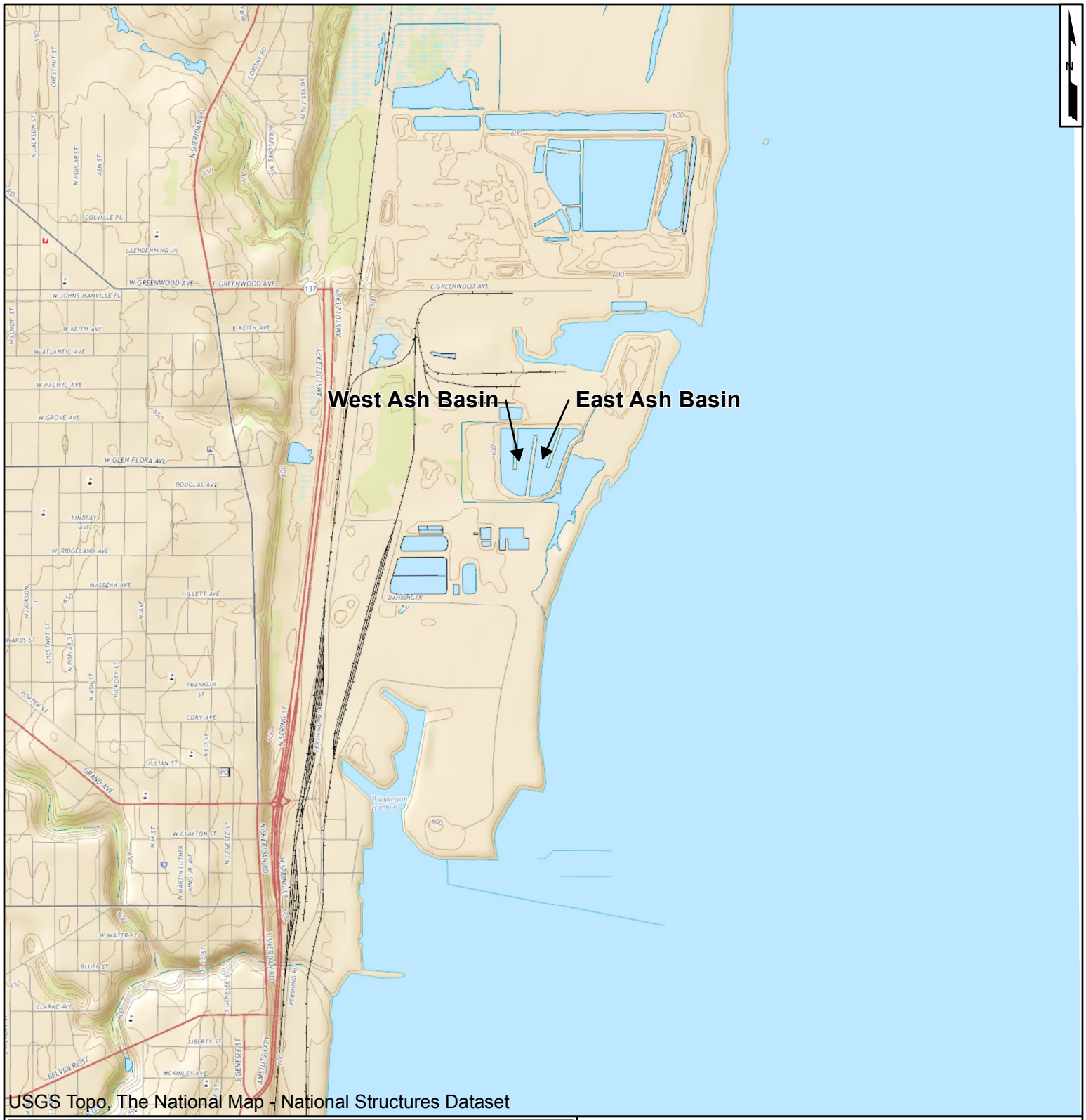
Valdes Engineering, 2014. "Ash Pond Berm Visual Assessment," Letter to Chris Lux, 12 June 2014.

Valdes Engineering, 2015. "Ash Pond Berm Visual Assessment," Letter to Chris Lux, 29 May 2015.

Attachments

Figure 1 – Site Location
Figure 2 – Area-Capacity Curves
Appendix A – Construction Drawings
- Appendix A-1 NUS Construction Drawings
- Appendix A-2 Liner Replacement Construction Drawing
- Appendix A-3 East Ash Basin Slope Modification Construction Drawings

Appendix B – Technical Specifications
- Appendix B-1 East Ash Basin Liner Replacement Specifications
- Appendix B-2 West Ash Basin Liner Replacement Specifications
- Appendix B-3 East Ash Basin Slope Modification Technical Specifications



2,000 1,000 0 2,000 Feet

Site Location

East and West Ash Basins
Waukegan Station
Waukegan, Illinois

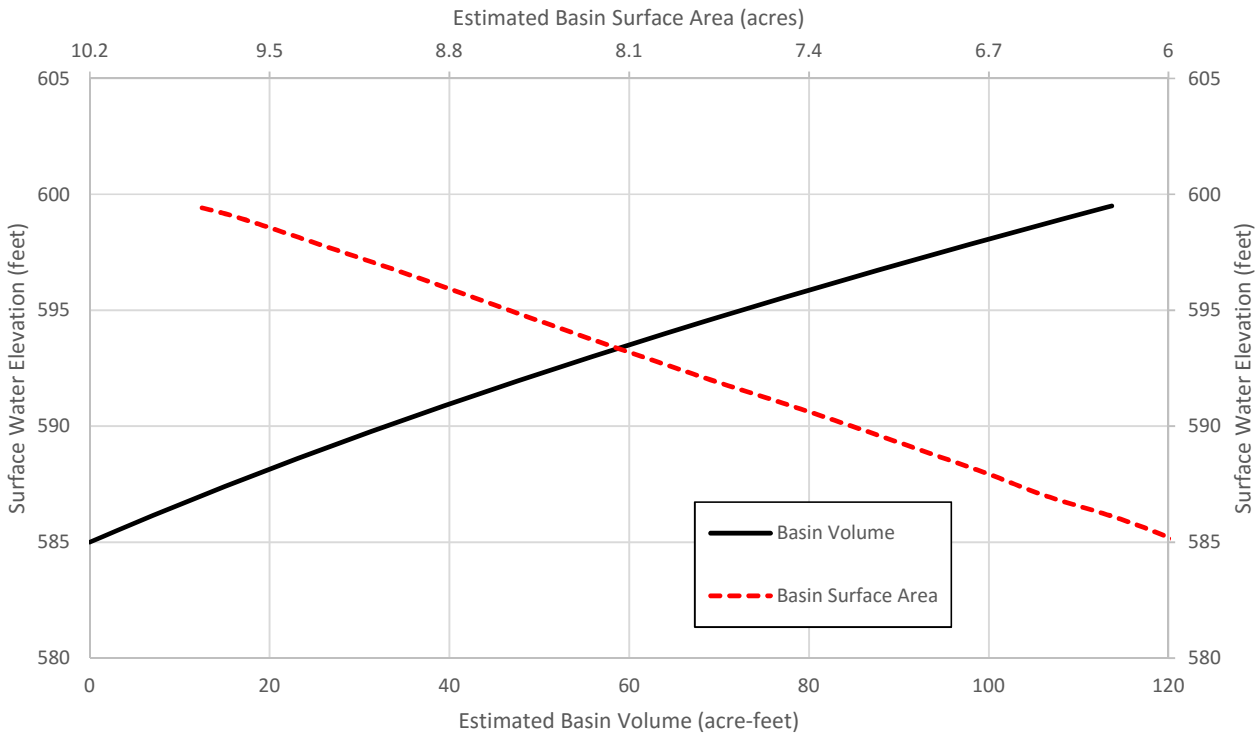
Geosyntec consultants

San Diego | October 2016

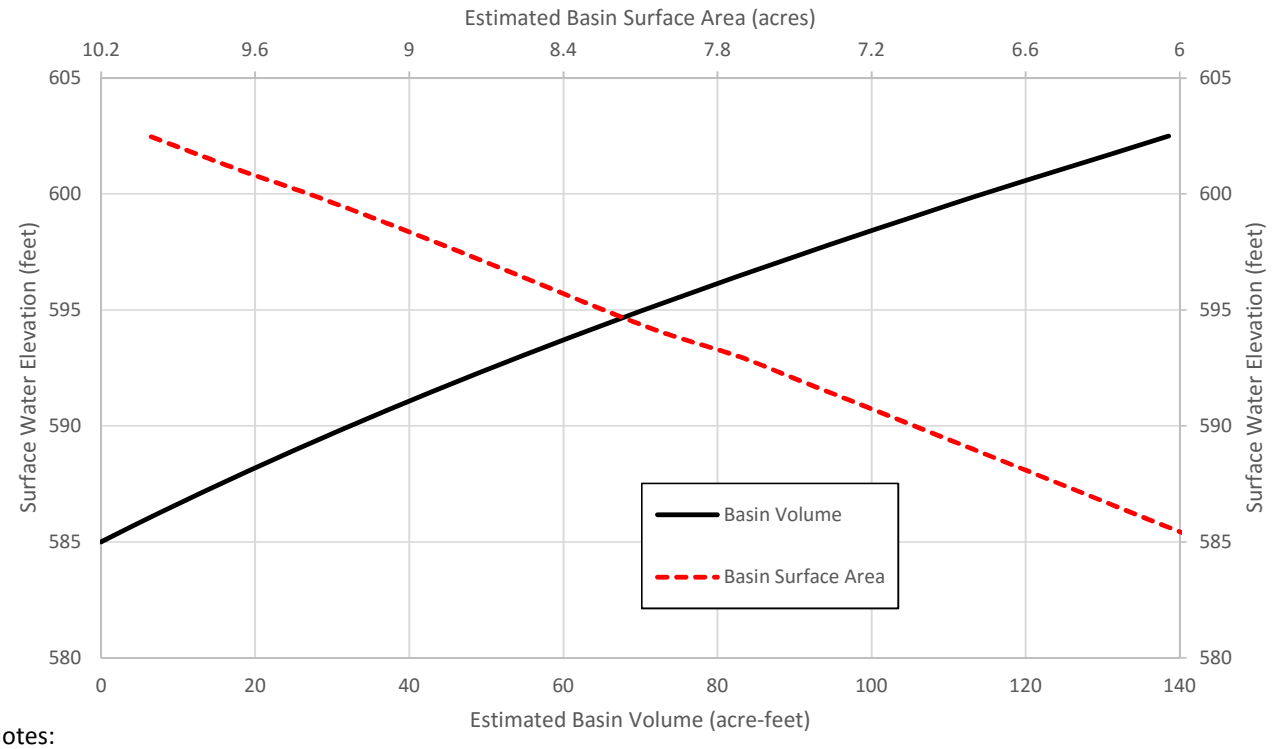
Figure 1

K:\GIS\WaukeganSiteLocation.mxd.JGordon

East Ash Basin



West Ash Basin



Notes:
(1) Surface water elevations are NAVD88.
(2) Basin volumes are estimated based on as-built information and 2015 site

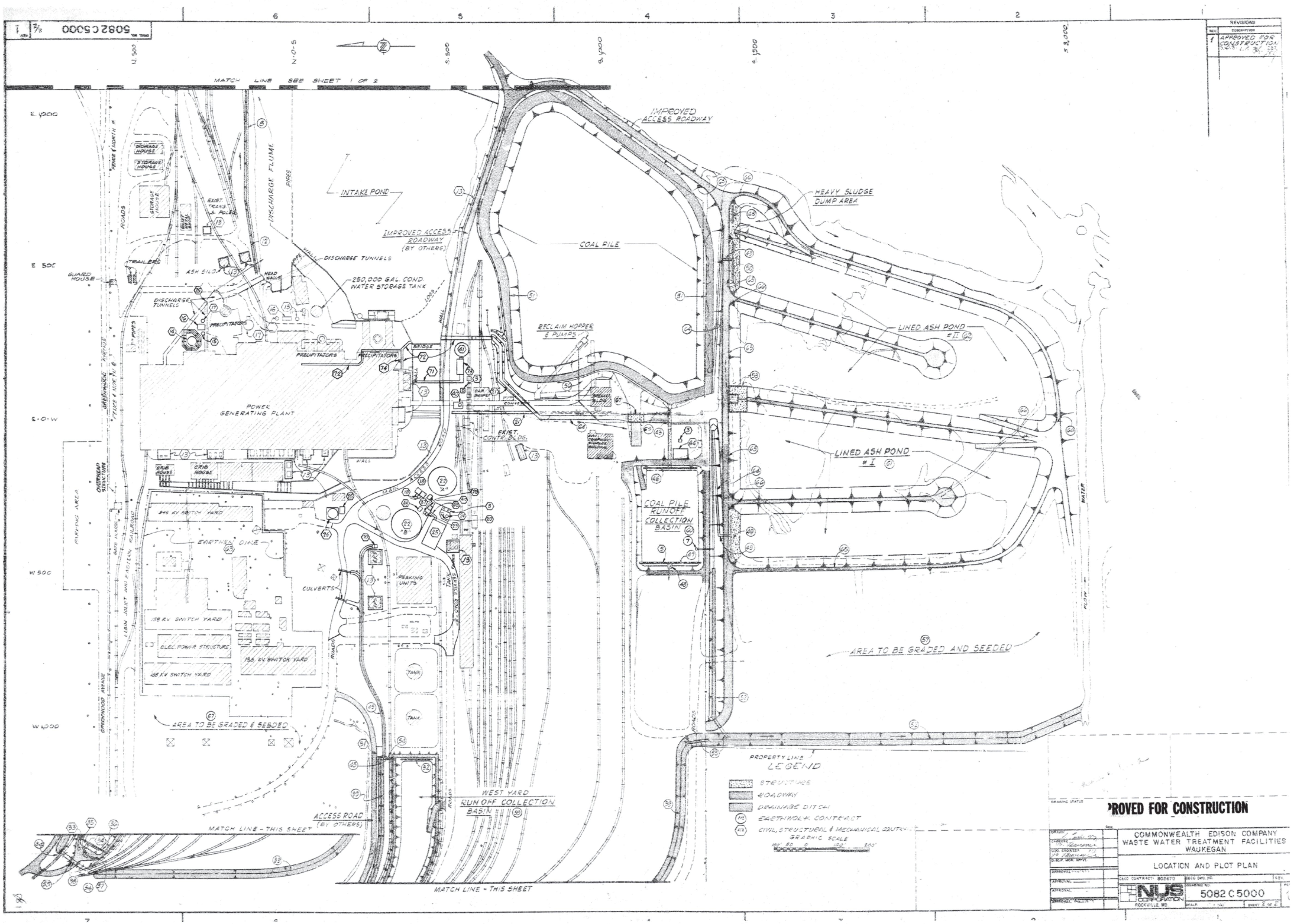
Geosyntec consultants	AREA-CAPACITY CURVES EAST AND WEST ASH BASINS WAUKEGAN STATION WAUKEGAN, ILLINOIS	**FIGURE 2**
OCTOBER 2016		
SW0251-08		

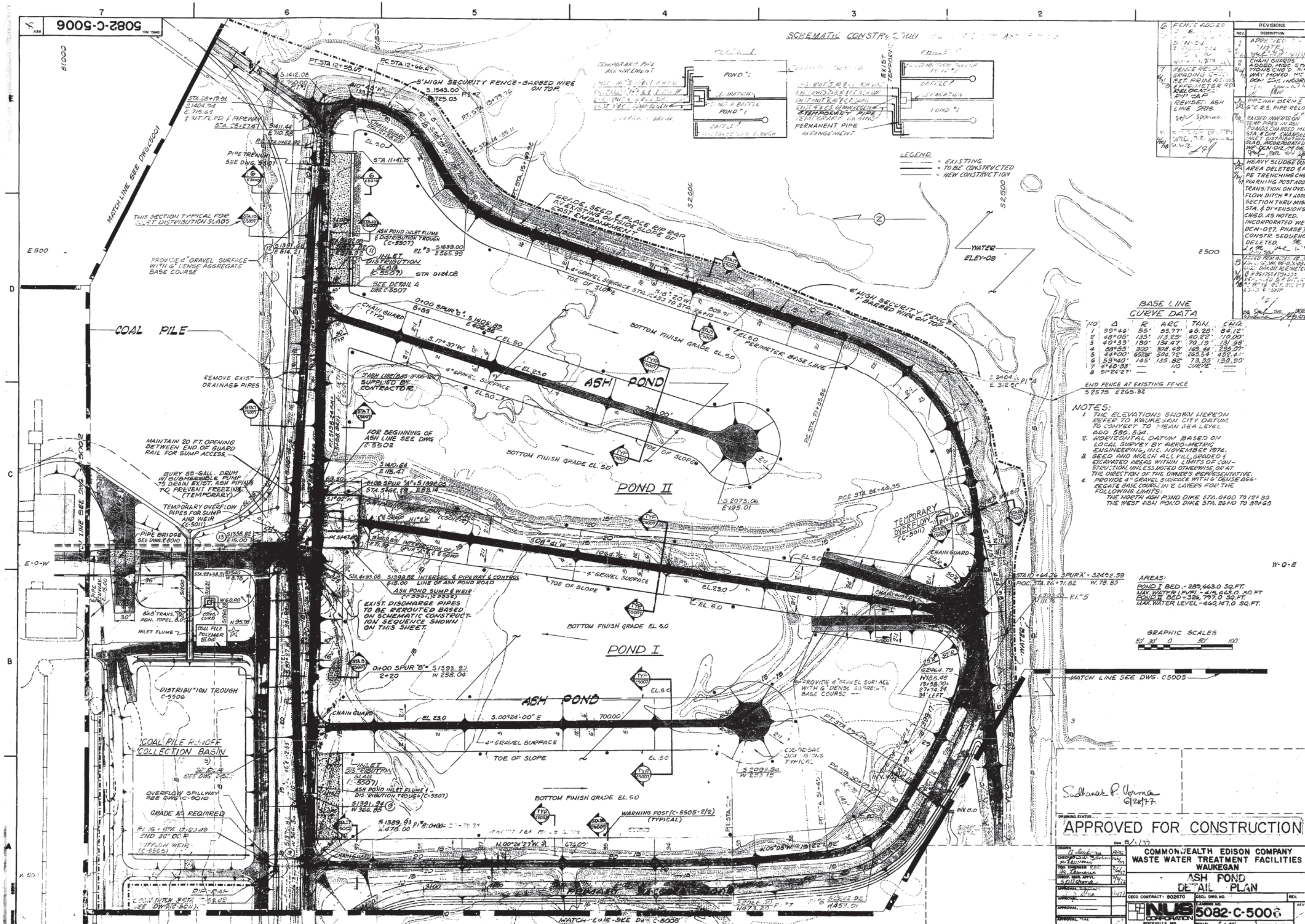
APPENDIX A

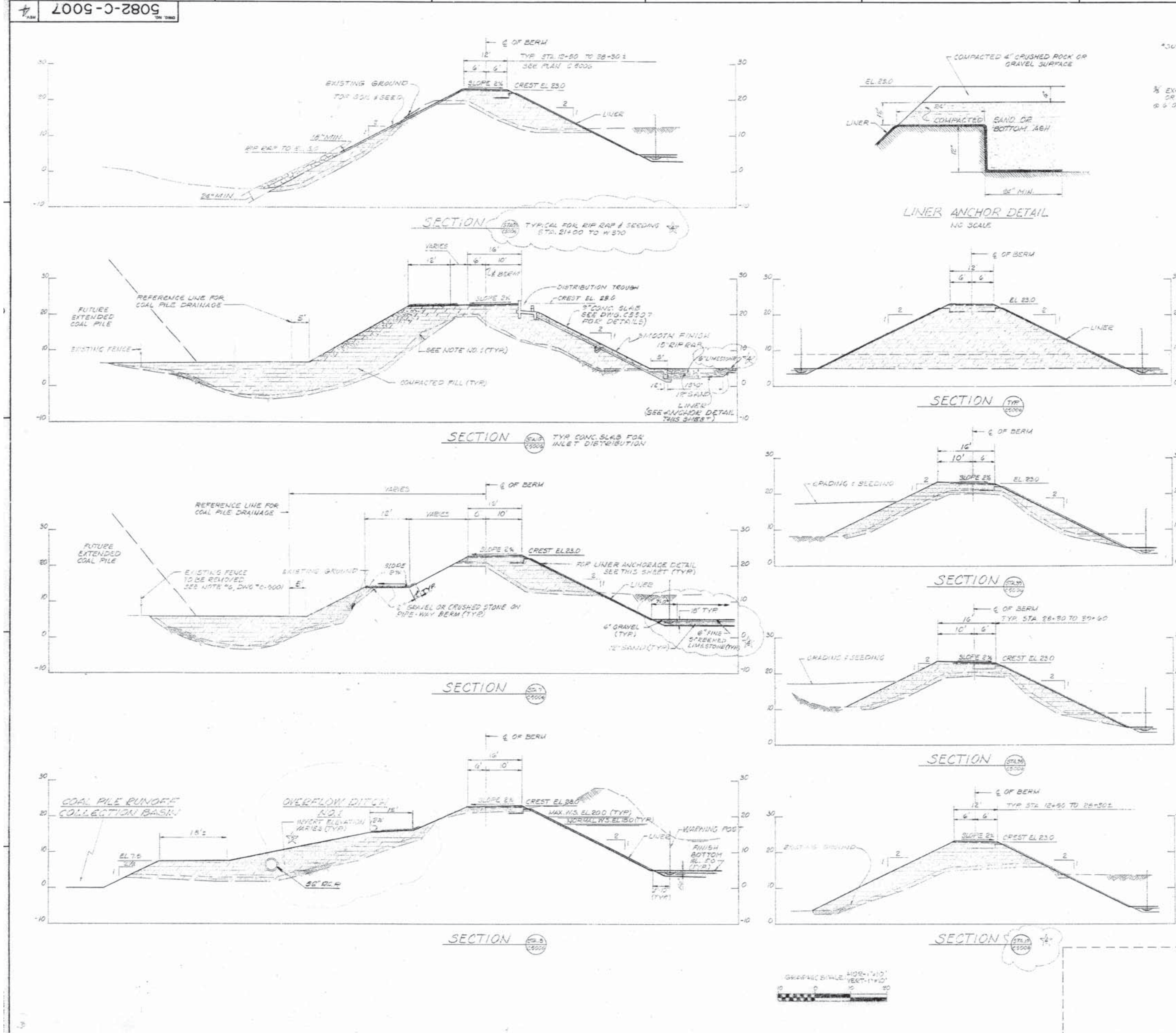
Construction Drawings

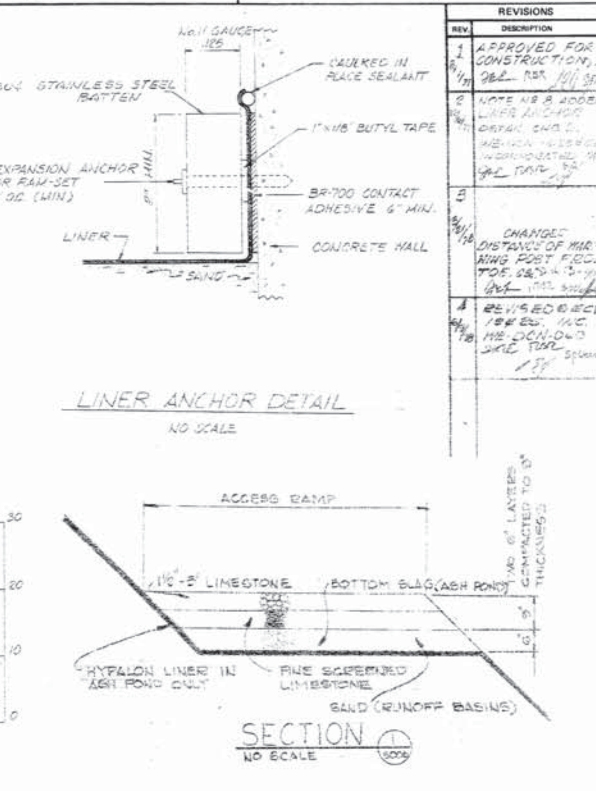
APPENDIX A-1

NUS Construction Drawings


5082 C 5000
MATCH LINE SEE SHEET 1 OF 2
IMPROVED ACCESS ROADWAY
INTAKE POND
DISCHARGE FLUME
IMPROVED ACCESS ROADWAY (BY OTHERS)
COAL PILE
HEAVY SLUDGE DUMP AREA
DISCHARGE TUNNELS
250,000 GAL. COND. WATER STORAGE TANK
GUARD HOUSE
ASH SILO
TRAILERS
STORAGE HOUSE
DISCHARGE TUNNELS
PRECIPITATORS
RECLAIM HOPPER & PUMPS
LINED ASH POND # II
BRIDGE
POWER GENERATING PLANT
EXIST. CONTR. BLDG.
LINED ASH POND # I
CRIB HOUSE
345 KV SWITCH YARD
EARTHEN DIKE
COAL PILE RUNOFF COLLECTION BASIN
CULVERTS
PEAKING UNITS
138 KV SWITCH YARD
ELEC. POWER STRUCTURE
138 KV SWITCH YARD
138 KV SWITCH YARD
AREA TO BE GRADED AND SEEDED
AREA TO BE GRADED & SEEDED
TANK
TANK
WEST YARD RUN OFF COLLECTION BASIN
ACCESS ROAD (BY OTHERS)
MATCH LINE - THIS SHEET
MATCH LINE - THIS SHEET
PROPERTY LINE
LEGEND
STRUCTURE
ROADWAY
DRAINAGE DITCH
EARTHWORK CONTRACT
CIVIL, STRUCTURAL & MECHANICAL CONTRACT
GRAPHIC SCALE
PARKING AREA
GREENWOOD AVENUE
ELGIN JOLIET AND EASTERN RAILROAD
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
LOCATION AND PLOT PLAN
NUS CORPORATION
ROCKVILLE, MD
5082 C 5000


5082-C-5006
SCHEMATIC CONSTRUCTION
TEMPORARY PIPE ARRANGEMENT
PERMANENT PIPE ARRANGEMENT
LEGEND
= EXISTING
= TO BE CONSTRUCTED
= NEW CONSTRUCTION
8' HIGH SECURITY FENCE-BARBED WIRE ON TOP
6' HIGH SECURITY FENCE 1 BARBED WIRE ON TOP
MATCH LINE SEE DWG. C5001
THIS SECTION TYPICAL FOR INLET DISTRIBUTION SLABS
PROVIDE 4" GRAVEL SURFACE WITH 6" DENSE AGGREGATE BASE COURSE
COAL PILE
REMOVE EXIST. DRAINAGE PIPES
MAINTAIN 20 FT. OPENING BETWEEN END OF GUARD RAIL FOR SUMP ACCESS.
BURY 55-GALL. DRUM W/ SUBMERSIBLE PUMP TO DRAIN EXIST. ASH PIPING TO PREVENT FREEZING (TEMPORARY)
TEMPORARY OVERFLOW PIPES FOR SUMP AND WEIR (C-5011)
PIPE BRIDGE
INLET FLUME
COAL PILE POLYMER BLDG.
COAL PILE RUNOFF COLLECTION BASIN
DISTRIBUTION TROUGH C-5506
OVERFLOW SPILLWAY SEE DWG C-5010
GRADE AS REQUIRED
ASH POND
POND II
POND I
BOTTOM FINISH GRADE EL. 5.0
PERIMETER BASE LINE
TOE OF SLOPE
4" GRAVEL SURFACE
ASH POND INLET FLUME & DISTRIBUTION TROUGH (C-5507)
INLET DISTRIBUTION SLAB (C-5507)
FOR BEGINNING OF ASH LINE SEE DWG C-5502
ASH POND SUMP & WEIR
EXIST. DISCHARGE PIPES TO BE REROUTED BASED ON SCHEMATIC CONSTRUCTION SEQUENCE SHOWN ON THIS SHEET.
WARNING POST (C-5505-2/2) (TYPICAL)
TEMPORARY OVERFLOW (C-5011)
CHAIN GUARD
WATER
MATCH LINE SEE DWG. C5005
MATCH LINE SEE DWG. C-5005
GRADE, SEED & PLACE RIP RAP ON EXISTING OUTSIDE SLOPE OF EAST EMBANKMENT
BASE LINE CURVE DATA
END FENCE AT EXISTING FENCE
NOTES:
1. THE ELEVATIONS SHOWN HEREON REFER TO WAUKEGAN CITY DATUM. TO CONVERT TO MEAN SEA LEVEL ADD 580.524.
2. HORIZONTAL DATUM BASED ON LOCAL SURVEY BY AERO-METRIC ENGINEERING, INC. NOVEMBER 1974.
3. SEED AND MULCH ALL FILL, GRADED & EXCAVATED AREAS WITHIN LIMITS OF CONSTRUCTION, UNLESS NOTED OTHERWISE, OR AT THE DIRECTION OF THE OWNER'S REPRESENTATIVE.
4. PROVIDE 4" GRAVEL SURFACE WITH 6" DENSE AGGREGATE BASE COURSE IN 2 LAYERS FOR THE FOLLOWING LIMITS:
THE NORTH ASH POND DIKE STA. 0+00 TO 12+30
THE WEST ASH POND DIKE STA. 26+10 TO 30+68
AREAS:
POND I BED - 289,663.0 SQ.FT.
MAX WATER LEVEL - 415,663.0 SQ.FT.
POND II BED - 326,797.0 SQ.FT.
MAX. WATER LEVEL - 460,147.0 SQ.FT.
GRAPHIC SCALES
REVISIONS
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND
DETAIL PLAN
NUS CORPORATION
ROCKVILLE, MD.
5082-C-5006





NOTES:

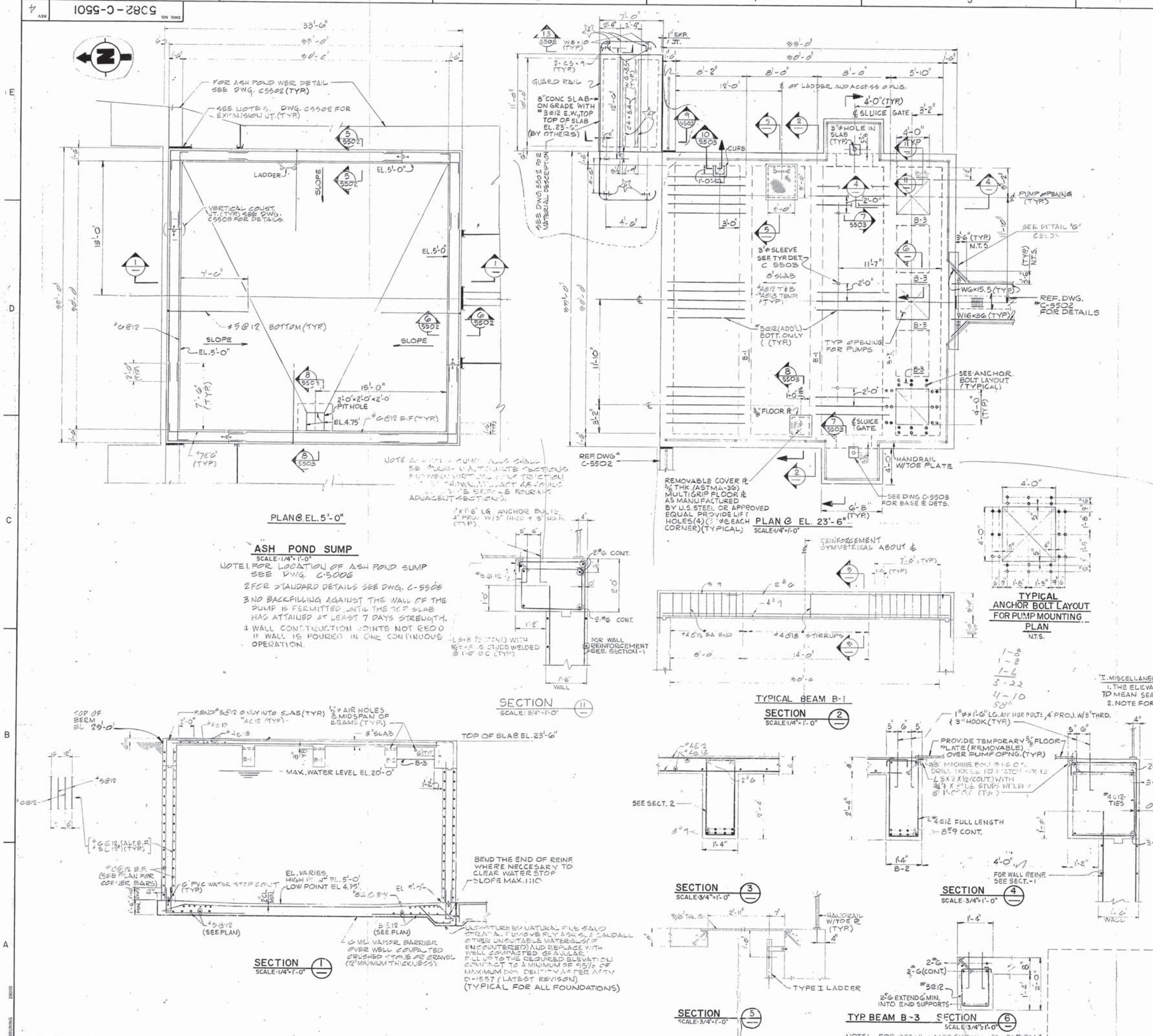
1. ALL ORGANIC MATERIAL, DEBRIS AND LOOSE BOTTOM SLAG OR FLY-ASH SHALL BE STRIPPED FROM THE EXISTING DIKE FOUNDATION AREA. THE EXPOSED FOUNDATION SOILS SHALL BE PROOF ROLLED WITH A PNEUMATIC SMALL TIRE COMPACTOR OF 10 TONS WEIGHT.
2. THE FOUNDATION MATERIAL FOR ALL NEW (INTERIOR) DIKES SHALL BE PLACED BELOW ORGANIC SOILS, DEBRIS, LOOSE FILL MATERIAL IN THE STRATUM OF NATURAL BROWN GRAY SAND.
3. ALL EARTHWORK, FILL, BACKFILL AND EXCAVATION SHALL BE DONE AS PER NUS SPECIFICATION C513. ALL FILL SHALL BE PLACED IN LIFTS NOT TO EXCEED 9 INCHES IN LOOSE THICKNESS AND COMPACTED TO A MINIMUM OF 95 % OF THE MAXIMUM DENSITY AS PER ASTM D1557-70, METHOD A.
4. DIKE CONSTRUCTION SHALL UTILIZE BOILER BOTTOM SLAG OF ACCEPTABLE FLY ASH CONTENT, TO THE EXTENT THAT MATERIAL IS READILY AVAILABLE. OTHER MATERIAL IF ANALYSED & APPROVED BY THE OWNER'S REPRESENTATIVE, WILL BE ACCEPTABLE.
5. EXISTING WET BOTTOM SLAG REMOVED FROM INTERIOR OF ASH POND AREA MAY BE DRIED AND REUSED FOR DIKE CONSTRUCTION IF FREE OF ORGANIC MATERIAL & WITH ACCEPTABLE FLY ASH CONTENT. UNSUITABLE MATERIAL, AS DETERMINED BY THE OWNER'S REPRESENTATIVE, SHALL NOT BE USED FOR DIKE CONSTRUCTION.
7. BEDDING BLANKET FOR FILTER MATERIAL AND IMPERVIOUS BASIN LINERS SHALL BE PROVIDED TO THE DEPTH, GRADE AND DIMENSIONS AS SHOWN. SAND, CRUSHED STONE OR LOCALLY AVAILABLE BOTTOM ASH CONFORMING TO NUS STANDARD SPECIFICATION C613 AND C515 MAY BE USED.
8. FILL SHALL HAVE SUFFICIENT BEARING CAPACITY FOR SUPPORTING TRAFFIC.

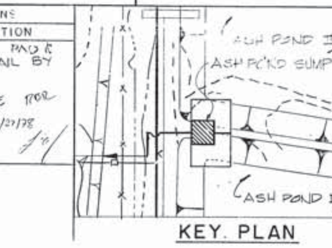
DRAWING STATUS: APPROVED FOR CONSTRUCTION

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN

ASH POND
SECTIONS & DETAILS

NUS CORPORATION, ROCKVILLE, MD.
CECO CONTRACT: 802670
DRAWING NO. 5082-C-5007





REV	DESCRIPTION
3	ADDED SECTION 11 & NOTES
	APPROVED FOR CONSTRUCTION

GENERAL NOTES

THESE NOTES SHALL BE USED AS A SUPPLEMENT TO THE NOTES SHOWN ON INDIVIDUAL DRAWINGS

I. FOUNDATION

1. THE BOTTOM OF ALL EXCAVATIONS SHALL BE INSPECTED AND APPROVED BY THE OWNER OR HIS AUTHORIZED REPRESENTATIVE
2. THE DESIGN BEARING CAPACITY OF SOIL IS ASSUMED TO BE 3000 P.S.F.
3. ALL SLABS ON GRADE INCLUDING FOUNDATION PADS FOR EQUIPMENT SHALL BE PLACED ON 6 MIL POLYETHYLENE VAPOR BARRIER PLACED OVER WELL COMPACTED CRUSHED STONE OR GRAVEL (8" MINIMUM). UNLESS OTHERWISE NOTED ON DRAWINGS.
4. ALL FOUNDATIONS SHALL BEAR UPON UNDISTURBED SOIL AND WELL PREPARED COMPACTED SOIL

II. CONCRETE

1. ALL STRUCTURAL CONCRETE SHALL BE STONE CONCRETE AND SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4000 P.S.I. AT 28 DAYS
2. ALL REINFORCING BARS SHALL BE DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO A.S.T.M. A-615 GRADE 40 AND SHALL HAVE A MINIMUM YIELD STRESS OF 40,000 P.S.I.
3. UNLESS OTHERWISE NOTED, ALL DOWELS SHALL BE SAME IN NUMBER AND SIZE AS THE VERTICAL BARS TO WHICH THEY ARE SPLICED.
4. MINIMUM CONCRETE PROTECTION FOR REINFORCING BARS SHALL BE AS INDICATED BELOW. PLACING OF ALL REINFORCING BARS SHALL CONFORM TO ACI 381-71, SECTION 7.3.

Cast-In-Place Concrete	Min. Cover, In	Cast-In-Place Concrete	Min. Cover, In
Cast against and permanently exposed to earth	3	Exposed to earth or weather: No 6 through No.18 Bars	2
Not exposed to weather or in contact with the ground:		No 5 Bars, 5/8 In. wire, and smaller	1-1/2
Slabs, walls, joists: No.14 and No.18 Bars	1-1/2	Beams, girders, columns: Principal reinforcement, ties, stirrups or spirals	1-1/2
No.11 and smaller	3/4		

5. UNLESS OTHERWISE NOTED ALL SPLICES, BENDS, STANDARD HOOKS AND OTHER DETAILING OF REINFORCING BARS SHALL BE DONE AS RECOMMENDED IN THE "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" (ACI 315 74).
6. CONTRACTOR SHALL VERIFY DIMENSIONS & LOCATIONS OF ALL OPENINGS, PIPE SLEEVES, ANCHOR BOLTS, ETC., AS REQUIRED BY OTHER TRADES BEFORE PLACING ANY CONCRETE
7. CONSTRUCTION JOINTS OF LIQUID CONTAINING STRUCTURES SHALL HAVE 6" P.V.C. CONTINUOUS WATER STOP UNLESS NOTED OTHERWISE ON THE CONTRACT DRAWINGS
8. W.W.F. SHALL CONFORM TO REQUIREMENTS OF ASTM 185

III. STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-36
2. THE DESIGN, FABRICATION AND ERECTION OF ALL STRUCTURAL STEEL SHALL BE DONE IN ACCORDANCE WITH THE AISC MANUAL OF STEEL CONSTRUCTION (SEVENTH EDITION)
3. ALL STRUCTURAL BOLTS SHALL BE 3/4" Ø HIGH STRENGTH TYPE ASTM A 325-X.
4. UNLESS OTHERWISE NOTED, ALL CONNECTIONS SHALL BE SELECTED TO SUPPORT HALF THE TOTAL UNIFORM LOAD CAPACITY SHOWN IN "TABLES FOR ALLOWABLE LOADS ON BEAMS" (AISC MANUAL OF STEEL CONSTRUCTION – SEVENTH EDITION) + 5 KIPS FOR THE SHAPE AND SPAN SHOWN ON DRAWINGS
5. ALL WELDING SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF "STRUCTURAL WELDING CODE, AWS D1.1–REV 1-73" WELDING ELECTRODES SHALL BE E70XX

IV. EARTHWORK.

1. ONE FOOT OF POROUS BACKFILL SHALL BE PLACED ALONG ALL WALLS FROM TOP OF FOUNDATION TO 1'–0" BELOW FINISHED GRADE WHERE SHOWN ON CONTRACT DRAWINGS
2. BACKFILLING SHALL NOT BE DONE UNTIL ALL CONCRETE HAS ATTAINED ITS' FULL DESIGN COMPRESSIVE STRENGTH
3. BACKFILLING SHALL BE DONE AND COMPACTED IN EQUAL LAYERS ALONG ALL SIDES OF STRUCTURE
4. CONTRACTOR SHALL ADEQUATELY PROTECT ALL WALLS DURING BACKFILLING OPERATIONS

V. MISCELLANEOUS.

1. THE ELEVATIONS SHOWN ON THESE DRAWINGS REFER TO WAUKEGAN CITY DATUM. TO CONVERT TO MEAN SEA LEVEL, ADD 580.564
2. NOTE FOR COVER SLAB, DESIGN LIVE LOAD = 200 PSF, DESIGN PUMP WT. 4K.

DRAWING STATUS

APPROVED FOR CONSTRUCTION

Date 6/28/78

DRAWN	
CHECKED	
COG ENGINEER	
DISCIP MGR APPVL.	3/4/77
APPROVAL	
APPROVAL	
APPROVAL	
APPROVAL	

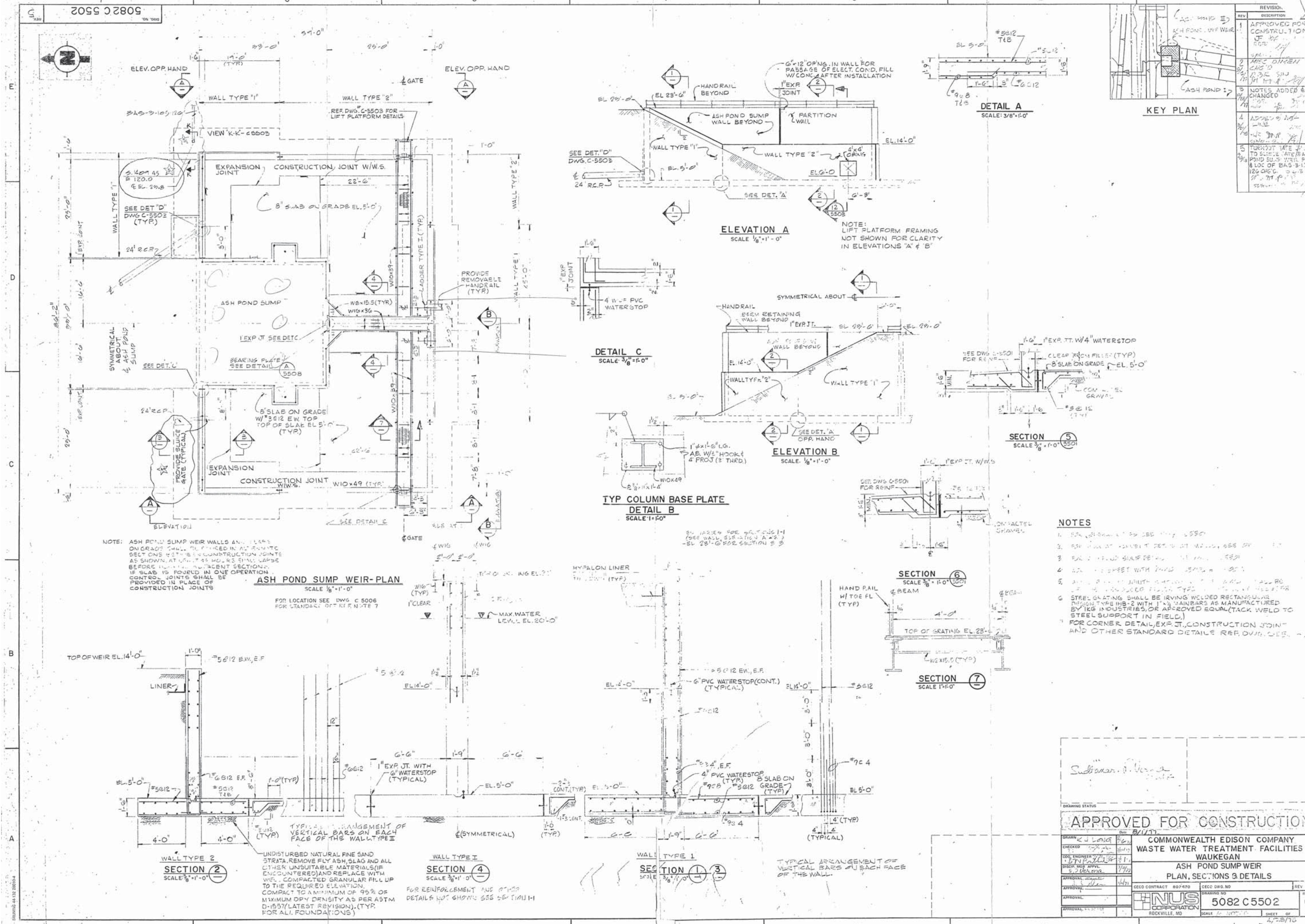
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN

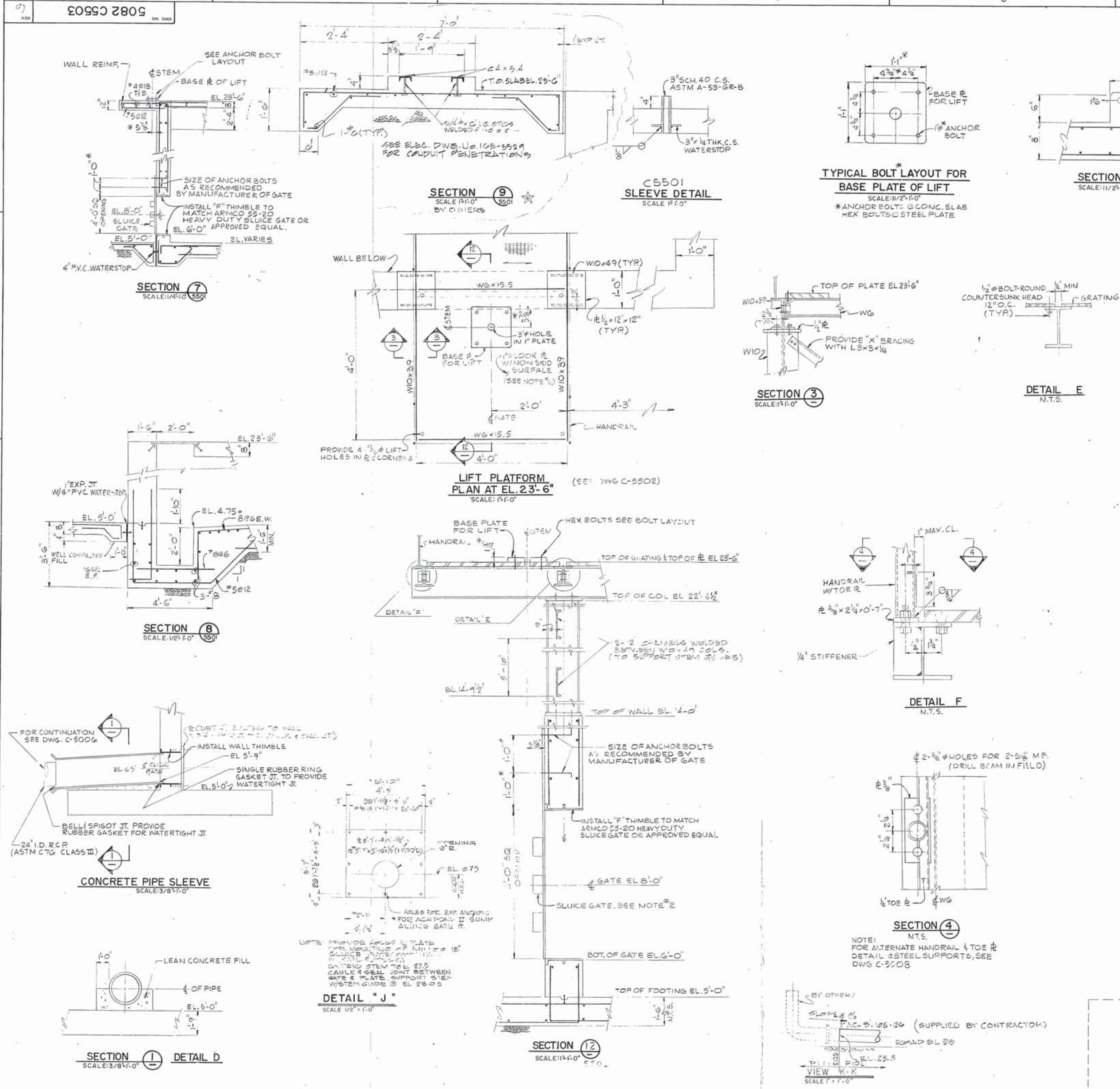
ASH POND SUMP
PLAN, SECTIONS AND DETAILS

CECO CONTRACT #02670
CECO DWG NO

NUS CORPORATION
ROCKVILLE, MD

DRAWING NO 5082 C 5501
SCALE AS NOTED
SHEET 1 OF 1


5082 C 5502
ASH POND SUMP WEIR-PLAN
SCALE 1/8"=1'-0"
FOR LOCATION SEE DWG C 5006
ELEV. OPP. HAND
WALL TYPE "1"
WALL TYPE "2"
VIEW 'K-K'-C5503
EXPANSION JOINT
CONSTRUCTION JOINT W/W.S.
8" SLAB ON GRADE EL.5'-0"
SEE DET "D" DWG C-5503 (TYP.)
ASH POND SUMP
PROVIDE REMOVABLE HANDRAIL (TYP.)
BEARING PLATE SEE DETAIL
8" SLAB ON GRADE W/ #5@12 E.W. TOP TOP OF SLAB EL 5'-0" (TYP.)
PROVIDE SLUICE GATE (TYPICAL)
SYMMETRICAL ABOUT ℄ ASH POND SUMP
NOTE: ASH POND SUMP WEIR WALLS AND SLABS ON GRADE SHALL BE PLACED IN ALTERNATE SECTIONS BETWEEN CONSTRUCTION JOINTS AS SHOWN, AT LEAST 48 HOURS SHALL LAPSE BEFORE POURING ADJACENT SECTIONS. IF SLAB IS POURED IN ONE OPERATION CONTROL JOINTS SHALL BE PROVIDED IN PLACE OF CONSTRUCTION JOINTS
ELEVATION A
SCALE 1/8"=1'-0"
HAND RAIL BEYOND
ASH POND SUMP WALL BEYOND
PARTITION WALL
6"x12" OP'NG. IN WALL FOR PASSAGE OF ELECT. COND. FILL W/ CONC. AFTER INSTALLATION
NOTE: LIFT PLATFORM FRAMING NOT SHOWN FOR CLARITY IN ELEVATIONS "A" & "B"
DETAIL A
SCALE: 3/8"=1'-0"
KEY PLAN
DETAIL C
SCALE 3/8"=1'-0"
4" WIDE PVC WATERSTOP
ELEVATION B
SCALE 1/8"=1'-0"
TYP COLUMN BASE PLATE
DETAIL B
SCALE 1"=1'-0"
SECTION 5
SCALE 3/8"=1'-0"
SECTION 6
SCALE 3/8"=1'-0"
SECTION 7
SCALE 1"=1'-0"
HYPALON LINER
MAX. WATER LEVEL EL. 20'-0"
TOP OF WEIR EL. 14'-0"
WALL TYPE 2
SECTION 2
SCALE 3/8"=1'-0"
WALL TYPE I
SECTION 4
SCALE 3/8"=1'-0"
WALL TYPE 1
SECTION 1 3
TYPICAL ARRANGEMENT OF VERTICAL BARS ON EACH FACE OF THE WALL TYPE II
UNDISTURBED NATURAL FINE SAND STRATA. REMOVE FLY ASH, SLAG AND ALL OTHER UNSUITABLE MATERIALS (IF ENCOUNTERED) AND REPLACE WITH WELL COMPACTED GRANULAR FILL UP TO THE REQUIRED ELEVATION. COMPACT TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY AS PER ASTM D-1557 (LATEST REVISION). (TYP. FOR ALL FOUNDATIONS)
FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN SEE SECTION 1-1
TYPICAL ARRANGEMENT OF VERTICAL BARS ON EACH FACE OF THE WALL.
NOTES
6. STEEL GRATING SHALL BE IRVING WELDED RECTANGULAR DESIGN TYPE IHB-2 WITH 1"x3/16 MAINBARS AS MANUFACTURED BY IKG INDUSTRIES, OR APPROVED EQUAL (TACK WELD TO STEEL SUPPORT IN FIELD.)
7. FOR CORNER DETAIL, EXP. JT., CONSTRUCTION JOINT AND OTHER STANDARD DETAILS REF. DWG.
REVISIONS
1 APPROVED FOR CONSTRUCTION
2 MISC. DIMEN. CHG'D
3 NOTES ADDED & CHANGED
5 TURNOUT GATE ... TO SLUICE GATE, ASH POND SUMP WEIR ... & LOC OF BAS-3-135
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND SUMP WEIR
PLAN, SECTIONS & DETAILS
CECO CONTRACT 807-670
NUS CORPORATION ROCKVILLE, MD
5082 C5502



NOTES:

1. THE CONTRACTOR SHALL FURNISH AND INSTALL SLUICE GATES & LIFTS IN THE LOCATION SHOWN ON DWG. C-5501 AND CONFORMING TO THE FOLLOWING. C-5502

   SLUICE GATE

   TYPE 55-20 HEAVY DUTY WITH FLATBACK FRAME, RISING STEM (2" SST) STANDARD BOTTOM AND ADJUSTABLE WEDGES (TOP, BOTTOM & SIDES) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

   LIFT

   MODEL CPE-12 (CRANK OPERATED) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL

2. INSTALLATION OF THE GATE & LIFT SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION.
3. INSTALLATION OF WALL THIMBLE SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION.
4. DIMENSIONS MARKED THUS * SHALL BE COORDINATED WITH THE GATE MANUFACTURER.
5. FOR GENERAL NOTES, SEE DWG # C5501.
6. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF PLATE WITH THE LIFT GATE SUPPLIER.
7. THE CONTRACTOR SHALL [illegible] INSTALL SLUICE [illegible] THE LOCATIONS SHOWN ON [illegible] & CONFORMING [illegible]

   SLUICE GATE: MODEL 20-10C WITH FLATBACK FRAME, RISING STEM (1/8 SST) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

   LIFT: TYPE 41-14 (HAND OPERATED) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

8. 18" DIA. SLUICE GATE IS TO BE SUPPLIED WITH AN EPOXY COATING OF [illegible] BITUMASTIC 300-M OR AN APPROVED EQUAL, SHOP APPLIED AT [illegible] MANUFACTURER'S INSTRUCTIONS.

DRAWING STATUS: APPROVED FOR CONSTRUCTION

DRAWN	FUHR
CHECKED	
COG ENGINEER	
DISCIP MGR APPVL	
APPROVAL	

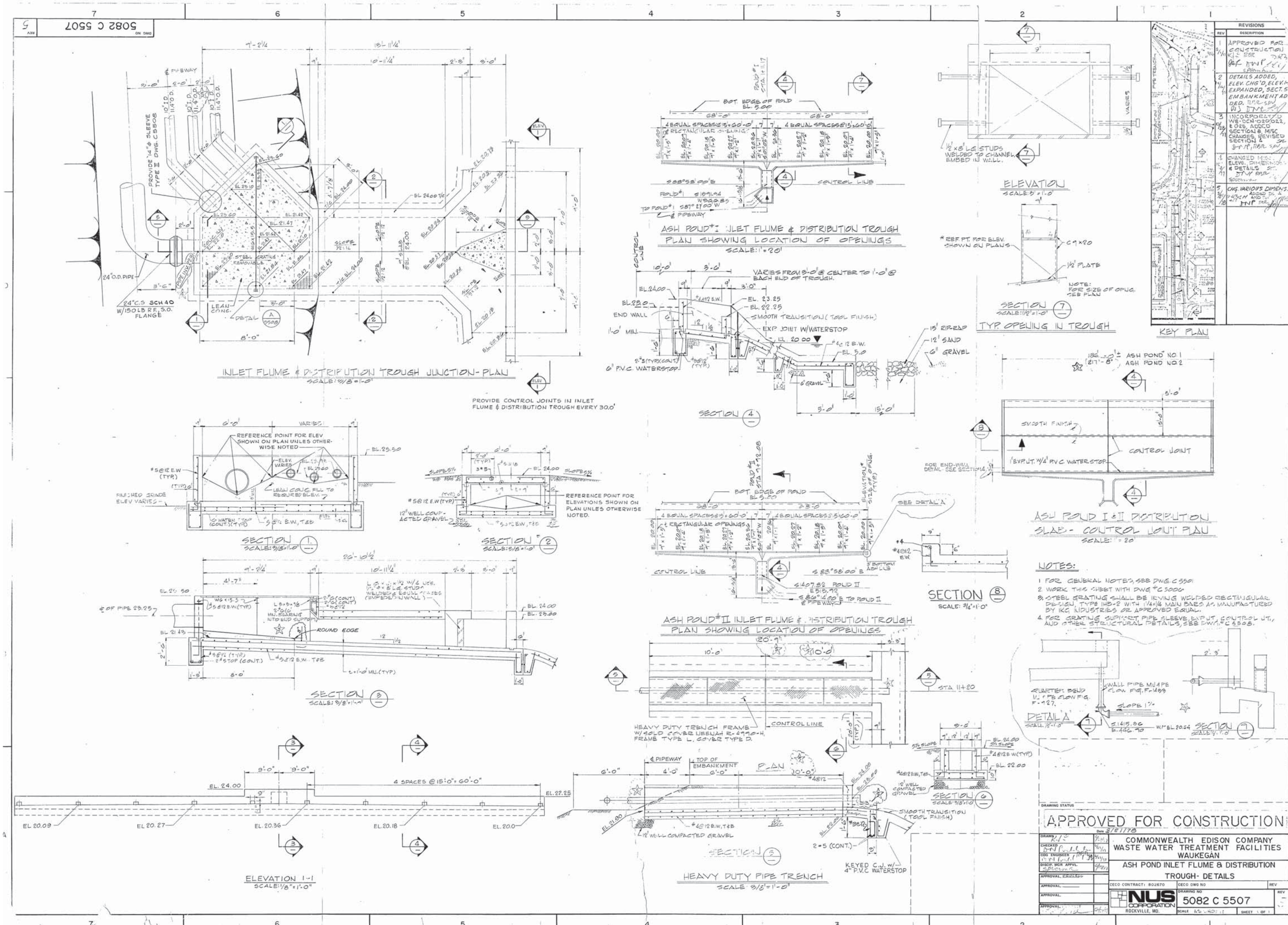
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN

ASH POND SUMP AND WEIR
MISCELLANEOUS SECTIONS AND DETAILS

NUS CORPORATION, ROCKVILLE, MD

DRAWING NO 5082C5503

SCALE AS NOTED — SHEET 1 OF 1

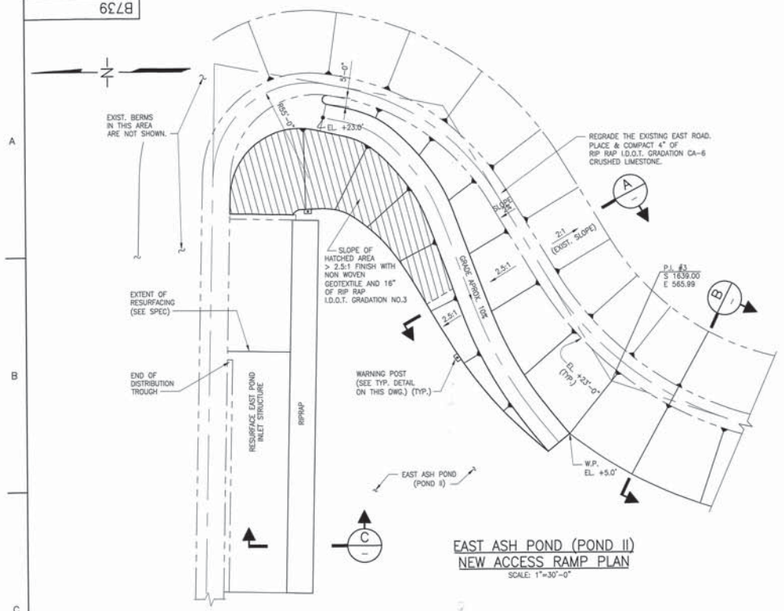


INLET FLUME & DISTRIBUTION TROUGH JUNCTION - PLAN
SCALE: 3/8"=1'-0"
PROVIDE CONTROL JOINTS IN INLET FLUME & DISTRIBUTION TROUGH EVERY 30.0'
ASH POND #I INLET FLUME & DISTRIBUTION TROUGH PLAN SHOWING LOCATION OF OPENINGS
SCALE: 1"=20'
SECTION 4
ELEVATION
SCALE: 3/4"=1'-0"
SECTION 7
TYP. OPENING IN TROUGH
KEY PLAN
REVISIONS
1 APPROVED FOR CONSTRUCTION
2 DETAILS ADDED, ELEV. CHG'D, ELEV.H EXPANDED, SECT. 5 EMBANKMENT ADDED.
3 INCORPORATED WE-DCN-020/022, 026, ADDED SECTION 8, MISC CHANGES, REVISED SECTION 3
4 CHANGED MISC. ELEVS., DIMENSIONS & DETAILS
5 CHG. VARIOUS DIMENS. ADDED DL 4
ASH POND I & II DISTRIBUTION SLAB - CONTROL JOINT PLAN
SCALE: 1"=20'
SECTION 1
SCALE: 3/8"=1'-0"
SECTION 2
SCALE: 3/8"=1'-0"
ASH POND #II INLET FLUME & DISTRIBUTION TROUGH PLAN SHOWING LOCATION OF OPENINGS
SECTION 8
SCALE: 3/4"=1'-0"
NOTES:
1. FOR GENERAL NOTES, SEE DWG. C 5501
2. WORK THIS SHEET WITH DWG #C 5000
3. STEEL GRATING SHALL BE IRVING WELDED RECTANGULAR DESIGN, TYPE IHB-2 WITH 1 1/4x1/4 MAIN BARS AS MANUFACTURED BY IKG INDUSTRIES OR APPROVED EQUAL.
4. FOR GRATING SUPPORT, PIPE SLEEVE, EXP. JT, CONTROL JT., AND OTHER STRUCTURAL DETAILS, SEE DWG. C 5508.
SECTION 3
SCALE: 3/8"=1'-0"
PLAN
DETAIL A
SECTION 9
SECTION 6
SCALE: 3/8"=1'-0"
ELEVATION 1-1
SCALE: 1/8"=1'-0"
SECTION 5
HEAVY DUTY PIPE TRENCH
SCALE: 3/8"=1'-0"
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND INLET FLUME & DISTRIBUTION TROUGH - DETAILS
CECO CONTRACT: 802670
NUS CORPORATION
ROCKVILLE, MD.
5082 C 5507

APPENDIX A-2

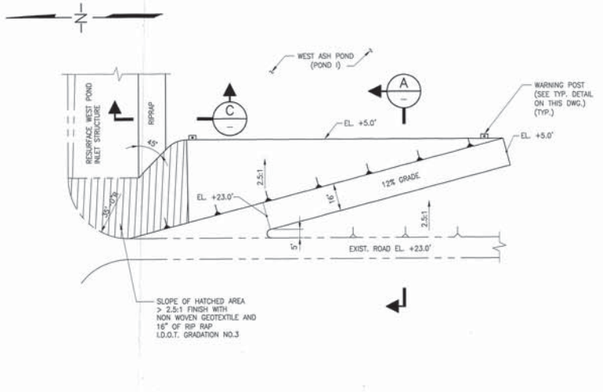
Liner Replacement Construction Drawing

B739



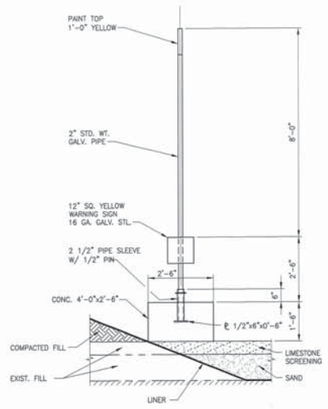
EAST ASH POND (POND II) NEW ACCESS RAMP PLAN

SCALE: 1"=30'-0"



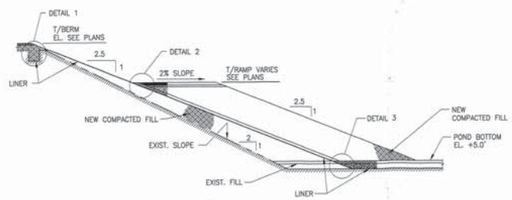
WEST ASH POND NEW ACCESS RAMP PLAN

SCALE: 1"=30'-0"



TYP. WARNING POST DETAIL

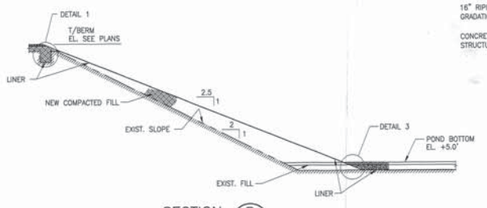
SCALE: 1/2"=1'-0"
(50 REQUIRED)



SECTION A

SCALE: 1"=10'-0"

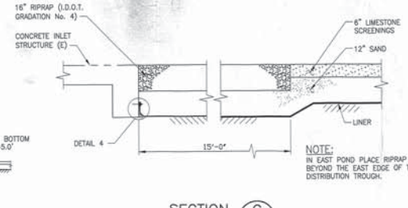
(TYPICAL SECTION THROUGH NEW RAMP)



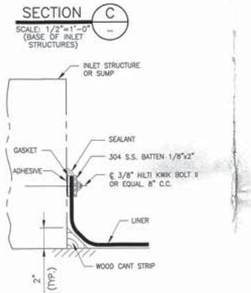
SECTION B

SCALE: 1"=10'-0"

(TYPICAL SECTION THROUGH BERM)

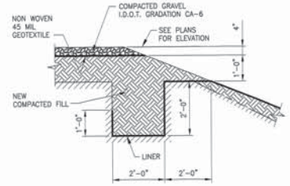


NOTE:
IN EAST POND PLACE RIPRAP ONLY TEN FEET BEYOND THE EAST EDGE OF THE CONCRETE DISTRIBUTION TROUGH.



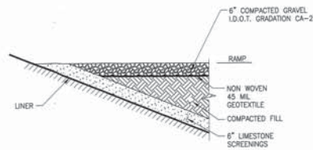
SECTION C

SCALE: 1/2"=1'-0"
(BASE OF INLET STRUCTURES)



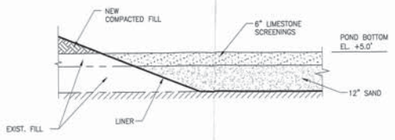
DETAIL 1

SCALE: 1/2"=1'-0"
(LINER ANCHOR)



DETAIL 2

SCALE: 1/2"=1'-0"
(RAMP CONSTRUCTION)



DETAIL 3

SCALE: 1/2"=1'-0"
(POND BOTTOM)

DETAIL 4

N.T.S.
(LINER ANCHOR DETAIL AT CONCRETE STRUCTURES)

REFERENCE DRAWINGS

5082 C-5006	WASTE WATER TREATMENT FACILITIES ASH POND DETAIL PLAN
5082 C-5007	WASTE WATER TREATMENT FACILITIES ASH POND SECTIONS AND DETAILS
5082 C-5507	ASH POND INLET FLUME AND DISTRIBUTION TROUGH

BY:	REV	DATE	REVISION	BY	CKD	ENG/APPD
BY:						
BY:						
BY: RAYMOND PROFESSIONAL GROUP	A	7/12/02	ISSUED FOR BIDS	IH	MS	MS / MR
BY: (FIRM MAKING REVISIONS)						

EAST AND WEST ASH POND LINER REPLACEMENT PLANS, SECTIONS AND DETAILS

STATION 16 — WAUKEGAN

MIDWEST GENERATION
An EDISON INTERNATIONAL® Company

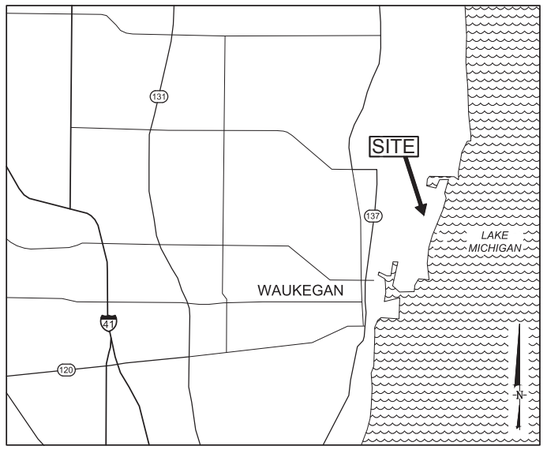
SCALE	AS NOTED
DATE	05/31/02
	B739

(SEAL)

B739.DWG IH 05/31/02

APPENDIX A-3

East Ash Basin Slope Modification Construction Drawings



VICINITY MAP

NOT TO SCALE

PLANS FOR THE CONSTRUCTION OF:

EAST ASH BASIN SLOPE MODIFICATION

JULY 2016

WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

PREPARED FOR:

MIDWEST GENERATION, LLC

PREPARED BY:

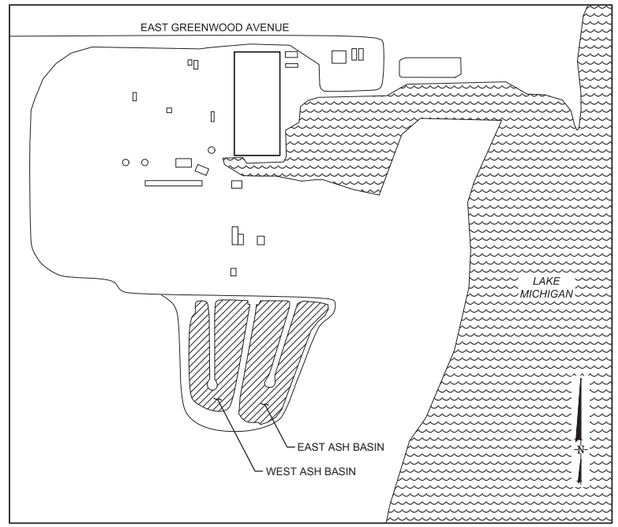
Geosyntec Consultants

3990 OLD TOWN AVENUE, SUITE A–101

SAN DIEGO, CALIFORNIA 92110

(619) 810–4000

www.geosyntec.com



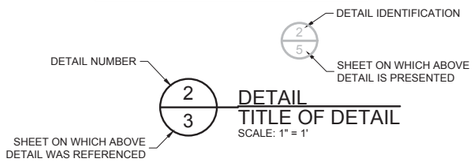
SITE LOCATION MAP

NOT TO SCALE

DRAWING INDEX

DRAWING NO.	DRAWING TITLE	FILE NAME
1	TITLE INDEX AND LEGEND	SW0251-11-01
2	SITE PLAN	SW0251-11-02
3	GRADING PLAN	SW0251-11-03
4	CROSS SECTIONS	SW0251-11-04
5	DETAILS	SW0251-11-05
6	SWPPP	SW0251-11-06
7	SURVEY CONTROL POINTS	SW0251-11-07

DETAIL IDENTIFICATION LEGEND

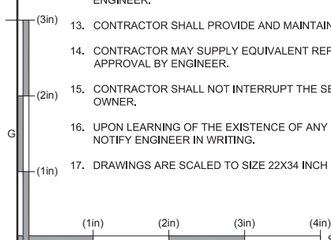


EXAMPLE: DETAIL NUMBER 2 PRESENTED ON SHEET NO. 5 WAS REFERENCED ON SHEET NO. 3.

NOTE: ABOVE REFERENCING SYSTEM ALSO APPLIES TO SECTION IDENTIFICATIONS.

GENERAL NOTES

1. THE WORK UNDERTAKEN BY THIS DOCUMENT IS FOR MIDWEST GENERATION, LLC, HEREAFTER REFERRED TO AS OWNER. GEOSYNTEC CONSULTANTS, HEREAFTER REFERRED TO AS ENGINEER, PERFORMED DESIGN.
2. THE PLANS AND OTHER DOCUMENTS SHALL GOVERN THE WORK AND SHALL BE CONSIDERED COMPLIMENTARY. ANYTHING FOUND IN THE PLANS AND NOT IN ANOTHER DOCUMENT OR FOUND IN ANOTHER DOCUMENT AND NOT IN THE PLANS SHALL BE CONSIDERED TO BE IN BOTH.
3. CONTRACTOR SHALL, UPON DISCOVERING ANY ERROR OR OMISSION IN THE PLANS, IMMEDIATELY BRING IT TO THE ATTENTION OF ENGINEER.
4. CONSTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF PUBLIC AND PRIVATE PROPERTY ADJACENT TO THE WORK, AND EXERCISE DUE CAUTION TO AVOID DAMAGE TO SUCH PROPERTY. CONTRACTOR SHALL NOT PERFORM ANY WORK OR DISTURBANCE OUTSIDE OF THE WORK ZONE AND APPROVED SITE ACCESS ROUTES WITHOUT PREAPPROVAL BY THE OWNER.
5. THROUGHOUT ALL PHASES OF CONSTRUCTION, INCLUDING SUSPENSION OF WORK, AND UNTIL FINAL ACCEPTANCE OF THE PROJECT, CONTRACTOR SHALL KEEP THE WORK SITE CLEAN AND FREE FROM RUBBISH AND DEBRIS.
6. THE WORK SHALL BE CONDUCTED TO MINIMIZE DISTURBANCE TO ONGOING PLANT OPERATIONS. WORK THAT IMPACTS PLANT OPERATIONS SHALL BE COORDINATED THROUGH THE OWNER.
7. CONTRACTOR SHALL KEEP A COPY OF THE PLANS AND OTHER DOCUMENTS AT THE WORK SITE, TO WHICH THE OWNER SHALL HAVE ACCESS UPON REQUEST.
8. CONTRACTOR SHALL ASCERTAIN THE EXISTENCE OF ANY CONDITIONS AFFECTING THE COST OF THE WORK WHICH WOULD HAVE BEEN DISCLOSED BY REASONABLE EXAMINATION OF THE SITE.
9. EXISTING IMPROVEMENT VISIBLE AT THE JOB SITE, FOR WHICH NO SPECIFIC DISPOSITION IS MADE ON THE PLANS, BUT WHICH COULD REASONABLY BE ASSUMED TO INTERFERE WITH SATISFACTORY COMPLETION OF THE WORK, SHALL BE BROUGHT TO THE ATTENTION OF OWNER.
10. ALL MATERIALS, PARTS, AND EQUIPMENT FURNISHED BY CONTRACTOR SHALL BE NEW, HIGH GRADE, AND FREE OF DEFECTS. QUALITY OF WORK SHALL BE IN ACCORDANCE WITH GENERALLY ACCEPTED STANDARDS. MATERIALS AND WORK QUALITY SHALL BE SUBJECT TO APPROVAL BY ENGINEER.
11. DEFECTIVE WORK OR MATERIAL SHALL BE REMOVED IMMEDIATELY FROM THE SITE BY CONTRACTOR, AT CONTRACTOR'S EXPENSE, WHEN SO DIRECTED.
12. SOIL AND ROCK MATERIALS, REQURIED FOR THE WORK, SHALL BE STOCKPILED AT LOCATIONS DESIGNATED BY THE OWNER AND APPROVED BY ENGINEER.
13. CONTRACTOR SHALL PROVIDE AND MAINTAIN FACILITIES TO PROTECT ALL WORK AND EQUIPMENT WHETHER IN PLACE OR NOT.
14. CONTRACTOR MAY SUPPLY EQUIVALENT REPLACEMENTS FOR ANY MATERIALS REQUIRED FOR COMPLETION FO THE WORK, SUBJECT TO APPROVAL BY ENGINEER.
15. CONTRACTOR SHALL NOT INTERRUPT THE SERVICE FUNCTION OR DISTURB THE SUPPORT OF ANY UTILITY WITHOUT AUTHORIZATION FROM OWNER.
16. UPON LEARNING OF THE EXISTENCE OF ANY UTILITY OMITTED FROM OR SHOWN INCORRECTLY ON THE PLANS, CONTRACTOR SHALL IMMEDIATELY NOTIFY ENGINEER IN WRITING.
17. DRAWINGS ARE SCALED TO SIZE 22X34 INCH SHEETS. REPRODUCTION OF SHEETS MAY DISTORT DRAWINGS AND SCALE.



SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

LEGEND

- PROOF ROLLED SUBGRADE
- SELECT FILL
- EXISTING GRADE
- AGGREGATE BASE
- GEOTEXTILE
- GEOMEMBRANE
- 125 — PROPOSED GRADE POINT

GENERAL LINES

- 600 — PROPOSED GRADING CONTOUR (10')
- PROPOSED GRADING CONTOUR (2')
- 600 — EXISTING GRADE CONTOUR (10')
- EXISTING GRADE CONTOUR (2')
- LIMITS OF PROPOSED GRADING
- FLOW LINE

ABBREVIATIONS

AC	ASPHALT CONCRETE	L	LENGTH
APPROX.	APPROXIMATE	LF	LINEAL FEET
C	CENTER LINE	MH	MANHOLE
CF	CUBIC FOOT	MIN.	MINIMUM
DIA.	DIAMETER	N	NORTHING
DIM.	DIMENSION	NTS	NOT TO SCALE
E	EASTING	NO.	NUMBER
EL.	ELEVATION	OC	ON CENTER
EW	EACH WAY	oz.	OUNCE
FG	FINISH GRADE	OD	OUTSIDE DIAMETER
F	FLOW LINE	R	RADIUS
GALV.	GALVANIZED	SCH.	SCHEDULE
HDPE	HIGH DENSITY POLYETHYLENE	STD.	STANDARD
INV.	INVERT	TYP.	TYPICAL

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants

3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: TITLE, INDEX, AND LEGEND

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE

7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-01
REVIEWED BY:	JS	DRAWING NO.:	1 OF 7
APPROVED BY:	JS		

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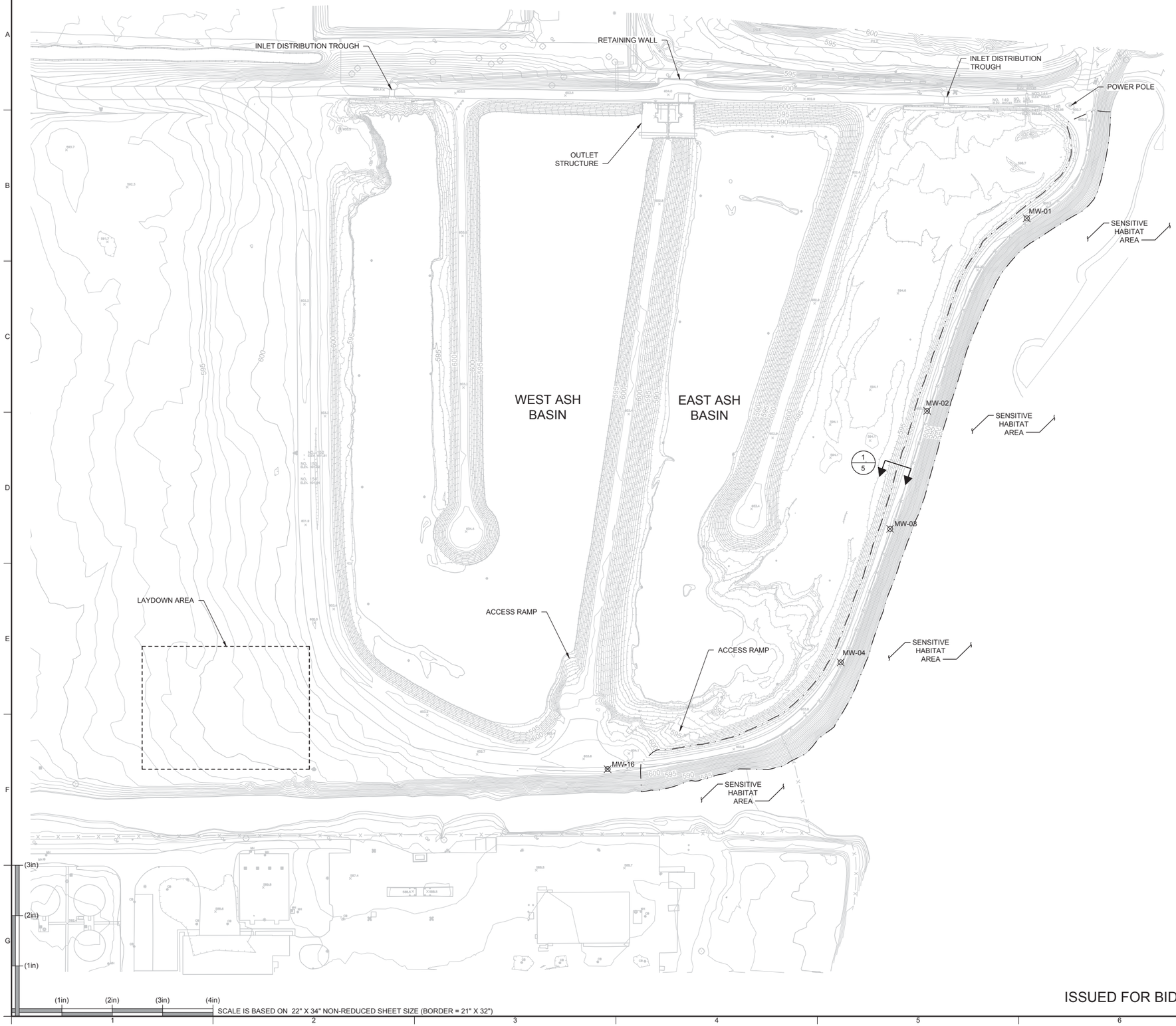

LEGEND

- EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- EXISTING FENCE
- MW-01 MONITORING WELL
- LIMITS OF GRADING

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. BASINS ARE CURRENTLY LINED WITH A SMOOTH HDPE GEOMEMBRANE ANCHORED NEAR THE INTERIOR CREST OF THE EMBANKMENT.
4. EXISTING TOPOGRAPHY ABOVE APPROXIMATE ELEVATION OF 587 FT REPRESENTS APPROXIMATE CCR DEPOSITS WITHIN EASTERN ASH BASIN.
5. SENSITIVE HABITAT IS PRESENT AT THE DOWNSTREAM TOE OF THE EASTERN AND SOUTHERN EMBANKMENTS.

N

0 80' 160'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SITE PLAN

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE

7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-02
REVIEWED BY:	JS	DRAWING NO.:	2 OF 7
APPROVED BY:	JS		

ISSUED FOR BID

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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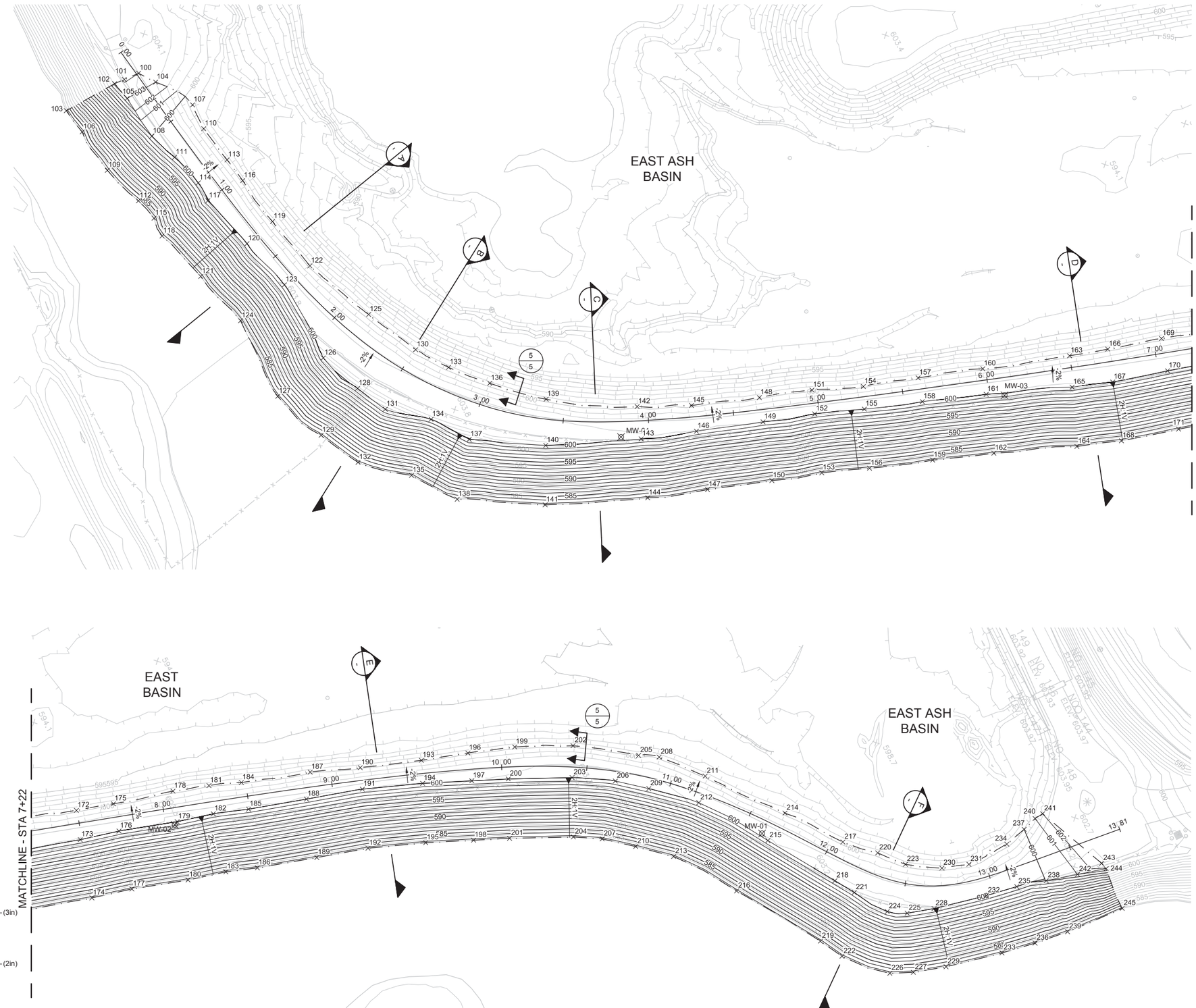

LEGEND

- EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- EXISTING FENCE
- PROPOSED GRADE MAJOR CONTOUR (10')
- PROPOSED GRADE MINOR CONTOUR (2')
- LIMITS OF GRADING
- MW-01 MONITORING WELL
- CROSS SECTION LOCATION
- 125 SURVEY CONTROL POINT

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. CONTRACTOR SHALL REMOVE EXISTING FENCE AND GATES WITHIN WORK AREA AND PROPERLY DISPOSE OF OFFSITE.
4. CONTRACTOR SHALL INSTALL AND MAINTAIN 4-FT HIGH ORANGE BARRIER FENCING AT THE TOE OF THE SLOPE DURING THE DURATION OF THE WORK.
5. GRADING ELEVATIONS AT CREST OF EMBANKMENT REPRESENT TOP OF ROAD SURFACING LAYER.

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: GRADING PLAN

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE
7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-03
REVIEWED BY:	JS	DRAWING NO.:	3 OF 7
APPROVED BY:	JS		

ISSUED FOR BID

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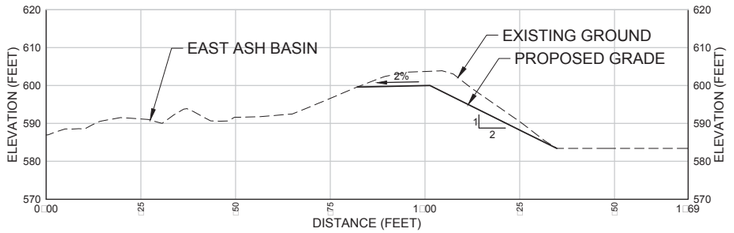
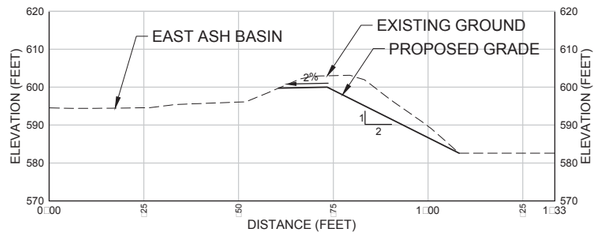
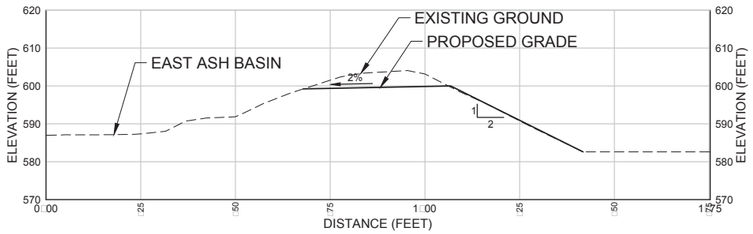


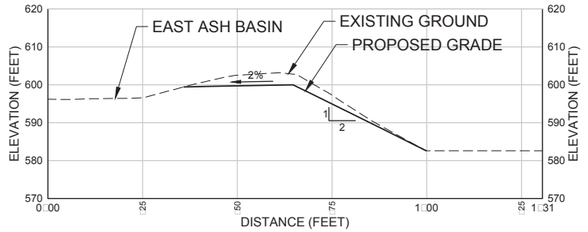
SECTION A
(STA. 1+49)



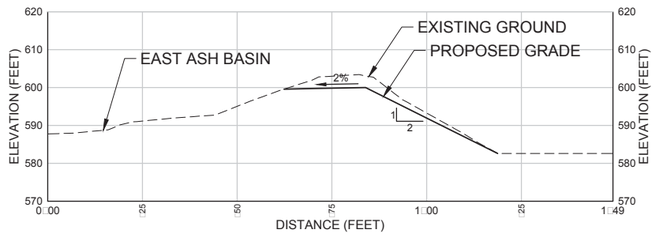
SECTION E
(STA. 9+29)



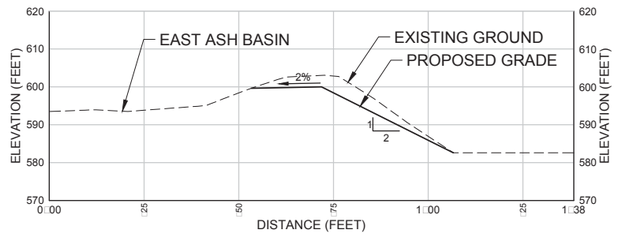
SECTION B
(STA. 2+50)



SECTION F
(STA. 12+35)



SECTION C
(STA. 3+70)



SECTION D
(STA. 6+58)

LEGEND

EXISTING GROUND

PROPOSED GRADE

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. FOR SECTION LOCATIONS, SEE SHT 3.

0 20' 40'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: CROSS SECTIONS

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE

7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-04
REVIEWED BY:	JS	DRAWING NO.:	4 OF 7
APPROVED BY:	JS		

ISSUED FOR BID

(3in) (2in) (1in)
(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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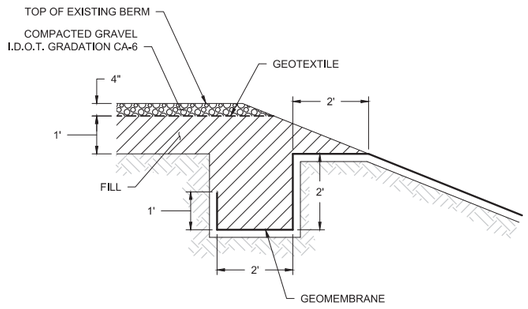
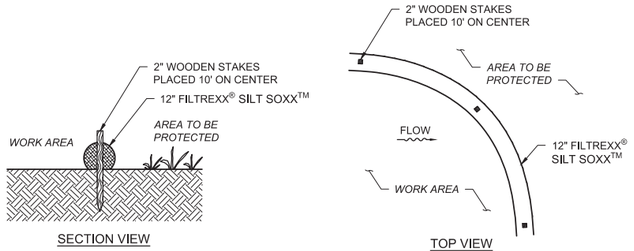
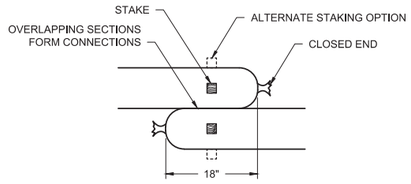


1/2 DETAIL
EXISTING ANCHOR TRENCH
SCALE: NTS

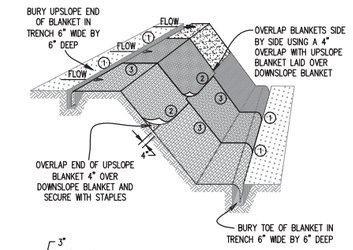


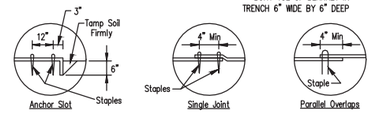


COMPOST SOCK CONNECTION/ATTACHMENT DETAIL

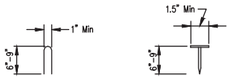
NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. SILT SOXX™ FILL TO MEET APPLICATION REQUIREMENTS.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

2/6 DETAIL
COMPOST SOCK
SCALE: NTS





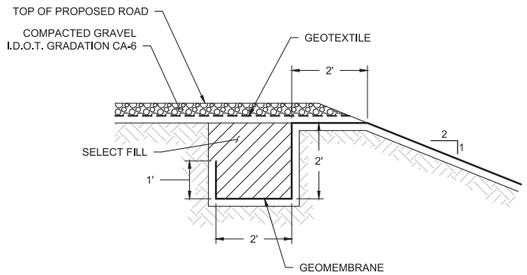
DETAIL 1 DETAIL 2 DETAIL 3



STAPLE DETAIL PUSH PIN DETAIL

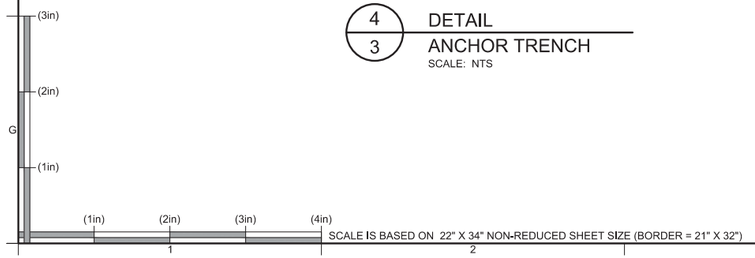
NOTES:
1. Staples shall be placed in a diamond pattern at 2 per s.y. for stitched blankets. Non-stitched shall use 4 staples per s.y. of material. This equates to 200 staples with stitched blanket and 400 staples with non-stitched blanket per 100 s.y. of material.
2. Staple or push pin lengths shall be selected based on soil type and conditions. (minimum staple length is 6").
3. Erosion control material shall be placed in contact with the soil over a prepared seedbed.
4. All anchor slots shall be stapled at approximately 12" intervals.
5. Erosion Control Blanket shall be BioNet™ SC150BN® Erosion Control Blanket or approved equivalent. Blanket must be made of 100% biodegradable materials (i.e. no plastic netting).
6. Anchor trench shall be be 2' from top of slope.

3/6 DETAIL
EROSION CONTROL BLANKET
INSTALLATION
SCALE: NTS



NOTES:
1. Grading shown on Sheet 3 represents the top of the road surfacing layer.
2. Geotextile shall be Propex 200ST or equivalent.

4/3 DETAIL
ANCHOR TRENCH
SCALE: NTS



SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: DETAILS

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-05
REVIEWED BY:	JS	DRAWING NO.:	5 OF 7
APPROVED BY:	JS		

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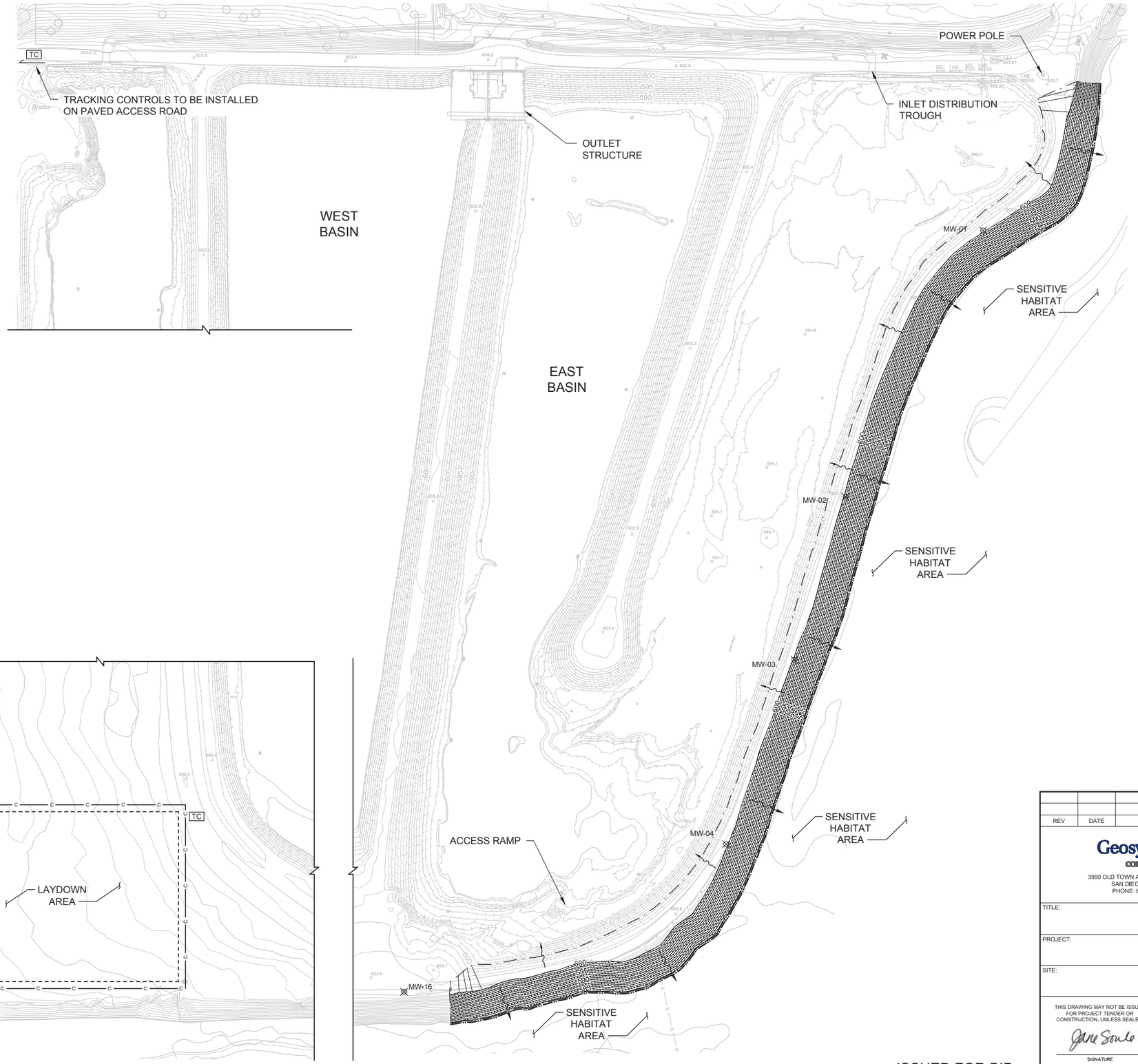

LEGEND

- EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- PROPOSED GRADE MAJOR CONTOUR (10')
- PROPOSED GRADE MINOR CONTOUR (2')
- LIMITS OF GRADING
- MW-01 MONITORING WELL
- FLOW DIRECTION
- C COMPOST SOCK (2/5)
- HABITAT SENSITIVE AREA BOUNDARY (NOTE 3)
- STABILIZATION (SEE NOTE 6) (3/5)
- TC TRACKING CONTROLS (SEE NOTE 7)

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. EARTH DISTURBING ACTIVITIES ARE PROHIBITED OUTSIDE OF THE LIMITS OF DISTURBANCE.
4. DOWNGRADIENT PROTECTIVE MEASURES MUST BE IN PLACE PRIOR TO EARTH DISTURBANCES.
5. CONSTRUCTION SHOULD BE SEQUENCED SUCH THAT EXPOSED AREAS ARE LIMITED TO WHAT CAN BE STABILIZED PRIOR TO FORECAST RAIN.
6. STABILIZATION MEASURE MUST BE IMPLEMENTED WITHIN 1 WORKING DAY OF CESSATION OF EARTH DISTURBING ACTIVITIES, FOR PORTIONS OF THE SITE THAT HAVE REACHED FINAL GRADE OR WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED, AND COMPLETED WITHIN 14 DAYS.
7. STREET SWEEPING SHALL BE IMPLEMENTED AS NEEDED AT THE NEAREST PAVED SURFACE, APPROXIMATELY 1300-FT FROM CONSTRUCTION ACTIVITY.
8. CONTRACTOR SHALL COMPLY WITH REQUIREMENTS OF 'STORMWATER POLLUTION PREVENTION PLAN, EAST ASH BASIN SLOPE MODIFICATION' BY GEOSYNTEC, JULY 2016.

N

0 60' 120'
SCALE IN FEET

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SWPPP

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE
7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-06
REVIEWED BY:	JS	DRAWING NO.:	6 OF 7
APPROVED BY:	JS		

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SURVEY CONTROL POINTS

PT NO.	NORTHING	EASTING	ELEV
100	2080081.36	1124398.00	604.00
101	2080072.25	1124397.50	604.19
102	2080066.08	1124397.19	603.33
103	2080033.65	1124398.72	583.40
104	2080087.98	1124407.11	603.00
105	2080068.79	1124408.21	603.00
106	2080036.43	1124414.03	583.40
107	2080101.42	1124428.72	599.40
108	2080071.84	1124434.52	600.00
109	2080039.57	1124440.76	583.40
110	2080101.02	1124444.16	599.52
111	2080078.27	1124451.51	600.00
112	2080047.90	1124464.91	583.40
113	2080105.13	1124466.59	599.57
114	2080083.99	1124471.13	600.00
115	2080051.53	1124478.09	583.40
116	2080107.88	1124481.58	599.55
117	2080084.37	1124483.01	600.00
118	2080051.09	1124489.55	583.40
119	2080112.86	1124510.84	599.60
120	2080093.64	1124515.78	600.00
121	2080060.84	1124520.90	583.40
122	2080120.84	1124543.90	599.63
123	2080102.49	1124547.18	600.00
124	2080070.12	1124554.54	583.40
125	2080138.95	1124584.79	599.31
126	2080103.78	1124595.75	600.00
127	2080069.83	1124603.94	582.60
128	2080113.78	1124620.67	600.00
129	2080082.40	1124635.73	582.60
130	2080154.39	1124615.57	599.23
131	2080122.89	1124638.85	600.00
132	2080094.66	1124659.61	582.60
133	2080167.03	1124633.47	599.36
134	2080144.24	1124656.14	600.00
135	2080119.32	1124680.43	582.60
136	2080184.50	1124652.60	599.33
137	2080159.01	1124676.65	600.00
138	2080137.02	1124704.92	582.60
139	2080209.88	1124675.70	599.46
140	2080197.56	1124699.83	600.00
141	2080181.73	1124730.88	582.60
142	2080255.71	1124703.37	599.62
143	2080249.34	1124721.36	600.00
144	2080237.38	1124754.04	582.60
145	2080284.53	1124717.03	599.69
146	2080280.35	1124731.84	600.00
147	2080270.89	1124765.33	582.60
148	2080322.19	1124730.64	599.71
149	2080317.74	1124744.37	600.00
150	2080307.02	1124777.48	582.60
151	2080351.75	1124740.47	599.72
152	2080346.98	1124753.72	600.00
153	2080335.21	1124786.47	582.60

PT NO.	NORTHING	EASTING	ELEV
154	2080379.65	1124752.08	599.74
155	2080374.25	1124764.16	600.00
156	2080361.52	1124796.55	582.60
157	2080410.64	1124761.84	599.72
158	2080406.61	1124775.44	600.00
159	2080396.74	1124808.81	582.60
160	2080446.96	1124773.99	599.70
161	2080442.02	1124788.33	600.00
162	2080430.67	1124821.23	582.60
163	2080495.87	1124789.90	599.63
164	2080476.01	1124839.43	582.60
165	2080488.99	1124807.05	600.00
166	2080517.66	1124796.42	599.61
167	2080511.62	1124814.96	600.00
168	2080500.83	1124848.07	582.60
169	2080548.62	1124804.88	599.61
170	2080543.36	1124823.44	600.00
171	2080533.87	1124856.92	582.60
172	2080591.08	1124819.10	599.65
173	2080585.43	1124835.48	600.00
174	2080576.30	1124869.06	582.60
175	2080612.22	1124825.36	599.67
176	2080608.01	1124841.09	600.00
177	2080599.61	1124874.87	582.60
178	2080646.78	1124834.29	599.64
179	2080640.97	1124851.38	600.00
180	2080631.45	1124884.87	582.60
181	2080667.10	1124840.80	599.67
182	2080662.01	1124856.75	600.00
183	2080653.40	1124890.47	582.60
184	2080684.90	1124847.68	599.68
185	2080681.74	1124863.52	600.00
186	2080671.00	1124896.63	582.60
187	2080723.78	1124860.22	599.70
188	2080714.72	1124873.38	600.00
189	2080704.88	1124906.76	582.60
190	2080751.18	1124870.99	599.75
191	2080746.65	1124882.79	600.00
192	2080734.17	1124915.27	582.60
193	2080785.20	1124883.14	599.73
194	2080779.79	1124895.56	600.00
195	2080765.90	1124927.46	582.60
196	2080811.48	1124891.47	599.67
197	2080806.25	1124907.08	600.00
198	2080791.67	1124938.69	582.60
199	2080837.64	1124900.56	599.63
200	2080825.88	1124915.65	600.00
201	2080811.02	1124947.12	582.60
202	2080868.55	1124915.15	599.63
203	2080859.71	1124931.63	600.00
204	2080844.85	1124963.10	582.60
205	2080900.45	1124937.39	599.65
206	2080881.52	1124944.75	600.00
207	2080859.48	1124971.68	582.60

PT NO.	NORTHING	EASTING	ELEV
208	2080910.75	1124943.66	599.61
209	2080897.09	1124957.50	600.00
210	2080875.04	1124984.43	582.60
211	2080929.94	1124965.68	599.68
212	2080919.62	1124977.96	600.00
213	2080892.35	1124999.58	582.60
214	2080962.13	1125005.97	599.62
215	2080945.99	1125015.91	600.00
216	2080916.36	1125034.16	582.60
217	2080984.92	1125036.30	599.56
218	2080970.60	1125054.50	600.00
219	2080947.16	1125082.42	582.60
220	2081000.35	1125051.10	599.46
221	2080977.71	1125065.76	600.00
222	2080954.57	1125096.01	582.60
223	2081011.89	1125064.39	599.43
224	2080990.03	1125084.39	600.00
225	2081000.04	1125090.47	600.00
226	2080975.23	1125117.45	582.60
227	2080987.80	1125123.13	582.60
228	2081015.31	1125095.09	600.00
229	2081006.42	1125128.75	582.60
230	2081030.06	1125075.92	599.56
231	2081045.21	1125080.97	599.59
232	2081046.14	1125101.99	600.00
233	2081039.38	1125136.13	582.60
234	2081070.37	1125080.32	599.49
235	2081064.50	1125105.23	600.00
236	2081059.28	1125139.65	582.60
237	2081083.36	1125077.08	600.00
238	2081081.49	1125109.79	600.02
239	2081079.32	1125142.19	582.60
240	2081091.91	1125074.28	601.00
241	2081097.13	1125073.74	602.00
242	2081099.55	1125114.69	601.00
243	2081115.13	1125115.22	603.00
244	2081116.09	1125119.17	601.90
245	2081114.11	1125144.19	582.60

(3in)
(2in)
(1in)
(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SURVEY CONTROL POINTS

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-07
REVIEWED BY:	JS	DRAWING NO.:	7 OF 7
APPROVED BY:	JS		

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APPENDIX B

Technical Specifications

APPENDIX B-1

East Ash Basin Liner Replacement Specifications

1.0 WORK INCLUDED

1.1 This work includes furnishing materials, tools, equipment, and labor to perform bulk and structural excavation, grading, dewatering and place and compact fill, backfill, and bedding materials.

1.2 Excavation includes, sheeting and bracing required for proper execution of the work, loosening, digging, wedging, ripping, loading, hauling, stockpiling, dumping, and disposal of excavated materials in legal disposal areas approved by Owner's Representative.

1.3 Excavation is unclassified and includes, but is not limited to soil, ash and rock materials, abandoned underground conduits or pipes, and buried concrete and masonry structures.

2.0 QUALITY CONTROL

2.1 Existing and new materials to be used as fill, backfill or bedding are subject to the approval of Owner's Representative.

2.2 Bottom ash from the site may be incorporated in the fill material if the Contractor provides tests results and a statement from a geotechnical engineer that use of the bottom ash in conjunction with the other proposed fill materials will not compromise the stability of the 2.5:1 slope.

2.3 To obtain approval of fill, backfill, and bedding materials, designate the proposed borrow area and notify the Owner's Site Representative for a visual inspection prior to placing the material.

3.0 REFERENCES

3.1 Occupational Safety and Health Administration (OSHA)

A. OSHA 2206 General Industry Standards

B. OSHA 2207 Construction Industry Standards

3.2 Illinois Department of Transportation (IDOT) - Standard Specifications for Road and Bridge Construction.

3.3 American Society for Testing and Materials (ASTM)

A. ASTM D 1556- Test for Density of Soil in place by Sand Cone Method

B. ASTM D 1557- Tests for Moisture-Density Relations of Soils Using 10 lb. Hammer and 18 inch drop.

C. ASTM D 2167- Test for Density of Soil in place by Rubber Balloon Method

3.4 The above references shall be the current revision for each.

4.0 SUBMITTALS

4.1 With Contractors' Proposals

A. Submit product data sheets for the chosen liner material.

B. Submit the estimated quantities of materials required to complete the work.

4.2 Two weeks prior to the start of the work, submit to the Owner's Engineer for review, procedures for placing and compacting fill on top of the new liner without damaging the liner material. Include a statement from the liner manufacture that says the procedure is acceptable.

5.0 SITE CONDITIONS

5.1 Prior to start of work become thoroughly familiar with the site, site access, the site conditions, and all portions of the work.

5.2 One pond will be operational while the work on the second pond is being performed.

6.0 MATERIALS

6.1 Make maximum use of suitable on site material for fill when building the pond slopes and entrance ramps. Suitable on site fill material is granular soil or soil/rock mixture that is free from organic matter and other deleterious substances. Material containing rocks or lumps over 1½" in greatest dimension, or containing 15% rocks or lumps larger than ½" in greatest dimension is not acceptable. The material shall have an angle of repose of 30° or greater.

6.2 Imported fill and backfill material shall meet the requirements of Item 6.1 above and, in addition, shall contain predominantly granular material with a maximum particle size of 2".

6.3 Sand used as the protective layer for the pond liners shall be approved by the liner manufacturer.

6.4 Rip rap, coarse aggregate and limestone screenings shall comply with I.D.O.T. specifications.

7.0 BULK AND STRUCTURAL EXCAVATION

7.1 Perform bulk and structural excavation in accordance with the most recent revision of the OSHA General Industry Standards (OSHA 2206) and the OSHA Construction Industry Standards (OSHA 2207).

7.2 Provide temporary grading, ditches and other means as required to drain the areas of the work.

7.3 Perform excavation to lines and grades shown on the contract drawings and as directed by Owner's Representative.

7.4 When the sides of an excavation are five feet or more in depth or when employees are required to enter the excavated area where danger from moving ground exists, perform excavation by open cut to a stable slope or by sheeting and bracing.

7.5 Remove unstable subsoil material, where encountered at the bottom of excavation, to a depth required to obtain satisfactory bearing conditions. Contractor is responsible for bringing the excavation back to the proper elevation by installing compacted bedding material as specified in this section.

7.6 Remove spoil from areas of excavation and stockpile for later use at locations no closer than 2'-0" from edge of excavation unless otherwise approved by Owner's Representative. Remove excess spoil and excavated materials not specifically approved by Owner's Representative for fill, backfill or stockpiling from the site and dispose of these materials at locations and in a manner approved by Federal, State and Local Authorities.

7.7 Properly grade bottom of bulk and structural excavations, remove loose materials, and maintain excavations in good condition, keeping them dry in accordance with Article 8.0 Dewatering, of this section, and free from debris, ice, and frost until completion of the work.

8.0 DEWATERING

8.1 Provide and maintain in operation adequate pumping capacity from sumps, deep wells, or well point installation and perform all other work necessary to keep excavations dry and free of groundwater or surface water during the progress of the work.

8.2 Construction is not permitted in flowing or standing water.

8.3 Dispose of water pumped or drained from the work area in a manner satisfactory to the Owner's Representative, without damage to adjacent property or to other work under construction.

8.4 Take necessary precautions to protect the work against flooding.

9.0 COMPACTION

9.1 Determine the types of equipment and the number of passes required to obtain the required compaction. A pass is defined as one complete coverage of the area by the compaction equipment being used.

9.2 Compact fill and backfill materials to a minimum of 90% of maximum dry density in all areas except in road areas where a minimum of 95% of maximum dry density is required.

9.3 Compact surfaces that are scarified along with and as part of the first lift of fill material that is spread thereon.

9.4 Maximum dry density is defined as the maximum density that can be produced when the same material is compacted in the laboratory in accordance with ASTM D 698 (Standard Proctor).

10.0 INSTALLATION OF FILL AND BACKFILL

10.1 Install fill and backfill material by placing fill and backfill material in uniform layers not to exceed 6" loose measurement unless otherwise noted on the contract drawings or elsewhere in this specification. Compact to minimum specified compaction as set forth in Article 9.2 of this Section.

10.2 Install the 12" protective sand layer on top of the liner material in a single layer.

10.3 Moisten and scarify surfaces to a depth of 4", against which new fill or roadway material is to be placed.

10.4 Remove shoring as backfill progresses only when banks are safe from caving or collapse.

10.5 Water or aerate the material as necessary, and thoroughly mix to obtain a moisture content that will permit proper compaction.

10.6 Do not place fill or backfill materials on a frozen surface. Do not incorporate snow, ice or frozen earth with the fill. Distribute and grade fill and backfill materials throughout the work such that fill will be free from lenses, pockets, streaks or layers of materials differing in texture or gradation from the surrounding material. Do not place successive layers until the layer under construction has been satisfactorily compacted. Place materials in horizontal lifts.

10.7 Remove, dispose and replace any material that Owner's Representative considers objectionable without additional cost to Owner.

10.8 Bring subgrades to a plus or minus tolerance of 0.10 feet.

11.0 FIELD QUALITY CONTROL

11.1 Do not allow or cause any of the work performed or installed to be covered up or enclosed prior to required inspections, tests, and approvals.

11.2 Should any of the work be enclosed or covered up before it has been approved, uncover such work at no additional cost to Owner.

11.3 After the work has been completed, tested, inspected, and approved, make repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.

11.4 Owner may engage (at his own expense), a testing laboratory to inspect and perform tests on all fill, backfill, and bedding materials.

A. The testing laboratory shall conduct and interpret the following ASTM tests to determine the degree of compaction achieved by compaction operations:

1.	ASTM D 1556	Test for Density of Soil in place by Sand Cone Method
2.	ASTM D 2167	Test for Density of Soil in place by Rubber Balloon Method
3.	ASTM D 2922	Test for Density of Soil in place by Nuclear Methods

B. The testing laboratory shall prepare a test report stating whether the test specimens comply with the work requirements, and specifically state any deviations therefrom.

C. Contractor shall provide access for Owner's testing personnel to all required areas so that required inspection and testing can be accomplished.

D. The Owner shall have the right to reject any materials or work not complying with the requirements of the Specification.

E. Contractor shall be responsible for all costs associated with the removal and replacement of all materials determined by Owner's testing personnel to have failed the testing acceptance standards.

END OF SECTION

1.0 WORK INCLUDED

This work includes furnishing materials, tools, equipment, and labor to install a 60-mil thick, high-density polyethylene liner with a reflective white coating.

2.0 REFERENCES

2.1 American Society for Testing and Materials (ASTM)

- D 638 Standard Test Method for Tensile Properties of Plastics
- D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
- D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D 1603 Test Method for Carbon Black in Olefin Plastics
- D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

2.2 Geosynthetic Research Institute

- GM9 Cold Weather Seaming of Geomembranes
- GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

3.0 DEFINITIONS

3.1 Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

3.2 Construction Quality Assurance Consultant (consultant) - Party, independent from manufacturer and installer that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

3.3 Engineer - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

3.4 Geomembrane Manufacturer (manufacturer) - The party responsible for manufacturing the geomembrane rolls.

3.5 Geosynthetic Quality Assurance Laboratory (testing laboratory) - Party, independent from the owner, manufacturer and installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the owner.

3.6 Installer - Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

3.7 Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

3.8 Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

3.9 Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material.

4.0 SUBMITTALS POST-AWARD

4.1 Furnish the following product data, in writing, to engineer prior to installation of the geomembrane material:

A. Resin Data shall include certification stating that the resin meets the specification requirements (see Section 8.0).

B. Statement certifying no more than 10% reclaimed polymer (of the same type) is added to the resin (product run may be recycled) per GRI GM 13.

4.2 The installer shall furnish the following information to the engineer and owner prior to installation:

A. Installation layout drawings

1. Must show proposed panel layout including field seams and details

2. Must be approved prior to installing the geomembrane (Approved drawings will be for concept only and actual panel placement will be determined by site conditions).

B. Installer's Geosynthetic Field Installation Quality Assurance Plan

4.3 The installer will submit the following to the engineer upon completion of installation:

A. Certificate stating the geomembrane has been installed in accordance with the Contract Documents

B. Material and installation warranties

C. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail/

5.0 QUALITY ASSURANCE

5.1 The Owner may engage and pay for the services of a Quality Assurance Consultant to monitor geomembrane installation.

5.2 Qualifications

A. Manufacturer

1. Geomembrane shall be manufactured by GSE Lining Technology, Inc. or an approved equal.
2. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer

1. The liner manufacturer shall install the liner.
2. Installer shall have installed a minimum of 3,000,000 square feet of HDPE geomembrane during the last five years.
3. Installer shall have worked in a similar capacity on at least three projects similar in complexity to the project described in the contract documents.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
5. The installer shall provide a minimum of one Master Seamer for work on the project.
6. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

6.0 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

6.1 Labeling - Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label will identify:

A. Manufacturer's name

B. Product identification

C. Roll number

6.2 Delivery - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

6.3 Storage - The on-site storage location for geomembrane material, provided by the contractor to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:

A. Level (no wooden pallets)

B. Smooth

C. Dry

D. Protected from theft and vandalism

E. Adjacent to the area being lined

6.4 Handling - Materials are to be handled so as to prevent damage.

7.0 WARRANTY

7.1 Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of five years from the date of geomembrane installation.

7.2 Installation shall be warranted against defects in workmanship for a period of one year from the date of geomembrane completion.

8.0 GEOMEMBRANE

8.1 Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

8.2 Resin

A. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.

B. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Property	**Test Method**[1]	**HDPE**
Density [g/cm^3]	ASTM D 1505	0.932
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

8.3 Geomembrane Rolls

A. Do not exceed a combined maximum total of one percent by weight of additives other than carbon black.

B. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

C. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating both number, thickness, length, width and manufacturer.

D. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Section 8.2, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

8.4 Smooth, white surfaced geomembrane shall meet the requirements shown in Table 1.2

The geomembrane shall be a white-surfaced, coextruded geomembrane. The white surface shall be installed upwards.

8.5 Extrudate Rod or Bead

A. Extrudate material shall be made from same type resin as the geomembrane.

B. Additives shall be thoroughly dispersed.

C. Materials shall be free of contamination by moisture or foreign matter.

9.0 EQUIPMENT

Welding equipment and accessories shall meet the following requirements:

9.1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.

9.2 An adequate number of welding apparatus shall be available to avoid delaying work.

9.3 Power source capable of providing constant voltage under combined line load shall be used.

10.0 DEPLOYMENT

10.1 Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

10.2 Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

10.3 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

A. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).

B. Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

D. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than six psi.

E. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

10.4 Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

11.0 FIELD SEAMING

11.1 Seams shall meet the following requirements:

A. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

B. Minimize number of field seams in corners, odd shaped geometric locations and outside corners.

C. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

D. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the consultant and installer.

E. Align seam overlaps consistent with the requirements of the welding equipment being used. A six-inch overlap is commonly suggested.

11.2 During Welding Operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

11.3 Extrusion Welding

A. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.

B. Clean geomembrane surfaces by disc grinder or equivalent.

C. Purge welding apparatus of heat degraded extrudate before welding.

11.4 Hot Wedge Welding

A. Welding apparatus shall be a self-propelled device equipped with an electronic controller that displays applicable temperatures.

B. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

C. Protect against moisture build up between sheets.

12.0 Trial Welds

A. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

B. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

C. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

D. Cut four, one-inch wide by six-inch long test strips from the trial weld.

E. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

F. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.

1. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).

2. The break is ductile.

G. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

H. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

12.2 Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

12.3 Defects and Repairs

A. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

B. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

13.0 FIELD QUALITY ASSURANCE

13.1 Manufacturer/installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. Contractor shall be responsible for assuring this participation.

13.2 Field Testing

A. Non-destructive testing shall be carried out as the seaming progresses.

1. Vacuum Testing - Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

2. Air Pressure Testing - Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

13.3 Destructive Testing (performed by the installer witnessed by the consultant)

A. Location and Frequency of Testing

1. Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.

2. Test locations will be determined after seaming.

3. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.

B. Sampling Procedures are performed as follows:

1. Installer shall cut samples at locations designated by the consultant as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.

2. Consultant will number each sample, and the location will be noted on the installation as built.

3. Samples shall be twelve inches wide by minimal length with the seam centered lengthwise.

4. Cut a two-inch wide strip from each end of the sample for field-testing.

5. Cut the remaining sample into two parts for distribution as follows:

   a. One portion for installer, twelve -inches by twelve inches

   b. One portion for the third party laboratory, 12-inches by 18-inches

   c. Additional samples may be archived if required.

C. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

D. Installer shall repair all holes in the geomembrane resulting from destructive sampling.

E. Repair and test the continuity of the repair in accordance with these Specifications.

13.4 Failed Seam Procedures

A. If the seam fails, installer shall follow one of two options:

1. Reconstruct the seam between any two passed test locations.

2. Trace the weld to an intermediate location at least ten feet minimum or to where the seam ends in both directions from the location of the failed test.

B. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than ten feet long.

C. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.

D. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

14.0 REPAIR PROCEDURES

14.1 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

14.2 Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

14.3 Installer shall be responsible for repair of defective areas.

14.4 Agreement upon the appropriate repair method shall be decided between consultant and installer by using one of the following repair methods:

A. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

B. Abrading and Rewelding - Used to repair short section of a seam.

C. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

D. Capping - Used to repair long lengths of failed seams.

E. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

F. Remove the unacceptable seam and replace with new material.

14.5 The following procedures shall be observed when a repair method is used:

A. All geomembrane surfaces shall be clean and dry at the time of repair.

B. Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

C. Extend patches or caps at least six inches for extrusion welds and four inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

14.6 Repair Verification

A. Number and log each patch repair (performed by consultant).

B. Non-destructively test each repair using methods specified in this Specification.

Table 3.1: Minimum Weld Values for Smooth HDPE Geomembranes

Property	**Test Method**	**60 (1.5)**
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	98 (17)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	78 (14)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	121 (21)

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	Test Method	
Thickness, mil (mm)	ASTM D 5199	
Minimum Average		60 (1.5)
Lowest Individual Reading		54 (1.4)
Density, g/cm^3	ASTM D 1505	0.94
Carbon Black Content[(2)], %	ASTM D 1603	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 3*
Tensile Properties:	ASTM D 638	
(each direction)	Type IV, 2 ipm	
Strength at Yield, lb/in (kN/m)		130 (23)
Strength at Break, lb/in (kN/m)		243 (43)
Elongation at Yield, %	(1.3" gauge length)	13
Elongation at Break, %	(2.0" gauge length)	700
Tear Resistance, lb (N)	ASTM D 1004	42 (187)
Puncture Resistance, lb (N)	ASTM D 4833	119 (530)
Notched Constant Tensile Load, hours	ASTM D 5397,	400
Oxidative Induction Time, min.	ASTM D 3895	100

Geomenbrane may have an overall ash content greater than 3.0% due to the white layer.

The OIT values apply to the black layer only.

Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

END OF SECTION

1.0 SCOPE OF WORK

1.1 The work to be performed under this section of the specification shall consist of furnishing all necessary supervision, materials, labor, and equipment to design a shotcrete mix, prepare the surface and install the repair/wear layer on the ash pond inlet structures as specified herein.

1.2 Shotcrete Mix: The shotcrete mix selected by the contractor shall be designed to minimize shrinkage cracking and to provide an abrasion resistant surface.

A. Option 1: Use a mix design of Portland cement, hard natural aggregates and admixtures that data and references show to be abrasion resistant.

B. Option 2: Incorporate silica fume into the mix design at a rate of not less than 4%.

2.0 REFERENCES

2.1 American Concrete Institute

A. ACI 308 Standard Practice for Curing Concrete

B. ACU 506R Guide to Shotcreting

C. ACI 506.2 Specification for Shotcrete

2.2 American Society for Testing and Materials

A. ASTM C33 Standard Specification for Concrete Aggregates

B. ASTM C150 Standard Specification for Portland Cement

C. ASTM C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

D. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

E. ASTM C1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete

3.0 MATERIALS

3.1 Cement: Portland Cement conforming to ASTM C150 Type I.

3.2 Aggregate: Shall conform to ASTM C33.

3.3 Mixing Water: Shall conform to the requirements of ASTM C-94.

3.4 Silica Fume: "Force 10,000D" microsilica as manufactured by W.R. Grace or an approved equal.

3.5 Synthetic Reinforcing Fibers: "Strux 85/50" fibers as manufactured by W.R. Grace or an approved equal.

3.6 Curing Compounds: Wax based (Type I) or water emulsified, resin base (Type II)

4.0 SUBMITTALS

4.1 The contractors shall submit the proposed mix designs and test data with their proposal. If test data is not available prior to award, the contractor shall be responsible for performing preconstruction testing of the mix after award. The mix shall have a 28-day strength of not less than 6,000 psi.

4.2 Two weeks before starting the shotcreting work, the contractor shall submit the qualifications of the nozzlemen who will be performing the work. Every nozzelman shall be certified and have a minimum of 3000 hours of experience as a nozzleman.

5.0 SURFACE PREPARATION

5.1 Inspect surfaces and conditions where shotcrete is to be placed. Notify the Owner's Representative immediately of any unsatisfactory conditions and do not proceed until those unsatisfactory conditions have been corrected.

5.2 Remove previously applied patching materials.

5.3 Chip or scarify the edges of the eroded areas of the concrete slab such that the change in thickness of the shotcrete application will be no greater than ... per linear foot. Scarify the remainder of the existing structure to allow for a minimum shotcrete application of —", Taper edges to leave no square shoulders at the perimeter of a cavity. Perform these procedures with equipment and in a manner that leaves the maximum reveal to insure excellent bonding.

5.4 Inspect the surface upon completing the scarifying to insure no residual fractured fragments from the scarifying process remain.

5.5 Thoroughly clean the surfaces to be repaired by water blasting to remove any traces of dirt, dust, grease, oil or other substances that could effect the bond of the shotcrete to the existing concrete.

5.6 Adequately saturate the repair surface before beginning the shotcreting process.

6.0 INSTALLATION

6.1 Shotcrete shall be applied using the dry mix process.

6.2 Batching and Mixing:

A. Materials shall be volume proportioned by a calibrated screw conveyor or other approved methods.

B. Batching tolerances shall not exceed 1% for water, 1 | % for cementitious materials, 2% for sand and coarse aggregates and 3% for reinforcing fibers.

C. The percentage of surface moisture in the sand shall be maintained within 3% to 6% by weight.

D. Shotcrete batches that have been in contact with damp aggregate or other moisture for more than two hours shall be wasted at the contractor's expense.

E. Mixers for the mixing the dry ingredients shall be capable of mixing and discharging a uniform product without segregation of ingredients.

F. The discharge nozzle of the applicator shall be equipped with a manual water injection system capable of ready adjustment and convenient to the nozzleman.

6.3 Placing of Shotcrete:

A. Shotcrete shall be placed, starting at the bottom of the Work and proceeding upward, using nozzles and air compressors capable of supplying clean and dry air adequate for maintaining uniform and sufficient nozzle velocity for the Work.

B. The minimum thickness of shotcrete shall be — in. per layer. The maximum total thickness shall not exceed 3" per layer, unless otherwise indicated on the Contract Drawings.

C. The surface of freshly placed shotcrete shall be broomed or cleaned to remove laitance. Shotcrete shall be placed in one layer; where shotcrete is placed over existing cementitious surfaces, such surfaces shall be dampened prior to application of the new shotcrete.

D. The finished repair surface shall not very from smooth by more than +/- ..." within any ten feet.

E. Fill corners filled first with sound material so as to prevent rebound collecting therein. Corners, or any area where rebound cannot easily escape or be blown out, are the most likely places for "sand pockets" to develop.

F. If placement results in sagging or sloughing off of materials, shotcreting shall be halted until causes have been determined and corrections have been made. If wind or air currents cause separation of nozzle stream during placement, or if rain occurs and it may wash cement out of the freshly placed material, shotcreting shall be discontinued or suitable means shall be provided to eliminate the problem. Shotcreting shall not be performed when ambient temperature is below 40°F at the pump or at the placement area.

G. The contractor shall provide and maintain sufficient standby equipment to assure continuous production and application of shotcrete.

6.4 All construction, placement and other joints shall be tapered with a height of at least twice the shotcrete thickness.

6.5 Any placed shotcrete which is damaged, or lacks uniformity, exhibits segregation, honeycomb or lamination, or contains dry patches, slugs, voids or sand pockets, shall be removed and replaced with dry mixed mortar.

6.6 Under no circumstances shall any rebound or previously expended material be used in the shotcrete mix.

6.7 Curing:

A. Curing shall commence immediately after the concrete has attained enough set to prevent damage to the concrete surface. Water curing shall be continued for seven days after shotcreting. During this curing period, the shotcrete work shall be maintained above 50°F.

B. After water curing, final curing may be performed by apply curing compounds. The rate of application shall be at least twice that recommended by the manufacturer for smooth concrete surfaces.

7.0 INSPECTION AND TESTING

7.1 Contractor shall be responsible for all inspection and testing work as required or as needed, unless otherwise indicated. Owner's Representative may, during the course of the Work, observe the various phases of the Work for full compliance with all requirements of this Specification and the Contract Drawings. Any work failing to meet the specified requirements shall be rectified or replaced by Contractor at his expense at no additional cost to Owner.

7.2 Test Specimens:

A. Test specimens shall be made by each shotcrete application crew using the materials, equipment, and mix proportions used for the subject work.

B. A test panel of at least 30" x 30" shall be made with suitable backing material for each mix design being considered, and also for each shooting position to be encountered in the Work (i.e., horizontal, vertical and overhead positions). At least half of each panel to be tested for proper embedment of reinforcement shall contain the same reinforcement as the structure. The thickness of test panels shall be the same as the structure.

C. At least five cores shall be taken from each test panel for testing. All cored surfaces shall be dense and free from laminations and sand pockets. Embedment of reinforcement shall be examined in each panel.

7.3 Test specimens shall be obtained and tested in accordance with ASTM C42 and C39 for compressive strength only.

END OF SECTION

APPENDIX B-2

West Ash Basin Liner Replacement Specifications

1.0 WORK INCLUDED

1.1 This work includes furnishing materials, tools, equipment, and labor to perform bulk and structural excavation, grading, dewatering and place and compact fill, backfill, and bedding materials.

1.2 Excavation includes, sheeting and bracing required for proper execution of the work, loosening, digging, wedging, ripping, loading, hauling, stockpiling, dumping, and disposal of excavated materials in legal disposal areas approved by Owner's Representative.

1.3 Excavation is unclassified and includes, but is not limited to soil, ash and rock materials, abandoned underground conduits or pipes, and buried concrete and masonry structures.

2.0 QUALITY CONTROL

2.1 Existing and new materials to be used as fill, backfill or bedding are subject to the approval of Owner's Representative.

2.2 To obtain approval of fill, backfill, and bedding materials, designate the proposed borrow area and notify the Owner's Site Representative for a visual inspection prior to placing the material.

3.0 REFERENCES

3.1 Occupational Safety and Health Administration (OSHA)

A. OSHA 2206 General Industry Standards

B. OSHA 2207 Construction Industry Standards

3.2 Illinois Department of Transportation (IDOT) - Standard Specifications for Road and Bridge Construction.

3.3 American Society for Testing and Materials (ASTM)

A. ASTM D 1556- Test for Density of Soil in place by Sand Cone Method

B. ASTM D 1557- Tests for Moisture-Density Relations of Soils Using 10 lb. Hammer and 18 inch drop.

C. ASTM D 2167- Test for Density of Soil in place by Rubber Balloon Method

3.4 The above references shall be the current revision for each.

4.0 SUBMITTALS

4.1 With Contractors' Proposals

A. Submit product data sheets for the chosen liner material.

B. Submit the estimated quantities of materials required to complete the work.

4.2 Two weeks prior to the start of the work, submit to the Owner's Engineer for review, procedures for placing and compacting fill on top of the new liner without damaging the liner material. Include a statement from the liner manufacture that says the procedure is acceptable.

5.0 SITE CONDITIONS

5.1 Prior to start of work become thoroughly familiar with the site, site access, the site conditions, and all portions of the work.

5.2 One pond will be operational while the work on the second pond is being performed.

6.0 MATERIALS

6.1 Make maximum use of suitable on site material for fill when building the pond slopes and entrance ramps. Suitable on site fill material is granular soil or soil/rock mixture that is free from organic matter and other deleterious substances. Material containing rocks or lumps over 1½" in greatest dimension, or containing 15% rocks or lumps larger than ½" in greatest dimension is not acceptable. The material shall have an angle of repose of 30° or greater.

6.2 Imported fill and backfill material shall meet the requirements of Item 6.1 above and, in addition, shall contain predominantly granular material with a maximum particle size of 2".

6.3 Sand used as the protective layer for the pond liners shall be approved by the liner manufacturer.

6.4 Rip rap, coarse aggregate and limestone screenings shall comply with I.D.O.T. specifications.

7.0 BULK AND STRUCTURAL EXCAVATION

7.1 Perform bulk and structural excavation in accordance with the most recent revision of the OSHA General Industry Standards (OSHA 2206) and the OSHA Construction Industry Standards (OSHA 2207).

7.2 Provide temporary grading, ditches and other means as required to drain the areas of the work.

7.3 Perform excavation to lines and grades shown on the contract drawings and as directed by Owner's Representative.

7.4 When the sides of an excavation are five feet or more in depth or when employees are required to enter the excavated area where danger from moving ground exists, perform excavation by open cut to a stable slope or by sheeting and bracing.

7.5 Remove unstable subsoil material, where encountered at the bottom of excavation, to a depth required to obtain satisfactory bearing conditions. Contractor is responsible for bringing the excavation back to the proper elevation by installing compacted bedding material as specified in this section.

7.6 Remove spoil from areas of excavation and stockpile for later use at locations no closer than 2'-0" from edge of excavation unless otherwise approved by Owner's Representative. Remove excess spoil and excavated materials not specifically approved by Owner's Representative for fill, backfill or stockpiling from the site and dispose of these materials at locations and in a manner approved by Federal, State and Local Authorities.

7.7 Properly grade bottom of bulk and structural excavations, remove loose materials, and maintain excavations in good condition, keeping them dry in accordance with Article 8.0 Dewatering, of this section, and free from debris, ice, and frost until completion of the work.

8.0 DEWATERING

8.1 Provide and maintain in operation adequate pumping capacity from sumps, deep wells, or well point installation and perform all other work necessary to keep excavations dry and free of groundwater or surface water during the progress of the work.

8.2 Construction is not permitted in flowing or standing water.

8.3 Dispose of water pumped or drained from the work area in a manner satisfactory to the Owner's Representative, without damage to adjacent property or to other work under construction.

8.4 Take necessary precautions to protect the work against flooding.

9.0 COMPACTION

9.1 Determine the types of equipment and the number of passes required to obtain the required compaction. A pass is defined as one complete coverage of the area by the compaction equipment being used.

9.2 Compact fill and backfill materials to a minimum of 90% of maximum dry density in all areas except in road areas where a minimum of 95% of maximum dry density is required.

9.3 Compact surfaces that are scarified along with and as part of the first lift of fill material that is spread thereon.

9.4 Maximum dry density is defined as the maximum density that can be produced when the same material is compacted in the laboratory in accordance with ASTM D 698 (Standard Proctor).

10.0 INSTALLATION OF FILL AND BACKFILL

10.1 Install fill and backfill material by placing fill and backfill material in uniform layers not to exceed 6" loose measurement unless otherwise noted on the contract drawings or elsewhere in this specification. Compact to minimum specified compaction as set forth in Article 9.2 of this Section.

10.2 Install the 12" protective sand layer on top of the liner material in a single layer.

10.3 Moisten and scarify surfaces to a depth of 4", against which new fill or roadway material is to be placed.

10.4 Remove shoring as backfill progresses only when banks are safe from caving or collapse.

10.5 Water or aerate the material as necessary, and thoroughly mix to obtain a moisture content that will permit proper compaction.

10.6 Do not place fill or backfill materials on a frozen surface. Do not incorporate snow, ice or frozen earth with the fill. Distribute and grade fill and backfill materials throughout the work such that fill will be free from lenses, pockets, streaks or layers of materials differing in texture or gradation from the surrounding material. Do not place successive layers until the layer under construction has been satisfactorily compacted. Place materials in horizontal lifts.

10.7 Remove, dispose and replace any material that Owner's Representative considers objectionable without additional cost to Owner.

10.8 Bring subgrades to a plus or minus tolerance of 0.10 feet.

11.0 FIELD QUALITY CONTROL

11.1 Do not allow or cause any of the work performed or installed to be covered up or enclosed prior to required inspections, tests, and approvals.

11.2 Should any of the work be enclosed or covered up before it has been approved, uncover such work at no additional cost to Owner.

11.3 After the work has been completed, tested, inspected, and approved, make repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.

11.4 Contractor shall engage a testing laboratory to inspect and perform tests on all fill, backfill, and bedding materials.

A. The testing laboratory shall conduct and interpret the following ASTM tests to determine the degree of compaction achieved by compaction operations:

1.	ASTM D 1556	Test for Density of Soil in place by Sand Cone Method
2.	ASTM D 2167	Test for Density of Soil in place by Rubber Balloon Method
3.	ASTM D 2922	Test for Density of Soil in place by Nuclear Methods

B. The testing laboratory shall prepare a test report stating whether the test specimens comply with the work requirements, and specifically state any deviations therefrom.

C. The Owner shall have the right to reject any materials or work not complying with the requirements of the Specification.

D. Contractor shall be responsible for all costs associated with the removal and replacement of all materials determined by testing personnel to have failed the testing acceptance standards.

END OF SECTION

1.0 WORK INCLUDED

This work includes furnishing materials, tools, equipment, and labor to install a 60-mil thick. high-density polyethylene liner with a reflective white coating.

2.0 REFERENCES

2.1 American Society for Testing and Materials (ASTM)

- D 638 Standard Test Method for Tensile Properties of Plastics
- D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
- D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D 1603 Test Method for Carbon Black in Olefin Plastics
- D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

2.2 Geosynthetic Research Institute

- GM9 Cold Weather Seaming of Geomembranes
- GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

3.0 DEFINITIONS

3.1 Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

3.2 Construction Quality Assurance Consultant (consultant) - Party, independent from manufacturer and installer that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

3.3 Engineer - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

3.4 Geomembrane Manufacturer (manufacturer) - The party responsible for manufacturing the geomembrane rolls.

3.5 Geosynthetic Quality Assurance Laboratory (testing laboratory) - Party, independent from the owner, manufacturer and installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the owner.

3.6 Installer - Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

3.7 Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

3.8 Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

3.9 Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material.

4.0 SUBMITTALS POST-AWARD

4.1 Furnish the following product data, in writing, to engineer prior to installation of the geomembrane material:

A. Resin Data shall include certification stating that the resin meets the specification requirements (see Section 8.0).

B. Statement certifying no more than 10% reclaimed polymer (of the same type) is added to the resin (product run may be recycled) per GRI GM 13.

4.2 The installer shall furnish the following information to the engineer and owner prior to installation:

A. Installation layout drawings

1. Must show proposed panel layout including field seams and details

2. Must be approved prior to installing the geomembrane (Approved drawings will be for concept only and actual panel placement will be determined by site conditions).

B. Installer's Geosynthetic Field Installation Quality Assurance Plan

4.3 The installer will submit the following to the engineer upon completion of installation:

A. Certificate stating the geomembrane has been installed in accordance with the Contract Documents

B. Material and installation warranties

C. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail/

5.0 QUALITY ASSURANCE

5.1 The Contractor shall engage and pay for the services of a Quality Assurance Consultant to monitor geomembrane installation.

5.2 Qualifications

A. Manufacturer

1. Geomembrane shall be manufactured by GSE Lining Technology, Inc. or an approved equal.
2. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer

1. The liner manufacturer shall install the liner.
2. Installer shall have installed a minimum of 3,000,000 square feet of HDPE geomembrane during the last five years.
3. Installer shall have worked in a similar capacity on at least three projects similar in complexity to the project described in the contract documents.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
5. The installer shall provide a minimum of one Master Seamer for work on the project.
6. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

6.0 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

6.1 Labeling - Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label will identify:

A. Manufacturer's name

B. Product identification

C. Roll number

6.2 Delivery - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

6.3 Storage - The on-site storage location for geomembrane material, provided by the contractor to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:

A. Level (no wooden pallets)

B. Smooth

C. Dry

D. Protected from theft and vandalism

E. Adjacent to the area being lined

6.4 Handling - Materials are to be handled so as to prevent damage.

7.0 WARRANTY

7.1 Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of five years from the date of geomembrane installation.

7.2 Installation shall be warranted against defects in workmanship for a period of one year from the date of geomembrane completion.

8.0 GEOMEMBRANE

8.1 Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

8.2 Resin

A. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.

B. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Property	**Test Method**[1]	**HDPE**
Density [g/cm^3]	ASTM D 1505	0.932
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

8.3 Geomembrane Rolls

A. Do not exceed a combined maximum total of one percent by weight of additives other than carbon black.

B. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

C. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating both number, thickness, length, width and manufacturer.

D. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Section 8.2, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

8.4 Smooth, white surfaced geomembrane shall meet the requirements shown in Table 1.2

The geomembrane shall be a white-surfaced, coextruded geomembrane. The white surface shall be installed upwards.

8.5 Extrudate Rod or Bead

A. Extrudate material shall be made from same type resin as the geomembrane.

B. Additives shall be thoroughly dispersed.

C. Materials shall be free of contamination by moisture or foreign matter.

9.0 EQUIPMENT

Welding equipment and accessories shall meet the following requirements:

9.1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.

9.2 An adequate number of welding apparatus shall be available to avoid delaying work.

9.3 Power source capable of providing constant voltage under combined line load shall be used.

10.0 DEPLOYMENT

10.1 Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

10.2 Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

10.3 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

A. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).

B. Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

D. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than six psi.

E. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

10.4 Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

11.0 FIELD SEAMING

11.1 Seams shall meet the following requirements:

A. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

B. Minimize number of field seams in corners, odd shaped geometric locations and outside corners.

C. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

D. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the consultant and installer.

E. Align seam overlaps consistent with the requirements of the welding equipment being used. A six-inch overlap is commonly suggested.

11.2 During Welding Operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

11.3 Extrusion Welding

A. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.

B. Clean geomembrane surfaces by disc grinder or equivalent.

C. Purge welding apparatus of heat degraded extrudate before welding.

11.4 Hot Wedge Welding

A. Welding apparatus shall be a self-propelled device equipped with an electronic controller that displays applicable temperatures.

B. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

C. Protect against moisture build up between sheets.

12.0 Trial Welds

A. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

B. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

C. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

D. Cut four, one-inch wide by six-inch long test strips from the trial weld.

E. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

F. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.

1. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).

2. The break is ductile.

G. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

H. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

12.2 Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

12.3 Defects and Repairs

A. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

B. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

13.0 FIELD QUALITY ASSURANCE

13.1 Manufacturer/installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. Contractor shall be responsible for assuring this participation.

13.2 Field Testing

A. Non-destructive testing shall be carried out as the seaming progresses.

1. Vacuum Testing - Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

2. Air Pressure Testing - Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

13.3 Destructive Testing (performed by the installer witnessed by the consultant)

A. Location and Frequency of Testing

1. Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.

2. Test locations will be determined after seaming.

3. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.

B. Sampling Procedures are performed as follows:

1. Installer shall cut samples at locations designated by the consultant as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.

2. Consultant will number each sample, and the location will be noted on the installation as built.

3. Samples shall be twelve inches wide by minimal length with the seam centered lengthwise.

4. Cut a two-inch wide strip from each end of the sample for field-testing.

5. Cut the remaining sample into two parts for distribution as follows:

   a. One portion for installer, twelve -inches by twelve inches

   b. One portion for the third party laboratory, 12-inches by 18-inches

   c. Additional samples may be archived if required.

C. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

D. Installer shall repair all holes in the geomembrane resulting from destructive sampling.

E. Repair and test the continuity of the repair in accordance with these Specifications.

13.4 Failed Seam Procedures

A. If the seam fails, installer shall follow one of two options:

1. Reconstruct the seam between any two passed test locations.

2. Trace the weld to an intermediate location at least ten feet minimum or to where the seam ends in both directions from the location of the failed test.

B. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than ten feet long.

C. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.

D. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

14.0 REPAIR PROCEDURES

14.1 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

14.2 Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

14.3 Installer shall be responsible for repair of defective areas.

14.4 Agreement upon the appropriate repair method shall be decided between consultant and installer by using one of the following repair methods:

A. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

B. Abrading and Rewelding - Used to repair short section of a seam.

C. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

D. Capping - Used to repair long lengths of failed seams.

E. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

F. Remove the unacceptable seam and replace with new material.

14.5 The following procedures shall be observed when a repair method is used:

A. All geomembrane surfaces shall be clean and dry at the time of repair.

B. Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

C. Extend patches or caps at least six inches for extrusion welds and four inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

14.6 Repair Verification

A. Number and log each patch repair (performed by consultant).

B. Non-destructively test each repair using methods specified in this Specification.

Table 3.1: Minimum Weld Values for Smooth HDPE Geomembranes

Property	**Test Method**	**60 (1.5)**
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	98 (17)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	78 (14)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	121 (21)

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	Test Method	
Thickness, mil (mm)	ASTM D 5199	
Minimum Average		60 (1.5)
Lowest Individual Reading		54 (1.4)
Density, g/cm^3	ASTM D 1505	0.94
Carbon Black Content[(2)], %	ASTM D 1603	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 3*
Tensile Properties:	ASTM D 638	
(each direction)	Type IV, 2 ipm	
Strength at Yield, lb/in (kN/m)		130 (23)
Strength at Break, lb/in (kN/m)		243 (43)
Elongation at Yield, %	(1.3" gauge length)	13
Elongation at Break, %	(2.0" gauge length)	700
Tear Resistance, lb (N)	ASTM D 1004	42 (187)
Puncture Resistance, lb (N)	ASTM D 4833	119 (530)
Notched Constant Tensile Load, hours	ASTM D 5397,	400
Oxidative Induction Time, min.	ASTM D 3895	100

Geomenbrane may have an overall ash content greater than 3.0% due to the white layer.

The OIT values apply to the black layer only.

Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

END OF SECTION

1.0 SCOPE OF WORK

1.1 The work to be performed under this section of the specification shall consist of furnishing all necessary supervision, materials, labor, and equipment to design a shotcrete mix, prepare the surface and install the repair/wear layer on the ash pond inlet structures as specified herein.

1.2 Shotcrete Mix: The shotcrete mix selected by the contractor shall be designed to minimize shrinkage cracking and to provide an abrasion resistant surface.

A. Option 1: Use a mix design of Portland cement, hard natural aggregates and admixtures that data and references show to be abrasion resistant.

B. Option 2: Incorporate silica fume into the mix design at a rate of not less than 4%.

2.0 REFERENCES

2.1 American Concrete Institute

A. ACI 308 Standard Practice for Curing Concrete

B. ACU 506R Guide to Shotcreting

C. ACI 506.2 Specification for Shotcrete

2.2 American Society for Testing and Materials

A. ASTM C33 Standard Specification for Concrete Aggregates

B. ASTM C150 Standard Specification for Portland Cement

C. ASTM C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

D. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

E. ASTM C1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete

3.0 MATERIALS

3.1 Cement: Portland Cement conforming to ASTM C150 Type I.

3.2 Aggregate: Shall conform to ASTM C33.

3.3 Mixing Water: Shall conform to the requirements of ASTM C-94.

3.4 Silica Fume: "Force 10,000D" microsilica as manufactured by W.R. Grace or an approved equal.

3.5 Synthetic Reinforcing Fibers: "Strux 85/50" fibers as manufactured by W.R. Grace or an approved equal.

3.6 Curing Compounds: Wax based (Type I) or water emulsified, resin base (Type II)

4.0 SUBMITTALS

4.1 The contractors shall submit the proposed mix designs and test data with their proposal. If test data is not available prior to award, the contractor shall be responsible for performing preconstruction testing of the mix after award. The mix shall have a 28-day strength of not less than 6,000 psi.

4.2 Two weeks before starting the shotcreting work, the contractor shall submit the qualifications of the nozzlemen who will be performing the work. Every nozzelman shall be certified and have a minimum of 3000 hours of experience as a nozzleman.

5.0 SURFACE PREPARATION

5.1 Inspect surfaces and conditions where shotcrete is to be placed. Notify the Owner's Representative immediately of any unsatisfactory conditions and do not proceed until those unsatisfactory conditions have been corrected.

5.2 Remove previously applied patching materials.

5.3 Chip or scarify the edges of the eroded areas of the concrete slab such that the change in thickness of the shotcrete application will be no greater than ¼" per linear foot. Scarify the remainder of the existing structure to allow for a minimum shotcrete application of ¾". Taper edges to leave no square shoulders at the perimeter of a cavity. Perform these procedures with equipment and in a manner that leaves the maximum reveal to insure excellent bonding.

5.4 Inspect the surface upon completing the scarifying to insure no residual fractured fragments from the scarifying process remain.

5.5 Thoroughly clean the surfaces to be repaired by water blasting to remove any traces of dirt, dust, grease, oil or other substances that could effect the bond of the shotcrete to the existing concrete.

5.6 Adequately saturate the repair surface before beginning the shotcreting process.

6.0 INSTALLATION

6.1 Shotcrete shall be applied using the dry mix process.

6.2 Batching and Mixing:

A. Materials shall be volume proportioned by a calibrated screw conveyor or other approved methods.

B. Batching tolerances shall not exceed 1% for water, 1 1/2% for cementitious materials, 2% for sand and coarse aggregates and 3% for reinforcing fibers.

C. The percentage of surface moisture in the sand shall be maintained within 3% to 6% by weight.

D. Shotcrete batches that have been in contact with damp aggregate or other moisture for more than two hours shall be wasted at the contractor's expense.

E. Mixers for the mixing the dry ingredients shall be capable of mixing and discharging a uniform product without segregation of ingredients.

F. The discharge nozzle of the applicator shall be equipped with a manual water injection system capable of ready adjustment and convenient to the nozzleman.

6.3 Placing of Shotcrete:

A. Shotcrete shall be placed, starting at the bottom of the Work and proceeding upward, using nozzles and air compressors capable of supplying clean and dry air adequate for maintaining uniform and sufficient nozzle velocity for the Work.

B. The minimum thickness of shotcrete shall be ¾" per layer. The maximum total thickness shall not exceed 3" per layer, unless otherwise indicated on the Contract Drawings.

C. The surface of freshly placed shotcrete shall be broomed or cleaned to remove laitance. Shotcrete shall be placed in one layer; where shotcrete is placed over existing cementitious surfaces, such surfaces shall be dampened prior to application of the new shotcrete.

D. The finished repair surface shall not very from smooth by more than +/- ¼" within any ten feet.

E. Fill corners filled first with sound material so as to prevent rebound collecting therein. Corners, or any area where rebound cannot easily escape or be blown out, are the most likely places for "sand pockets" to develop.

F. If placement results in sagging or sloughing off of materials, shotcreting shall be halted until causes have been determined and corrections have been made. If wind or air currents cause separation of nozzle stream during placement, or if rain occurs and it may wash cement out of the freshly placed material, shotcreting shall be discontinued or suitable means shall be provided to eliminate the problem. Shotcreting shall not be performed when ambient temperature is below 40°F at the pump or at the placement area.

G. The contractor shall provide and maintain sufficient standby equipment to assure continuous production and application of shotcrete.

6.4 All construction, placement and other joints shall be tapered with a height of at least twice the shotcrete thickness.

6.5 Any placed shotcrete which is damaged, or lacks uniformity, exhibits segregation, honeycomb or lamination, or contains dry patches, slugs, voids or sand pockets, shall be removed and replaced with dry mixed mortar.

6.6 Under no circumstances shall any rebound or previously expended material be used in the shotcrete mix.

6.7 Curing:

A. Curing shall commence immediately after the concrete has attained enough set to prevent damage to the concrete surface. Water curing shall be continued for seven days after shotcreting. During this curing period, the shotcrete work shall be maintained above 50°F.

B. After water curing, final curing may be performed by apply curing compounds. The rate of application shall be at least twice that recommended by the manufacturer for smooth concrete surfaces.

7.0 INSPECTION AND TESTING

7.1 Contractor shall be responsible for all inspection and testing work as required or as needed, unless otherwise indicated. Owner's Representative may, during the course of the Work, observe the various phases of the Work for full compliance with all requirements of this Specification and the Contract Drawings. Any work failing to meet the specified requirements shall be rectified or replaced by Contractor at his expense at no additional cost to Owner.

7.2 Test Specimens:

A. Test specimens shall be made by each shotcrete application crew using the materials, equipment, and mix proportions used for the subject work.

B. A test panel of at least 30" x 30" shall be made with suitable backing material for each mix design being considered, and also for each shooting position to be encountered in the Work (i.e., horizontal, vertical and overhead positions). At least half of each panel to be tested for proper embedment of reinforcement shall contain the same reinforcement as the structure. The thickness of test panels shall be the same as the structure.

C. At least five cores shall be taken from each test panel for testing. All cored surfaces shall be dense and free from laminations and sand pockets. Embedment of reinforcement shall be examined in each panel.

7.3 Test specimens shall be obtained and tested in accordance with ASTM C42 and C39 for compressive strength only.

END OF SECTION

APPENDIX B-3

East Ash Basin Slope Modification Technical Specifications

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary to perform all Earthwork. The Work shall be carried out as specified herein and in accordance with the Construction Drawings.

B. The Work shall include, but not be limited to clearing and grubbing, excavating, hauling, placing, moisture conditioning, backfilling, compacting, grading, and subgrade preparation. Earthwork shall conform to the dimensions, lines, grades and sections shown on the Construction Drawings or as directed by the Construction Manager.

1.02 RELATED SECTIONS

A. Section 02770 – Geosynthetics

1.03 REFERENCES

A. Construction Drawings

B. Latest version of the Occupational Safety and Health Administration (OSHA) rules and regulations.

C. "Stormwater Pollution Prevention Plan, East Ash Basin Slope Modification", Geosyntec, July 2016.

D. 2015 Standard Specifications for Public Works Construction "Greenbook" (Greenbook)

E. "Construction Quality Assurance (CQA) Plan, East Ash Basin Slope Modification, Waukegan Generating Station" by Geosyntec, dated June 2016

F. Illinois Department of Transportation (IDOT), Standard Specifications for Road and Bridge Construction, January 2012.

G. Latest version of the American Society for Testing and Materials (ASTM) standards:

ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Standard Method for Particle-Size Analysis of Soils
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
ASTM D2487	Standard Test Method for Classification of Soils for Engineering Purposes
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

H. Submittals

I. The Contractor shall submit to the Construction Manager a description of equipment and methods proposed for all earthwork components including excavation, ash relocation, select and engineered fill placement, moisture conditioning, and compaction, stockpiling, road subgrade preparation and road surfacing placement and compaction at least 5 days prior to the start of activities covered by this Section.

J. The Contractor shall submit copies of all permits obtained for site work. The permits shall be provided prior to initiating the applicable site activities.

K. The Contractor shall submit as-built Record Drawing electronic files and data, to the Construction Manager, within 7 days of project substantial completion, in accordance with this Section. The Record Drawings shall be submitted in AutoCAD version 2015 format or newer, or in a DXF format that can be converted to AutoCAD.

1.04 QUALITY ASSURANCE

A. The Contractor shall ensure that the materials and methods used for Earthwork meet the requirements of the Construction Drawings and this Section. Any material or method that does not conform to these documents, or to alternatives approved in writing by the Construction Manager will be rejected and shall be repaired or replaced by the Contractor at the Contractor's expense.

B. The Contractor shall be aware of and accommodate all monitoring and field/laboratory conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed Work, will be performed by the CQA Consultant. If nonconformances or other deficiencies are found in the materials or completed Work, the Contractor will be required to repair the deficiency or replace the deficient materials at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Engineered Fill – Engineered Fill shall consist of relatively homogeneous soils that contain no debris, foreign objects, large rock fragments (greater than 6 inches in maximum dimension), roots, and organics. No materials larger than 6 inches shall be allowed within the Engineered Fill. The Engineered Fill shall be classified according to the Unified Soil Classification System (per ASTM D2487) as, ML, CL, CL-ML, SM, SC, SW, SP, GW, GP, GM, GC, or combinations of these materials. The Contractor may propose the use of other soil types as Engineered Fill, but such use shall be at the sole discretion of the Engineer.

B. Select Soil – Select Soil shall have at least 40 percent material smaller than ¼-inch in size, no particles larger than 3 inches, and not having any sharp, angular pieces greater than ¼-inch or perishable, spongy, deleterious, or otherwise unsuitable material. Select soil shall be utilized to backfill geomembrane anchor trenches.

C. Aggregate Base – Aggregate Base shall meet the requirements of Illinois Department of Transportation Gradation CA 6.

D. CCR – CCR (Coal Combustion Residuals) are materials located within the geomembrane lined areas of the West and East Ash Basins.

2.02 EQUIPMENT

A. The Contractor shall furnish, operate, and maintain compaction equipment as necessary to produce the required in-place soil density and moisture content.

B. The Contractor shall furnish, operate and maintain tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

C. The Contractor shall furnish, operate, and maintain miscellaneous equipment such as scarifiers or disks, earth excavating equipment, earth hauling equipment, and other equipment, as necessary for Earthwork construction.

D. When relocating CCR Deposits or placing excavated material within the basin in areas lined with a geomembrane, the Contractor shall use equipment which will not damage the underlying geomembrane in accordance with the Geomembrane Manufacturer's recommendations.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall not disturb or impact areas outside of the limits of work as defined on the Construction Drawings without prior approval from the Construction Manager. If work outside of the limit cannot be avoided, the Contractor shall notify the Construction Manager a minimum of 3 days prior to disturbance outside of the limits for approval prior to starting the work.

B. Prior to initiating earthwork activities, the Contractor shall have implemented the site SWPPP.

C. The Contractor shall obtain all applicable grading permits, or other applicable work permits, prior to initiating the work covered by the permit.

D. When hauling is done over roadways or city streets, the loads shall comply with legal load requirements, all material shall be removed from shelf areas of vehicles in order to eliminate spilling of material, and loads shall be watered or covered to eliminate dust.

E. Under this Work, the Contractor shall apply water for dust control, for compaction purposes, and for such other purposes (not provided for in other Sections) called for on the Construction Drawings or as directed by the Construction Manager. Contractor shall coordinate with Owner for access to onsite water source. Contractor shall not waste water or allow water application to create erosion or other deleterious conditions to the work area or adjacent areas.

F. Well heads for existing groundwater wells within the work area will removed by others and wells will be capped prior to work. The Contractor shall provide protection to existing groundwater monitoring wells throughout construction. Any damage to these items shall be repaired or replaced to the Construction Manager's satisfaction at the Contractor's sole expense.

3.02 FAMILIARIZATION

A. Prior to implementing any of the Work in this Section, the Contractor shall become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this and other related Sections.

3.03 CLEARING AND GRUBBING

A. Prior to Site clearing, Contractor shall have implemented the SWPPP.

B. The Contractor shall remove and properly dispose of all vegetation, debris, organic and deleterious material that exist along the crest of the embankment and eastern and southern facing slopes of the embankment within the work area.

C. No burning of combustible materials shall be allowed.

D. Clearing and grubbing shall include, but not be limited to removal and disposal of trees, plants and shrubs and vegetation as well as rocks, and surficial and shallow debris.

E. Vegetation, debris and organic matter shall be properly disposed of offsite.

F. Remove all tree root balls associated with trees with a diameter greater than 4-inches. Tree root ball holes in non-excavation areas shall be backfilled in accordance with Section 3.07.

3.04 EXCAVATION

A. CCR located on top of the geomembrane along the slope area within the East Ash Basin shall be relocated, as necessary, to accommodate grading of the embankment. Excavated CCR materials shall be placed within the western portion of the East Ash Basin. CCR shall not be placed at inclinations greater than 5H:1V (Horizontal:Vertical). Excavation of CCR shall be performed with care to ensure no damage to the underlying geomembrane. Damage to the underlying geomembrane shall be repaired to the Construction Manager's satisfaction at the Contractor's expense.

B. Perform all excavations, regardless of the type, nature, or condition of material encountered, as specified, shown, required or implied to accomplish the construction. Excavated soil shall be placed within the western portion of the East Ash Basin at inclinations no greater than 5H:1V.

C. Allow for working space, overlying materials, and finish grades as shown or required. Do not carry excavations deeper than the elevation shown, unless soft or wet materials are encountered. Excavation carried below the grade lines in areas of unsuitable materials, including root balls, shall be replaced with over excavated material compacted to at least 90% relative compaction and to -3 percent to +1 percent of optimum moisture. Cuts below grade shall be corrected by filling and compacting soil material to at least 90% relative compaction and -3 percent to +1 percent of optimum moisture, and creating a smooth transition. All overexcavation in areas of suitable materials will be filled and compacted at the Contractor's expense.

D. After completion of excavation, and prior to placement of aggregate base on the embankment crest (Section 3.06), proof-roll the berm crest to detect soft, wet, or loose materials. Notify the Owner or Owner's Representative prior to commencement of proof rolling. If soft, wet, or loose materials are found, excavate the soft or loose material to a depth accepted by the Engineer, then fill and compact in accordance with Section 3.07.

E. Perform all earthwork to the lines and grades as shown and/or established by the Owner or Owner's Representative. Make slopes free of all exposed roots and stones exceeding 3-inch diameter which are loose and liable to fall. Neatly blend all new grading into surrounding, existing terrain. The Owner or Owner's Representative shall review finished site grading.

F. After excavating existing aggregate base materials on the embankment crest within the work area, Contractor shall remove existing geotextile and properly dispose of offsite.

3.05 ANCHOR TRENCH EXCAVATION AND BACKFILL

A. The Contractor shall excavate 2 ft by 2 ft anchor trenches to secure the geomembrane prior to placement of the geotextile and aggregate base material.

B. Anchor trenches shall be backfilled with select fill and compacted in accordance with Subpart 3.07, below.

3.06 ACCESS ROAD SURFACING

A. The Contractor shall grade access road along the crest of the embankment to the widths and minimum slope inclinations as shown on the Construction Drawings.

B. Prior to placing aggregate base, the Contractor shall moisten the area to be covered. The area shall be kept moist, but not wet (i.e. no ponding water or saturated soils), until the geotextile and overlying aggregate base is installed.

C. Geotextile shall be placed prior to aggregate base placement in accordance with Section 02770.

D. The access road shall be surfaced with 4 inches of aggregate base to the lines and grades shown on the Construction Drawings. Aggregate base shall be as described in Section 2.01 and in locations indicated on the Construction Drawings.

E. The aggregate base shall be compacted to a minimum of 95 percent relative compaction and within ± 2 percent of the optimum moisture content as determined by ASTM D1557.

F. After initial compaction, the Contractor shall trim off high spots to within tolerance wherever the finished surface is higher than the specified tolerance. Following trimming, the Contractor shall compact trimmed areas with one complete coverage so the entire layer complies with compaction requirements. Loose material at the surface and tear marks shall not be permitted.

3.07 ENGINEERED AND SELECT FILL

A. Prior to placing engineered fill, the soil subgrade shall be scarified to a depth of 6 inches and recompacted.

B. Engineered fill and select fill shall be compacted to a minimum of 90 percent relative compaction and -3 percent to +1 percent of optimum moisture percent as measured in accordance with ASTM D1557.

3.08 STOCKPILING

A. If deemed acceptable for reuse, existing aggregate base material may be stockpiled within the laydown area or an area approved by the Owner. Stockpiles shall be no steeper than 2.5H:1V (Horizontal:Vertical), unless stockpiles are to be created within the East Ash Basin in which case the stockpiles shall be no steeper than 5H:1V, or other slope approved by the Engineer, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the Construction Manager, and dressed daily during periods when fill is taken from the stockpile. The Contractor shall employ temporary erosion and sediment control measures (i.e. silt fence) around stockpile areas in accordance with Construction Drawings.

B. There are no compaction requirements for temporary stockpiled materials.

3.09 FIELD TESTING

A. The minimum frequency and details of quality control testing are provided below. This testing will be performed by the CQA Consultant. Additional testing may be performed at the discretion of the CQA Consultant, Construction Manager or Owner. The Contractor shall consider this testing frequency when preparing the construction schedule.

1. The CQA Consultant will perform conformance tests on placed and compacted engineered fill, select soil and aggregate base to evaluate compliance with these Specifications. These tests will include in-situ moisture content and dry density. The frequency and procedures for moisture-density testing are provided in the CQA Plan. At a minimum, the dry density and moisture content of the soil will be measured in-situ in accordance with ASTM D6938. The CQA Consultant shall approve the material prior to placement of overlying materials.

2. Increased testing frequencies may be used by the CQA Consultant when visual observations of construction performance indicate a potential problem. Additional testing will be considered when:

    a. The rollers slip during rolling operation

    b. The lift thickness is greater than specified

    c. The fill is at improper and/or variable moisture content

    d. Fewer than the specified number of roller passes are made

    e. Dirt-clogged rollers are used to compact the material

    f. The rollers do not have optimum ballast

    g. The degree of compaction is doubtful

3. During construction, the frequency of testing will be increased by the CQA Consultant in the following situations:

    a. Adverse weather conditions

    b. Breakdown of equipment

    c. At the start and finish of grading

    d. If the material fails to meet specifications

    e. The Work area is reduced

B. Defective Areas:

1. If a defective area is discovered in the Earthwork, the CQA Consultant will evaluate the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. If the defect is related to adverse Site conditions, such as overly wet soils or surface desiccation, the CQA Consultant shall define the limits and nature of the

defect. The CQA Consultant shall notify the Construction Manager within 1 day of defective area discovery.

2. Once the extent and nature of a defect is determined, the Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Construction Manager. The Contractor shall not perform additional Work in the area until the CQA Consultant and Construction Manager approve the correction of the defect.

3. Additional testing may be performed by the CQA Consultant to verify that the defect has been corrected. This additional testing will be performed before any additional Work is allowed in the area of deficiency. The cost of the additional testing shall be borne by the Contractor.

3.10 SURVEY CONTROL

A. The Contractor shall perform all surveys necessary for construction layout and control.

1. At a minimum, all surfaces should be surveyed on a square grid not wider spaced than 50 ft and shall include additional points for grade breaks (top and toe of slope).

3.11 CONSTRUCTION TOLERANCE

A. Tolerances for designed thicknesses shown on Construction Drawings and for elevations shown on Construction Drawings are ±0.10 foot unless otherwise specified.

3.12 AS-BUILT SURVEY

A. The Contractor shall produce complete electronic as-built Record Drawings in conformance with the requirements set forth in this Section. This electronic file shall be provided to the Construction Manager for verification. Surveys shall be submitted for the following:

1. Existing topography;

2. Anchor trench;

3. Finish grade and limits of the access road;

4. Final topography.

A. Record survey shall be performed, at a minimum, at all grade breaks, flow lines, and on a 50-foot grid.

3.13 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect completed Work of this Section.

B. At the end of each day, the Contractor shall verify that the entire Work area is left in a state that promotes drainage of surface water away from the area and from finished Work. If threatening weather conditions are forecast, at a minimum, compacted surfaces shall be seal-rolled to protect finished Work.

C. In the event of damage to prior Work, the Contractor shall make repairs and replacements to the satisfaction of the Construction Manager, at the expense of the Contractor.

[END OF SECTION]

SECTION 02770
GEOSYNTHETICS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the repair of the existing geomembrane and installation of geotextile. The Work shall be carried out as specified herein and in accordance with the Drawings.

B. The Work shall include, but not be limited to, delivery, storage, and placement of the various geosynthetic components of the project.

C. The intent is for the Contractor to re-use existing geomembrane by cutting the existing geomembrane in sections to facilitate folding the geomembrane down the slope to allow excavation of the underlying soils. Contractor shall exercise caution while folding geomembrane and excavating soil to not damage the existing geomembrane. Once excavation is complete and the new anchor trench has been excavated, the intent is to pull the sections of geomembrane back up the slope, cut the geomembrane to the appropriate length, and place the geomembrane into the new anchor trench. Vertical cuts in the existing geomembrane, along with other damage, will be repaired with new geomembrane, in accordance with this section.

D. Geotextile shall be placed beneath the aggregate base surfacing on the embankment crest.

E. Existing geomembrane shall be repaired/patched as necessary to achieve the lines and grades shown on the Drawings.

1.02 RELATED SECTIONS

Section 02200 – Earthwork

1.03 REFERENCES

A. Drawings

B. "Construction Quality Assurance (CQA) Plan, East Ash Basin Slope Modification, Waukegan Generating Station" by Geosyntec, dated June 2016

C. Latest version of ASTM International (ASTM) standards:

ASTM D792 Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement

ASTM D1004 Standard Test Method for Initial Tear Resistance (Graves Tear) of Plastic Film and Sheeting

ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D1505 Standard Test Methods for Density of Plastics by Density-Gradient Technique

ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics

ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

ASTM D4439 Terminology for Geosynthetics

ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

ASTM D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

ASTM D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics

ASTM D5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test

ASTM D5641 Practice for Geomembrane Seam Evaluation by Vacuum Chamber

ASTM D5820 Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

ASTM D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products using a 50-mm Probe

ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced using Thermo-Fusion Methods.

ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

D. GRI GM9 Cold Weather Seaming of Geomembranes

E. GRI GM10 The Stress Crack Resistance of HDPE Geomembrane Sheet

F. GRI GM13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

G. GRI GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

1.04 WARRANTY

A. The Geosynthetic Installer shall furnish the Owner with a 1-year written warranty against defects in workmanship. Warranty conditions concerning limits of liability will be evaluated by, and must be acceptable to, the Owner.

1.05 SUBMITTALS

A. The Contractor shall submit to the Construction Manager, at least 7 days prior to commencement of work, the following information regarding the proposed geomembrane and geotextile:

1. Manufacturer and product name

2. Minimum property values of the proposed geotextile and the corresponding test procedures

3. Minimum property values of the proposed geomembrane and the corresponding test procedures

4. Projected delivery dates

5. List of roll numbers for rolls to be delivered to the Site

B. Upon completion of the installation, the Contractor shall be responsible for the submission to the Construction Manager of a warranty as specified in Subpart 1.04 of this Section.

C. Upon completion of the installation of the geomembrane repair, the Contractor shall be responsible for the submission to the Construction Manager of a Record Drawing showing the locations and numbers of repairs.

1.06 QUALITY ASSURANCE

A. The Contractor shall ensure that the geomembrane and geotextile materials, and installation methods used meet the requirements of the Drawings and this Section. Any material or method that does not conform to these documents, or to alternatives approved in writing by the Construction Manager, will be rejected and shall be repaired or replaced by the Contractor.

B. The Contractor shall be aware of and accommodate all monitoring and conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed Work, will be performed by the CQA Consultant. If non-conformances or other deficiencies are found in the Contractor's materials or completed Work, the Contractor will be required to repair the deficiency or replace the deficient materials, at the expense of the Contractor.

PART 2 – PRODUCTS

2.01 GEOTEXTILE

A. Geotextile shall be GEOTEX® 200ST woven polypropylene manufactured by Propex GeoSolutions or equivalent as approved by the Engineer.

B. Geotextile suppliers shall furnish materials, which meet or exceed the criteria specified in Table 02770-1 in accordance with the minimum average roll value (MARV), as defined by ASTM D4439.

2.02 GEOMEMBRANE

A. The geomembrane shall be a 60-mil smooth or textured high density polyethylene (HDPE) geomembrane.

B. Geomembranes shall be produced in rolls free of holes, blisters, striations, undispersed raw materials, or any sign of contamination by foreign matter.

C. Resin used in the manufacturing of the geomembrane shall be new, first-quality, virgin polyethylene resin. The addition of reworked polymer (from the manufacturing process) to resin shall be permitted if it does not exceed 2% by weight, contains no encapsulated scrim, and is performed with appropriate cleanliness. The addition of post-consumer resin shall not be permitted.

D. Geomembrane resin shall be mixed with the specified amount of carbon black. The carbon black shall be pre-blended with the resin.

E. The geomembrane shall exhibit the minimum physical properties listed in Table 02770-2 (smooth geomembrane) or Table 02770-3 (textured geomembrane). Manufacturer quality control testing shall be performed in accordance with the frequencies presented in Table 02770-2 or 02770-3, accordingly.

F. The geomembrane shall be a white-surface geomembrane. The white surface shall be installed upwards.

G. Geomembrane trials seams shall meet the minimum requirements listed in GRI Test Method GM-19, shown in Table 02770-4. Frequency of trial seam testing shall be in accordance with Section 3.05H

H. Resin used for extrusion welding shall be produced from same resin type as the geomembrane and shall be the same color as the geomembrane surface to be exposed (i.e. white). Physical properties of the welding resin shall be the same as those of the resin used in the geomembrane.

2.03 MANUFACTURING QUALITY CONTROL (MQC)

A. The geotextile and geomembrane shall be manufactured with MQC procedures that meet or exceed generally accepted industry standards.

2.04 PACKING AND LABELING

A. Geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

B. Geomembrane and geotextile rolls shall be marked or tagged with the following information:

1. Manufacturer's name
2. Product identification
3. Lot or batch number
4. Roll number

5. Roll dimensions

2.05 TRANSPORTATION, HANDLING, AND STORAGE

A. The Contractor shall be liable for any damage to the materials incurred prior to and during transportation to the Site.

B. Handling, unloading, storage, and care of the geomembrane and geotextile prior to and following installation at the Site, is the responsibility of the Contractor and shall be performed in accordance with ASTM D4873.

C. The geotextile shall be protected from sunlight, puncture, or other damaging or deleterious conditions.

D. The geomembrane shall be protected from excessive puncture, cutting, or other damaging or deleterious conditions. Any additional storage procedures required by the Geomembrane Manufacturer shall be the Contractor's responsibility.

2.06 EQUIPMENT

A. The Contractor shall furnish all necessary equipment required to accomplish the installation of the geosynthetics specified herein.

PART 3 – EXECUTION

3.01 FAMILIARIZATION

A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work described in this Section.

B. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Construction Manager shall be notified, in writing, prior to commencing the work. Failure to notify the Construction Manager or commencing installation of the geomembrane or geotextile will be construed as the Contractor's acceptance of the related work of all other Sections.

3.02 GEOTEXTILE PLACEMENT

A. The Contractor shall handle all geotextile in such a manner as to ensure it is not damaged in any way.

B. All geotextiles shall be deployed in accordance with the Manufacturer's recommendations, standards, and guidelines.

C. The Contractor shall ballast or anchor all geotextile with sandbags, or equivalent, to prevent wind uplift.

D. The Contractor shall examine the entire geotextile surface after installation to ensure that no foreign objects are present that may damage the geotextile. The Contractor shall remove any such foreign objects and shall replace any damaged geotextile.

E. Adjacent geotextile panels shall be overlapped a minimum of 12 inches.

3.03 GEOTEXTILE REPAIR

A. Holes or tears in the geotextile shall be repaired as follows: A patch made from the same geotextile shall be overlapped a minimum of 12 inches in each direction.

3.04 GEOMEMBRANE PLACEMENT

A. Cuts to existing geomembrane will be minimized to only those needed to facilitate temporary movement. Horizontal cuts on the side slope will not be allowed. Panel seams shall be installed at an angle of at least 45 degrees from vertical.

B. The geomembrane shall be weighted with sandbags or the equivalent ballast materials, to prevent movement caused by wind. In case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind uplift of panels.

C. Geomembrane shall not be placed when the ambient temperature is below 32°F or above 122°F unless otherwise authorized in writing by the Engineer. Geomembrane panels shall be allowed to equilibrate to temperature of adjacent panels prior to seaming.

D. Geomembrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of wind speeds greater than 20 mph.

E. The Contractor shall ensure that:

1. No vehicular traffic is allowed on the geomembrane with the exception of ATV's with a contact pressures less than 6 psi.

2. Equipment used does not damage the geomembrane by handling, trafficking, or leakage of hydrocarbons (i.e., fuels).

3. Personnel working on the geomembrane do not smoke, wear damaging shoes, bring glass onto the geomembrane, or engage in other activities that could damage the geomembrane.

4. The method used to unroll the panels does not scratch or crimp the geomembrane and does not damage the supporting soil or geosynthetics.

5. The geomembrane shall be securely anchored and then rolled in such a manner as to continually keep the geomembrane in tension to preclude folding.

6. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels). The method used to place the panels results in intimate contact between the geomembrane and adjacent components.

7. The geomembrane is especially protected from damage in heavily trafficked areas.

8. Any field panel or portion thereof that becomes seriously damaged (torn, twisted, or crimped) shall be replaced with new material. Less serious damage to the geomembrane may be repaired, as approved by the Construction Manager and CQA Site Manager. Damaged panels or portions of damaged panels that have been rejected shall be removed from the work area and not reused.

F. If the Contractor intends to install geomembrane between one hour before sunset and one hour after sunrise, he shall notify the Construction Manager in writing prior to the start of

the work. The Contractor shall indicate additional precautions that shall be taken during these installation hours. The Contractor shall provide proper illumination for work during this time period.

3.05 FIELD SEAMING

A. Seam Layout:

1. In corners and at odd-shaped geometric locations, the number of field seams shall be minimized. No seams shall be located in an area of potential stress concentration.

B. Weather Conditions for Seaming:

1. No seaming shall be attempted below 32°F or above 122°F without approval of the Owner or Owner's Representative.

2. Geomembrane seaming below 32°F, if approved by the Owner or Owner's Representative, shall be performed in accordance with GRI Test Method GM9.

3. Preheating of the geomembrane is not required for temperatures above 32°F.

4. Geomembrane shall be dry and protected from wind.

5. In the event of seaming below 32°F or above 122°F, certify in writing that low-temperature or high-temperature seaming procedures does not cause any physical or chemical modification to geomembrane that will generate any short or long-term damage to geomembrane.

C. Seam Preparation:

1. Prior to seaming, seam shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

2. If seam overlap grinding is required, process shall be completed according to the Manufacturer's instructions and in a way not damaging to the geomembrane.

3. Align seams with least possible number of wrinkles and "fish mouths".

D. General Seaming Requirements:

1. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap, ending the cut with circular cut-out. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is insufficient shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

2. Place electric generator on smooth base. Place smooth insulating plate or fabric beneath hot welding apparatus after use. When protective material is in place, sudden stops or starts, sharp turns, and stationary churning of vehicles shall be strictly prohibited. Only use apparatus specifically approved by geomembrane Manufacturer.

3. Use double-track fusion welding for installation seaming wherever possible.

4. Seams shall extend to the top of the anchor trench.

E. Seaming Process:

1. Approved processes for field seaming are fusion welding and extrusion welding. Proposed alternate processes shall be documented and submitted to the Design Engineer and/CQA Engineer for approval prior to use. Extrusion welding shall be restricted to repairs and welding applications not possible by the fusion process.

2. Extrusion Equipment and Procedures:

   a. The Contractor shall maintain at least one spare operable seaming apparatus on site.

   b. Extrusion welding apparatuses shall be equipped with gauges giving the temperatures in the apparatuses.

   c. Prior to beginning an extrusion seam, the extruder shall be purged until all heat-degraded extrudate has been removed from the barrel.

   d. Grind edges of cross seams to an incline prior to welding.

F. Trial Seams:

1. Trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Trial seams shall be conducted on the same material to be installed and under similar field conditions as production seams. Such trial seams shall be made at the beginning of each seaming period, typically at the beginning of the day and after lunch, for each seaming apparatus used each day, but no less frequently than once every 5 hours. The trial seam sample shall be a minimum of 5 feet long by 1 foot wide (after seaming) with the seam centered lengthwise for fusion equipment and at least 3 feet long by 1 foot wide for extrusion equipment. Seam overlap shall be as indicated in Subpart 3.05.C of this Section.

2. Four coupon specimens, each 1-inch wide, shall be cut from the trial seam sample by the Geosynthetics Installer using a die cutter to ensure precise 1-inch wide coupons. The coupons shall be tested, by the Contractor, with the CQA Site Manager present, in peel (both the outside and inside track for fusion welded seams) and in shear using an electronic readout field tensiometer in accordance with ASTM D 6392, at a strain rate of 2 inches/minute. The samples shall not exhibit failure in the seam, i.e., they shall exhibit a Film Tear Bond (FTB), which is a failure (yield) in the parent material. The required peel and shear seam strength values are listed in Table 02770-4. At no time shall specimens be soaked in water.

3. An additional trial weld shall be performed if a wide change in temperature (± 30ºF), humidity, or wind speed occurs since the previous trial weld.

4. If any coupon specimen fails, the trial seam shall be considered failing and the entire operation shall be repeated. If any of the additional coupon specimens fail, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved.

G. Nondestructive Seam Continuity Testing:

1. The Contractor shall nondestructively test for continuity on all field seams over their full length. Continuity testing shall be carried out as the seaming work progresses, not

at the completion of all field seaming. The Contractor shall complete any required repairs in accordance with Subpart 3.05.I of this Section. The following procedures shall apply:

a. Vacuum testing in accordance with ASTM D 5641.

b. Air channel pressure testing for double-track fusion seams in accordance with ASTM D 5820 and the following:

i. Insert needle, or other approved pressure feed device, from pressure gauge and inflation device into the air channel at one end of a double track seam.

ii. Energize the air pump and inflate air channel to a pressure between 25 and 30 pounds per square inch (psi). Close valve and sustain the pressure for not less than 5 minutes.

iii. If loss of pressure exceeds 3 psi over 5 minutes, or if the pressure does not stabilize, locate the faulty area(s) and repair seam in accordance with Subpart 3.05.I of this Section.

iv. After 5 minutes, cut the end of air channel opposite from the end with the pressure gauge and observe release of pressure to ensure air channel is not blocked. If the channel does not depressurize, find and repair the portion of the seam containing the blockage per Subpart 3.05.I of this Section. Repeat the air pressure test on the resulting segments of the original seam created by the repair and the ends of the seam. Repeat the process until the entire length of seam has successfully passed pressure testing or contains a repair. Repairs shall also be non-destructively tested per Subpart 3.05.I.5 of this Section.

v. Remove needle, or other approved pressure feed device, and seal repair in accordance with Subpart 3.05.I of this Section.

H. Defects and Repairs:

1. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the Contractor if surface contamination inhibits inspection.

2. At observed suspected flawed location, both in seamed and non-seamed areas, shall be nondestructively tested using the methods described herein. Each location that fails nondestructive testing shall be marked by the CQA Site Manager and repaired by the Contractor.

3. When seaming of a geomembrane is completed (or when seaming of a large area of a geomembrane is completed) and prior to placing overlying materials, the CQA Site Manager shall identify all excessive geomembrane wrinkles. The Contractor shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested.

4. Repair Procedures:

a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Contractor. Several repair procedures are acceptable. The final decision as to the appropriate repair procedure shall be agreed upon between the Design Engineer and the Contractor. The procedures available include:

   i. Patching – extrusion welding a patch to repair holes larger than 1/16 inch, tears, undispersed raw materials, and contamination by foreign matter;

   ii. Abrading and re-seaming – applying an extrusion seam to repair very small sections of faulty extruded seams;

   iii. Spot seaming – applying an extrusion bead to repair minor, localized flaws such as scratches and scuffs;

   iv. Capping – extrusion welding a geomembrane cap over long lengths of failed seams; and

   v. Strip repairing – cutting out bad seams and replacing with a strip of new material seamed into place on both sides with fusion welding.

b. In addition, the following criteria shall be satisfied:

   i. Surfaces of the geomembrane that are to be repaired shall be abraded no more than 20 minutes prior to the repair;

   ii. The grind depth around the repair shall not exceed ten percent of the core geomembrane thickness;

   iii. All surfaces must be clean and dry at the time of repair;

   iv. All seaming equipment used in repair procedures must be approved by trial seaming;

   v. Any other potential repair procedures shall be approved in advance, for the specific repair, by the design engineer;

   vi. Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches and holes shall be rounded with a radius of at least 3 inches;

   vii. All ends of wrinkle or relief cuts should be cut to a rounded hole and patched or capped; and

   viii. Extrudate shall extend a minimum of 3 inches beyond the edge of the patch.

   ix. Cap strips shall not be installed on top of existing cap strips. In the event that a cap strip is required in proximity to an existing repair, the existing cap strip should be removed and a single new cap strip should be installed over the entire repair area.

   x.

5. Repair Verification:

a. Repairs shall be nondestructively tested using the methods described in Subpart 3.05.H of this Section, as appropriate. Repairs that pass nondestructive testing shall be considered acceptable repairs. Repairs that failed nondestructive or destructive testing will require the repair to be reconstructed and retested until passing test results are observed. At the discretion of the CQA Consultant, destructive testing may be required on any caps.

3.06 PROTECTION OF WORK

A. The Contractor shall protect all Work of this Section.

B. In the event of damage, the Contractor shall make repairs and replacements to the satisfaction of the CQA Consultant at the expense of the Contractor.

TABLE 02770-1
WOVEN GEOTEXTILE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values
Grab Strength (min. avg.)	ASTM D4632	1 per 100,000 sf	200 lbs
Puncture Strength (min. avg.)	ASTM D6241	1 per 100,000 sf	700 lbs
UV Resistance	ASTM D4355	1 per resin formulation	70%(1)

Notes: (1) After 500 hours of exposure.

TABLE 02770-2
60-MIL SMOOTH HDPE GEOMEMBRANE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values[9]
Thickness (min. avg.) • Lowest individual of 10 values	ASTM D5199	1 per Roll	54 mil
Density (min ave.)	ASTM D792 or ASTM D1505	1 per 200,000 lb	0.940 g/cc
Tensile Properties[1] (min. avg.) • Yield strength • Break strength • Yield elongation • Break elongation	ASTM D6693 Type IV	1 per 20,000 lb	 126 lb/in 228 lb/in 12% 700%
Tear Resistance (min. avg.)	ASTM D1004 Die C	1 per 45,000 lb	42 lbs
Puncture Resistance (min. avg.)	ASTM D4833	1 per 45,000 lb	108 lbs
Stress Crack Resistance[2]	ASTM D5397 (App.)	Per GRI-GM10	500 hr
Carbon Black Content	ASTM D4218	1 per 20,000 lb	2.0-3.0%
Carbon Black Dispersion	ASTM D5596	1 per 45,000 lb	Note 3
Oxidative Induction Time (OIT)[4] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)	 ASTM D3895 ASTM D5885	1 per 200,000 lb	 100 400
Oven Aging at 85°C [4][5] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)	ASTM D5721 ASTM D3895 ASTM D5885	1 per Formulation	 55% retained after 90d 80% retained after 90d
UV Resistance[6] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)[8]	ASTM D7238 ASTM D3895 ASTM D5885	1 per Formulation	 N.R. (7) 50% retained after 1600 hrs

Notes:

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Yield elongation is calculated using a gage length of 1.3 inches
- Break elongation is calculated using a gage length of 2.0 inches

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQA testing.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views. 9 in Categories 1 or 2 and 1 in Category 3.

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluation the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(6) The condition of the test should be 20hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed sample.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(9) Based on GRI GM13, Rev. 14, 1/6/16

TABLE 02770-3
60-MIL TEXTURED HDPE GEOMEMBRANE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values[9]
Thickness (min. avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D5199	1 per Roll	57 mil 54 mil 51 mil
Asperity Height (min. avg.)	ASTM D7466	Every 2nd Roll	16 mil
Density (min ave.)	ASTM D792 or ASTM D1505	1 per 200,000 lb	0.940 g/cc
Tensile Properties[1] (min. avg.) • Yield strength • Break strength • Yield elongation • Break elongation	ASTM D6693 Type IV	1 per 20,000 lb	 126 lb/in 90 lb/in 12% 100%
Tear Resistance (min. avg.)	ASTM D1004 Die C	1 per 45,000 lb	42 lbs
Puncture Resistance (min. avg.)	ASTM D4833	1 per 45,000 lb	90 lbs
Stress Crack Resistance[2]	ASTM D5397 (App.)	Per GRI-GM10	500 hr
Carbon Black Content	ASTM D4218	1 per 20,000 lb	2.0-3.0%
Carbon Black Dispersion	ASTM D5596	1 per 45,000 lb	Note 3
Oxidative Induction Time (OIT)[4] (c) Standard OIT (min avg.) or (d) High Pressure OIT (min avg.)	 ASTM D3895 ASTM D5885	1 per 200,000 lb	 100 400
Oven Aging at 85°C [4][5] (c) Standard OIT (min avg.) or (d) High Pressure OIT (min avg.)	ASTM D5721 ASTM D3895 ASTM D5885	1 per Formulation	 55% retained after 90d 80% retained after 90d
UV Resistance[6] (c) Standard OIT (min avg.), or (d) High Pressure OIT (min avg.)[8]	ASTM D7238 ASTM D3895 ASTM D5885	1 per Formulation	 N.R. (7) 50% retained after 1600 hrs

Notes:

(10) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Yield elongation is calculated using a gage length of 1.3 inches
- Break elongation is calculated using a gage length of 2.0 inches

(11) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQA testing.

(12) Carbon black dispersion (only near spherical agglomerates) for 10 different views. 9 in Categories 1 or 2 and 1 in Category 3.

(13) The manufacturer has the option to select either one of the OIT methods listed to evaluation the antioxidant content in the geomembrane.

(14) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(15) The condition of the test should be 20hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C.

(16) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed sample.

(17) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(18) Based on GRI GM13, Rev. 14, 1/6/16

TABLE 02770-4
MINIMUM 60-MIL HDPE SEAM PROPERTIES

Property	Qualifier	Unit	Specified Value(1)	Test Method
Shear Strength (at yield point)	Minimum	lb./in. width	120	ASTM D6392
Peel Adhesion Fusion	Minimum	lb./in. width	91	ASTM D6392
Peel Adhesion Extrusion	Minimum	lb./in. width	78	ASTM D6392

(1) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values

[END OF SECTION]

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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 corrective 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).

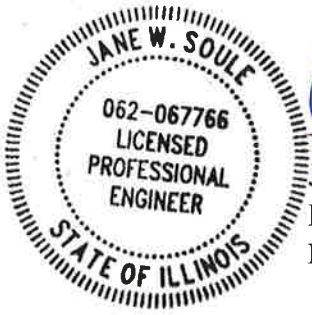
4.4 Retaining Wall Analyses

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.

Geosyntec, 2016a. History of Construction Report, East and West Ash Basins, Waukegan Station, October.

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.

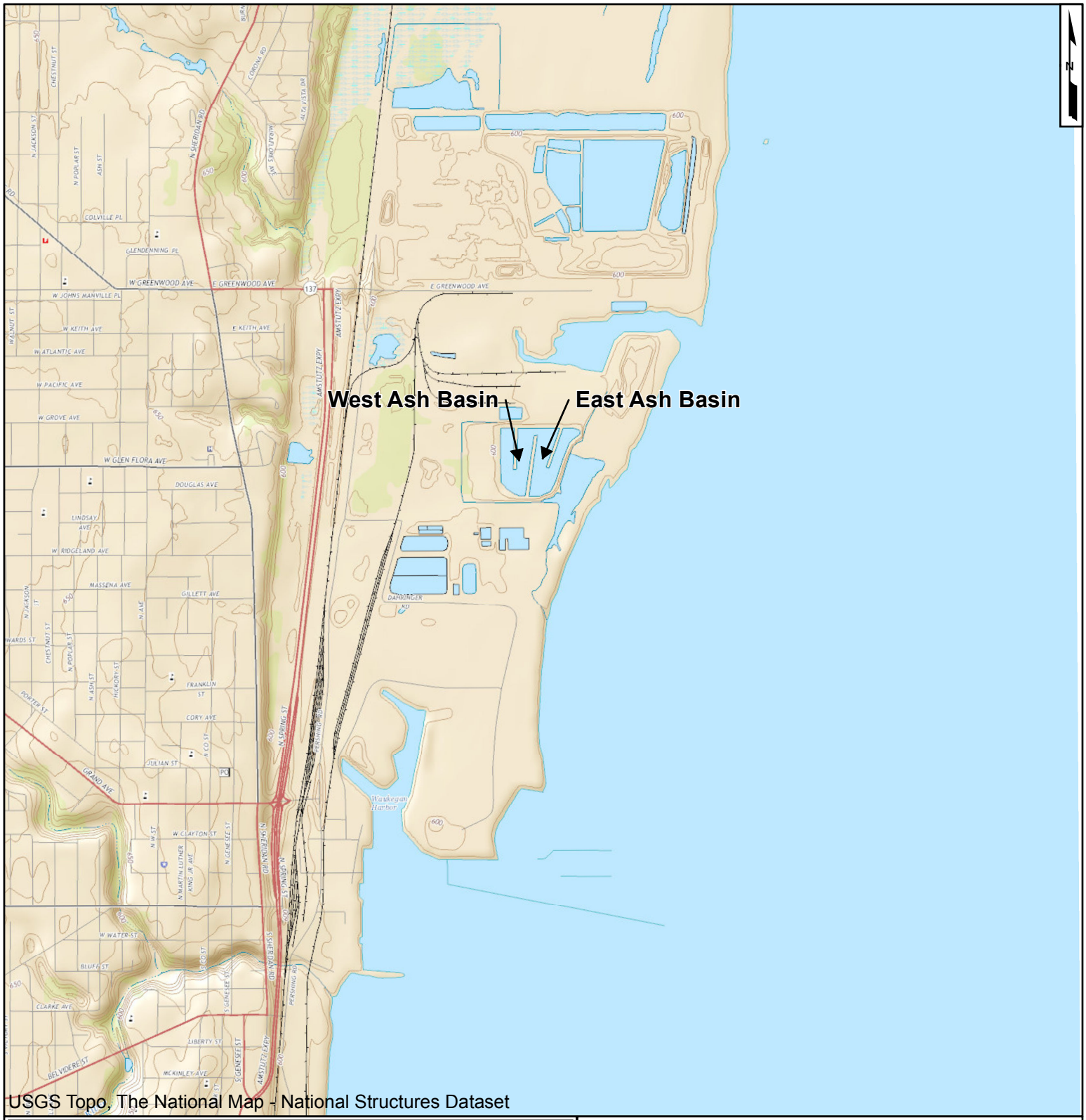
Geosyntec, 2016g. East and West Ash Basin – Seismic Coefficient Calculations, Waukegan Station, October.

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

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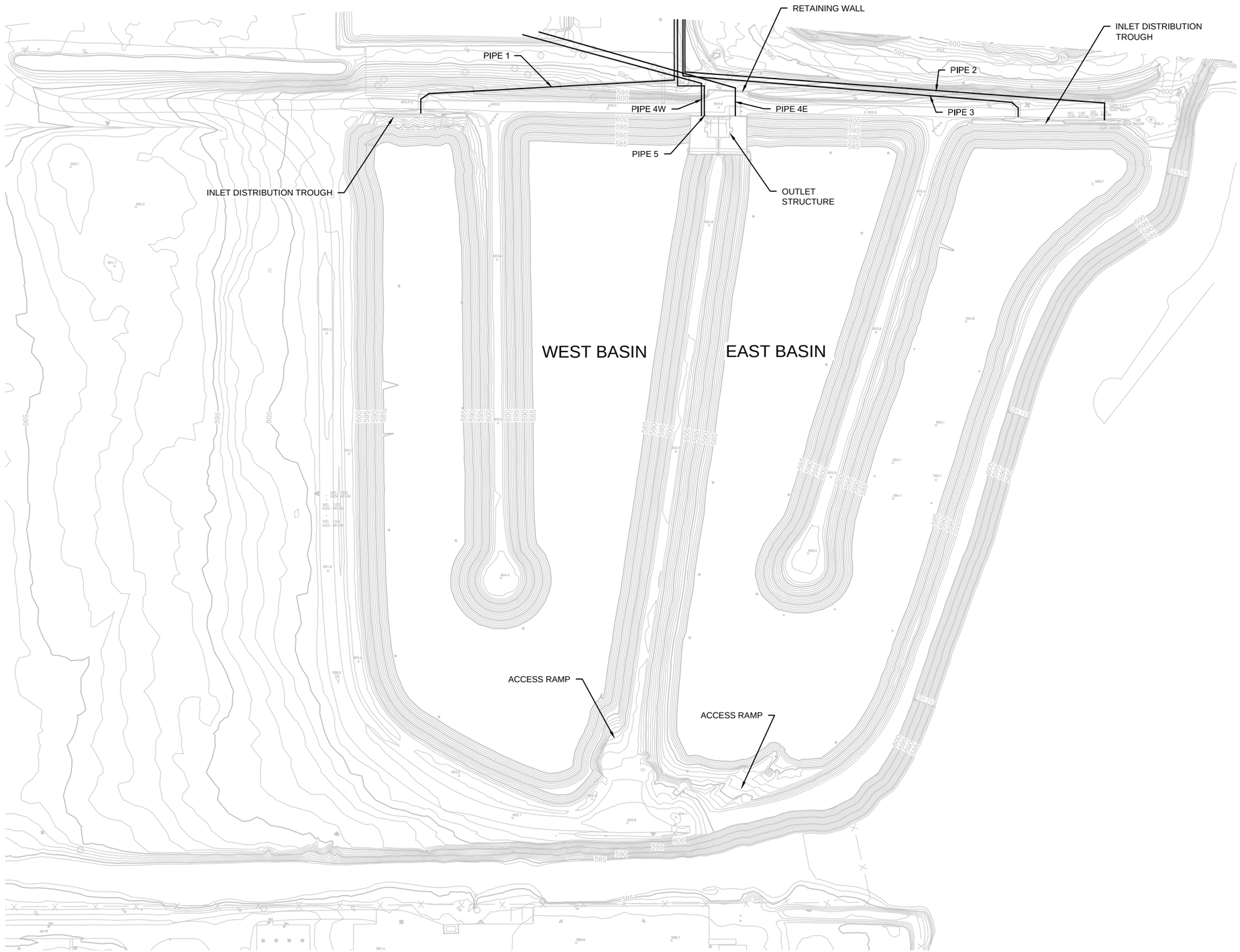


LEGEND

- 600 — EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- X — 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.

N

0 150' 300'

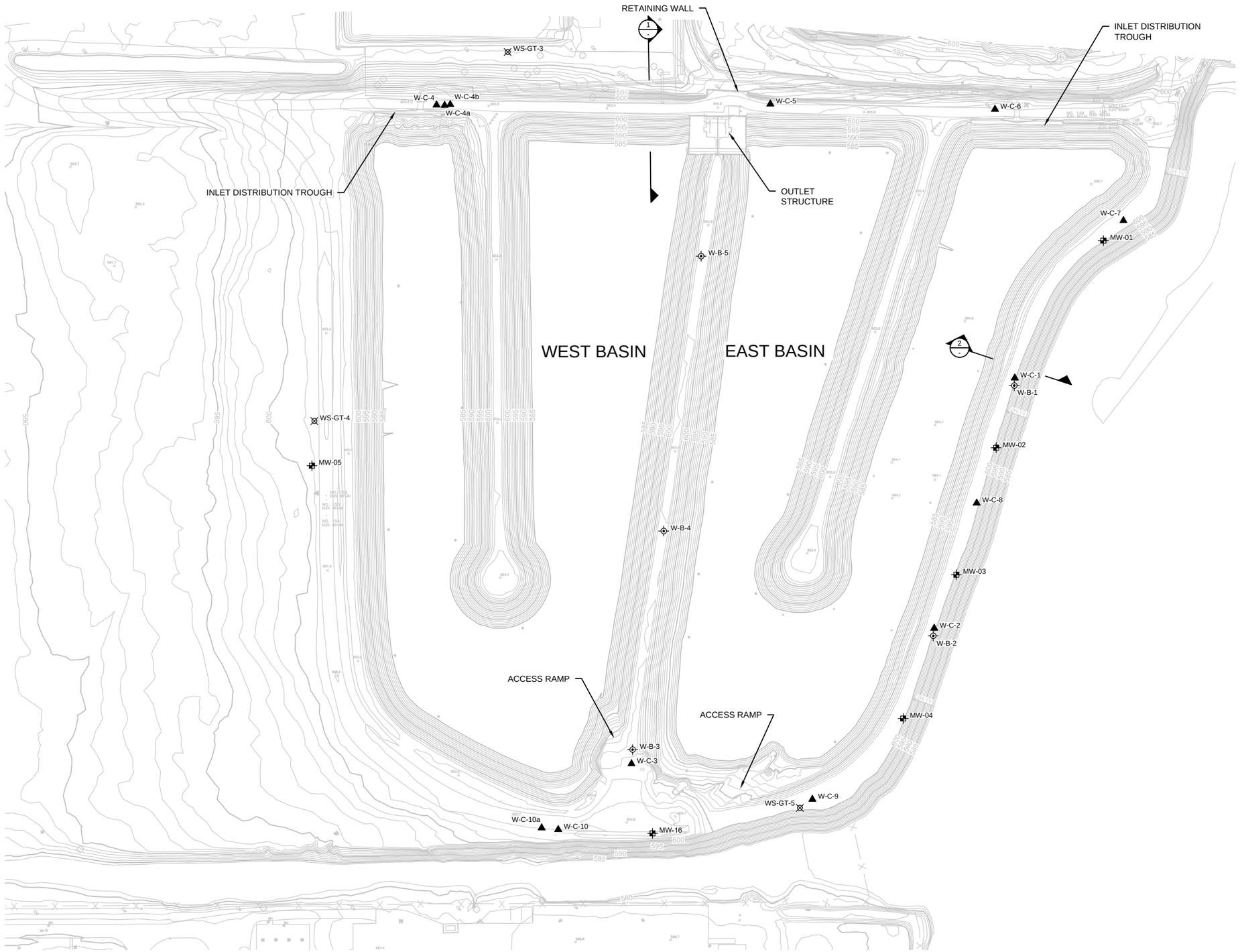
SCALE IN FEET

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

Geosyntec consultants

PROJECT NO: SW0251-08 | OCTOBER 2016 | FIGURE 2

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.

N

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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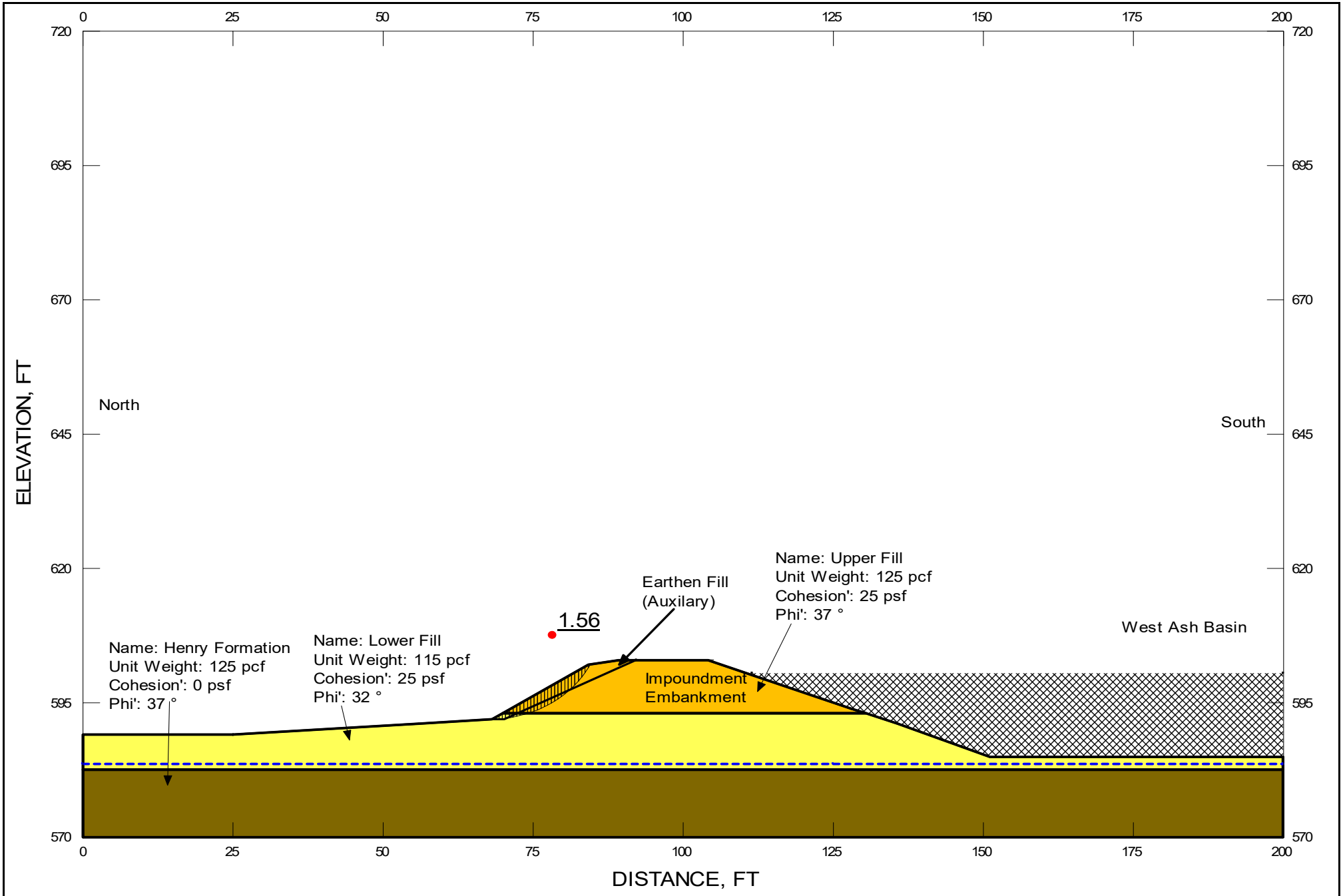
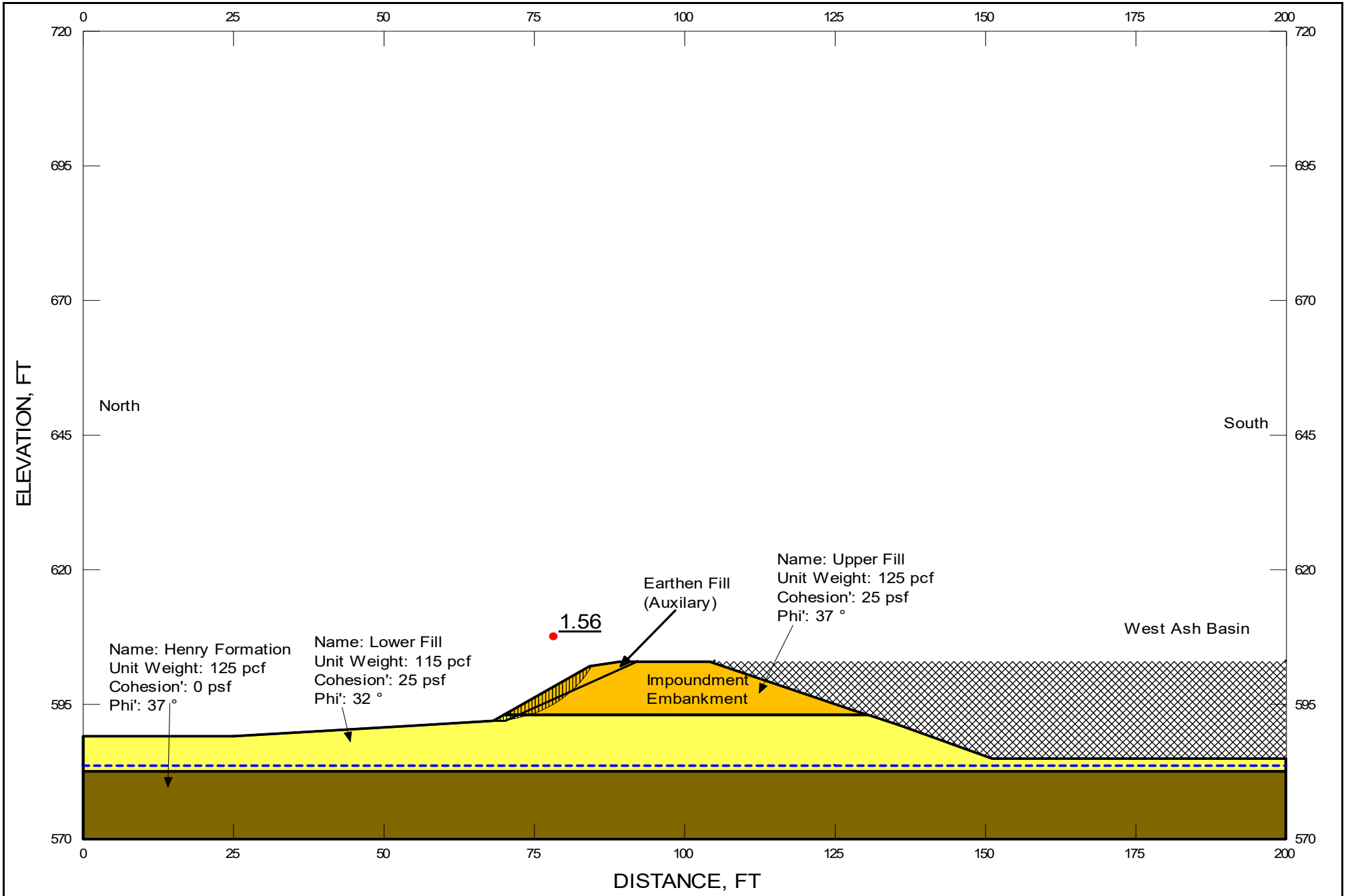
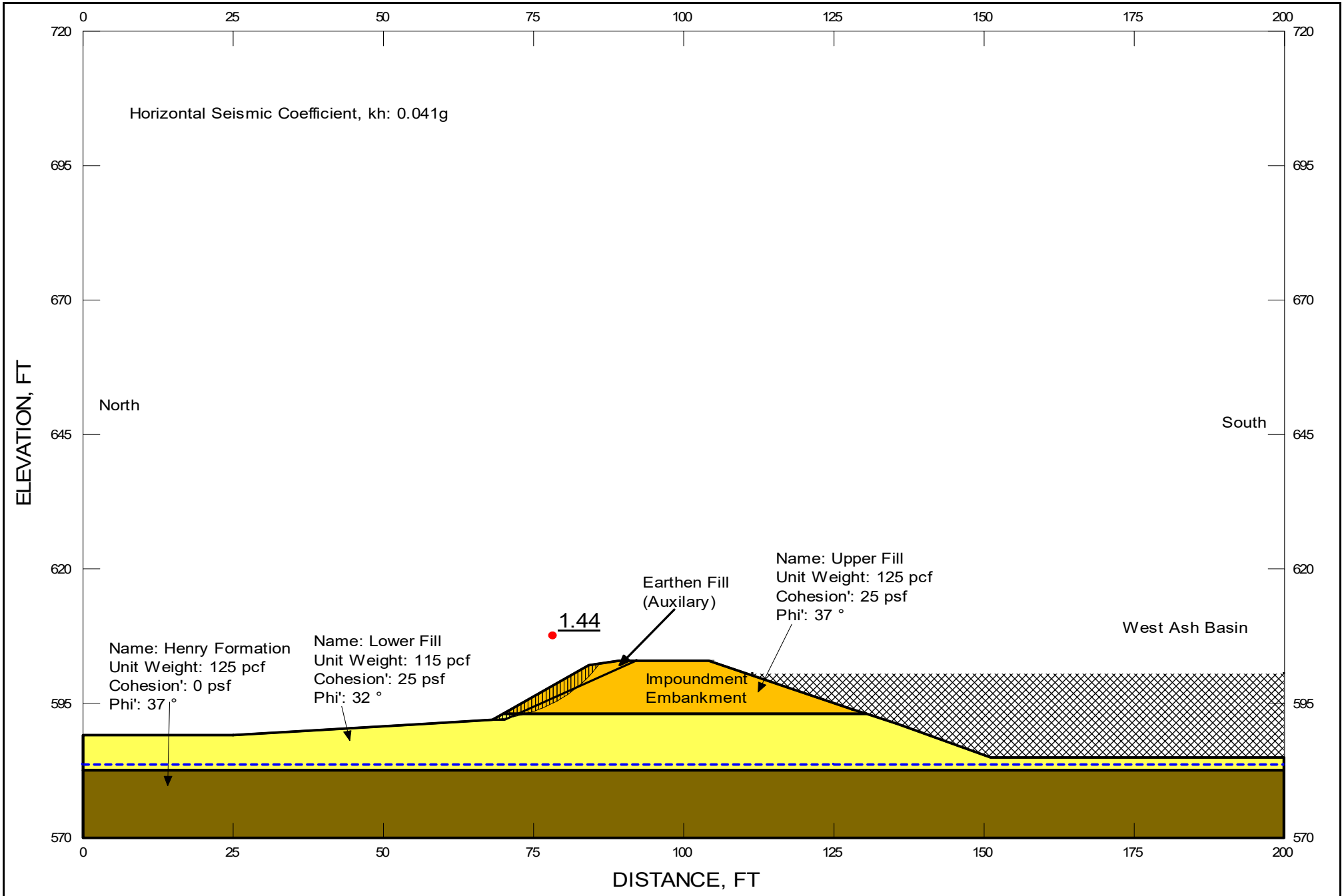


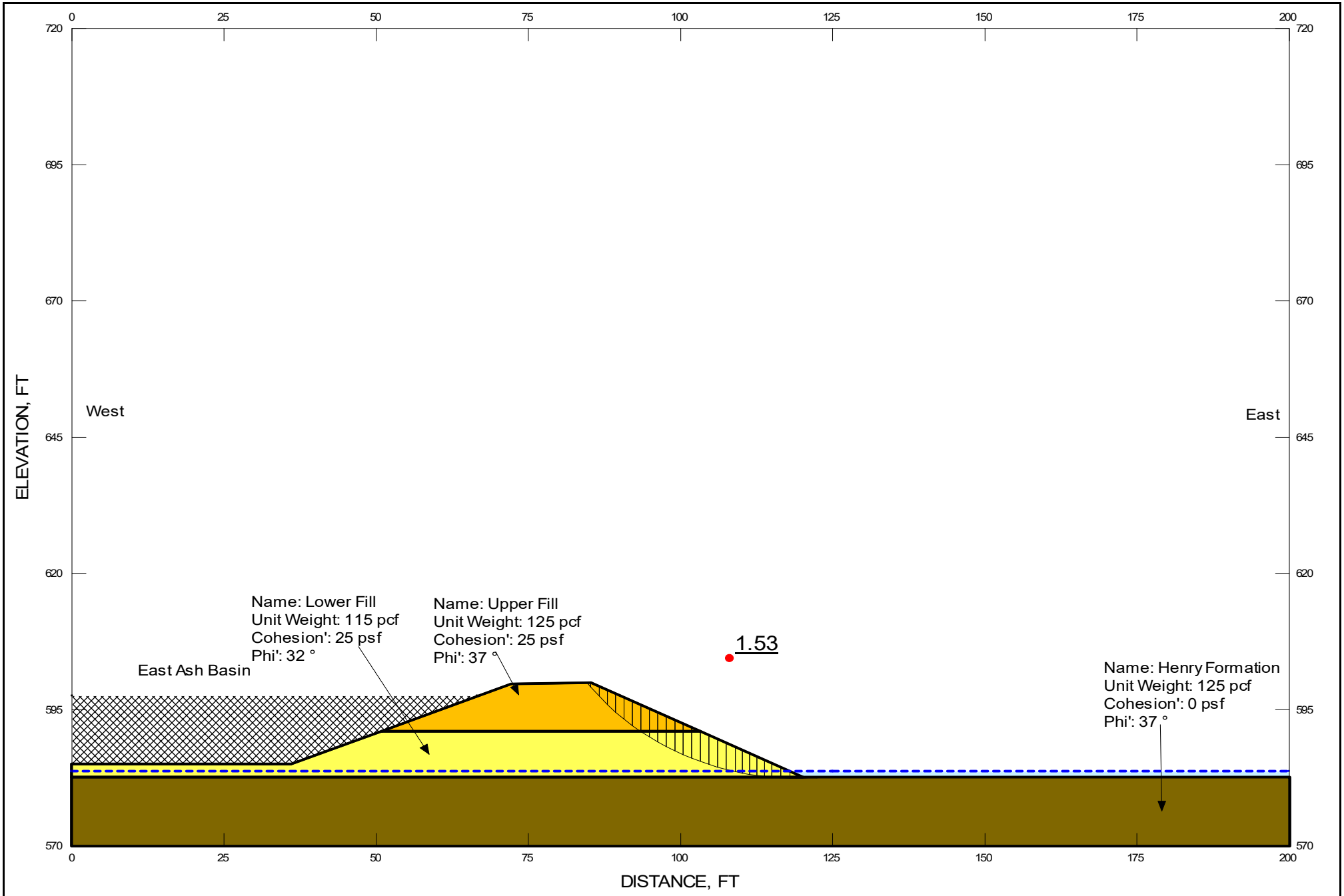
Geosyntec consultants	Analysis: Section 1 - §257.73(e)(1)(i): Long Term, Maximum Storage Pool Loading		FIGURE 4
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 1.gsz	Date: October 2016	



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	



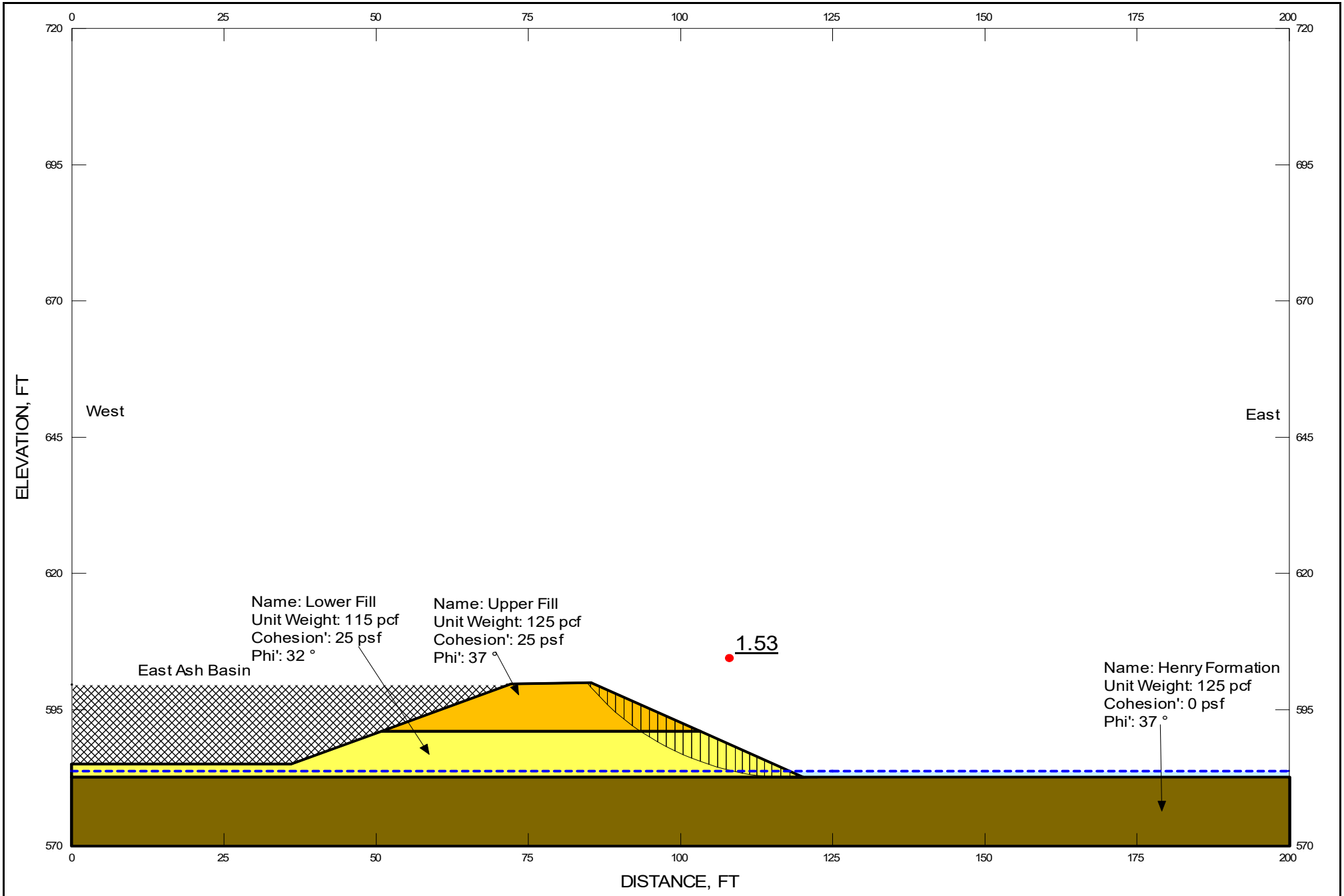
Geosyntec consultants	Analysis: Section 1 - §257.73(e)(1)(iii): Long Term, Maximum Storage Pool Loading with Seismic		FIGURE 6
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 1.gsz	Date: October 2016	



Geosyntec consultants

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

FIGURE 7



Geosyntec consultants	Analysis: Section 2 - §257.73(e)(1)(ii): Maximum Surcharge Pool Loading		FIGURE 8
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
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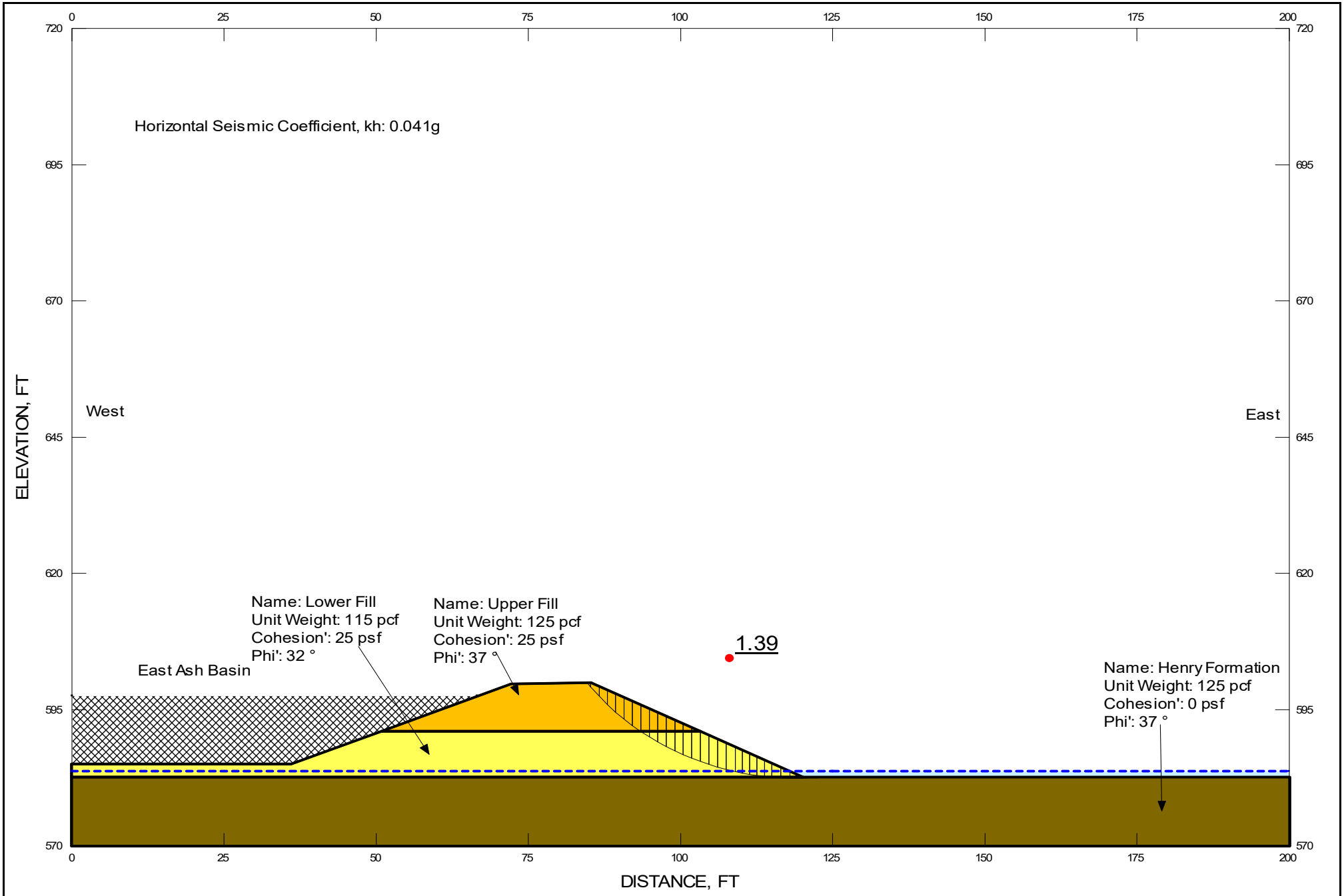

Geosyntec consultants	Analysis: Section 2 - §257.73(e)(1)(iii): Long Term, Maximum Storage Pool Loading with Seismic		FIGURE 9
	Project: Waukegan East and West Ash Basins	Analysis By: Jay Griffin	
	File Name: Waukegan Section 2.gsz	Date: October 2016	