HERCULES

Hercules Incorporated
Ashland Hercules Research Center
500 Hercules Road
Wilmington, Delaware 19808-1599

March 17, 2015

VIA ELECTRONIC DELIVERY

Ms. Meredith C. Anderson
Restoration and Underground Storage Tank Branch
RCRA Division
United States Environmental Protection Agency, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-3104

Mr. Willie McKercher
Mississippi Department of Environmental Quality
P.O. Box 2261
Jackson, Mississippi 39225

Subject: Submission of the Final Interim Measures Design Report (100% Design)
Hercules Incorporated, Hattiesburg Facility
Hattiesburg, Forrest County, Mississippi
USEPA RCRA 3008(h) Administrative Order
Docket No. RCRA-04-2014-4201(b)
EPA I.D. No. MSD 008 182 081

Dear Ms. Anderson and Mr. McKercher:

Hercules Incorporated (Hercules) is pleased to submit the above report (Report) for the decommissioning of the impoundment basin (IB) and associated tanks at the Hercules facility located in Hattiesburg, Mississippi. The Report has been prepared as required by Attachment 2 of the Resources Conservation and Recovery Act (RCRA) Section 3008(h) administrative Order on Consent (3008(h) Order), Docket No. RCRA-04-2014-4201(b), July 8, 2014 (USEPA). This Report revises the previously submitted draft report dated February 17, 2015 based on comments received from USEPA in a letter dated March 3, 2015 as clarified in an email to Hercules Inc. dated March 4, 2015. The Report contains design details that will be implemented to prepare the IB, solidify and dispose of sludge removed from the IB, tank ET-10, and tank ET-18, and backfill the IB. This Report combined with the approved Revised Interim Measures Work Plan dated November 7, 2015 shall be used to implement the project.

In accordance with Section IV of Attachment 2 of the 3008(h) Order, Hercules will begin implementation of this work (i.e. mobilization to site) within 10 days from written approval of this Report by USEPA. As specified in Paragraph 59 of the 3008h Order, the following certification is made:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature: Gary R. Allen

Name: Gary R. Allen

Title: Director - Environmental, Responsible Care, Remediation and Sustainability

Date: 3-17-15

If there are any questions concerning this submittal, please contact Hercules Project Coordinator Mr. Timothy Hassett at (302) 995-3456.

Sincerely,

Gary R. Allen

Gary R. Allen

cc: Melissa Collier-McGee – MDEQ, Jackson, MS (electronic copy – CD)
Hercules Incorporated – Hattiesburg, MS
Timothy Hassett – Hercules, Wilmington, DE
Kristina Woods – Hercules, Dublin, OH
John Ellis – ARCADIS, Baton Rouge, LA (electronic copy – CD)

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

HERCULES

Final Interim Measures Design Report (100% Design)

USEPA RCRA 3008(h) Administrative Order
Docket No. RCRA-04-2014 (b)
EPA I.D. No. MSD 008 182 081

Hercules Facility
Hattiesburg, Mississippi
March 17, 2015

ARCADIS

Andrew Davis, P.E. (MS)
Senior Engineer

John Ellis

John Ellis
Principal Scientist

William M Golla

William Golla
Project Manager

Final Impoundment Basin Interim Measures Design Report (100% Design)

Hercules Facility
Hattiesburg, Mississippi

Prepared for:
Hercules Incorporated

Prepared by:
ARCADIS U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:
LA002999.0023

Date:
March 17, 2015

Table

Figures

Appendix

1. Introduction

This Impoundment Basin (IB) Final Interim Measures Design Report (IMDR) is being submitted as required by Attachment II of the Resource Conservation and Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent (3008(h) Order), Docket No. RCRA-04-2014-4201(b), July 8, 2014 (USEPA, 2014). One focus of the 3008(h) Order is to complete interim measures of the IB associated with the former wastewater treatment system at the Hercules Incorporated (Hercules) facility located in Hattiesburg, Mississippi.

This Final IMDR is generally consistent with the Revised Interim Measures Work Plan (IMWP) dated November 7, 2014 (ARCADIS, 2014), which was approved with modifications by the United States Environmental Protection Agency (USEPA) in a letter dated December 4, 2014. Additionally, clarifications to the USEPA comments on the Revised IMWP were electronically mailed to Hercules on December 11, 2014. The USEPA approved Hercules' request to submit the Draft IMDR on or before February 4, 2015. On January 27, 2015, USEPA granted an extension (via email) for the submittal of the Draft IMDR to February 17, 2015. The Draft IMDR was submitted on February 17, 2015 and was approved with modifications by the USEPA in a letter dated March 3, 2015. Additionally, clarifications to the USEPA comments on the Draft IMDR were emailed to Hercules on March 4, 2015. This Final IMDR incorporates USEPA's comments and also includes additional details on the sheet pile design (Appendix G), temporary structure design (Appendix H), and water/air treatment components (Appendix I). A copy of the above referenced correspondence is included in Appendix A.

In addition to the IB, this Final IMDR presents data and proposed plan to remove, solidify and dispose of sludge from two equalization tanks (ET-10 and ET-18) and a small sump associated with the IB's more recent operations. This Final IMDR is a supplemental document to the Revised IMWP and both this Final IMDR and the Revised IMWP shall be used for the implementation of the decommissioning activities.

The primary purpose of this Final IMDR is to summarize pre-construction activities, provide design details on the work to be completed, and present the anticipated schedule of work. This Final IMDR includes the following sections:

- Background;

- Pre-Construction Activities;

- Site Preparations;
- Sheet Pile Design;
- Temporary Structure and Ventilation Design;
- Solidification Details;
- Additional Odor/Vapor Control Details;
- Water Treatment Design, Installation and Operation;
- Waste Management Plan;
- IB Backfilling/Restoration;
- ET-10 Demolition;
- Contingency Plans;
- Permits; and
- Schedule.

2. Background

This Final IMDR provides some additional details (compared to the Revised IMWP) on the method or methods to be used to decommission the IB, ET-10, and ET-18 including the water infiltration controls, capturing and treatment of constituents of concern (and odors) following potential cross media transfer, sludge dewatering, water treatment, sludge solidification, waste management and additional odor/vapor controls. Background

2.1 Description of Sludge Containing Structures

The IB is generally rectangular in shape and measures approximately 70 feet by 250 feet (17,500 square feet). The IB was constructed with an earthen bottom and interior baffles, and was retro-fitted with wooden sides. The total depth is approximately 10 feet deep. A concrete cap surrounds the perimeter of the IB and is constructed on pilings. A series of wooden mixing baffles is located in the western end of the IB, and in the northeastern corner around the lift pump area. There is an estimated 8 feet of sludge present in the IB (4,431 cubic yards/3,957 tons) requiring removal. Following removal of the sludge, the IB is to be backfilled with clean fill from both on-site and off-site sources. All structures are to remain (except piping entering the IB shall be plugged and mixing baffles shall be removed) unless there is a technical advantage to remove them. During the initial decommissioning activities in 2012 using the belt-filter press for dewatering, approximately 280 cubic yards of sludge was removed via pumping and dewatered and disposed of at permitted off-site facilities.

In addition to the sludge within the IB, sludge outside the IB walls in the southeastern corner of the IB and approximately 6 inches of native material from beneath the sludge will be removed and disposed of as part of this project. On September 20, 2012, six direct-push boreholes were advanced just outside the IB's timber sidewalls to look for indications of IB constituents and/or sludge (Figure 1) (ARCADIS 2012). The samples were analyzed with a field screening instrument and visually inspected for the presence of sludge. Of the six boreholes advanced, one borehole in the southeastern corner of the IB contained sludge behind the IB sidewalls.

The sludge in the IB is too wet to directly dispose of at a landfill; therefore, removal or solidification of the free liquids in the sludge is required. In 2012 and early 2013, mechanical dewatering of the sludge was implemented using a belt filter press; however, this dewatering technique proved to be ineffective. The filter press was accumulating a sticky/gummy material on the belt and rollers, preventing effective operation. Therefore, solidification of the sludge prior to off-site disposal is the most appropriate and effective approach to drying the sludge and decommissioning the IB. Use of a reagent for stabilization or solidification of the sludge that will be managed as hazardous that contains organic constituents will be completed in compliance with applicable portions of 40 Code of Federal Regulations(CFR) Part 265 Subpart CC, and in accordance with Section 7 of this Final IMDR.

In addition to the IB, sludge ET-10 and ET-18 will be solidified and removed. The 5 million-gallon equalization tank identified as ET-10 is approximately 160 feet in diameter and 32 feet tall with an open top. ET-10 was constructed in approximately 1980 and is separated from the IB by a city street. ET-10 has a single 24-inch-diameter man-way located approximately 4 feet above grade. The bottom of the tank is equipped with an 18-inch slope to the center drain line. There is an air sparge manifold system in the bottom of the tank that may be removed if cost effective.

There is an opening cut in the tank sidewall roughly 12 feet above land surface, which is approximately 20 feet wide. There is an estimated average thickness of 11 feet of sludge remaining in ET-10 (8,329 tons/8,400 cubic yards [yd^3]) that requires removal. The thickness of sludge is not expected to be uniform across the foot print of the tank and may be thicker adjacent to the man-way.

Sludge from equalization tank ET-18 shall be removed as well. ET-18 has approximately 300 tons/302 yd^3 of sludge and 120,000 gallons of free liquid water. Four additional tanks have minimal if any sludge and just require some cleaning so that they can be demolished at a later date. Lastly, a secondary sump will require cleaning at the completion of the job. When in operation treated wastewater is passed through the secondary sump prior to being discharged to the publically owned water treatment works (POTW) under the facilities existing discharge permit (MSP091286).

2.2 Revised Interim Measures Work Plan

The Revised IMWP was submitted on November 7, 2014 (ARCADIS 2014) and approved in a letter dated December 4, 2014 (Appendix A). The approval letter also granted an extension from 30 days to 60 days for the submittal of this Final IMDR. The USEPA sent an email entitled, “Clarifications to IB Work Plan Modifications Comment Letter Dated 12/04/2014.” The email clarified comments made by the USEPA regarding side wall sampling, water treatment, and sludge sampling (Appendix A).

The Revised IMWP proposed a phase approach for the decommissioning of the IB. The first phase included the investigation and preparation necessary to promote a safe and effective interim measures design. The second phase included bidding the project to interested, qualified contractors and preparation of this Final IMDR. The third phase entails the implementation of the interim measures design elements. This Final IMDR includes the construction of the sheet piling, placement of a structure over top of the IB, implementation of a vapor management system, sludge dewatering, water management, solidification and disposal of sludge, backfilling the IB, environmental monitoring, and associated permitting and reporting.

Revisions and/or additions to the approved Revised IMWP included in this Final IMDR are as follows:

- Solidification of sludge from tanks ET-10 and ET-18, and a sump located north of the IB identified as the “secondary sump”.

- Pumping of ET-10 and ET-18 sludge to an empty nonhazardous cell of the IB for solidification under the controlled environment of the temporary structure to address potential odor issues.
- Cleaning of three tanks in the Kymene area and ET-19. Little or no sludge remains in these tanks and a simple cleaning is required before they undergo demolition.
- Backfilling of the IB with soil stockpiled from the Providence Road Sewer Replacement project.
- Sheet piling will remain in place following the completion of the project.
- Cells 2, 4, 5, 6 and 8 within the IB will be sampled and analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) for benzene and carbon tetrachloride following solidification to confirm the nonhazardous nature of the sludge before disposal.
- Sludge to be managed in accordance with hazardous waste regulations that is not accepted by Waste Management's (WM's) facility in Emelle, Alabama will be incinerated at Clean Harbors' facility in La Porte, Texas.

2.3 Bidding Summary

On November 21, 2014, a preliminary invitation to bid was sent to nine qualified contractors. Contractors interested in the project were permitted to collect sludge samples from the IB in December 2014, prior to completing their proposals. On January 6, 2015 a formal request for proposal (RFP) was sent to eight contractors with a due date of January 26, 2015 for final bids. The RFP included technical specifications that are provided in Appendix B. Following two RFP Addendums, six bids were received on January 26, 2015. The contractors and bids were evaluated based on technical approach (specifically solidification strategy, odor mitigation approach, and safety considerations), experience with similar projects, proposed costs, and potential for cost increases. Following a thorough evaluation including interviews with three contractors, Clean Harbors was awarded the project on February 9, 2015. This Final IMDR was developed with support from Clean Harbors including their technical experts and subcontractors.

Clean Harbors will also provide a Contractor's Health and Safety Plan (CHASP) prior to implementing the interim measures. The CHASP can be made available upon request.

3. Pre-Construction Activities

3.1 Sludge and Soil Sampling

Sludge and soil sampling was completed on December 16 through 18, 2014 on the five nonhazardous cells of the IB. This activity was completed due to the USEPA's concerns that prior sludge removal activities may have mixed sludge between the cells that would be managed as hazardous cells and nonhazardous cells. To complete the sampling the IB was divided using imaginary lines marked along the IB walls into eight zones or cells. The cells were designated Cell-1 through Cell-8 consistent with the previous sampling location labels (i.e. sample location IBS-1 is within Cell-1). Each of the eight cells is estimated to contain approximately 700 to 800 yd^3 of sludge, in-place, with the exception of Cell-7 which only contains approximately 350 yd^3 of sludge. Three of these cells (Cell-1, Cell-3, and Cell-7) were previously designated as cells containing sludge that will be managed in accordance with hazardous waste regulations (referred to herein as "hazardous waste cells") and contain some sludge in excess of the toxicity characteristics for benzene.

Sludge samples were collected at each cell previously deemed nonhazardous (Cell-2, Cell-4, Cell-5, Cell-6, and Cell-8). Eight grab samples (four lower, four upper) were collected and composited into two lower and two upper samples for laboratory analysis. Samples labeled as upper or lower 1 were composites of sampling locations "A" and "B" in each cell while upper or lower 2 were composites of sampling locations "C" and "D" in each cell. Locations of samples A through D for each cell can be found on Figure 2. The upper samples were collected from the midpoint of the upper two-thirds of the sludge column while the lower samples were collected from the midpoint of the lower one-third of the sludge column. The sludge samples were analyzed for TCLP volatile organic compounds (VOCs). One sample from Cell 2 (upper zone) was split at the laboratory to allow for a duplicate analysis. In addition, a matrix spike/matrix spike duplicate was analyzed by the laboratory.

In addition to sampling the sludge, a grab sample from the top six inches of native soil immediately beneath the sludge at each cell was collected. These grab samples were composited into four composite samples (Cell-1/Cell-3, Cell-7, Cell-2/Cell-4, Cell-5/Cell-6/Cell-8) for laboratory analysis of TCLP VOCs to complete a waste determination of the underlying soil. Refer to Figure 2 for the layout of the cell configuration. Sludge coring logs can be found in Appendix C.

Sampling results were compared to the RCRA TCLP VOC limits. All sludge samples were below the RCRA TCLP VOC limits except for Cell 2 lower 1 sample which exceeded the limit for carbon tetrachloride (1.2 milligrams per liter [mg/L]), Cell 4 lower 2 sample which exceeded the limit for benzene (0.59 mg/L), and Cell 2 upper 2 duplicate sample which exceeded the limits for benzene (0.55 mg/L) and carbon tetrachloride (0.62 mg/L). Note that for Cell 2 upper 2 samples only the duplicate sample exceeded RCRA TCLP VOC limits. Averaging the two Cell 2 upper 2 samples results in a concentration that does not exceed the RCRA TCLP VOC limit. Since the two samples came from the same sample bottle and were divided at the laboratory, averaging the data from Cell 2 upper 2 is a viable method to evaluate the data. No soil samples exceeded the RCRA TCLP VOC limits. Results of the sludge and soil sampling are provided in Table 1.

Sludge from Cells 2, 4, 5, 6, and 8 will be managed as a nonhazardous waste based on the current waste determination for these cells. However, as required by USEPA in their email dated March 4, 2015 to Hercules, two representative samples will be taken from each of these cells following solidification for TCLP analysis of benzene and carbon tetrachloride to confirm the nonhazardous nature of the sludge. One sample will be collected from each half of each cell. This data will be provided to USEPA, Mississippi Department of Environmental Quality (MDEQ), and Pine Belt Regional Landfill (PBRL) to confirm that the waste can be disposed of at the PBRL as nonhazardous waste. If the sample results from the corresponding half of a cell exceed the toxicity limit for benzene or carbon tetrachloride, then compliance with the Universal Treatment Standards per the Land Disposal Restrictions will be determined for benzene and the underlying hazardous constituents (UHCs) and the sludge will be shipped to WM’s Subtitle C landfill in Emelle, Alabama or Clean Harbors’ incinerator in La Porte, Texas.

Based on the results of the soil sampling, the soil beneath the sludge can be disposed of at a nonhazardous landfill facility (PBRL).

3.2 Contractor Sludge Treatability Analysis

Prior to bidding on the project, Clean Harbors personnel collected sludge samples from the IB for a treatability analysis from December 15 through 18, 2014. Objectives of the treatability analysis were as follows:

- Identify additives (specifically Calciment [quick lime and Portland cement], cement kiln dust ([CKD], lime, and/or zeolite) that will solidify partially dewatered

IB sludge to a shippable and disposable consistency, e.g., the material will pass the Paint Filter Liquid Test (PFLT).

- Identify additives (sawdust and polymer) that will solidify IB liquid to a shippable and disposable consistency, e.g., the material will pass the PFLT.
- Identify if an oxidant (sodium percarbonate or potassium permanganate) can reduce the release, creation, or dispersal of unacceptable odors during water handling and treatment and during sludge handling, treatment, and curing.

3.2.1 Contractor Sludge and Water Collection Methods

Sludge was collected from three cells (Cell 1, Cell 7, and Cell 8) where sludge will be disposed of in accordance with hazardous waste rules and two nonhazardous cells (Cell 3 and Cell 6). Two methods of sludge collection were attempted. The most efficient involved a 10-foot length of 2-inch-diameter Schedule 40 polyvinylchloride (PVC) pipe. Field personnel collected samples from the concrete walk surrounding the IB. Samples for each designated cell were collected according to marks (placed by ARCADIS personnel) that designated each cell boundary.

To collect each sample, the PVC pipe was forced into the IB sludge at angles varying from 5 to 25 degrees from vertical surrounding the lagoon. The PVC pipe was withdrawn and, depending on the volume of sludge and water thought to be within the pipe by its weight and the one to four effort required for pipe insertion and retrieval, the PVC pipe was inserted from one to four times at each sub-location within a single area. If more than one insertion occurred, the PVC pipe was not lifted above the surface of the water to minimize sample loss. The area from which the pipe was reinserted was typically 4 to 8 square feet in size.

After each insertion, the open end of the 2-inch-diameter PVC pipe above the water was closed with an expandable plug. The plug prevented the entry of air into the pipe, which maintained a slight vacuum and minimized the loss of its contents. The pipe was then raised above the surface of the water and the open end was positioned above the 5-gallon bucket assigned to that area. The expandable plug was then removed. The pipe was raised to a vertical position and shaken gently, which often loosened the sample and allowed it to fall into the bucket. If the shaking was not effective, the pipe was lowered to a near horizontal position with its open end above the bucket. A 10-foot length of 1-inch-diameter PVC pipe with its lower end capped was inserted into the 2-inch-diameter PVC pipe pushing the sludge into the bucket. The 1-inch PVC pipe was partially withdrawn and re-inserted between five and ten times while the 2-inch PVC pipe was rotated and shaken to maximize the transfer of sludge from the pipe to the bucket.

Twenty to thirty insertions of the pipe were necessary to recover approximately 4 gallons of sludge from each cell. The 5-gallon bucket for the area was covered with a removable/re-sealable lid. All buckets were allowed to settle overnight.

Standing water was also collected from the IB samples contained in buckets. Three, 200-milliliter (mL) clear glass bottles with removable/replaceable lids were filled with water from each of the five 5-gallon buckets on Wednesday, December 17, 2014. Each empty bottle was weighed first. Approximately 150 mL of water from a single bucket was transferred to each bottle using a plastic container filled via vacuum. This procedure minimized disturbance and re-suspension of the settled sludge. The lid was re-placed on each bucket as soon as the three bottles had been filled. Each bottle was then re-weighed to determine its total weight and calculate the net water sample weight.

3.2.2 Contractor Treatability Study Conclusions and Recommendations

- The nature of the sludge from each area varied widely based on visual, olfactory, and instrument values determined during this Solidification and Odor Control Bench Test (BT) and previous investigations. Variables included:
  - Relative abundance of free and sorbed organic compounds.
  - Percentage of solids, either organic or inorganic, in sludge samples.
  - Nature and abundance of hydrogen cyanide and hydrogen sulfide gas and volatile organic vapors in the headspace above sludge samples.
- The physical variability of the sludge within the IB will likely necessitate modification of the additive dosage within individual cells as well as modifications in odor controls. However, the differences in dose and effort are presently anticipated to vary no more than 20 percent among areas.
- The study concluded that the most cost-effective additive for both sludge and water thickening was dry sawdust. If the material is available, the challenge will be the collection and transportation of 3 million or more pounds of dry sawdust.
- The second most cost-effective additive for sludge thickening was CKD. CKD is more available than the amount of sawdust that would be required.
- Sufficient Waste Lock 770 (a solid, granular superabsorbent polymer developed by M^2 Polymer Technologies, Inc.) absorbed all liquid water. However, it was observed that the inorganic ions were able to break the gel back into water over time. Incidental contact with inorganics during loading, transport to a landfill, and

after placement could potentially release the water, creating challenges in transportation of the material.

- Potassium permanganate and sodium percarbonate were equally effective at reducing hydrogen sulfide concentrations in the sample off-gas; however, potassium permanganate was more effect at reducing VOC concentrations in the sample off-gas plus the reaction did not result in bubbling from the water like the sodium percarbonate.

The complete procedures and results of the Clean Harbors' treatability study are included in Appendix D.

3.3 Geotechnical Sampling and Testing

As discussed in the Revised IMWP, the geotechnical investigations (described below) were completed to address data needs for design of the excavation support system for decommissioning of the IB. Investigation field activities were performed between December 18 and 23, 2014, and on January 5 and 6, 2015, along the outside perimeter of the IB to determine geotechnical properties of the soils. Specifically, the investigation gathered information about the soil stratigraphy, strength and consolidation properties of the soil, and groundwater level.

A total of five borings (i.e., B-101, B-103, B-103A, B-104, and B-106), as located on Figure 1 were advanced using a 6⅞-inch hollow-stem auger drilled to depths ranging from 11 to 52 feet below ground surface (bgs). Hand augering to a depth of 5 feet was completed at each location for utility clearance purposes. Soil sampling and Standard Penetration Testing (SPT) were performed throughout each boring using a 2-inch outside diameter (OD), 2-foot-long split spoon sampler, in accordance with ASTM International (ASTM) D1586. Three-inch-diameter undisturbed samples (Shelby Tubes) were also collected at field-determined intervals based on visual classification of materials encountered. Upon completion, the borings were backfilled with grout to ground surface.

All samples were visually classified with respect to general material types and consistency and stored for potential laboratory testing. Field data such as blow counts (N-values), pocket penetrometer readings, groundwater elevations, and general details related to the advancement and sampling of each boring was recorded by the ARCADIS on-site representative. Logs for each of the borings are included in Appendix E.

In addition to visual classification and recording N-values (i.e., SPT ASTM D1586) at each of the boring locations, representative samples were selected for potential analysis of one or more of the following geotechnical properties:

- Moisture content as a percentage of dry weight (ASTM D2216);
- Particle size analysis (ASTM D422);
- Specific gravity of soil (ASTM D854);
- Atterberg limits (ASTM D4318), as necessary;
- Consolidation (ASTM D2435); and
- Consolidated/undrained (CU) triaxial compression test for cohesive soils (ASTM D4767).

The geotechnical investigations completed around the perimeter of the IB indicated the area is underlain by an initial layer of fill, followed by silty sand and then a clay unit. The fill unit consists primarily of silt and sand that ranges in thickness from approximately 5 to 8.5 feet and may be locally absent. Fill material was noted in two of the borings, B-103 (0 to 5 feet) and B-104 (0 to 8.5 feet).

The silty sand unit was encountered in each exploration and is continuous across the area. N-values recorded in the sand unit vary from 4 to 18 blows per foot (bpf) with a median of 11 bpf indicating loose to medium dense conditions. The thickness varied from 1.5 feet (boring B-104) to 13 feet (boring B-101).

With the exception of boring B-103, all of the borings extended through the silty sand layer into the clay unit. The top of the clay unit was encountered starting at depths ranging from 11 to 17 feet bgs and extended into the clay layer between 17 and 35 feet before termination. In general, the clay unit was described as gray, clay to silty clay to sandy clay, with firm to very stiff consistency. N-values recorded in the clay vary from 6 to 28 bpf, with a median of 17 bpf. Results of field pocket penetrometer readings varied from 1 ton/square foot (tsf) to greater than 4 tsf, indicating generally stiff to very stiff conditions. Groundwater levels noted on the boring logs vary from 5 to 9 feet bgs. Geotechnical laboratory testing results are included in Appendix F.

3.4 Design Objectives

The purpose of the project is to solidify and remove sludge from the IB, ET-10, ET-18, and the secondary sump for proper disposal.

To achieve this, the following design objectives have been established:

- Implement interim measures in a manner safe to all personnel and the public.
- Separate the cells effectively without any mixing of sludge between cells being managed as hazardous and nonhazardous cells.
- Minimize sludge volume by removing, treating and discharging free liquids to the POTW while minimizing the addition of groundwater and precipitation prior to solidification.
- Solidify sludge to be in compliance with the PFLT so that it can be removed, transported and disposed of appropriately while minimizing the amount of solidification agent required.
- Recover and treat any volatilization of organic compounds from cells identified as cells being managed as hazardous (cross media transfer).
- Monitor and mitigate the release of odors that may be considered a nuisance and vapors that may be considered harmful to the public.
- Backfill the IB to promote drainage of surface water and minimize erosion.
- Comply with applicable rules and regulations including the facility Storm Water Pollution Prevention Plan (SWPPP), the facility discharge permit to the POTW, and RCRA (for the removal and disposal of the sludge).

To accomplish these objectives many tasks will be completed. These tasks include the design and construction of sheet piling within the IB, design and construction of a temporary structure for odor control, odor mitigation and monitoring, management/treatment of free liquids, tank cleaning, IB pipe and baffle decommissioning, backfilling, demolition of ET-10, and site restoration.

4. Site Preparations

4.1 Sediment and Erosion Controls

Appropriate erosion control measures (i.e. silt fence) will be purchased and installed in addition to any other required pre-job grading or improvements to allow for appropriate access to the IB and/or staging areas.

Erosion control measures such as silt fencing, berms, sediment logs, and hay bales will be placed to prevent water and sediment from leaving the area. In general, local storm drains and potential conduits for surface water runoff will be protected using silt collection socks and booms. All erosion controls will be inspected weekly and after a one inch rain event to make sure they are in sound working order. Any required repairs will be completed immediately and documented in the daily report.

Clean Harbors and its subcontractors will take measures to ensure compliance with the facility's SWPPP and prevent deleterious materials from entering the storm sewer system. During the course of the anticipated scope of work, fuel, chemicals, grease, bituminous materials, solids, waste, wash water, oil or other pollutants will not be purposely discharged or spilled onto any part of the site. All contractors will take necessary precautions to prevent the release of pollutants by ignorance, accident, or vandalism. In the event a spill does occur on the site, MDEQ and USEPA will be notified.

4.2 Site Preparation and Management

Approximately one week prior to mobilization, Clean Harbors will notify the state via the one-call utility notification service, so that utilities, above and below ground surface, are properly marked. The contact number for filing the notification shall be made by dialing 811. In addition, Clean Harbors will subcontract a private utility locating company to mark as many potential utilities in the vicinity of the IB where excavation is planned.

An office trailer will be mobilized to the site and positioned in close proximity to the IB in order to closely manage daily operations. Once the field crew has mobilized to the site and taken part in the necessary orientation at the facility, the crew will ready the site for the scope of work. Clean Harbors' employees will complete a full inspection of the mobilized equipment to verify that all safety equipment is present and of sound working order. At the completion of each working day, all keys for the equipment will be returned to the office trailer.

To prepare the site for the scope of work, the crew will move the previously staged soil pile located immediately west of the IB and consolidate these soils to a location further south. The surface water ditch to the south of the IB will be backfilled with on-site soils. A temporary drainage pipe will be installed in the ditch to convey the surface. This work will bridge the currently open ditch to create an even work zone for installing sheeting and the temporary structure enclosure. Piping and other obstructions around the perimeter of the IB will be removed during this time as well.

A local licensed electrician from Hattiesburg, Mississippi, will be utilized to supply electrical services associated to the scope. There are power lines running north to south within 25 feet of the east side of the IB. These lines may need to be removed, relocated or shielded prior to installation of the sheet piling and temporary structure.

Clean Harbors will coordinate the sheet piling delivery and installation as well as the delivery and installation of the temporary structure. A local Hattiesburg, Mississippi, contractor will be installing the sheet piling. The contractor will conduct appropriate orientation and on-boarding procedures prior to the mobilization of materials and equipment. Clean Harbors will also conduct a preliminary meeting with the contractor prior to the installation of the sheet piling.

4.3 Surveying

A licensed surveyor will be procured to install control points and determine pre-existing conditions of the IB and surroundings. Once the sludge removal of the IB is complete, a post excavation survey of the IB will be completed. Finally, a survey of the site after the IB has been backfilled and graded per the specifications will be completed. Clean Harbors' employees may work with the surveyor to perform interim data collection to improve the beneficial use of the survey information. Clean Harbors has personnel on-staff who are trained to utilize the following equipment; Global Positioning System (GPS) and Total Station (manual or robotic).

5. Sheet Pile Design

Clean Harbors will work with the sheet piling contractor and finalize the design for the sheet piling. The preliminary design is presented in Appendix G. Sheets will be AZ-19 sheets with a length of 30 feet. The sheets will be imbedded into the soil beneath the IB approximately 22 feet deep.

Following design approval the equipment and materials will be delivered to the site for unloading, inventory, and installation. The exterior (perimeter) sheet piling will be installed along the south side of the IB and progress in a clockwise fashion to enclose the IB. All sheets installed will be water tight with appropriate joints and corners sealed (Wadit sealant). During the installation of the perimeter sheet piling Clean Harbors and the contractor may identify baffles obstructing the installation. As a result the sheet piling line may be adjusted or baffles will be removed as necessary. If the baffles are removed they will be cleaned and segregated in roll-off boxes for Transportation and Disposal (T&D). Once the perimeter sheet piling is complete the contractor will begin the installation of interior sheet piling to delineate grids (cells) and assist removal and solidification of the sludge within the IB. Once installed the interior sheet piling will be sealed with the exterior sheet piling. Please refer to the odor control measures below regarding odor concerns while driving sheet piling.

6. Temporary Structure and Ventilation Design

6.1 Temporary Structure

Clean Harbors has a strong working relationship with their vendor/sub-contractor for the temporary structure that will be placed over top of the IB. The preliminary design is that of the current configuration, 295-foot (length) x 131-foot (width) x 49-foot (height) structure, see Appendix H. This structure will have doors for personnel and curtain doors to allow equipment access inside the structure. The structure will be mobilized to the site during sheet piling installation to inventory and assemble the structure. Assembly of the temporary structure will be scheduled so that when the interior sheet piling is complete the structure will be lifted into place and located over the IB. The structure will be protected and anchored securely for wind events. Once the structure has been secured, the air equipment (ventilation) system will be located to maximize the turn-over efficiency and minimize any obstructions during the work scope. When all equipment has been laid out, the licensed electrical contractor will start connecting the wiring and power for operation. See below for additional information regarding the air ventilation and odor control systems.

No work will commence until the temporary structure and ventilation system are complete and functional. The goal is to minimize potential concerns to the public.

6.2 Ventilation and Air Treatment

Air pressure inside the temporary structure must be maintained at a pressure lower than the exterior atmosphere. This will promote capture and treatment of vapors and odors released during sludge solidification and removal.

The following scope and tasks are proposed.

- Air-handling systems will be mobilized to the site. Multiple, complete systems will be used. Clean Harbors anticipates mobilizing sufficient units to move 30,000 to 90,000 cubic feet of air per minute (cfm) with an average of 65,000 cfm during working hours. This flow rate equates to an air flow exchange rate of three air exchanges per hour. During non-working hours only a slight negative pressure is required so only approximately 10,000 cfm will be required. Multiple units will allow treatment of the IB, ET-10, and ET-18 simultaneously or sequentially, as needed. It will also allow the use of different flow rates at different times of the day, e.g., during work or idle periods, if needed.

- Air-handling system has the following main components.
  - Fan – Centrifugal fans manufactured by Cincinnati Fan (model number HDBI-360HD) with an impeller mounted on the motor shaft and capable of variable speed. At 1,780 rotations per minute (RPM), each fan will move 25,000 cfm at 15 inches of water pressure.
  - Electrical panel and variable frequency drive (VFD) – Electrical controls are mounted in a National Electrical Manufacturers Association (NEMA) 4 panel. The VFD facilitates starting of high horsepower motors and regulation of air flow.
  - Carbon media bed – A typical bed will contain from 10,000 to 20,000 pounds of activated carbon. Air is introduced below an expanded metal and screen floor and flows upward. Treated air is discharged at a point above the activated carbon.
  - The use of two carbon beds in series with sampling ports before, between, and behind sampling ports inserted at a point between the top and bottom of the carbon mass in a larger bed will enable Clean Harbors to monitor vapor and gas concentrations and schedule replacement of activated carbon media before all media is saturated and breakthrough occurs.
- The air pressure outside and inside the temporary structure will be monitored to confirm negative pressure inside the structure. Monitoring will be done twice per shift during work hours with air flow adjusted accordingly. Pressure reading pairs will be recorded.
- Concentrations of VOCs, oxygen, hydrogen cyanide, and hydrogen sulfide, and the percentage of lower explosive limit will be monitored periodically inside the building. Stationary air monitoring stations will be provided for external monitoring that provide real-time data and data logging with wireless connection to a central personal computer. Air quality within the structure will be monitored as needed or twice per shift at a minimum, utilizing handheld four or five-gas meters. Monitoring levels will be recorded.
- Discharged air will be monitored periodically to verify treatment has sufficiently reduced or eliminated concentrations. Handheld four or five-gas meter devices will be utilized with readings recorded.

Factors affecting the air flow rate can include the material being worked and ambient temperature. At a minimum, negative pressure will be maintained during non-working hours to control fugitive odors. At a maximum, sufficient blower and treatment capacity will be present to exchange the air within the enclosure six times per hour. Through periodic monitoring in work areas, the air flow can be adjusted to minimize worker exposure and the level of personal protective equipment (PPE) required within the enclosure. The temporary structure design is provided in Appendix H and the ventilation/air treatment details are provided in Appendix I. Additional detail on the air monitoring program can be found in the Revised IMWP.

7. Solidification Details

7.1 Sludge Removal between IB Walls and Sheet Piling

Once the enclosure and associated equipment are in place the sludge work will begin. The material present in the space between the perimeter sheet piling and the IB walls will be removed and transferred to the cell immediately adjacent to where it is located. The transfer of the material will be performed by a slurry gate pump or CUSCO truck. During or immediately after removing the sludge from this space, flowable fill will be placed within the void. The flowable fill will not require compaction like traditional backfilling practices. This work will be completed prior to the excavation and solidification of each cell within the basin.

7.2 Sludge Solidification

The sludge removal and solidification process will start on the southeast side of the IB. A conventional excavator will pull the sludge along the south side and move to the west. A percentage of the solidification product will be added along the south side to aid in the removal of moisture from the material in the IB. After the initial dosage, the remaining solidification agent will be blended to meet the PFLT requirement. When Clean Harbors performed their BT in December 2014, a 15 percent dosage by weight of CKD produced favorable solidification results and passed the PFLT.

Clean Harbors will apply the following methods to remove liquids from the sludge within the IB structure. This technique has been successfully used on previous projects. A sump will be created to pump free liquids from the sludge. A minimum of one sump per divided area will be installed. The liquids will be captured by a filter box and pumped to the treatment area in the vicinity of the IB for processing. Once the liquid is removed from the sludge, Clean Harbors will apply the solidification agent.

The solidification material will be added to the sludge in one ton super sack increments. Prior to mobilization to the site a sample of the CKD will be analyzed for TCLP metals and the results will be provided to MDEQ and USEPA. Introducing the reagent in a controlled manner allows the sludge and agent to properly mix and solidify. The mixing will be performed with an excavator bucket in the mixing area (mixing bowl). The objective will be to solidify approximately 500 cubic yards per day in the mixing bowl. Based on experience, this technique thoroughly combines and solidifies the material to satisfy the paint filter test. The mix will also be visually inspected to verify that the proper amount of solidification agent has been added in order to fulfill the passing PFLT requirement. The IB solidified material from each cell will either be removed from the IB and isolated in a bermed area or left within the cell until waste characterization confirmation data is received from the laboratory prior to loading into trucks for disposal to the appropriate disposal facility. The trucks will be loaded with an excavator to control the placement of the solidified materials per legal loading limitations. After loading, the trucks will be visually inspected to confirm that the vehicle is clean and prepared to transport the materials to the approved facility. Each truck will be manifested separately and will travel through a prescribed truck route, exiting through the main gate located at West 7th street. Sludge within the trucks will be tarped and/or wrapped in plastic to control odors during transportation to the appropriate facility (See Section 10). Work will continue from one cell to the next without any comingling of the material between cells with sludge to be managed in accordance with hazardous waste rules and nonhazardous cells.

To observe a demonstration of the solidification an observer must comply with PPE protocols. Note that solidification may be completed in Level B. Observations without respiratory protection can be made from the doorways when solidification is occurring and the ventilation system is in operation. The work area can be observed adjacent to the IB once work has halted and the air is monitored and approved for entry without respiratory protection.

7.3 Pipe Decommissioning

Prior to removing the sludge, pipe penetrations will be excavated to access them outside the IB. The interior of the pipes will be cleaned of materials in order to enable plug and cap placement. The pipes will be capped and plugged with a non-expanding grout. The excavation on the perimeter of the IB will be backfilled with excavated materials from the same area. Access to these pipes will be conducted per the Clean Harbors' CHASP and meet all Clean Harbors' prescribed safety protocol.

7.4 ET-10 and ET-18 Sludge Removal and Solidification

When the sludge removal from the IB is approximately 55 percent complete, preparations for transfer of materials from ET-10 to the IB will begin. By transferring the sludge from ET-10 to the IB, odor can be mitigated under a controlled environment.

The material in ET-10 has been categorized as nonhazardous and the contents of the tank will be transferred to a nonhazardous cell in the IB. The material from ET-10 would be transferred to the southeast cell (Cell 8) of the IB and then managed identical to the IB sludge removal and solidification process. Transferring materials from ET-10 to the IB will utilize the existing line that crosses under Providence Street if possible. If this line proves to be unusable then the materials will be transferred through a culvert using double contained high-density polyethylene (HDPE) butt-fused pipe. The HDPE piping will run under Providence Street through conduit and terminate at the IB. Isolation valves will be installed to isolate sections of the piping if necessary. A slurry gate pump will be used in the tank to draw down material from the tank and transfer to the IB. The solidified ET-10 sludge will be staged within the IB or in a bermed area outside the IB to rest for a period of 20 hours prior to loading into trucks for disposal to PBRL.

All liquids from any of the above processes will be handled per the management of free liquids included below. Odor controls and water management will be handled as presented within this document and the Revised IMWP. Once ET-10 has been emptied Clean Harbors will clean the tank and demolish the tank per Section 12 of this report.

Sludge from ET-18 will also be pumped or trucked to the IB for solidification. If needed, to facilitate the transfer of sludge from ET-10 and ET-18, potable water or treated water from the free water treatment system will be used to assist in slurrying the sludge for pumping.

All remaining tanks will be cleaned after the majority of work is completed at the IB. These tanks are comprised mostly of free liquids with minimal or no-sludge in the structures. These tanks will be processed as previously mentioned in the free liquids management and the tank cleaning headings. Tanks ET-19, K-210, K-268 and K-269 will be cleaned during any downtime or during the backfilling operation of the IB. This work will be scheduled to reduce the project length and maximize work efforts. It is the understanding of Clean Harbors that the cleaning of the tanks will be based on a visual inspection for the status of clean.

8. Additional Odor Control Details

Vapor monitoring and mitigation is critical to project success and maintaining a safe work environment. Odors generated during activities inside the temporary structure will be captured by the ventilation and air treatment system as described above. However, sheet-pile driving may liberate odors before the temporary structure is installed. In addition, the management of free water and cleaning of tanks may also liberate odors outside the IB. Therefore, some of the tasks below will be implemented in addition to the ventilation and air treatment system. Details on the required monitoring of odors and VOCs are located in the Revised IMWP.

It is preferred to destroy or contain the majority of toluene and other VOC's before they transfer to the vapor phase in the atmosphere. Several situations during which gases and vapors may be released have been identified below. Each situation and potential pre-emptive measures are described below. Additional methods, such as deployment of an acceptable foam or reinforced plastic sheeting to physically restrict transfer of odors or vapors to the overlying air may also be employed in any of the situations below.

- Water Management – Water within ET-10, ET-18, or IB before and during pumping/treating may contain odors or vapors that can be emitted. Therefore as needed, the water will be amended to destroy/transform dissolved organics and inorganics and raise the oxidation-reduction potential (ORP) to a positive value. The amendment will be either potassium permanganate or sodium permanganate. The choice will depend on solution preparation and handling, required oxidant strength and volume, and health and safety. The objective will be to maintain a positive ORP to ensure the complete oxidation of all amenable compounds. If the water within poorly circulated portions of the structure has not been positively impacted by oxidant solution additional solution will be applied in these areas and allowed to mix and diffuse naturally.
- Sheet-pile installation – Water/sludge will be agitated during sheet pile installation in the IB. This may allow gases trapped in the sludge to escape into the overlying water or atmosphere. A permanganate solution will be applied to the water as needed to reduce odors.
- Previously submerged material adhered to the walls of ET-10, ET-18, or other structures will be exposed as the water or sludge is removed. This material may release associated odors. In addition, aerobic bacteria may biodegrade organic matter on the structure walls and release biogenic gases. Neither phenomena should present a long term problem because the material that will volatize or be metabolized will be exhausted or dry out, which will slow or stop volatilization or biodegradation.

Nonetheless, preparations will be made to wash down the sides of the structure with limited amounts of previously treated site water, or to spray a diluted sodium or potassium permanganate solution on the walls to destroy susceptible organics, reducing the mass available for volatilization or biodegradation. The equipment likely will be a tank to hold water or a system to mix an oxidant solution and a high-pressure pump, hose, and nozzle or nozzles to distribute either.

9. Water Treatment Design, Installation and Operation

Free liquids include liquids within the IB basin, ET-10, ET-18, secondary sump, wash water from decontaminating tanks/sump, equipment decontamination water, surface water, and groundwater infiltration.

During/prior to mobilization, Hercules will discharge water to the POTW from the IB and ET-10 prior to sludge disturbance in accordance with recent practices. Water from the west side of Providence Street will be pumped to the secondary sump through piping that leads to the outfall manhole in Providence Street. Water from the east side of Providence Street will be pumped to an on-site manhole that leads to the outfall manhole in Providence Street. The outfall manhole conveys the water to the POTW.

Water generated is expected to have high turbidity and potentially VOCs, therefore the treatment process will involve the following:

- A clarifier or settling tank with the potential addition of a reagent to settle suspended particles;
- Sand filter with media;
- Bag filter with bags;
- Treatment vessels with liquid-phase activated carbon;
- Flow meter; and
- Fractionation (frac) tank.

Water will be pumped through the treatment trailer and placed in a frac tank. Upon filling ARCADIS will collect a sample for analysis to confirm compliance with the facility discharge permit. Upon receipt of the results, the water will be discharged to the POTW at a pre-determined rate in compliance with the discharge permit.

10. Waste Management Plan

Waste generated during this project will be disposed of at either WM’s facility in Emelle, Alabama (a landfill that accepts hazardous waste) or PBRL, a (nonhazardous landfill). Material that cannot be accepted by WM’s facility in Emelle, Alabama will be incinerated at Clean Harbors’ facility in La Porte, Texas. Truck routes from the site to each of these facilities are presented in Appendix J. The following sections present the results of the waste determination for each waste already evaluated or the planned approach for making this determination. In addition, the following presents the anticipated location for the disposal (or treatment) of the waste streams.

10.1 IB Cells (Managed Per Hazardous Waste Regulation)

The sludge from the Cells 1, 3, and 7 has been pre-characterized for toxicity during the ARCADIS Sludge Characterization and Bench Scale Treatability Report in 2010 (ARCADIS, 2010). These data is presented in the Revised IMWP. As required by USEPA, sludge within Cells 1, 3, and 7 will be addressed in compliance with the hazardous waste regulations. Per RCRA, the sludge will also need to be sampled for underlying hazardous constituents to determine if treatment of the sludge is required to comply with the Land Disposal Requirements.

While solidifying each cell (Cells 1, 3, and 7), ARCADIS will collect 8 grab samples to be composited into 4 samples to be shipped to TestAmerica Laboratories, Inc. for analysis of the underlying hazardous constituents (UHCs) specified in USEPA's approval letter of the Revised IMWP. These UHCs include:

- Acetone
- Benzene
- Carbon Tetrachloride
- Chlorobenzene
- Chloroform
- 1,4-Dioxane
- Ethylbenzene
- Methyl Isobutyl Ketone
- Napthalene
- Tetrachloroethene
- Toluene

These data will be received by the laboratory with a quick turnaround to minimize the temporary staging of solidified sludge on a liner or within the IB inside the temporary structure. The results of this data will determine if the solidified sludge will be live loaded and treated/disposed at WM's hazardous waste facility in Emelle, Alabama or incinerated at Clean Harbors' facility in La Porte, Texas to meet the Universal Treatment Standards (40 CFR 268.48) as required by the Land Disposal Restrictions (40 CFR 268.40).

10.2 IB Nonhazardous Cells

The sludge from the nonhazardous cells has been pre-characterized for toxicity by ARCADIS in 2010 and again in 2014. The 2010 data is presented in the Revised IMWP and the 2014 data is presented in Table 1. This sludge once solidified will be disposed of at the PBRL once it meets the PFLT. Each load will be inspected for free liquids and a minimum of two PFLTs will be collected per day.

In addition to PFLTs, two representative samples will be taken from each nonhazardous cell (Cells 2, 4, 5, 6 and 8) following solidification for TCLP analysis of benzene and carbon tetrachloride to confirm the nonhazardous nature of the sludge as required by USEPA in their email to Hercules dated March 4, 2015. One sample will be collected from each half of each cell. This data will be provided to USEPA, MDEQ, and PBRL to confirm that the waste can be disposed of at the PBRL. If the data confirms the nonhazardous nature of the sludge, the sludge will be removed from the bermed area or IB inside the temporary structure, live loaded onto trucks and transported to PBRL for disposal.

If the sample results from the corresponding half of a cell exceed the toxicity limit for benzene or carbon tetrachloride, then compliance with the Universal Treatment Standards per the Land Disposal Restrictions will be determined for benzene and the UHCs and the sludge will be shipped to WM’s Subtitle C landfill in Emelle, Alabama or Clean Harbors’ incinerator in La Porte, Texas.

10.3 Soil

The top 6 inches of soil beneath the sludge in the IB will be removed per the Revised IMWP. In 2014, this soil was sampled and determined to be nonhazardous. A separate profile will be prepared for the disposal of this soil to PBRL. Additional soil that may be generated during construction activities (i.e. excavation of sludge around southeast corner of the IB), will be stockpiled in a roll-off box, sampled for characterization and managed appropriately.

10.4 IB Baffles

The IB baffles will be removed, cleaned, and staged within a lined roll-off box. The baffles will be sampled for characterization prior to determination of the disposal location. It is anticipated that the baffles will be disposed at the PBRL under a separate profile from the solidified sludge or soil.

10.5 ET-10 Sludge

ET-10 was a sludge equalization tank associated with the wastewater treatment system at the Hercules facility in Hattiesburg, Mississippi. The tank was constructed in approximately 1979, was a component of the facility's wastewater treatment system which operated under the facility's discharge permit (Mississippi Permit MSP091286) and ceased operation in approximately 2007 to 2008.

When the facility was in operation, sludge was transferred from the IB to ET-10 for equalization as part of the wastewater treatment process. Wastewater was transferred out of the IB via pumps in the northeast corner of the IB. At one time this flow went to a dissolved air flotation (DAF) unit (referred to as "Flotator" on operator logs) and for a short time (unknown period) a sand filter system. Flow left the DAF while it was in operation and was pumped to the 5-million gallon ET-10. Since the DAF was shutdown, wastewater was transferred directly from the IB to the ET-10. From the ET-10 wastewater was transferred to secondary treatment consisting of granular activated carbon (GAC).

All the sludge was removed from ET-10 during a 1996 cleanout. This was accomplished by draining the sludge from ET-10 to the IB.

Sludge from the IB that was pumped to ET-10 since the 1996 cleanout can be represented by facility sampling of IB sludge obtained from 1996 to 2001 and analyzed for TCLP VOCs while the facility was operating. This data set includes five samples of IB sludge analyzed for TCLP VOCs by Bonner Laboratories. These IB data included samples collected on the following dates, with benzene concentrations noted in parentheses: March 5, 1996 (TCLP benzene 0.095 mg/L), August 28, 1996 (estimated TCLP benzene of 0.012J mg/L); May 13, 1998 (TCLP benzene was non-detect at <0.002 mg/L); August 24, 2000 (TCLP benzene was non-detect at <0.1 mg/L); and July 27, 2001 (TCLP benzene was non-detect at <0.1 mg/L). The sample collection location and techniques for these samples are not known; however, these data indicate that none of the IB sludge sampled between 1996 and 2001 contained concentrations of benzene above the Toxicity Characteristic (TC) limit.

On July 1, 2008, Eco-Systems, Inc. collected one composite sample from ET-10 (SS-3) and analyzed it for TCLP benzene at Bonner Laboratories. This sample was non-detect for benzene. These laboratory data are provided in Appendix K. The SS-3 composite sample was made up of two aliquots collected from the platform on the western rim of the tank and one aliquot collected from the platform on the eastern rim of the tank. This ET-10 data corroborates the facility process data which indicates the

IB sludge likely being transferred to ET-10 was nonhazardous for TCLP benzene. The USEPA obtained a sample of sludge from ET-10 and analyzed. The result of this analysis also showed the ET-10 sludge to be nonhazardous.

The data collected from ET-10 is presumed to be representative of the entire ET-10 and therefore the sludge within ET-10 has been determined to be nonhazardous. The sludge will be disposed at PBRL under the same profile as the nonhazardous IB cells.

10.6 ET-18 sludge

ET-18 is another sludge equalization tank associated with the wastewater treatment system at the Hercules facility. ET-18 is approximately 33-feet tall with a diameter of 36-feet and contains approximately 300 tons/302 yd^3 of sludge and 120,000 gallons of free liquid water.

In July 23, 2009 the sludge contained within ET-18 was investigated by Eco-Systems, Inc. The bottom sludge in ET-18 was sampled for TCLP VOC/semivolatile organic compounds (SVOC), TCLP organochlorine pesticides and herbicides, RCRA TCLP metals, total cyanide, sulfide and ignitibility. Results of the above analyses were non-detect with the exception of sulfide (1,500 milligrams/kilogram). Ignitibility results showed the sludge was non-ignitable. The Eco-Systems, Inc. laboratory data is provided as Appendix K.

Based on the above information, this sludge has been determined to be nonhazardous and therefore will be disposed of at PBRL under the same profile as the nonhazardous IB cells.

10.7 Residuals in Empty Tanks (Kymene, ET-19, Frac Tanks, Portable Clarifier)

Residual sludge in the above mentioned tanks was generated from the same process as sludge in the IB. This sludge is unlikely to have any significant VOCs since they consist of insignificant amounts of sludge at the bottom of empty tanks. Based on this information, this sludge will be disposed of at PBRL under the same profile as the nonhazardous IB cells.

10.8 Secondary Sump

As of the date of this Final IMDR, the sludge present in the secondary sump has not been sampled. As this project begins, the sludge will be sampled and analyzed for

TCLP to confirm the nonhazardous nature of the sludge prior to disposal. It is anticipated that this sludge will be disposed of at PBRL under the same profile as the nonhazardous IB cells.

10.9 Used/Spent Granular Activated Carbon

Spent activated carbon used as part of the air treatment system will be characterized to determine if it should be managed as hazardous or nonhazardous waste. If the spent activate carbon is nonhazardous (as assumed it will be) it will be hauled offsite and taken for regeneration. If it is determined that the spent activated carbon is hazardous, it will disposed of as a hazardous solid waste at WM's landfill in Emelle, Alabama or Clean Harbors' incinerator in La Porte, Texas.

10.10 Used Bag Filters and Sand from Sand Filters

Used bag filters will be disposed of at the PBRL as a nonhazardous waste. Sand from the sand filter will be sampled for TCLP VOCs for waste determination. It is expected that the sand will be disposed of as a nonhazardous waste at PBRL.

11. IB Backfilling/Restoration

Backfill will utilize the two on-site borrow sources as well as the procurement of clean off-site source materials to finalize backfilling of the IB. One on-site borrow source is located immediately west of the IB which was stockpiled from a previous effort to close the IB. This soil has been sampled and is acceptable material for backfilling. A second on-site source is located either south of the IB or northwest of the IB. This soil is from the Providence Street sewer replacement project. Samples for each off-site soil source will be collected for analysis of metals (SW-846 Method 6010), VOCs (SW-846 Method 82060B- Appendix IX), SVOCs, SW-846 Method 8270C, Appendix IX) to ensure that the material is acceptable for use prior to delivery on site. Backfill of the IB will be performed in eight inch loose lifts. During the backfilling the on-site representative and Clean Harbors project manager will agree upon the number of passes to be acceptable for the compaction aspect. Currently four passes of a CAT 815 or an equivalent machine will be the standard of compaction.

The IB will be graded with a 1 to 2 percent grade to promote drainage. Upon completion of this task, a local landscaping firm will be subcontracted for the placement of seeding.

12. ET-10 Demolition

Following the removal of sludge and cleaning of ET-10, this tank will be demolished. Hercules is proposing to downsize the tank into 6 to 12-inch size rubble to potentially use as backfill for the IB. Prior to implementing this approach, the concrete will be sampled for RCRA 8 metals, VOCs, and SVOCs. If the concrete meets the MDEQ Tier 1 Restricted Target Remedial Goals, it will be placed into the IB or recycled off-site. If the concrete does not meet the criteria, it will be hauled to PBRL.

13. Contingency Plan

Several contingency plans will be put in place to deal with odor and water treatment issues. Areas where contingency plans may be required beyond what is currently planned are detailed below.

- Odor control during sheet piling is insufficient;
- Odor control at tanks is insufficient;
- Total suspended solid (TSS) concentrations in the water are excessively high;
- Separate phase product observed; and
- Bridging during IB backfilling is required.

If odor control beyond what is originally scoped is required, the subcontractor will use sprayers to deliver a permanganate solution or Rusmar foam to the area in question. Additional details regarding contingency plans for complaints from the surrounding community due to odors is detailed in the Revised IMWP. If elevated TSS concentrations are encountered, flocculants or coagulants will be added to the portable clarifier to produce acceptable TSS concentrations. Any separate phase product that is observed will be treated with an oil/water separator that will be installed in the current water treatment design. Based on what is needed the oil/water separator may be a standalone unit or a modified tank such as a frac tank. It is possible that groundwater infiltration prior to backfilling the IB could impede the proper compaction of soil in the bottom of the IB. If so, gravel will be place in the bottom of the IB to bridge the water and allow for the compaction of soil overtopping the gravel.

14. Permits and Licensing

The following permit (or permit exclusion) and licensing is expected to be required for the project.

14.1 Air Permit Exclusion

Air permitting for the solidification and removal of sludge from the IB is not expected to be required. According the MDEQ, "Permit Regulations for the Construction and/or Operation of Air Emissions Equipment (APC-S-2)," remediation of sites contaminated with hazardous constituents required under State authority on the site of contamination are excluded from the need to have a permit to construct or a permit to operate. A letter requesting concurrence with this determination will be submitted to MDEQ prior to implementing the work.

14.2 Required Licensing

Clean Harbors and their contractors have the required Certificate of Responsibility from the State of Mississippi Board of Contractors to work in the State of Mississippi.

14.3 Construction Permits

Clean Harbors will obtain any license or permit from the City of Hattiesburg in order to work within the city limits. This will likely include an electrical permit as well as a demolition permit.

14.4 Existing Plans/Permits

Work will be completed in accordance with the existing SWPPP. In addition, discharge to the POTW will be performed in compliance with the facilities discharge permit (MDEQ permit MSP091286) including monitoring requirements and concentration limitations. In addition, as required by USEPA in the approval letter of the Revised IMWP, discharge samples will also be analyzed for 1,1-biphenyl and 1,4 dioxane.

15. Schedule

The anticipated schedule for work related to the decommissioning of the IB and tanks is as follows:

Description	Date
IMWP Submittal	August 22, 2014 (within 45 days of effective date of 3008(h) Order)
Comments received by USEPA on the IMWP	October 23, 2014
IB IMWP Re-Submittal/Response to	November 7, 2014

Description	Date
Comments (Revised IMWP)	
Preliminary Studies (geotechnical study, pre-characterization sampling, and contractor sludge studies)	Implement within 15 days of approval of IMWP
USEPA Approval of Revised IMWP	December 4, 2014
Submittal of Draft IMDR (90%)	February 17, 2015 (submit within 60 days of approval of IMWP, plus 13-day extension as granted by USEPA)
USEPA Approval of Draft IMDR (90%)	March 3, 2015 with clarification via email on March 4, 2015.
Submittal of Final IMDR (100%)	March 17, 2015
Solidification Demonstration	To be determined
Public Meeting	March 24, 2015
Project Implementation (Tentative Schedule)	See Appendix L. (Mobilization tentative scheduled for March 25, 2015)
Final Report	30 days following project completion

Additional details on the project management, health and safety, project communications, community involvement and reporting requirements of this project are provided in the Revised IMWP.

16. References

ARCADIS. 2010. Sludge Characterization and Bench Scale Treatability Report. August 20.

ARCADIS. 2012. Sampling Outside of Impoundment Basin Walls. November 21.

ARCADIS. 2014. Revised Interim Measures Work Plan. November 7.

USEPA. 2014. Resource Conservation and Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent (3008(h) Order), Docket No. RCRA-04-2014-4201(b). July 8.

Tables

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

	Location ID:	RCRA	Cell 2 - Upper 1	Cell 2 - Upper 2			Cell 2 - Lower 1	Cell 2 - Lower 2
	Sample Date:	TCLP	12/17/2014	12/17/2014	12/17/2014	12/17/2014	12/17/2014	12/17/2014
Chemical Name	Unit:	Limit			(DUP)	Average		
VOCs - TCLP								
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.12	0.30	**0.55**	0.43	0.33	0.40
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.020 U	**0.62**	0.020 U	**1.2**	0.39
Chlorobenzene	mg/L	100	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Chloroform	mg/L	6	0.031	0.16	0.23	0.20	0.065	0.14
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U

mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detected.
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of samples A and B. Upper and Lower 2 samples were composites of samples C and D.

ARCADIS

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

Chemical Name	Location ID: Sample Date: Unit:	RCRA TCLP Limit	Cell 4 - Upper 1 12/17/2014	Cell 4 - Upper 2 12/17/2014	Cell 4 - Lower 1 12/17/2014	Cell 4 - Lower 2 12/17/2014
VOCs - TCLP						
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.066	0.036	0.38	**0.59**
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Chlorobenzene	mg/L	100	0.020 U	0.020 U	0.020 U	0.020 U
Chloroform	mg/L	6	0.020 U	0.020 U	0.020 U	0.030
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U

mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detect
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of s

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

Chemical Name	Location ID: Sample Date: Unit:	RCRA TCLP Limit	Cell 5 - Upper 1 12/16/2014	Cell 5 - Upper 2 12/16/2014	Cell 5 - Lower 1 12/16/2014	Cell 5- Lower 2 12/16/2014
VOCs - TCLP						
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.030	0.063	0.030	0.10
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Chlorobenzene	mg/L	100	0.020 U	0.020 U	0.020 U	0.020 U
Chloroform	mg/L	6	0.020 U	0.020 U	0.020 U	0.020 U
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U

mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detect
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of s

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

Chemical Name	Location ID: Sample Date: Unit:	RCRA TCLP Limit	Cell 6 - Upper 1 12/16/2014	Cell 6 - Upper 2 12/16/2014	Cell 6 - Lower 1 12/16/2014	Cell 6 - Lower 2 12/16/2014
VOCs - TCLP						
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.020 U	0.067	0.20	0.067
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Chlorobenzene	mg/L	100	0.020 U	0.020 U	0.020 U	0.020 U
Chloroform	mg/L	6	0.020 U	0.020 U	0.020 U	0.020 U
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U

mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detect
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of s

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

	Location ID:	RCRA	Cell 8 - Upper 1	Cell 8 - Upper 2	Cell 8 - Lower 1	Cell 8 - Lower 2
	Sample Date:	TCLP	12/16/2014	12/16/2014	12/16/2014	12/16/2014
Chemical Name	Unit:	Limit				
VOCs - TCLP						
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.064	0.10	0.061	0.42
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Chlorobenzene	mg/L	100	0.020 U	0.020 U	0.020 U	0.020 U
Chloroform	mg/L	6	0.020 U	0.020 U	0.020 U	0.020 U
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U

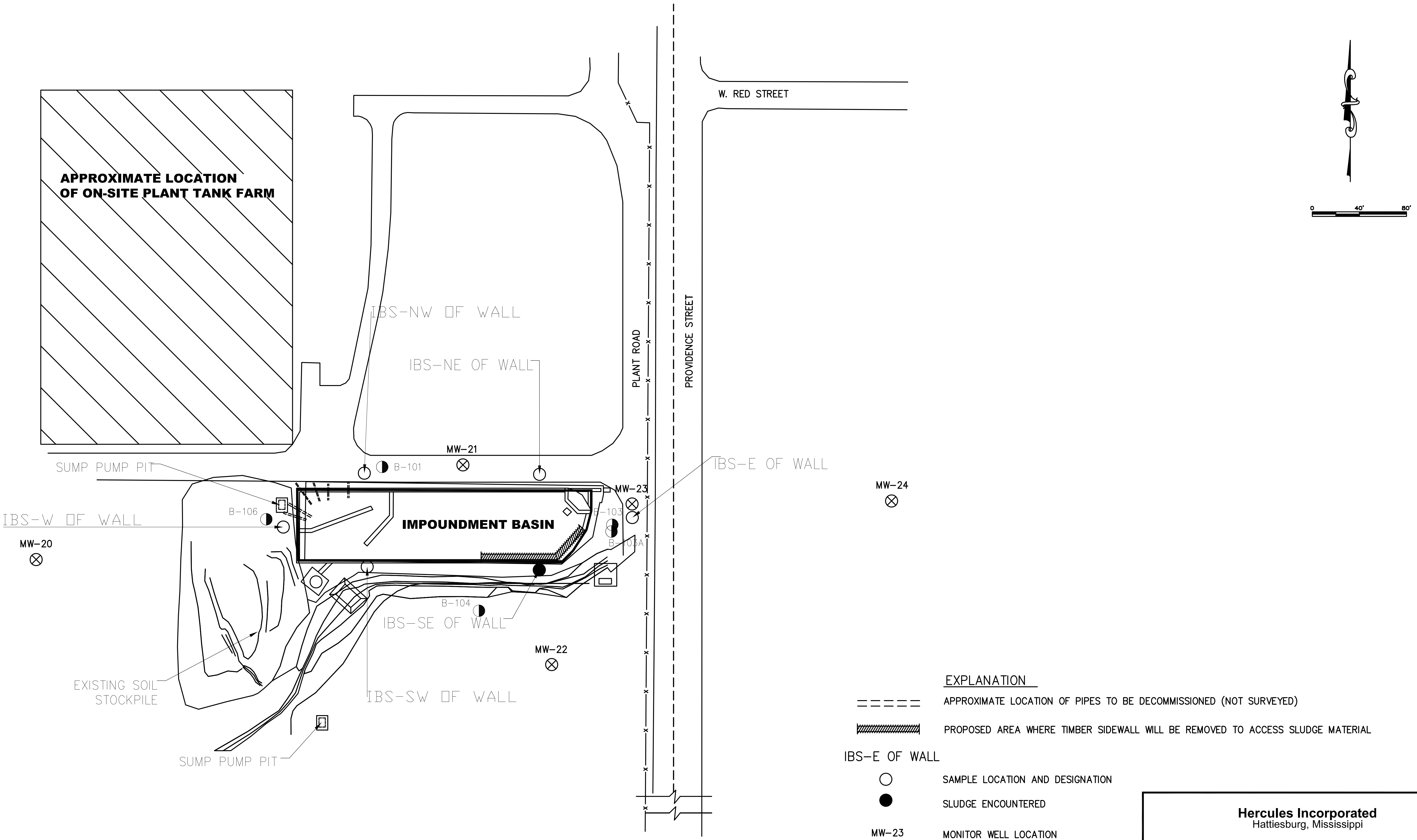
mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detect
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of s

Table 1 - Summary of Toxicity Characteristic Leaching Procedure, New Sludge Data, Hercules Incorporated, Hattiesburg, Mississippi

			Soil (Immediately Beneath Sludge)			
	Location ID:	RCRA TCLP Limit	Composite 1 (5,6,8)	Composite 2 (2,4)	Composite 3 (1,3)	Composite 4 (7)
	Sample Date:		12/16/2014	12/17/2014	12/18/2014	12/18/2014
Chemical Name	Unit:					
VOCs - TCLP						
1,1-Dichloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
1,4-Dichlorobenzene	mg/L	7.5	0.020 U	0.020 U	0.020 U	0.020 U
Benzene	mg/L	0.5	0.020 U	0.046	0.020 U	0.020 U
2-Butanone (MEK)	mg/L	200	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	mg/L	0.5	0.020 U	0.12	0.020 U	0.020 U
Chlorobenzene	mg/L	100	0.020 U	0.030	0.020 U	0.020 U
Chloroform	mg/L	6	0.020 U	0.020 U	0.029	0.020 U
Tetrachloroethene	mg/L	0.7	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	mg/L	0.5	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	mg/L	0.2	0.020 U	0.020 U	0.020 U	0.020 U

mg/L - Milligram per liter.
RCRA - Resource Conservation and Recovery Act.
TCLP - Toxicity Characteristic Leaching Procedure.
U - Indicates the analyte was analyzed for but not detect
VOCs - Volatile Organic Compounds.
Bold type indicates result exceeds RCRA toxicity limit.
Note: Upper and Lower 1 samples were composites of s

Figures



EXPLANATION

= = = = = APPROXIMATE LOCATION OF PIPES TO BE DECOMMISSIONED (NOT SURVEYED)

▨ PROPOSED AREA WHERE TIMBER SIDEWALL WILL BE REMOVED TO ACCESS SLUDGE MATERIAL

IBS–E OF WALL

○ SAMPLE LOCATION AND DESIGNATION

● SLUDGE ENCOUNTERED

MW–23 ⊗ MONITOR WELL LOCATION AND DESIGNATION

B–104 ◑ GEOTECHNICAL BORING LOCATION AND DESIGNATION

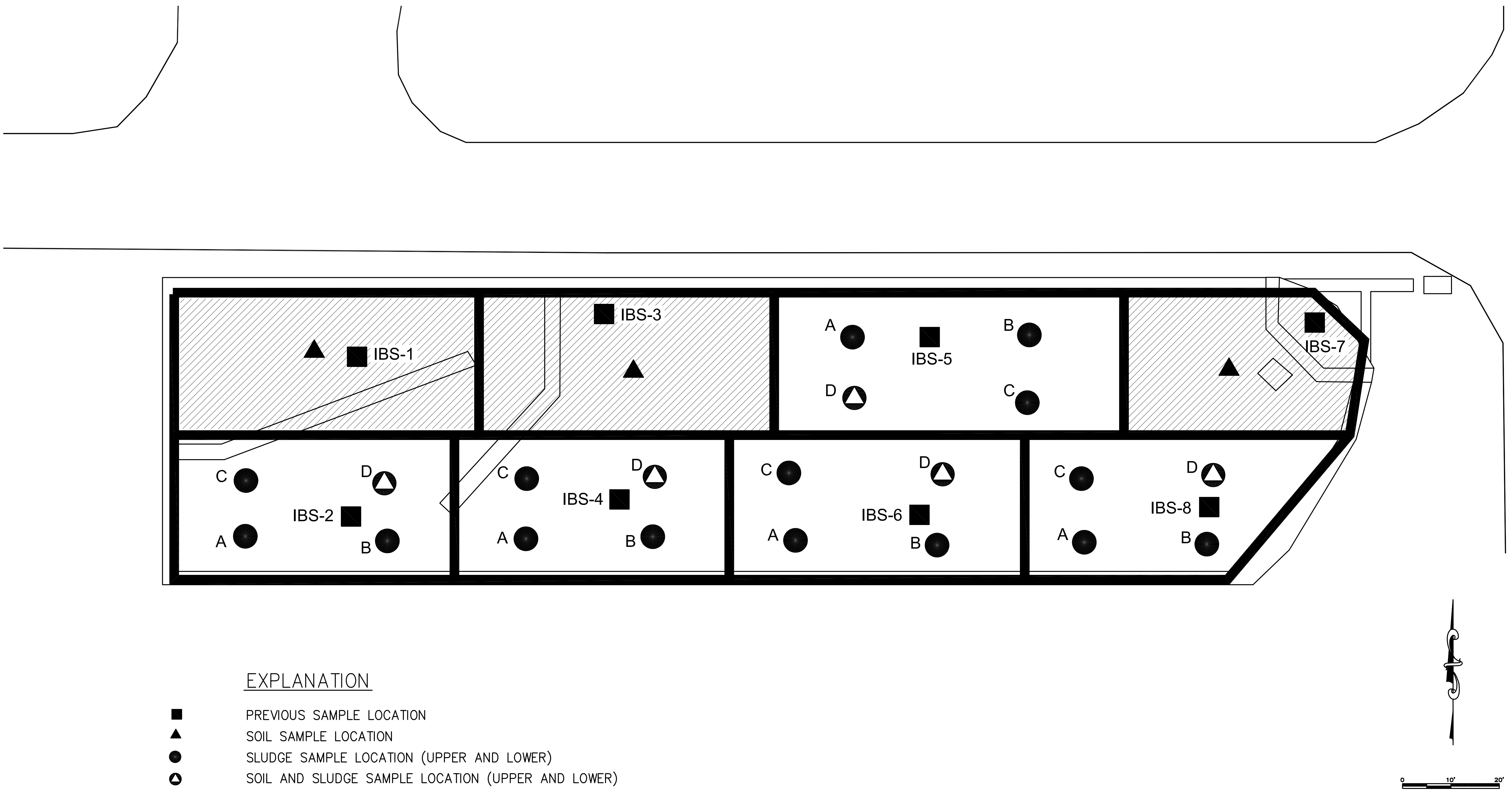
Hercules Incorporated
Hattiesburg, Mississippi

IB SIDEWALL AND GEOTECHNICAL SAMPLE LOCATIONS

ARCADIS

FIGURE
1

DB:(S. MEN) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\APROJECT\Ashland\LA002999.0017 2014 IB and Tanks\Figures\LA002999-17-01B.dwg PLOTTED: 3/12/2015 1:58 PM BY: MEN, SOTHON



EXPLANATION

■ PREVIOUS SAMPLE LOCATION
▲ SOIL SAMPLE LOCATION
● SLUDGE SAMPLE LOCATION (UPPER AND LOWER)
△ SOIL AND SLUDGE SAMPLE LOCATION (UPPER AND LOWER)

▨ PREVIOUS DETERMINED CELLS CONTAINING HAZARDOUS SLUDGE

NOTES:

LOWER SAMPLES AT A & B WERE COMPOSITED TO BE LOWER 1.
LOWER SAMPLES AT C & D WERE COMPOSITED TO BE LOWER 2.
UPPER SAMPLES AT A & B WERE COMPOSITED TO BE UPPER 1.
UPPER SAMPLES AT C & D WERE COMPOSITED TO BE UPPER 2.

Hercules Incorporated
Hattiesburg, Mississippi

IB SAMPLING LOCATIONS

ARCADIS

FIGURE
2

DB:(S. MEN) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\APROJECT\Ashland\LA002999.0017\Figures\LA002999-17-02B.dwg PLOTTED: 1/23/2015 1:11 PM BY: MEN, SOTHON

Appendix A

Correspondence

From: Wolford, Robert
Sent: Monday, March 16, 2015 3:04 PM
To: Wolford, Robert
Subject: FW: Clarification on Modification 3 of the IMDR

From: "Allison, John" <Allison.John@epa.gov>
To: Timothy D Hassett/Plaza/NA/Herc@Ashland, "Ellis, John" <John.Ellis@arcadis-us.com>
Cc: "Anderson, Meredith" <Anderson.Meredith@epa.gov>
Date: 03/04/2015 03:13 PM
Subject: Clarification on Modification 3 of the IMDR

Tim,

Per EPA's discussion with John Ellis (Arcadis) regarding modification 3 in the Interim Measures Design Report Approval Letter, with this email EPA is clarifying the language regarding disposal requirements of the non-hazardous sludge. The original comment and then clarification (in red) are below:

3) Section 10.2 – IB Non-Hazardous Cells: On page 22, Hercules states, "Upon USEPA approval of this IMDR, Pine Belt Regional Landfill (PBRL) has pre-approved acceptance of this waste and therefore the sludge will be live loaded from the bermed area inside the temporary structure for live loading." **EPA's approval of the IMDR cannot be used as pre-approved acceptance of the treated sludge.** The EPA requests confirmatory sampling of the treated sludge from the non-hazardous cells (cells 2,4,5,6, and 8) prior to mobilization to the PBRL. Approximately 10 representative samples should be taken from the treated sludge of the non-hazardous cells (e.g. two from each non-hazardous cell), and compliance with the LDR requirements should be determined for benzene and the UHCs. EPA requests that Hercules' provide PBRL, in addition to the EPA and MDEQ, with the confirmatory sampling results of the non-hazardous cells as evidence of the non-hazardous nature of the treated sludge in these cells. As noted in the IMDR, any sludge or residuals from the ET-10, ET-18, Kymene, ET-19, Frac Tanks, and Portable Clarifier shall be treated in the same manner as the IB Non-Hazardous Cells.

On page 22, Hercules states, "Upon USEPA approval of this IMDR, Pine Belt Regional Landfill (PBRL) has pre-approved acceptance of this waste and therefore the sludge will be live loaded from the bermed area inside the temporary structure for live loading." **EPA's approval of the IMDR cannot be used as pre-approved acceptance of the treated sludge.** The EPA requests confirmatory sampling of the treated sludge from the non-hazardous cells (cells 2,4,5,6, and 8) prior to mobilization to the PBRL. *Approximately 10 representative samples should be taken from the treated sludge of the non-hazardous cells (e.g. two from each non-hazardous cell), and compliance with the* ***Toxicity Characteristic Leaching Procedure*** *(TCLP) should be determined for benzene and carbon tetrachloride. If the treated sludge passes TCLP then shipment to PBRL is approved. If the treated sludge does not pass TCLP then the waste will have to be shipped to an approved Subtitle C hazardous waste landfill.* EPA requests that Hercules' provide PBRL, in addition to the EPA and MDEQ, with the confirmatory sampling results of the non-hazardous cells as evidence of the non-hazardous nature of the treated sludge in these cells. As noted in the IMDR, any sludge or residuals from the ET-10, ET-18, Kymene, ET-19, Frac Tanks, and Portable Clarifier shall be treated in the same manner as the IB Non-Hazardous Cells.

RCRA Corrective Action and Permitting Section
EPA, Region IV
61 Forsyth Street, SW
Atlanta Federal Center
Atlanta, GA 30303-8960

Work: 404.562.8461
Fax: 404.562.8439

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

MAR 0 3 2015

Mr. Tim Hassett
Ashland Inc.
500 Hercules Road, 8139/13
Wilmington, Delaware 19808

SUBJ: EPA Comments on the Draft Interim Measures Design Report (90% Design), dated Feb. 17,2015
Hercules Incorporated, Hattiesburg, Mississippi
RCRA Section 3008(h) Administrative Order on Consent, Docket No. RCRA-04-2014-4201(b)
EPA ID No. MSD 008 182 081

Dear Mr. Hassett:

With this letter, the EPA is formally transmitting the U.S. Environmental Protection Agency's **approval with modifications** of Hercules' February 17, 2015, Draft Interim Measures Design Report (IMDR) prepared pursuant to the RCRA § 3008(h) Order referenced above. The specific modifications are enclosed with this letter (Enclosure 1) and the IMDR should be revised accordingly. The EPA does not expect these modifications to impact the schedule presented on page 27 of the IMDR and anticipates mobilization to commence on or near March 23, 2015.

If you have any questions regarding the modifications contained in this letter, please feel free to contact me at (404) 562-8461.

Sincerely,

John Allison
Environmental Engineer
RCRA Corrective Action and Permitting Section
RCB Branch, RCR Division

cc:

Rick Sumrall, MDEQ
John Ellis, Arcadis
Hunter Hudson, MDEQ
Gloria Tatum, MDEQ

Enclosure

Enclosure 1

EPA Modifications to the Draft Interim Measures Design Report (90% Design), dated February 17, 2014

Hercules Inc.
Hattiesburg, MS
MSD 008 182 081

1) **Section 6.2 (Task 4 & 5) – Ventilation and Air Treatment**: The air-monitoring program is not sufficiently addressed in these two sections. A more detailed explanation of the air monitoring program is detailed in the Revised Interim Measures Work Plan (IMWP) dated November 7, 2014. Please reference the IMWP in Section 6.2 of the IMDR.

2) **Section 10.1 – Impoundment Basin (IB) Cells (Managed Per Hazardous Waste Regulation):** For purposes of determining the appropriate disposition of the treated sludge from the hazardous IB cells (cells 1, 3, and 7), Hercules shall be in compliance with the treatment standards for benzene (Waste Code D018) set forth in the Land Disposal Restriction (LDR) regulations of 40 CFR 268.40. 40 CFR 268.40 also requires that the Universal Treatment Standards (UTSs) in 40 CFR 268.48 be met for all Underlying Hazardous Constituents (UHCs). The IB's list of UHCs that must meet 40 CFR 268.48 UTS requirements include:

   - Acetone
   - Benzene
   - Carbon Tetrachloride
   - Chlorobenzene
   - Chloroform
   - 1, 4-Dioxane
   - Ethylbenzene
   - Methyl Isobutyl Ketone
   - Napthalene
   - Tetrachloroethene
   - Toluene

   Therefore, if the treated sludge meets both the LDR treatment standards for benzene *and* the UTS requirements for the above listed UHCs, then the waste may be sent to a Subtitle D non-hazardous waste landfill. Sampling results shall be submitted to the EPA and MDEQ, as well as to the designated landfill. Additionally, there are special notification requirements in 40 CFR 268 for this situation (i.e., a one-time notice to the State and a certification statement – 268.9 and 268.7(b)(5)).

If, however, the treated sludge needs additional treatment to meet the LDR regulations for benzene or the UHCs, then the EPA requires the treated sludge to be sent to the facilities discussed in Section 10.1 of the IMDR.

3) **Section 10.2 – IB Non-Hazardous Cells:** On page 22, Hercules states, "Upon USEPA approval of this IMDR, Pine Belt Regional Landfill (PBRL) has pre-approved acceptance of this waste and therefore the sludge will be live loaded from the bermed area inside the temporary structure for live loading." **EPA's approval of the IMDR cannot be used as pre-approved acceptance of the treated sludge.** The EPA requests confirmatory sampling of the treated sludge from the non-hazardous cells (cells 2,4,5,6, and 8) prior to mobilization to the PBRL. Approximately 10 representative samples should be taken from the treated sludge of the non-hazardous cells (e.g. two from each non-hazardous cell), and compliance with the LDR requirements should be determined for benzene and the UHCs. EPA requests that Hercules' provide PBRL, in addition to the EPA and MDEQ, with the confirmatory sampling results of the non-hazardous cells as evidence of the non-hazardous nature of the treated sludge in these cells. As noted in the IMDR, any sludge or residuals from the ET-10, ET-18, Kymene, ET-19, Frac Tanks, and Portable Clarifier shall be treated in the same manner as the IB Non-Hazardous Cells.

4) **Section 10.5 – ET-10 Sludge (Page 23):** On page 23, Hercules states, "The data collected from the ET-10 is presumed to be representative of the entire ET-10 and therefore the sludge within the IB has been determined to be non-hazardous." The EPA assumes this is a typo and "IB" should be replaced with "ET-10" since data collected from the ET-10 cannot be used to determine the IB's status. Please revise.

5) **Section 13 – Contingency Plan:** The Contingency Plan does not address issues that may arise due to complaints the surrounding community may have regarding any potential odors. A more detailed explanation of how Hercules will address these issues is detailed in Section 10 the IMWP dated November 7, 2014. Please reference the IMWP in Section 13 of the IMDR.

Ordeneaux, Courtney A.

From: Golla, Bill
Sent: Thursday, January 22, 2015 10:40 AM
To: Wolford, Robert
Subject: FW: Clarifications to IB Work Plan Modifications Comments Letter Dated 12/04/2014

From: Allison, John [mailto:Allison.John@epa.gov]
Sent: Thursday, December 11, 2014 3:37 PM
To: P. E. Tim Hasset (tdhassett@ashland.com)
Cc: Ellis, John; Golla, Bill; Davis, Andrew; Willie McKercher; Hunter_Hudson@deq.state.ms.us; Rick_Sumrall@deq.state.ms.us; Anderson, Meredith
Subject: Clarifications to IB Work Plan Modifications Comments Letter Dated 12/04/2014

Hi Tim,

Below are EPA's clarification of comments (in red) on the December 4, 2014 letter regarding the November 7, 2014 Revised Impoundment Basin Interim Measures Work Plan (IB WP). Comments 1, 4, and 6 are addressed below.

- ***Section 5 – Construction Implementation Actions, Page 10, last bullet:*** *Hercules proposes to "Remove sludge between the sheet pile and the IB walls by pumping sludge to the adjacent IB cell. Backfill this void with clean fill such as flowable fill." Hercules shall perform confirmatory sampling of the exposed walls, as proposed in Section 5, in the excavated area before the "void" is filled.*

  Based upon conversations on 12/11/204, Hercules shall perform impoundment basin (IB) sidewall sampling, similar to the floor confirmatory samples that will be performed, in the southeastern corner of the impoundment basin. EPA is aware that sidewall sampling has occurred in other locations around the IB wall.

  Section 5 – Construction Implementation Actions, Page 10, second to last bullet: *1,1-biphenyl and 1,4-dioxane are not currently covered by the MDEQ pretreatment permit. Because neither constituent is addressed in the permit, MDEQ and the City of Hattiesburg should be notified and approve of the discharge. All wastewaters coming from the IB dewatering should pass through the carbon filtration system to meet the pretreatment permit standards.*

  All wastewaters coming from the IB dewatering that don't meet MDEQ's pretreatment permit should pass through the carbon filtration system to meet the pretreatment permit standards. Additionally, since 1,1 biphenyl and 1,4-dioxane are not currently covered by the MDEQ pretreatment permit, the concentrations of both constituents being discharged to the sanitary sewer should be included in the Discharge Monitoring Reports (DMRs). Copies of the DMRs should be sent to EPA, MDEQ, and the city of Hattiesburg.

- ***Appendix A, Section 4.1.1 – Sludge Samples:*** *All sludge characterization should be based on grab samples and not composites. If Hercules chooses to use composite samples, Hercules shall collect an additional grab sample to be used to determine if there are VOC losses during the compositing of the samples.*

Based upon phone conversations on 12/11/2014, there are no changes to the original sludge sampling plan detailed in the November 7, 2014 IB WP.

Let me know if you have any additional questions or comments.

Thanks,

John Allison

RCRA/Corrective Action Section
US EPA Region IV
61 Forsyth Street
Atlanta Federal Center
Atlanta, GA 30303-8960

Work: 404.562.8461
Fax: 404.5628439
Email: Allison.John@epa.gov

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

RECEIVED
DEC 08 2014
BY:

DEC 04 2014

Mr. Tim Hassett
Ashland Inc.
500 Hercules Road, 8139/13
Wilmington, Delaware 19808

SUBJ: Comments on November 7, 2014 Revised Impoundment Basin Interim Measures Work Plan
Hercules Incorporated, Hattiesburg, Mississippi, EPA ID No. MSD 008 182 081
RCRA Section 3008(h) Administrative Order, Docket No. RCRA-04-2014-4201(b)

Dear Mr. Hassett:

With this letter, the U.S. Environmental Protection Agency is formally transmitting its **approval with modifications** of Hercules' November 7, 2014, Revised Impoundment Basin Interim Measures Work Plan (IBWP). The EPA's modifications are set forth in Enclosure 1 to this letter. As indicated in Paragraph 32 of the RCRA 3008(h) Order, Hercules shall begin implementation of the work (i.e., preliminary studies) within **15 days** from your receipt of this letter. The revised Figure A-1 should also be resubmitted within **15 days** from your receipt of this letter. With this approval, the EPA is also requesting that the initial cost estimate and financial assurance mechanism be submitted within **7 days** from your receipt of this letter.

In addition, Hercules proposes to submit the Interim Measures Design Report (IMDR) within 60 days of approval of the IBWP, rather than the 30 days that is required by the 3008(h) Order. Although the EPA believes that 60 days is excessive, especially considering the length of time that has elapsed since plans first began to decommission the IB, the EPA recognizes that the holiday season is upon us. As a result, the EPA agrees to extend the due date for the submittal of the IMDR to **February 4, 2015.**

The successful completion of the Interim Measures at the IB is a priority for the EPA, and we look forward to the commencement of such work. If you have any questions regarding the modifications contained in this letter, please feel free to contact me at (404) 562-8608, or John Allison at (404) 562-8461.

Sincerely,

Meredith C. Anderson

Meredith C. Anderson
Chief, Corrective Action Section
RUST Branch, RCRA Division

cc: Willie McKercher, MDEQ
Hunter Hudson, MDEQ
Rick Sumrall, MDEQ
Melissa Collier, MDEQ
Gloria Tatum, MDEQ
John Ellis, Arcadis

Enclosure

Enclosure 1

EPA Modifications to Revised Impoundment Basin Interim Measures Work Plan, dated November 7, 2014

Hercules Incorporated
Hattiesburg, MS
MSD 008 182 081

1) **Section 5 – Construction Implementation Actions, Page 10, last bullet:** Hercules proposes to "Remove sludge between the sheet pile and the IB walls by pumping sludge to the adjacent IB cell. Backfill this void with clean fill such as flowable fill." Hercules shall perform confirmatory sampling of the exposed walls, as proposed in Section 5, in the excavated area before the "void" is filled.

2) **Section 5 – Construction Implementation Actions, Page 10, throughout the page:** The references to the Interim Measures Work Plan (IMWP) should be references to the Interim Measure Design Report (IMDR).

3) **Section 5 – Construction Implementation Actions, Page 11, second to last bullet:** "…the non-hazardous cells (presumably Cell-2, Cell-4, Cell-5, Cell-6, Cell-8) will be shipped to the Pine Belt Regional Landfill (PBRL), a subtitle C landfill." PBRL is a Subtitle D landfill.

4) **Section 5 – Construction Implementation Actions, Page 10, second to last bullet:** 1,1-biphenol and 1,4-dioxane are not currently covered by the MDEQ pretreatment permit. Because neither constituent is addressed in the permit, MDEQ and the City of Hattiesburg should be notified and approve of the discharge. All wastewaters coming from the IB dewatering should pass through the carbon filtration system to meet the pretreatment permit standards.

5) **Appendix A, Section 3 – Sludge Volume Verification and Section 4.2 Sampling Procedure:** Cores should remained sealed until aliquots are ready to be placed in sample containers for volatile organic compounds (VOCs)/Toxicity Characteristic Leaching Procedure (TCLP) analyses.

6) **Appendix A, Section 4.1.1 – Sludge Samples:** All sludge characterization should be based on grab samples and not composites. If Hercules chooses to use composite samples, Hercules shall collect an additional grab sample to be used to determine if there are VOC losses during the compositing of the samples.

7) **Appendix A, Section 4.1.1 – Sludge Samples:** Each core should be visually inspected to determine if there is an easily observed physical distinction (water content, color, odors, grain size, etc.) between the upper and lower layers. If no visual distinctions are noted, than dividing the core in half is acceptable. If physical distinction is observed, then that distinction shall determine the upper and lower layers.

8) **Appendix A, Section 4.1.2 – Soil Samples:** Figure A-1 depicts one grab soil sample per cell while this section describes collecting composite soil samples. Modify and resubmit Figure A-1 to accurately depict the sampling plan described in Section 4.1.2.

9) **Appendix A, Section 6 – Quality Assurance/Quality Control Sampling:** Trip blanks are only required for VOCs analyses, not TCLP. Additional QC samples should include a field duplicate sample to measure spatial variability, and a matrix spike/matrix spike duplicate (MS/MSD) for the laboratory to determine recoveries.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

OCT 23 2014

Mr. Tim Hassett
Ashland Inc.
500 Hercules Road, 8139/13
Wilmington, Delaware 19808

SUBJ: EPA Comments on DRAFT Interim Measures Work Plan, dated August 22, 2014
Hercules Incorporated, Hattiesburg, Mississippi
RCRA Section 3008(h) Administrative Order on Consent, Docket No. RCRA-04-2014-4201(b)
EPA ID No. MSD 008 182 081

Dear Mr. Hassett:

With this letter, the EPA is formally transmitting the U.S. Environmental Protection Agency's comments on Hercules' August 22, 2014, DRAFT Interim Measures Work Plan (IM WP) prepared pursuant to the RCRA § 3008(h) Order referenced above (RCRA 3008(h) Order). Most of these comments were previously forwarded to Hercules via email on September 10, 2014, and discussed during the meeting in Hattiesburg on September 11th. As a supplement to the EPA's previous comments on the IM WP, which are incorporated into this letter as Enclosure 1, the EPA provides the following **additional comments** with respect to the draft IM WP:

- For the Impoundment Basin (IB), the IM WP does not provide enough detail about the actions to delineate hazardous and non-hazardous sludge, and the approach to be taken to remove the sludge from the IB. Additional details regarding these processes should be provided.
- Hercules shall determine that the concentration of metals in the solidification agent to be used in the dewatering process in the IB will not cause the treated sludge to exhibit a hazardous waste characteristic of toxicity for any of the metals listed in 40 C.F.R. § 261.24.
- Compliance with land disposal restriction (LDR) requirements for the sludge and soils removed from the IB should be determined for the following list of underlying hazardous constituents:
    - Acetone
    - Benzene
    - Carbon Tetrachloride
    - Chlorobenzene
    - Chloroform
    - 1-1-Dichloroethene
    - 1,4-Dioxane
    - Ethylbenzene
    - Methylene Chloride
    - Methyl Isobutyl Ketone
    - Naphthalene
    - Tetrachloroethene
    - Toluene

- In the August 2013 Revised Impoundment Basin Decommissioning Work Plan, Hercules stated that "Hercules will present the laboratory data and calculated applicable discharge flow rate to MDEQ." This information shall also be submitted to the City of Hattiesburg and to the EPA.
- <u>Section 7.4</u> Confirmatory Floor Sampling: Hercules shall perform a hazardous waste determination on all soils excavated from the IB. In addition, confirmatory samples from each IB cell shall include all site constituents of concern (COCs), not just volatile organic compounds (VOCs).
- The IM WP shall clarify that all submissions regarding the IB decommissioning work shall be directed to both the EPA and MDEQ, and all required approvals relating to such work shall be obtained from both the EPA and MDEQ.
- <u>Section 9</u> Schedule: Hercules should revise the schedule to more closely mirror the schedule provided in the RCRA 3008(h) Order and IM Scope of Work. Pursuant to Paragraph 32 of the RCRA 3008(h) Order, implementation of the IM WP shall begin within fifteen (15) days of EPA approval. Under the Scope of Work, the design letter report is due within thirty (30) days of EPA approval of the IM WP, with construction/implementation to begin within ten (10) days of approval of the design letter report. Thus, the EPA would anticipate that the preliminary studies for the IB decommissioning activities would begin within fifteen (15) days of the EPA's approval of the IB WP, with subsequent deliverables adjusted accordingly.

The EPA understands that Hercules has several ongoing projects with respect to the Hattiesburg facility, in addition to the planned Interim Measures being addressed under the IM WP (i.e., finalization of the Phase I and II Report under the RCRA 3013 Order; field work on the Providence Street sewer line). As referenced in the Scope of Work for the RCRA 3008(h) Order, the EPA is amenable to a phased approach to the work to be undertaken under the IM WP, and believes that such approach is appropriate given the varying work being performed at the facility under both the RCRA 3013 Order and the RCRA 3008(h) Order. The EPA's proposed approach to prioritization of site activities is set forth below.

First, Hercules has requested an extension of time to finalize the Phase I and II Report required under the RCRA 3013 Order. The EPA requests that Hercules provide the revised Report, incorporating the EPA's prior comments, within **seven (7) calendar days** from the date of this letter.

Second, given the delay that has occurred with respect to implementing any decommissioning activities at the IB, and given its likely contribution to groundwater contamination in Area #1, the EPA is requesting that Hercules prioritize finalization of the portion of the IM WP that addresses the IB decommissioning work. Hercules may segregate the IB portion of the IM WP and resubmit it separately as a stand-alone work plan (hereinafter referred to as the "IB WP"). Consistent with Paragraph 30 of the RCRA 3008(h) Order, the IB WP shall address all of the EPA's comments on the IB portion of the IM WP and shall be submitted within **fifteen (15) calendar days** from the date of this letter.

The remainder of the IM WP shall be revised and resubmitted to address the EPA's comments **within thirty (30) calendar days** from the date of this letter.

Finally, the EPA is continuing to evaluate the information that Hercules provided with respect to the three (3) consecutive exceedances of 1,4-dioxane at MW-5 and MW-14, and CM-4 and CM-5. The EPA believes that these releases warrant further investigation of both the Industrial Landfill and the former Delnav production area, which have been identified as potential sources of this 1,4-dioxane contamination. In addition, the presence of 1,4-dioxane at these monitoring wells and surface water locations indicates that contamination is migrating off-site, thus triggering additional Interim Measures under the RCRA 3008(h) Order. The EPA is continuing to evaluate the potential human health and ecological risk to off-site receptors that could occur from these releases. Pursuant to the terms of the RCRA 3008(h) Order, the EPA is likely to request the performance of additional Interim Measures and/or investigation with respect to the Industrial Landfill and Delnav area.

If you have any questions regarding the comments contained in this letter, or the EPA's proposed approach to prioritization of site work, please feel free to contact me at (404) 562-8608, or John Allison at (404) 562-8461.

Sincerely,

Meredith C. Anderson

Meredith C. Anderson
Environmental Engineer
Chief, Corrective Action Section
RCRA Division

cc: Willie McKercher, MDEQ
Rick Sumrall, MDEQ
John Ellis, Arcadis

Enclosure

Enclosure 1

EPA Comments on
Draft Interim Measures Work Plan Report,
dated August 22, 2014

Hercules Inc.
Hattiesburg, MS
MSD 008 182 081

In general, the IM WP does not provide enough detail about the actions to be undertaken for Areas #1 and #2 in regards to the evaluation of dissolved phase plumes and appropriate hydraulic control to mitigate unacceptable risk to receptors. Several areas of the report refer, in a general way, to this evaluation being conducted but do not provide any information as to what this work will entail. More detail needs to be provided to describe the process and evaluation criteria for determining whether, and the level of, hydraulic control, mitigation, and/or removal that may be necessary in Areas #1 and #2.

Additionally, an initial Estimated Cost of the Work to be performed and associated documents should be submitted with the IM WP.

Specific Area #1 and #2 Comments

p. 5: For Area #2, a bullet should be added to state that the plume will be addressed if there are potential receptors (similar to the bullet in Area #1).

p. 6: Sections 1.3.2 and 1.3.3 state that evaluations will be conducted to determine the level of hydraulic control required in Areas #1 and #2; however, later portions of this work plan do not present information on what or how this will be done.

p. 9: Wells in Area #1 should be sampled quarterly **for a minimum** of 1 year.

p. 10: Ambient air and crawlspace air should be sampled quarterly **for a minimum** of 1 year.

p. 10: Sections 3.2 and 3.3 should include the details of investigation and preparation activities needed for evaluating hydraulic control measures for Areas #1 and #2 (e.g., are pump tests or slug tests needed?; specific conductivity study?; etc.).

p. 10 – 26: Sections 4, 5, 6, and 7 primarily pertain to the Impoundment Basin. Areas #1 and #2 should be addressed, as needed, by these sections also.

p. 27: Section 8.2 discusses the need for an Interim Measures Design Report in the event that further interim measures are required for Areas #1 and #2, but no information was presented on how this will be determined. Please include a discussion, and associated criteria, of how this determination will be made.

p. 28: Please include the submittal and due date for a Final Design Report for Areas #1 and #2 in the schedules for these areas including schedules for implementation.

p. 29: Paragraph 91.b. of the 3008(h) Consent Order requires that an initial Estimated Cost of the Work be submitted with the IM WP. Please include this estimate with the revised IM WP, as well as the submittal of draft financial assurance mechanisms and related documents (required by Paragraph 92.b.).

General IB Comments

Use of quick lime, Portland cement, fly ash or any other stabilization or solidification method used to treat hazardous waste that contain organic constituents is not allowed, unless it is conducted in compliance with Subpart cc of 40 CFR Part 265.

The work plan shall clarify that the land disposal restriction (LDR) treatment standard determination for hazardous waste sludge will be based on total concentration of the organic constituent in the sludge and not using the Toxicity Characteristic Leaching Procedure (TCLP).

Specific IB Comments:

First paragraph, Page 12: Due to the expected variations in the sludge (vertically and horizontally), the deep samples shall be analyzed separate from the shallow sample. Furthermore, each grab sample shall be analyzed separately, and not composite as proposed in the plan.

Second bullet, Page 13: The Interim Measures Design Report shall also be submitted to the EPA.

Second paragraph, Section 8.1, Page 30: The weekly reports shall also be submitted to the EPA.

Appendix B

RFP Technical Specifications

HERCULES INCORPORATED

TECHNICAL SPECIFICATIONS FOR THE IMPOUNDMENT BASIN AND TANKS DECOMMISSIONING

HERCULES INCORPORATED
HATTIESBURG, MISSISSIPPI

ARCADIS
Infrastructure · Water · Environment · Buildings

ITEM A - TECHNICAL SPECIFICATIONS
HERCULES INCORPORATED
IMPOUNDMENT BASIN AND TANKS DECOMMISIONING
TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS
HERCULES INCORPORATED
IMPOUNDMENT BASIN AND TANKS DECOMMISIONING

TABLE OF CONTENTS

ITEM A

Technical Specifications

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK - DEWATERING AND OFF-SITE DISPOSAL

A. The Scope of Work includes, but is not limited to, furnishing all labor, methods, services, materials, tools, machinery, and equipment necessary for the construction of the Work as specified herein and shown on the Drawings.

B. Section 1.01 is intended to outline the Scope of Work and is not to be taken as complete in all respects. CONTRACTOR shall provide all necessary labor, materials, equipment, tools, utilities, and protective equipment as required to effect a complete and finished job, acceptable to OWNER and in compliance with all applicable local, state, and federal codes. Work under this Contract Document includes, but is not limited to, the following items:

1. The CONTRACTOR shall submit the required CONTRACTOR's Work plan (including Odor Mitigation Plan, Final Sheet Pile Design, and Final Temporary Structure Design), schedule (in Microsoft Project), required analysis, and Health and Safety Plan prior to mobilization.

2. The CONTRACTOR shall profile the solidified sludge and soil for disposal at Pine Belt Regional Landfill and the selected and approved hazardous waste facility. In addition, CONTRACTOR shall obtain all the required permits to complete the work.

3. CONTRACTOR shall establish vertical and horizontal control points and provide topographic surveys of conditions prior to Work, following sludge/soil removal, and at the completion of the project ("As-built" Drawings).

4. The CONTRACTOR shall locate utilities in the vicinity of the IB using a private utility locator.

5. The CONTRACTOR shall purchase and install appropriate erosion control measures (i.e. silt fence) in addition to any other required pre-job grading or improvements to allow for appropriate access to the IB and/or staging areas.

6. CONTRACTOR shall mobilize, set-up, and demobilize of any support facilities (i.e. office trailer, rest rooms) as deemed necessary including required utilities.

7. CONTRACTOR shall mobilize all personnel, materials, labor and equipment to the Hattiesburg Plant as necessary to install the sheet piling in a safe, timely and cost-effective manner.

8. CONTRACTOR shall install perimeter and interior sheet piling as required including water tight sealing between pilings.

9. CONTRACTOR shall mobilize and install a temporary structure over the IB.

10. CONTRACTOR shall install and operate a ventilation and air treatment system for the temporary structure to induce a negative pressure within the structure to ensure that all vapors and odors emitted from the sludge during solidification and removal are captured and treated.

11. CONTRACTOR shall mobilize all personnel, materials, labor and equipment to the site as necessary to conduct the sludge solidification, sludge disposal, and IB backfilling in a safe, timely and cost-effective manner.

12. CONTRACTOR shall perform odor, vapor, and dust mitigation and monitoring during sludge removal/handling activities.

13. CONTRACTOR shall remove all sludge that is trapped between the IB walls and the sheet piling and place in the adjacent cell.

14. CONTRACTOR shall decommission (plug) a minimum of 8 pipes known to enter the IB.

15. CONTRACTOR shall drain the sludge (before solidification) and pump water to a frac tank or existing tank for testing by others. Following testing, CONTRACTOR shall discharge at the appropriate rate via the existing permitted outfall. CONTRACTOR may also be asked to treat the water prior to discharging.

16. CONTRACTOR shall implement the CONTRACTORs work plan with the mixing of a solidification agent and any other agents deemed necessary by the CONTRACTOR with the sludge beneath the temporary structure. At the start of the work, a demonstration to the USEPA and MDEQ shall be implemented prior to full scale operations.

17. Once nearly all the sludge is removed from each IB cell, a minimum of 6-inches of soil shall also be removed for proper disposal.

18. CONTRACTOR shall load, transport and dispose of solidified sludge to Pine Belt Regional Landfill in Ovett, Mississippi (non-hazardous sludge) or the approved hazardous waste facility.

19. CONTRACTOR shall demolish the baffle system. Baffles shall be removed, freed of sludge, characterized, profiled, and disposed by the CONTRACTOR in accordance with applicable rules and regulations.

20. CONTRACTOR shall excavate down along the southeast wall as directed by ARCADIS to remove sludge for solidification and off-site disposal that has been observed behind this wall.

21. CONTRACTOR shall provide costs for backfilling with the approximately 3,300 yd^3 of on-site backfill, importing and backfilling with approximately 3,500 yd^3 of clean material, compacting, grading, and seeding the IB.

22. The CONTRACTOR shall place 6-inches of top soil, grade to 1-2% slope, seed, and fertilize over the disturbed area of the IB.

23. CONTRACTOR shall submit a brief documentation report at the end of the project outlining the work completed.

24. CONTRACTOR shall clean the specified tanks (and sump) to ensure that no more sludge, sludge residue, or liquids remain in the tank.

25. OWNER may authorized additional work including but not limited to: removal and disposal of IB walls, backfill a portion of the IB with gravel, demolition of ET-10, roadway sweeping, and leaving the sheet piling in place.

1.02 JOB CONDITIONS

A. Site Access and Work Areas

Drawings, as referenced in this Specification, depict the location of the Work site. It is CONTRACTOR's sole responsibility to use and maintain present access. Any access roadways, storage areas, work areas, or other areas that CONTRACTOR must use are CONTRACTOR's sole responsibility to keep passable at CONTRACTOR's cost. CONTRACTOR fully understands that certain designated access roadways must be used by OWNER to maintain access to Work areas; CONTRACTOR shall cooperate with OWNER and ARCADIS in the maintenance of these common access roadways.

CONTRACTOR shall perform solidification activities within a temporary structure to assist in the containment of odors, unless an alternative approach is approved by the OWNER and ARCADIS.

CONTRACTOR will have access to tanks ET-10, ET-18, ET-19, DP-35, PS-45 and three kymene tanks (to be identified during the pre-bid meeting) for the temporary storage of water generated from the IB. All tanks shall be thoroughly cleaned to the satisfaction of the OWNER and/or ARCADIS following use.

B. Work Schedule

All Work on site shall be conducted between the hours of 7:00 a.m. and 7:00 p.m. on Monday through Friday. If CONTRACTOR would like to complete work at night, during OWNER holiday's, or on weekends, a written request shall be given to OWNER and ARCADIS at least 24 hours in advance of the beginning of performance of such Work. Work done at night shall only be done in a satisfactory and safe, first-class manner. Good lighting and all other necessary facilities for carrying out and inspecting the Work shall be provided and maintained by CONTRACTOR at all points where such Work is being done. CONTRACTOR shall provide a written request for any Work hours outside of the schedule presented within this Section.

C. Work in Bad Weather

During freezing, stormy, or inclement weather, no Work shall be performed by CONTRACTOR except such as can be done satisfactorily per manufacturer's and industry standard, these Specifications, and in a manner to secure safe, first-class construction throughout.

1.03 CODES AND STANDARDS

A. The Work shall adhere to all applicable federal, state, and local rules and regulations, including, but not limited to, regulatory requirements presented in Section 01060 -

REGULATORY REQUIREMENT AND RESPONSIBILITY TO THE PUBLIC and shall conform to the codes and standards presented in Section 01070 - STANDARDS, which are described elsewhere in these Specifications.

1.04 QUALITY ASSURANCE

A. In accordance with Section 01400 - QUALITY CONTROL.

1.05 COOPERATION

(Not Used)

1.06 CARE AND STORAGE OF MATERIALS

A. Unload, inspect, and store all equipment and material items delivered to the Work site for the Work, including items supplied by OWNER/ARCADIS.

B. Replace at CONTRACTOR's sole expense all OWNER/ARCADIS and CONTRACTOR furnished materials damaged during unloading and storage, damaged by weather, or damaged by any other cause.

C. CONTRACTOR shall follow all applicable manufacturers' instructions for handling and storage of materials and/or equipment.

1.07 CONTRACTOR'S RESPONSIBILITIES AND WORK

A. Furnish all construction equipment, machines, tools, materials, field toilets, decontamination equipment, personal protective equipment, and other services. All supplies, labor, and supervision that are necessary to complete the Work and requirements as described or implied in these Specifications, Drawings, and the Contract Documents shall be CONTRACTOR's full responsibility.

B. No housing facilities shall be permitted on the Work site or on other OWNER property.

C. Maintain the site of its activities completely free of refuse and debris at all times. Promptly comply with any directives from OWNER/ARCADIS regarding housekeeping. Upon completion of the Work and before final payment, completely remove all tools, equipment, supplies, materials, structures, and debris from the Work site and leave the premises clean.

1.08 WORK BY OTHERS

(Not Used)

PART 2 - PRODUCTS

2.01 REGISTERED TRADE NAMES

A. Products are referenced and specified throughout these Specifications by registered trade names. This does not constitute a recommendation of these products to the exclusion of other products. Equivalent products may be used upon receiving approval of OWNER and/or ARCADIS.

B. The reference to registered trade names establishes a standard of required function, dimension, appearance, and quality of the required equipment, materials, or products.

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01014
WORK SEQUENCE

PART 1 - GENERAL

1.01 CONSTRUCTION SCHEDULE

A. CONTRACTOR is referred to the General Conditions section of the Contract Documents for additional scheduling requirements. Upon receipt of the notice to proceed, CONTRACTOR shall provide a detail schedule. Following the submittal and review of all required documents, the sheet piling and temporary structure with air handling/treatment components can be installed. Following installation, a solidification demonstration (for MDEQ and USEPA) shall be completed first followed by full scale solidification and sludge removal from the IB.

B. It is recommended that sludge solidification activities start at ET-18 (prior to the IB) to free up some potentially necessary water storage capacity in the event that water infiltration becomes a significant concern at the IB. No agency demonstration is required at ET-18 however odor/vapor criteria will still be monitored at the property boundary by others to determine if the CONTRACTOR is properly controlling odors/vapors from this tank. Solidification efforts at ET-18 can be completed concurrent with sheet pile and temporary structure installation.

1.02 WEATHER

A. Take all necessary precaution for adverse weather so that the Work may be properly performed and be satisfactory in all respects. During cold weather, materials shall be preheated, if required, and the materials and structure into which they are to be incorporated shall be kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Heating shall be by an approved method and shall result in the appropriate atmosphere required for the Work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

1.03 PROGRESS REPORTS

A. Submit to OWNER and ARCADIS every week following written issuance of a Notice to Proceed a report, in form and substance satisfactory to OWNER and ARCADIS, stating the progress being made in fulfillment of this Contract and indicating the progress to date with respect to the Construction Schedule. Included with the report shall be an updated schedule indicating scheduled durations, scheduled start dates, scheduled completion dates, actual durations, actual start dates, and actual completion dates of construction activities identified in the initial approved Construction Schedule. This schedule shall be displayed in the Work site office trailer at all times.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01035
HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Work shall be performed in accordance with all applicable federal, state, and local laws, rules, regulations, orders, and standard health and safety requirements described in this Section. If a conflict occurs between the requirements outlined in these Specifications and current federal, state, and local laws, rules, regulations, orders, and standards, the more demanding shall apply.

B. These requirements are in accordance with and incorporate the health and safety guidelines established in the current editions of the Standard Operating Safety Guides, prepared by the U.S. Environmental Protection Agency (USEPA) Office of Emergency and Remedial Response, and the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, U.S. Department of Health and Human Services.

C. CONTRACTOR shall develop and maintain for the duration of this Contract a safety program that incorporates all applicable provisions of federal, state, and local safety regulations for construction. A component of the Work requires construction in an area that may contain contaminated soils and groundwater. A site-specific CONTRACTOR Health and Safety Plan (CHASP) shall be prepared for the Work. An outline of the minimum requirements for the CHASP is presented in Part 3 of this Section.

D. Submit the CHASP in duplicate to ARCADIS for review at least 1 week prior to the start of construction activities.

E. Plan for, and monitor, all personnel to ensure compliance with the basic provisions of Occupational Safety & Health Administration (OSHA) Safety and Health Standards (29 Code of Federal Regulations [CFR] 1910) and General Construction Standards (29 CFR 1926). Take all necessary precautions for the safety of and to provide the necessary protection to prevent damage, injury, or loss to:

1. All personnel on the Work site;
2. All the Work and all materials and equipment to be incorporated in the Work area, whether on or off the site;
3. Other property at or adjacent to the Work site; and
4. The general public on and off the Work site when hazards are created by CONTRACTOR's operations.

F. Plan for, and monitor, all CONTRACTOR (and subcontractor) personnel to ensure compliance with OSHA Hazardous Waste Operations and Emergency Response, Interim Final Rule (29 CFR 1910.120), as applicable to the specific tasks.

G. CONTRACTOR is solely responsible for the health, safety, and protection of on-site personnel during the performance of the Work.

H. CONTRACTOR's personal protective equipment that may be required to perform the Work shall include, but not be limited to, the following:

1. Modified Level D Protection - Chemical-resistant gloves; chemical-resistant safety boots/shoes, or safety boots/shoes with disposable boot covers; safety glasses; and hard-hat.

2. Level C Protection - Similar to modified Level D with the addition of a full-face air-purifying respirator.

3. Level B Protection.

4. Other levels of protection as working conditions warrant.

I. CONTRACTOR shall provide a Health and Safety Officer to implement, monitor, and enforce the CHASP. The Health and Safety Officer shall have a sound working knowledge of federal and state occupational safety and health regulations.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. The CHASP shall include the following information as a minimum:

1. Introduction of project scope of Work and project personnel with respect to health and safety hazards;

2. Medical surveillance;

3. CONTRACTOR health and safety officer;

4. Employee training;

5. Personal protection requirements and methods;

6. Monitoring equipment requirements including but not limited to lower explosive limit (LEL), hydrogen sulfide, and benzene monitors in the work area and dust monitors downwind of high traffic areas (in accordance with Section 02245);

7. Personnel and equipment decontamination;

8. Emergency provisions;

9. Site security and control;

10. Recordkeeping and reporting;

11. Hazard analysis;

12. Action levels; and

13. Emergency procedures.

3.02 INTRODUCTION OF PROJECT SCOPE OF WORK AND PERSONNEL

A. The introduction to the CHASP shall contain a brief description of the Work site, including a general Site background and the potential health and safety hazards associated with the Work. Any unusual Site features shall also be addressed. In addition, the CHASP shall identify the Project Manager and the Health and Safety Officer assigned to the Work.

3.03 CONTRACTOR HEALTH AND SAFETY OFFICER

A. Provide a Health and Safety Officer, who will direct the development of the CHASP, train employees as required, and provide overall management of CONTRACTOR's health and safety requirements covered in the CHASP.

B. The Health and Safety officer shall be responsible for ongoing safety and health surveillance during the Work and shall have authority to act on all health and safety measures and to establish new controls as needed. The qualifications and experience of CONTRACTOR's Health and Safety Officer assigned to the Work site shall be included in the CHASP and will be subject to review by OWNER and/or ARCADIS for acceptance.

C. The Health and Safety Officer shall conduct periodic inspections as necessary to determine the overall effectiveness of the CHASP. Any deficiencies shall be submitted to OWNER and ARCADIS in writing and the CHASP will be modified accordingly. Should the deficiencies be of a nature to present an immediate danger, the Health and Safety Officer shall stop all Work in the area and initiate changes as required immediately.

D. The Health and Safety Officer is required to conduct Health and Safety Tailgate Meeting at the start of any work shift and when conditions change at a minimum. CONTRATOR shall prepare a tailgate meeting form to document such meetings.

3.04 EMPLOYEE TRAINING

A. CONTRACTOR warrants that all personnel involved with solidification/excavation and/or handling of on-site soils or sludge shall be fully qualified and have successfully completed an occupational hazards training program that exceeds or meets the requirements of OSHA 1910.120 and that each person to be assigned to such Work has successfully completed an approved training program prior to entering the Work Site. The above certifications shall be available upon request prior to solidification/excavation activities.

B. The Health and Safety Officer shall be responsible for initially training all personnel entering the Site in order to make them aware of the Site-specific hazards and to explain emergency procedures and the use of required protective gear.

C. The Health and Safety Officer shall provide periodic follow-up training to on-site Workers as necessary and prior to each change in operations. This training shall be site- and task-specific and shall include basic training and special training. Basic training shall be conducted if special problems have been observed (e.g., improper use of respirators, protective clothing). Special training shall be conducted if unanticipated problems occur on the Site and when a change of operation occurs. The Health and Safety Officer shall also provide initial training to replacement personnel.

3.05 WORK ZONE AREAS

A. CONTRACTOR shall verify that all personnel have the proper personal protective equipment for the Work.

B. All people performing Work shall wear prescribed levels of protection.

C. A contamination reduction zone shall be established by CONTRACTOR to prevent the transfer of contaminants on people, equipment, or in the air to unregulated areas. This shall be accomplished, as required, through a combination of decontamination, minimum distances from active Work areas, and Work function. The equipment decontamination facility and areas designed for personnel decontamination and emergency equipment shall be located in this zone.

D. CONTRACTOR shall provide storage and disposal of used disposable outerwear. CONTRACTOR shall provide temporary containment for the water collected in the decontamination pad sump for subsequent transport and off-site disposal by CONTRACTOR. If CONTRACTOR can provide evidence that the decontamination water meets the Facilities discharge permit limits, this water can be discharge to the permitted outfall with the permission from OWNER or ARCADIS. Under no circumstances should water be pumped back into the IB.

E. A support zone is defined as an area outside the zone contamination does or could occur. The support zone shall be clearly delineated at the Site and shall be secured against active or passive contamination from the Work. The function of the area includes:

1. An entry area for personnel, materials, and equipment to the area of Work;

2. An exit area for decontaminated personnel, materials, and equipment from the Work area;

3. The housing of site services; and

4. A storage area for clean safety and construction equipment and materials.

F. No equipment or personnel shall be permitted to enter the support zone without passing through the personnel or equipment decontamination station located within the contamination reduction zone.

3.06 PERSONAL PROTECTION REQUIREMENTS AND METHODS

A. A description of on-site levels of protection and the personal protective equipment required for each level shall be included in the CHASP. Methods of monitoring the appropriate level of protection shall also be included.

B. Include in the CHASP an inventory of personal protective equipment that will be supplied on-site and indicate the methods of updating the inventory and resupplying the necessary equipment during construction.

C. Equipment for personal protection is described in publications such as the Standard Operating Safety Guides (USEPA - June 1992) and the Occupational Safety Guides Manual for Hazardous Site Activities (National Institute for Occupational Safety and Health [NIOSH]/OSHA/U.S. Coast Guard [USCG]/USEPA, October 1985).

D. Define the appropriate level of protection to be used for each Work activity at this Site in the CHASP.

E. Certify that all CONTRACTOR, subcontractor, or service personnel entering the construction zone or contamination reduction zone for the purpose of the Work; for health, safety, security, or administrative purposes; for maintenance; or for any other Site-related function; have received medical examinations and safety training provided by or for CONTRACTOR.

3.07 PERSONNEL AND EQUIPMENT DECONTAMINATION

A. Define in the CHASP proper methods of personnel and equipment decontamination. This shall include decontamination facilities layout, proper collection of decontamination-generated wastes for disposal by CONTRACTOR, and facilities and equipment necessary for decontamination.

B. The personnel decontamination unit shall be positioned at the entrance of the contamination reduction zone with a step-off area just inside the contamination reduction zone. All personnel entering or leaving the contamination reduction zone shall pass through this area to don or doff their protective equipment.

C. Prior to start of the Work, CONTRACTOR shall provide to OWNER and ARCADIS for review and approval proposed methods of personal protection and decontamination procedures pursuant to the Work.

D. Provide in the CHASP details explaining daily maintenance of safety equipment, including respirators, in accordance with the appropriate OSHA standards (29 CFR 1910.134).

E. All disposable clothing and other discarded materials shall be placed in CONTRACTOR supplied containers for temporary storage in an area designated by OWNER or ARCADIS. Labels identifying the contents of waste containers shall be affixed to containers of scrap, waste, debris, and clothing. CONTRACTOR is responsible for the transportation and disposal of nonhazardous garbage generated during construction activities in a manner approved by OWNER and/or ARCADIS.

3.08 EMERGENCY PROVISIONS

A. Develop as part of the CHASP a response plan for on-site and off-site emergencies which shall comply with 29 CFR 1910.120 and address, as a minimum, the following:

1. Pre-emergency planning;
2. Personnel roles, lines of authority, training, and communications;
3. Emergency recognition and prevention;
4. Site security and control;
5. Evacuation routes and procedures;
6. Emergency decontamination procedures;
7. Emergency medical treatment and first aid;
8. Emergency alerting and response procedures; and
9. Personal protective equipment and emergency equipment.

3.09 SITE SECURITY AND CONTROL

A. The CHASP shall describe methods for maintaining site security and control during the implementation of the required Work. As a minimum, the requirements shall include procedures for controlling and tracking personnel in each specific Work area and provisions for properly posting caution signs at and near the various Work zones defined above.

3.10 RECORDKEEPING AND REPORTING

A. Maintain logs and reports covering implementation of the CHASP and present the format of these logs and reports as part of the CHASP. The format of the reports shall be developed by CONTRACTOR and shall include, but not be limited to, inspection logs and weekly reports.

3.11 PHYSICAL HAZARDS

A. Excavation Work shall conform to OSHA requirements as covered in 29 CFR 1926.651. Before excavation Work begins, underground utilities such as electric, gas, water, and sewer mains shall be located and marked. Oxygen levels shall be monitored within trench excavation and confined spaces, if entry is planned and conducted. In addition, CONTRACTOR shall protect all adjacent equipment and premises in and around the area.

B. Include in the CHASP the appropriate measures to be taken to limit the release of dust to the ambient air during excavation, transfer, and temporary storage of sludges and soils. Control dust levels and thus limit the concentration of airborne particulates. If drums are used, they shall be equipped with locking lids. Truck beds shall be covered and secured with tarps.

C. The CHASP shall address any physical hazard that may expose a Worker to injury. List the hazards anticipated and the program for handling each potential hazard.

3.12 ACTION LEVELS

A. Action levels for personnel protection and emergency action shall be defined and included in the CHASP. Chemical constituents, physical parameters and associated action levels shall be selected by the CONTRACTOR and shall include but not necessarily be limited to the constituents previously detected in the sludge/effluent or sludge odors as presented in the Contract Scope of Work Items D and F, respectively. At a minimum, action levels shall meet the requirements specified in Section 02245.

3.13 EMERGENCY PROCEDURES

A. All accidents and unusual events shall be dealt with in a manner so as to minimize continued health risk of Site personnel and the general public.

B. Include in the CHASP a list of Emergency equipment and location of the equipment at the Site. As a minimum, the following equipment shall be available at the Work site and maintained fully stocked:

1. “Industrial” First aid kit supplies approved by a consulting physician to comply with CFR 1926.50(d)(i);
2. A class ABC type portable fire extinguisher with a 2A:10BC rating;
3. Five-minute emergency air-supplied escape masks;
4. Stretcher;
5. (Portable) Emergency eyewash station (three units), and
6. (Portable) Emergency shower (three units).

C. The names and phone numbers of all personnel and agencies that could be involved in emergency response shall be established by the Health and Safety Officer and will be posted at several prominent locations at the site. As a minimum, the following contacts shall be included on this list:

1. Fire department;
2. Police;
3. Ambulance; and
4. Hospital.

D. A map showing the location of the hospital and the preferred route shall be included in the CHASP. Prior to the start of construction, the emergency personnel listed above shall be contacted and briefed on the planned Work and the potential hazards that may be encountered. In addition, the route to the hospital shall be checked and traveled at least once by the Health and Safety Officer to verify its accuracy.

END OF SECTION

SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.01 DESCRIPTION

Primary Line and Grade and Measurements

A. CONTRACTOR shall arrange for and pay for a competent Surveyor licensed in the state of Mississippi to establish all benchmarks, lines, elevations, reference marks, batter boards, etc., needed by CONTRACTOR, OWNER or ARCADIS during the progress of the Work and from time to time to verify such marks by instrument or other appropriate means.

Said elevations and lines shall include, but not be limited to, IB contours (prior to work and following sludge removal), final grading contours, site drainage, and fence lines.

B. ARCADIS shall be permitted at all times to check the lines, elevations, reference marks, batter boards, etc., set by CONTRACTOR, who will correct any errors in lines, elevations, reference marks, batter boards, etc., disclosed by such check. Such a check shall not be construed to be an approval of CONTRACTOR’s Work and shall not relieve or diminish in any way the responsibility of CONTRACTOR for the accurate and satisfactory construction and completion of the entire Work.

C. At completion of the Work, CONTRACTOR shall have a licensed Surveyor prepare “As-built” Drawings showing the location and elevation of all Work installed, including Work installed by ARCADIS (if any), and submit the “As-built” Drawings to ARCADIS for review. Certification of the “As-built” Drawing by the Licensed Surveyor is required. Submittals of these “As-built” Drawings shall conform to requirements of Section 01300 - SUBMITTALS. In addition, all drawings shall conform to ARCADIS’s drawing format (i.e., sheet layout, layers, etc.) and in electronic ACAD format.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION

SECTION 01060
REGULATORY REQUIREMENT AND RESPONSIBILITY TO THE PUBLIC

PART 1 - GENERAL

1.01 REGULATION

A. Give all necessary notices, obtain all permits, and pay all fees and other costs in connection with the Work; file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. CONTRACTOR shall obtain all required Certificates of Inspection and approval for the Work and deliver these documents to OWNER and ARCADIS, except as expressly noted in the Contract Documents.

B. **CONTRACTOR shall obtain a certificate of responsibility from the Mississippi Contractors Board (per Section 31-3-15 of the Mississippi Code) and include it with their bid as required by Mississippi Law.** Per the Law, a contract that is awarded to a CONTRACTOR without a certificate are void and both the CONTRACTOR and the <u>entity awarding the contract</u> are subject to penalties,

C. Include in the Work, without extra cost to OWNER, labor, materials, services, and drawings required to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown in the Contract, Specifications, or Drawings or specified.

D. The Work shall be performed in accordance with all applicable federal, state, local, and municipal laws, ordinances, rules, and regulations.

E. Work shall be completed in compliance with the United States Resource Conservation and Recovery Act (RCRA) and Clean Water Act where applicable.

1.02 RESPONSIBILITY TO THE PUBLIC

A. Traffic

1. Construction operations shall be programmed and conducted to maintain adequate roadway and pedestrian traffic within and adjacent to the site. As necessary, the following shall be implemented for the Work duration: flagmen, furnishing, erecting and proper maintenance, removal, and disposal of traffic controls.

2. Construction operations shall be programmed and conducted not to impede upon the daily operations of OWNER. A minimum of one ingress and egress route shall be maintained and passable at all times.

3. Pedestrian access to abutting properties and vehicular access for ambulances, police, and fire or other emergency equipment shall be maintained at all times. When vehicular access is temporarily curtailed, it shall be CONTRACTOR's responsibility to give adequate notice to affected parties including but not limited to the police department having jurisdiction for the site, fire department

and emergency ambulance services prior to impairing access, and to provide means of temporary access when and if required.

4. When traffic is interrupted, every effort shall be exercised to restore normal traffic as soon as practicable.

5. Furnishing, erecting, proper maintenance, relocation, removal, and disposal of necessary signs, barricades, cones, warning lights, and other traffic controls shall be in accordance with local requirements and ordinances.

B. Sanitary Provision

1. CONTRACTOR shall provide all required adequate sanitary facilities, per local and federal regulations. Such facilities shall include, but not be limited to, restrooms, washrooms, and/or showers. Such facilities shall be made available when the first employees arrive on site for the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

2. CONTRACTOR shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. CONTRACTOR shall rigorously prohibit the committing of nuisances on the site of the Work or on adjacent property.

C. Protection of Property

1. All property along the line of the Work, or which is in the vicinity of, or is any way affected by the Work shall be protected and preserved from damage by CONTRACTOR. Trees, fences, water or gas pipes (pipeline owner shall be notified when Working near line), sewers, drains, conduits, poles or wires for electrical purposes, railways, or other structures shall not be moved without consent of the persons owning or controlling them; and in crossing or working near them, they shall be sustained securely in place and shall be so treated as to render their condition as efficient and permanent as before.

2. Property damaged shall be immediately repaired and restored at the expense of CONTRACTOR, or if required, CONTRACTOR shall make the necessary repairs. In case of failure on the part of CONTRACTOR to restore such property, OWNER will have repairs made and any cost thereof will be deducted from payments due or which may become due to CONTRACTOR under this Contract.

D Existing Utilities

When excavating in close proximity of a utility or structure, OWNER shall be notified thereof sufficiently in advance so that OWNER may accomplish any special protective measure CONTRACTOR or OWNER deems necessary. Construction operations shall be so conducted as to facilitate access to utility structures by OWNER.

E Sludge Odors

Refer to Specification 02245.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01070
STANDARDS

PART 1 - GENERAL

1.01 ACRONYMS

Where acronyms of the following organizations or any other standards, codes or specifications are referred to in the Specifications, the reference is to the particular standards, codes, or specification cited, together with all amendments applicable at the date of the opening of Bids; and shall apply except to the extent that said standards, and requirements may be in conflict with applicable laws or ordinances.

Acronym	Organization
AASHTO	American Assn. of State Hwy. & Trans. Officials
ACI	Alley Casting Institute or American Concrete Institute (as applicable)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASC	Adhesive and Sealant Council
ASCE	American Society of Civil Engineers
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards: U.S. Dept. of Commerce
EIA	Electronic Industries Association
ETL	Electrical Testing Laboratories, Inc.
Federal	Federal Government Specifications
IEEE	Institute of Electrical and Electronics Engineers
MBMA	Metal Building Manufacturers Association
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NIOSH	National Institute for Occupational Safety and Health
NRMCA	National Ready Mix Concrete Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
POTW	Publicly Owned Treatment Works
PS	Product Standard
RCRA	Resource Conservation and Recovery Act
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
UL	Underwriter’s Laboratories, Inc.
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01150
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 GENERAL

A. Payment for Work performed under this Contract will be made as set forth herein under the individual Base Bid Items contained within the Base Bid Form.

B. If a Contract is awarded on a combination of Items, other than the total, the Work performed shall be complete and operable with each Item standing alone and in conformance with all provisions of the Contract Documents.

C. There shall be no Work or cost added to an Item which has been included under any other Item.

D. The Work included under each Item shall consist of furnishing and installing the materials and/or equipment, complete, as enumerated below. Progress Payment for each Item will be made at the Lump Sum or Fixed Unit Price in accordance with the provisions of Section 1.02 of this Specification.

E. CONTRACTOR shall include in the price bid for each applicable Bid Item listed in the schedule of prices the cost of coordination, labor, health and safety measures, including equipment and decontamination, materials, tools and equipment, sheeting and shoring in trenches and pits, soil, material and equipment testing, repairs to the roads due to construction damage, dewatering, protection of adjacent work, maintenance of traffic, displacement, replacement and/or repair of damage to any existing utility and/or structure by CONTRACTOR activity, “As-built” Drawings, code inspections, quality assurance (QA) and (QC), and all other cost incurred as necessary to provide, complete in place, all Work required to complete each Item in the Base Bid Form.

F. Work Items included with each schedule of prices are described in the following paragraphs.

G. CONTRACTOR shall bid Items as provided in the Technical Specifications and Project Drawings. Any deviations from the Base Bid shall be broken out and attached as a separate Item.

1.02 BASE BID – IB & TANKS DECOMMISSIONING

A. Work Plans, Permits, and Waste Profiles (Item 1)

1. The CONTRACTOR shall submit a CONTRACTOR’s Work plan (including Odor Mitigation Plan, Final Sheet Pile Design, and Final Temporary Structure Design), schedule (in Microsoft Project), Health and Safety Plan, manufacturer’s certifications, list of submittals, manufacturer’s product literature, material analysis, and the required insurance and bonds, for review prior to mobilization. The cost to obtain a bond for the Grand Total of the project as provided on the Bid Form shall be included as Item 44 on the Bid Form. The Contractors Work Plan or execution plan shall clearly indicate how

the work is scheduled and sequenced. The CONTRACTOR shall successfully profile the solidified sludge and soil for disposal at Pine Belt Regional Landfill and the selected and OWNER approved hazardous waste facility. Profiling effort shall include sampling and analysis of any additional parameters that may be required by the landfills. In addition, CONTRACTOR shall provide both chemical and geophysical analysis of offsite borrow material and chemical analysis of the solidification agent(s) as required by the Technical Specifications. The CONTRACTOR shall obtain all required permits to complete the project. The facility sanitary sewer discharge permit and facility's storm water pollution prevention plan (SWPPP) have been provided in this RFP for use on the project.

2. The costs for the services requested under this task shall be paid for on a lump sum basis upon review of all pre-work submittals. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 1

B. Site Preparation/Management (Item 2)

1. The CONTRACTOR shall establish vertical and horizontal control points and provide topographic surveys of conditions prior to Work, following sludge/soil removal, and at the completion of the project ("As-built" Drawings). The CONTRACTOR shall locate utilities in the vicinity of the IB using the following lines of evidence: private utility locator company, drawings available for review on site, and a walk-through with Facility personnel. The CONTRACTOR shall purchase and install appropriate erosion control measures (i.e. silt fence). The CONTRACTOR shall implement any additional measures to ensure compliance with the site SWPPP. The CONTRACTOR shall provide a site equipment layout map to be included with the SWPPP by OTHERS. The CONTRACTOR shall conduct any required pre-job grading or other improvements to allow for appropriate access to the IB and/or staging areas. The CONTRACTOR shall set-up any required utilities needed for the project (electrical, telephone, etc.). This task also includes the mobilization, set-up, utilization, and demobilization of any support facilities (i.e. office trailer, sanitary facilities), security measures, and any other facilities required by the Specifications and state or local regulations. This item shall include all other CONTRACTOR preparations necessary to set up for the Work that isn't discussed elsewhere in these Specifications.

2. Price and payment shall be considered for all labor, materials, tools, equipment, services, and supervision necessary to perform all operations specified herein. The CONTRACTOR is instructed to place the cost for this service as a lump sum on the Bid Form under Item No. 2.

C. Sheet Piling Mobilization/Demobilization (Item 3)

1. The CONTRACTOR shall mobilize all personnel, materials, labor and equipment to the Hattiesburg Plant as necessary to install the sheet piling in a safe, timely and cost-effective manner. All CONTRACTOR personnel are required to attend plant safety orientation prior to the start of any Work. This task also includes setting up support systems as necessary to complete the Work. The costs for the services requested under this task shall be paid for on a lump sum basis upon successful start-up and operation of the process for a period of 24 hours (assuming 50% payment for

mobilization effort). The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 3a

2. The CONTRACTOR shall remove all personnel, equipment, trash, debris from the Site following the installation of the sheet piling. CONTRACTOR's price should include removal of the sheet piling, with an alternate price if leaving the piling in place provides a cost savings. The costs for the services requested under this task shall be paid for on a lump sum basis following the removal of all sheet piling equipment (assuming 50% payment for demobilization effort). The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 3a with cost savings (if any) for not removing the sheet piling as Item 41.

3. Work under this Item includes, but is not limited to, furnishing, installing, utilizing, maintaining, removing, and disposing of personnel protective and decontamination equipment/materials used for sheet pile installation in accordance with the Contract Documents and all applicable local, state, and federal regulations. Materials and equipment under this Item include, but are not limited to, Tyvek coveralls as well as protective clothing required by Sections 01035; pumps; power washers; emergency showers; detergents; and electrical materials and equipment required for decontamination of equipment and personnel.

D Perimeter Sheet Piling (Item 3b)

1. The CONTRACTOR shall install perimeter sheet piling along the inside of the IB walls in accordance with CONTRACTOR's design as reviewed by OWNER and ARCADIS. Installation shall include water tight sealing between pilings along the perimeter.

2. The costs for the services requested under this task shall be paid for on a linear feet basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 3b.

E Interior Sheet Piling (Item 3c)

1. The CONTRACTOR shall install interior sheet piling in accordance with CONTRACTOR's design as reviewed by OWNER and ARCADIS. OWNER and ARCADIS shall review the location and installation method of installing the interior sheet piling. Installation shall include water tight sealing between pilings within the interior and between the interior piling and the perimeter pilings.

2. The costs for the services requested under this task shall be paid for on a linear feet basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 3c.

F Temporary Structure (Item 4a)

1. The CONTRACTOR shall mobilize and install a temporary structure over all or portions of the IB as required by the IB Interim Measures Work Plan (IMWP) in accordance with the CONTRACTOR's design as reviewed by OWNER and ARCADIS. A temporary

structure over just a portion of the IB will require breakdown and re-installation of the structure as work progresses in the IB.

2. The costs for the services requested under this task shall be paid for on a lump sum percent complete basis as proposed by the CONTRACTOR and approved by OWNER. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 4a.

G Temporary Structure Ventilation & Air Treatment (Item 4b)

1. The CONTRACTOR shall install and operate a ventilation system for the temporary structure to induce a negative pressure within the structure to ensure that all vapors and odors emitted from the sludge during solidification and removal are captured and treated. Ventilation and air treatment shall be installed in accordance with the CONTRACTOR's design as reviewed by OWNER and ARCADIS. This task includes periodic monitoring to confirm treatment of the discharged air.

2. If air treatment involves a media that requires periodic replacement, the CONTRACTOR shall include all costs for such additional media, replacement efforts, and disposal of media for the duration of the project. No request for additional payment if the amount of media required exceeds expectations/assumptions will be accepted.

3. The costs for the services requested under this task shall be paid for on a lump sum percent complete basis as proposed by the CONTRACTOR and approved by OWNER. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 4b.

G Solidification Mobilization/Demobilization (Items 5, 18, 24)

1. The CONTRACTOR shall mobilize all personnel, materials, labor and equipment to the site as necessary to conduct the sludge solidification, sludge disposal, and IB backfilling in a safe, timely and cost-effective manner. CONTRACTOR personnel are required to attend plant safety orientation prior to the start of any Work. This task also includes setting up support systems as necessary to complete the Work. Note: All project Work shall be in accordance with OSHA 1910.120 Safety Standards. Proof of current OSHA training will be required for any site worker who may be exposed to sludge material or its vapors. The costs for the services requested under this task shall be paid for on a lump sum basis following successful start-up of operations for 24 hours at ET-10 and ET-18 or successful completion of the demonstration with the agency at the IB. Payment for mobilization will be paid as 50% of this line item. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item Numbers 5 (IB), 18 (ET-10), and 24 (ET-18).

2. The CONTRACTOR shall remove all personnel, equipment, trash, debris from the Site following complete decommissioning of the IB and the Tanks. The costs for the services requested under this task shall be paid for on a lump sum basis upon completion of all WORK at the Hattiesburg Plant. Payment for demobilization will be paid as 50% of this line item. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item Numbers 5 (IB), 18 (ET-10), and 24 (ET-18).

3. Work under this Item includes, but is not limited to, furnishing, installing, utilizing, maintaining, removing, and disposing of personnel protective and decontamination equipment/materials used for solidification and excavation effort in accordance with the Contract Documents and all applicable local, state, and federal regulations. Materials and equipment under this Item include, but are not limited to, Tyvek coveralls as well as protective clothing required by Sections 01035; pumps; power washers; emergency showers; detergents; and electrical materials and equipment required for decontamination of equipment and personnel.

H Odor Mitigation Plan Implementation (Items 6, 10 & 26)

1. Work under this Item shall include, but is not limited to, the purchase and deployment of substances, materials, devices, and/or best management practices for odor control and documentation of odor control activities (monitoring). The CONTRACTOR shall perform odor mitigation and monitoring during sludge removal/handling activities (not covered under item 4 above) for the IB, ET-10 and ET-18. The Hattiesburg Plant is located in close proximity to residential/commercial properties and odors must be minimized so that an off-site disturbance is not created. **This is an essential element of this project** and the CONTRACTOR must describe the methods intended to be used to mitigate production of odors and any steps that can be taken to minimize odors if generated. The CONTRACTOR shall describe proposed odor mitigation and monitoring measures in the technical approach section of the proposal (Odor Mitigation Plan).

2. Odor mitigation plan shall have contingency measures in the event that the odor/vapor criteria established for the property boundary in the Interim Measures Work Plan are not met. Implementation of contingency plans in the event that the odor mitigation does not meet the standards specified in the Contract Documents shall be included in this task.

3. Monitoring of odors, vapors from volatile organic compounds and dust shall be completed by the CONTRACTOR in the work area. The CONTRACTOR can assume that ARCADIS will perform the odor/vapor monitoring at the property boundary only as required by the IB Interim Measures Work Plan.

4. Work under this item shall include a demonstration for MDEQ and USEPA of the odor mitigation during sludge solidification and removal at the beginning of implementation to meet the requirements of the Contract Documents.

5. Price and payment shall be considered full compensation for all labor, materials, tools, equipment, services, QA/QC testing as specified, and supervision necessary to perform all operations specified herein. The costs for this task (odor management) shall be paid for on a lump sum percent complete basis as proposed by the CONTRACTOR and approved by OWNER. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item Numbers 6 (IB), 20 (ET-10), and 26 (ET-18).

I Transfer Sludge to Adjacent Cell & Backfill (Item 7)

1. At a point following installation of sheet piling but before solidification of sludge, CONTRACTOR shall remove all sludge that is trapped between the IB walls and the

sheet piling and place in the adjacent cell. In addition, CONTRACTOR shall backfill this void with a material requiring little or no compaction (i.e. flowable fill) that is approved by OWNER and ARCADIS.

2. The costs for the services requested under this task shall be paid for on a linear perimeter feet basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 7.

J Pipe Decommissioning (Item 8)

1. CONTRACTOR shall decommission (flush, cap, and abandon in place) a minimum of 8 pipes known to enter the IB. Pipes may be above or below current water and/or sludge level. Decommissioning can be implemented either on the inside or outside (excavate) as long as the pipe is completely plugged eliminating any potential for liquids to flow into the IB following decommissioning activities. If soil is excavated to decommission the pipes, the soil shall be placed in a container for proper characterization, profiling, and disposal by the CONTRACTOR.

2. The CONTRACTOR can assume that the soil would be non-hazardous for purposes of this RFP (to be verified by actual data). The CONTRACTOR is instructed to place the lump sum cost for this service on the Bid Form under Item No. 8.

K. Management of Free Liquids, Fractionation (Frac) tanks (Items 9, 19, 25, 37 & 38)

1. The CONTRACTOR shall be responsible for managing free liquids generated during sludge/soil solidification and removal from the IB and equalization tanks. Free liquids include liquids within the IB basin, tanks, secondary sump, surface water, and groundwater infiltration. Note that the CONTRACTOR shall sufficiently minimize the amount of groundwater and surface water infiltration, including but not limiting to an expedited schedule of backfilling following sludge removal efforts. CONTRACTOR shall provide all the equipment, materials, and labor to pump free liquids from the IB, ET-10, and/or ET-18 to an adjacent frac tank. CONTRACTOR shall also pump free liquids from the frac tank to the appropriate MDEQ permitted outfall location such as the secondary sump (for the IB and ET-18) or manhole east of Providence Street (for ET-10).

2. Frac tank costs are covered separately, shall be paid for on unit pricing, and shall be placed on the Bid Form under Task 38. Once a frac tank is nearly filled, CONTRACTOR shall inform OWNER/ARCADIS so that OWNER/ARCADIS can collect a sample for rush turnaround laboratory analysis. Upon receipt of data, ARCADIS/OWNER will provide an acceptable flow rate for discharge to the appropriate outfall location. The CONTRACTOR will be required to verify that discharge to the permitted outfall is conducted at the prescribed flow rate, or less. No additional chemicals or free liquids shall be added to the free liquids after testing. CONTRACTOR shall assume that instruction on discharging will be provided to the CONTRACTOR approximately 72 hours following notification of a filled frac tank.

3. The costs for pumping free liquids from the IB/Tanks to a frac tank and then to the discharge outfall shall be paid for on a unit price per gallon basis. The CONTRACTOR

is instructed to place the unit cost for this service on the Bid Form under Item Numbers 9 (IB), 19 (ET-10), and 25 (ET-18).

4. OWNER may instruct the CONTRACTOR to pump water to an existing tank rather than or in addition to, the frac tank. Such tanks may include the Kymene tanks, ET-19, or ET-18. CONTRACTOR shall include any additional costs (i.e. piping, pumps) incurred to pump free liquids to these specified tanks. CONTRACTOR can assume that OWNER will transfer free liquids from these tanks directly to the discharge outfall unless treatment is necessary as covered in Task 36 (below). The additional costs for pumping water to the Kymene tanks, ET-19 or ET-18 shall be paid for on a monthly fee basis. The CONTRACTOR is instructed to place the unit cost for this service on the Bid Form under Item No. 37.

5. Water shall be pumped in a manner to minimize turbidity. Pumping of water to frac tanks shall be metered with a flowmeter having an accuracy of +/- 2%. Flowmeter accuracy shall be checked periodically.

6. Price shall exclude any decontamination and/or wash water. Management of this water shall be including in the sheet pile or solidification decontamination effort or the tank/sump cleaning efforts.

L Free Liquids Treatment (Item 36)

1. Based on the results of the free liquids sampling and analysis conducted by OWNER/ARCADIS, some treatment of the free liquid is likely required particularly for the IB. CONTRACTOR can assume that treatment will include a settling tank, possibly some settling additives, a pre-carbon filter, and granular activated carbon; however, alternative approaches to free liquid treatment can be proposed. It is unknown how much liquid will be generated; however' with the IB and ET-10 being pumped down by the Facility prior to solidification efforts and the sheet piling limiting groundwater infiltration into the IB, excessive liquid treatment is not anticipated.

2. The costs for the services requested under Task 36a (mobilization/demobilization) shall be paid for on a lump sum price (50% for mobilization and 50% for demobilization). The costs for the services requested under Task 36b shall be paid for on a price per gallon basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item Numbers 36a and 36b.

M Sludge/Soil Solidification (Item 10, 21 & 27)

1. Prior to solidification, the CONTRACTOR shall utilize measures to reduce the free liquids mixed with the sludge within each cell or tank (i.e. sludge mounding and sump installation). Following this effort, the CONTRACTOR shall implement the CONTRACTOR's work plan as reviewed by OWNER and ARCADIS with the mixing of a solidification agent and any other agents deemed necessary by the CONTRACTOR at the IB, ET-10 and ET-18. All work at the IB must be completed beneath the temporary structure while it is under negative pressure from the air handling system. Prior to solidification efforts, odor mitigation plan shall be implemented as included in Task 6, 20 and 26 to ensure that the odor/vapor criteria as specified in the Interim Measures Work

Plan will be achieved. During and/or immediately following solidification of sludge in the IB hazardous cells (Cells 1, 3 & 7), ARCADIS will collect samples with the assistance of the CONTRACTOR to comply with Land Disposal Restrictions. Samples will be analyzed for rush analysis. Samples may be collected periodically while sludge is removed from the cell or all at one time once the entire cell is solidified, depending on the CONTRACTOR's approach to solidification. Results of the sampling will determine if additional treatment is required at the hazardous waste facility to meet LDR requirements. It is not anticipated that additional treatment will be required. As included in the tasks described below, solidified sludge (passing EPA's Paint Filter Liquids Test [SW-846 - 9095 A]) shall be live loaded onto trucks for shipment to either Pine Belt Regional Landfill (IB Cells 2, 4, 5, 6, and 8, ET-10, and ET-18) or an approved hazardous waste facility (IB Cells 1, 3, and 7).

2. Once nearly all the sludge is removed from each IB Cell, a minimum of 6-inches of soil shall also be removed per the approved IB Interim Measures Work Plan. All IB structures (excluding baffles) including wooden sidewalls and concrete cap surrounding the impounding basin can remain in place following sludge removal unless a decision is made by OWNER to remove the walls (Task 33).

3. The cost for the solidification effort shall include a demonstration to the USEPA and MDEQ prior to full scale implementation.

4. Price and Progress payment shall be considered full compensation for all labor, materials, tools, equipment, services, and supervision to perform all operations specified herein. The costs for this task shall be paid for on a unit pricing per ton of solidified sludge basis subject to the approval of OWNER and ARCADIS that the CONTRACTOR is sufficiently implementing means to remove free liquid prior to solidification. The tonnage will be based on weight tickets from a certified scale for each shipment. CONTRACTOR shall provide weight tickets from a certified scale for each shipment on a weekly basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item Numbers 10(IB), 21 (ET-10) and 27 (ET-18).

5. Include in this item the necessary QA/QC testing to meet the performance criteria established in these Specifications.

N Sludge/Soil Loading, Transportation and Disposal – Hazardous and Non-Hazardous (Items 11, 12, 22 & 28)

1. CONTRACTOR is responsible for coordinating, live loading, transportation and disposal of solidified sludge to Pine Belt Regional Landfill in Ovett, Mississippi (non-hazardous sludge) or the approved hazardous waste facility (refer to Appendix C, Exhibit A, Item H) in accordance with the reviewed CONTRACTOR's Work Plan. The CONTRACTOR shall describe the means and methods for accomplishing this task in their proposal. The approach to loading the trucks shall minimize odors or vapors emitted to the air. If odors at the property boundary caused by loading operations exceed the criteria in the IB Interim Measure Work Plan, additional odor mitigation will be required until the criteria are met.

2. This project will involve the off-site disposal of significant quantities of sludge and it will be essential that the flow of sludge off-site be managed in an efficient manner. This task includes managing all paperwork (manifests, bill of lading, etc.) associated with disposal of the sludge. CONTRACTOR shall provide this paperwork to OWNER and ARCADIS on a weekly basis throughout the project. The CONTRACTOR will be responsible to ensure each off-site shipment of sludge is properly manifested and the disposal facility provides the appropriate bill of lading. All sludge shipments must be properly tracked and accounted for. The appropriate paperwork shall be submitted to the OWNER and ARCADIS project managers on a weekly basis. The CONTRACTOR can assume that someone will be on site that has approval to sign the manifest as the waste generator or a representative of the waste generator.

3. CONTRACTOR shall monitor truck loads to ensure that no free liquids exist and that they are under all applicable road/bridge weight limits. Every load must be covered at a minimum. The sludge shall not emit noticeable odor during transportation. If odors are encountered, the CONTRACTOR shall provide means for controlling such odors at their own cost. CONTRACTOR shall verify that all truck loads are under applicable road/bridge weight limits. Any costs (including fines and legal fees) associated with overweight trucks will be the responsibility of the CONTRACTOR. Truck load documentation shall be provided to OWNER and ARCADIS weekly. Trucks shall not track any soil or sludge from this site. Dust shall be monitored per Tasks 6, 20 & 26 and controlled in needed per Task 40.

4. The costs for this task shall be paid for on unit pricing per ton of solidified sludge basis subject to the approval of OWNER and ARCADIS that the CONTRACTOR is sufficiently implementing means to remove free liquid prior to solidification. The tonnage will be based on weight tickets from a certified scale for each shipment. CONTRACTOR shall provide weight tickets from a certified scale for each shipment on a weekly basis. The CONTRACTOR is instructed to place the unit cost for this service on the Bid Form under Item No. 11 (IB- nonhaz), 12 (IB - haz), 22 (ET-10) and 28 (ET-18).

O. Demolition of Baffles and Pipe Decommissioning (Items 13 & 39)

1. CONTRACTOR shall demolish the baffle system. Baffles shall be removed, freed of sludge, characterized, profiled, and disposed by the CONTRACTOR in accordance with applicable rules and regulations. If the baffles require storage, they shall be placed in a container such as a roll-off. Roll-off costs are covered separately, shall be paid for on unit pricing, and shall be placed on the Bid Form under Item 39. The costs for this task shall be paid for on lump sum basis. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 13.

2. Price and payment shall be considered full compensation for all labor, materials, tools, equipment, services, and supervision necessary to perform all operations specified herein.

P Excavate and Backfilling Behind Southeast Wall (Item 14)

1. Following sampling around the perimeter of the IB, some sludge was observed behind the southeast wall of the IB. Therefore (as required by the IB Interim Measures Work

Plan) the CONTRACTOR shall excavate down along this wall as directed by OWNER and/or ARCADIS to remove this sludge for solidification and off-site disposal.

2. The costs for excavating, loading, transportation and disposal of this sludge shall be paid for on a per ton basis. The tonnage will be based on weight tickets from a certified scale for each shipment. The CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 14.

Q. Backfilling IB (Item 15)

1. Work under this Item shall include, but is not limited to, placing and compacting on-site stockpiled soil material to the area to backfill the IB (excluding top soil) in accordance with the Specifications as presented herein and as presented on the Project Drawings. The CONTRACTOR shall provide costs for backfilling with the approximately 3,300 yd^3 of on-site backfill, importing and backfilling with approximately 3,500 yd^3 of clean material, compacting, and grading the IB. Backfill shall not be placed into the IB until it is confirmed by OWNER/ARCADIS that all the sludge is removed. Backfilling shall also not be conducted until ARCADIS has collected soil samples for laboratory analysis from the bottom of the excavation (as required by the IB Interim Measure Work Plan) with the assistance from the CONTRACTOR. Backfilling of the IB will NOT be contingent on the results of the sample analysis. All backfill must be from a certified clean source and paperwork verifying the backfill is clean based on laboratory analysis will be required. A representative sample of the proposed backfill shall be analyzed for Priority Pollutant constituents and the results shall be compared to MDEQ Target Remediation Goals (TRGs) for industrial sites. The CONTRACTOR is responsible for ensuring the fill is appropriately compacted and the final grade contains a 1% to 2% slope to prevent water from ponding.

2. This task will be an estimated quantity in cubic yards until the removal of the sludge from the IB is completed, the survey is performed and an accurate measurement of clean fill necessary can be determined. CONTRACTOR shall have a source with ample supply of soil in the event that the quantity increases. CONTRACTOR will be paid based on a unit price per cubic yard of soil backfilled following compaction. The CONTRACTOR is instructed to place the unit cost for this service on the Bid Form under Item Numbers 15A (on site soil) and 15B (off site soil).

3. Price and payment shall be considered full compensation for all labor, materials, tools, equipment, services, QA/QC testing as specified, and supervision necessary to perform all operations specified herein.

4. Work under this Item shall include, but is not limited to, necessary independent geotechnical testing as given in Section 01410.

R. Site Grading and Restoration (Item 16)

1. The CONTRACTOR shall place 6-inches of top soil, grade, seed, and fertilize over approximately 1 acre, which meets the specifications as presented herein and as presented on the Project Drawings. The CONTRACTOR is responsible for ensuring final grade contains a 1% to 2% slope over the IB to prevent water from ponding. Within

this item, CONTRACTOR shall include the cost to remove the erosion control measures once appropriate vegetation is established.

2. Work under this Item shall include, but is not limited to, necessary independent geotechnical testing of the top soil as given in Section 01410.

3. Price and payment shall be considered full compensation for all labor, materials, tools, equipment, services, QA/QC testing as specified, and supervision necessary to perform all operations specified herein. Payment for top soil, seeding, and fertilizing shall be based on the final area covered based on the final survey. Included in this quantity all disturbed areas. The CONTRACTOR is instructed to place the cost per acre for this service on the Bid Form under Item No. 16.

S Final Construction Completion Report (Item 17)

1. The CONTRACTOR is required to submit a brief documentation report at the end of the project outlining the work completed. This document shall include all waste documentation (including profiles, manifests and load tables), field and laboratory test results, and survey information.

2. The costs for the services requested under this task shall be paid for on a lump sum basis upon submittal and review of the Report. The CONTRACTOR is instructed to place the cost for this service on the Bid Form under Item No. 17.

T. Tank/Sump Cleaning and Wash Water Management (Items 23, 29, 30, 31 & 32)

1. The CONTRACTOR shall clean the specified tank (and secondary sump) to ensure that no more sludge, sludge residue, or liquids remain in the tank/sump. Tank cleaning can be performed from existing openings or by cutting additional openings to access the tank (upon completion of all necessary safety precautions and receipt of proper hot work permit). Any wash water used during the cleaning shall be containerized by the CONTRACTOR. Following sampling and analyses by ARCADIS, washwater shall be discharged to the permitted outfall at the flowrate dictated by ARCADIS. CONTRACTOR shall have a means for determining compliance with this flowrate. Any appreciable amount of sludge generated during the cleaning operations shall be solidified and disposed under Items 21 and 22 for ET-10 and Items 27 and 28 for all other tanks/sump.

2. Tanks/sump shall be cleaned via power washing or approved equivalent approach. The intent of the cleaning is to remove gross residual solids to the extent that the entire bottom and sidewalls of the tanks/sump can be photographed and inspected for integrity purposes. Collection of electronic photos to document acceptable cleaning shall be included in this item.

3. Price and payment shall be considered full compensation for all labor, materials, tools, equipment, services, and supervision necessary to perform all operations specified herein. The cost of this effort shall be paid on a lump sum basis. The CONTRACTOR is

instructed to place the cost of this service on the Bid Form under Item Numbers 23 (ET-10), 29 (ET-18), 30 (K-210, K-268, K269), 31 (ET-19), and 32 (secondary sump).

U. Option: IB Sidewall Removal (Items 33)

1. CONTRACTOR shall provide a cost estimate to remove the wood sidewalls of the IB and properly decontaminate and dispose of the wood off-site in accordance with applicable rules and regulations in the event that OWNER chooses to have this work completed. The cost of this effort shall be paid on a lump sum basis. The CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 33.

2. Price and Progress payment shall be considered full compensation for all labor, materials, tools, equipment, services, and supervision to perform all operations specified herein.

V Option: Backfill IB with Gravel (Item 34)

1. Since it is unknown how much and how fast groundwater will be infiltrating into the IB following sludge and soil removal, the CONTRACTOR shall provide a cost for purchasing, delivering, and placing gravel into the bottom of the IB to bridge the water and allow for proper backfilling of soil above the gravel bridge.

2. The cost for this effort shall be paid for on a per ton basis. The CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 34.

W. Demolition of ET-10 (Item 42)

1. CONTRACTOR shall provide a cost to demolish equalization tank ET-10 down to ground surface or any existing concrete foundation in the event that OWNER chooses to have this work completed. CONTRACTOR shall grade land surface to be consistent with surrounding land which may include some limited fill or crushed concrete to be placed in the conical bottom of the tank. Proposal shall assume that the CONTRACTOR will retain any scrap value obtained from the tank. Since a technical specification for demolition has not been developed, CONTRACTOR shall make assumptions for the demolition and state those assumptions in the bid.

2. The cost of this effort shall be paid for on a lump sum basis. The CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 42.

X. Miscellaneous Items (Items 35, 40 & 43)

1. The CONTRACTOR shall provide a daily cost for any downtime following the demonstration of solidification activities that is not due to weather delays or delays under the control of the CONTRACTOR. For example, the USEPA may require a couple days to provide approval following the demonstration that full scale operations can commence. The cost of this effort shall be paid for on a daily basis. The

CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 35

2. The CONTRACTOR shall provide a daily cost for roadway sweeping if deemed necessary by OWNER/ARCADIS. The CONTRACTOR is instructed to place the cost of this service on the Bid Form under Item No. 40.

3. The CONTRACTOR shall provide the fuel rate or rates utilized to prepare their proposal. Additional fuel charges will be acceptable per the terms of the footnote in the Bid Form. Base fuel rate shall be reasonable considering historical rates and the time of year that the work will be completed. The CONTRACTOR is instructed to provide this rate or rates on a per gallon basis on the Bid Form under Item No. 43.

1.03 PAYMENT PROCEDURE

A. Breakdown of Lump Sum and Fixed Unit Price Items:

1. Within 3 days after the OWNER issues a Notice of Award of Agreement, the CONTRACTOR shall submit to the OWNER and ARCADIS, in a form approved by the OWNER/ARCADIS, a complete, detailed breakdown of all lump sum and fixed unit price Items awarded. The detailed breakdown shall include quantities with all material and labor costs for individual Work Items required to complete the lump sum and fixed unit price Item. Quantities estimated by the CONTRACTOR are for the purpose of providing a basis for realistic progress payments consistent with the actual performance of the Work. The job breakdown will be revised by the CONTRACTOR if the OWNER/ARCADIS so requests.

2. Payments will be made in accordance with the GENERAL CONDITIONS. Submission for payment shall be made to the ENGINEER. However, all payment requests will be made on the basis of the approved breakdown and accompanied by all supporting documentation required herein.

   a. The CONTRACTOR may request payment for specified Items of material and equipment which have been purchased for incorporation into the Project provided these Items have been previously approved for use in accordance with the Contract Documents and provided the ENGINEER agrees to the request of the CONTRACTOR.

   b. Payment requests for materials or equipment purchased may be honored for materials or equipment which are not on site but stored in a manner satisfactory to the ENGINEER. Payments will be made for specific Items of material and equipment provided an invoice and delivery ticket are submitted with the payment request which indicates clearly the materials and equipment to be used for the Project. The following periodic payment request must include a receipted invoice certified by the vendor as to payment received for the specified Item which had been previously paid for. Unless the required certified invoice is received with the following request for periodic payment, money previously paid will be deducted from any money due the CONTRACTOR without any penalty of any kind to the OWNER.

3. No payment shall be made for miscellaneous materials or equipment that are provided in a routine manner as Work progresses. Such Items include, and are not limited to, fuel, tools, dust preventive materials, personal protective equipment and supplies; protective devices such as tarps, etc., CONTRACTOR's equipment rental, operating or repair costs, lumber, stone, gravel, sand, or any material that is consumed as Work progresses.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Materials, equipment, workmanship, design, and arrangement of all Work performed under this Contract shall be subject to the review of OWNER and/or ARCADIS.

B. Work Included:

1. Procedures for submittal to OWNER and ARCADIS of List of Submittals, certificates and affidavits, samples for testing, material test results, Shop Drawings, operation and maintenance literature, and other miscellaneous data for review.

2. Procedures for turnover of CONTRACTOR prepared “As-built” Drawings.

PART 2 - PRODUCTS

2.01 LIST OF SUBMITTALS

A. Within 4 days after the Contract is executed, CONTRACTOR shall furnish OWNER and ARCADIS with a List of Submittals.

B. The List of Submittals shall indicate all products which CONTRACTOR believes will be incorporated in the Work. Omission from this list of any equipment, material, or product required by the Specifications shall not relieve CONTRACTOR of the Contract requirements for providing the equipment, materials, or products and completing the associated Work as specified.

C. For each entry of the List of Submittals, reference to the Specifications shall be made, along with an indication of the type of submittal(s) which CONTRACTOR plans to make to OWNER and ARCADIS. More than one type of submittal may be required. OWNER and/or ARCADIS will review the types of submissions offered, or request additional or alternative submissions. Types of submissions include but are not limited to the types listed below:

1. Certificate(s) and Accompanying Affidavit (discussed below).

2. Shop Drawings (discussed below).

3. As-Built Drawings (discussed below)

4. Progress Reports (Section 01014)

4. Survey Results (Section 01050)

5. Contractor Work Plan (detailed execution plan)

6. Health and Safety

7. Odor Mitigation Plan

8. Final Design Plans (Sheet Pile, Temporary Structures). Note that draft design shall be submitted with the CONTRACTORS bid.

9. Material and Load Documentation (manifest, profiles, weight tickets, materials tracking form etc.)

10. Testing Data (sludge, soil borrow, top soil, solidification agent etc.), (Section 01410)

D. For each item on the List of Submittals, CONTRACTOR shall indicate the proposed source of supply or manufacturer for that entry.

E. OWNER and/or ARCADIS will review CONTRACTOR's proposed source of supply or manufacturer for each entry. OWNER and/or ARCADIS will return the List of Submittals with any objections to CONTRACTOR within seven calendar days after OWNER's/ARCADIS's receipt thereof.

F. The following conditions apply concerning approvals:

1. Approval of a particular source of supply or manufacturer does not relieve CONTRACTOR of CONTRACTOR's obligation to fulfill all requirements of the Specifications.

2. Approval of a particular manufacturer shall in no way be construed by CONTRACTOR as obligating OWNER and/or ARCADIS to approve a Shop Drawing for a product from that manufacturer.

3. Subsequent to disapproval of a particular source of supply or manufacturer, CONTRACTOR shall submit to OWNER and ARCADIS for approval within 7 days after notification of such disapproval a different source of supply or manufacturer for that product. The entire List of Submittals need not be resubmitted.

4. As an alternative to disapproving a particular source of supply for equipment, materials, or products, OWNER reserves the option to alter the type of submittal required for that product.

2.02 SAMPLES

A. If OWNER so requires, either prior to or after commencement of the Work, CONTRACTOR shall submit samples of materials for such special tests, or for file purposes, as OWNER and/or ARCADIS deems necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, taken, stored, packed and shipped by CONTRACTOR as designated.

B. All samples shall be packed so as to reach their destination in good condition, and shall be labeled to indicate the material represented, the name of the Work and location for which the material is intended, and the name of firm submitting the sample. To ensure consideration of samples, CONTRACTOR shall notify OWNER by letter that the samples have been shipped and shall properly describe the same in the letter. The Letter of Notification shall be enclosed with the samples.

C. CONTRACTOR shall submit data and samples, or place its orders sufficiently early to permit consideration, inspection, testing, and review before the materials and equipment are needed for incorporation into the Work.

D. When required, CONTRACTOR shall furnish to OWNER and ARCADIS one certified copy of manufacturer's shop or reports from independent testing laboratories relative to the materials, equipment performance ratings, and data.

E. The cost of samples, sample testing, and analysis associated with the review of proposed materials and/or methods shall be borne in their entirety by CONTRACTOR.

2.03 CERTIFICATES AND AFFIDAVITS

A. Where specified in the Specifications that a certificate or affidavit be submitted to OWNER and ARCADIS for a particular material, product or product component, such submittals shall be made in accordance with the following:

Equipment, Materials, and Products: A Certificate of Compliance shall indicate that the equipment, material, product, or product component complies with the requirements of the Specifications, and it shall be accompanied by test results and/or other technical data substantiating such compliance. The certificate shall be supplied by the material supplier or product component manufacturer.

B. Each certificate shall include a signed sworn statement by an official of the manufacturer, supplier, etc., originating the certificate attesting to the truth and accuracy of all information contained in the certificate. If such attestation of truth and accuracy cannot be included in the certificate itself, it must be provided as an affidavit accompanying the certificate.

2.04 SHOP DRAWINGS

A. One copy of each Shop Drawing certified correct for construction shall be submitted for the review by OWNER and/or ARCADIS as soon as possible after approval of the List of Submittals and with due regard to the sequence in which such information will be required. This includes, but is not limited to, dewatering equipment, erosion control materials, offsite backfill material, odor mitigation and monitoring equipment, pumps and other mechanical equipment, details of any deviation which CONTRACTOR proposes from the Contract Documents, and any details not specifically indicated on the Drawings. It is CONTRACTOR's responsibility to provide finished Shop Drawings for review, based on field measurements of actual conditions, indicating how CONTRACTOR proposes to install the Work and the equipment, materials, and products being furnished under the Contract. Copies of Drawings will not be accepted for submission as Shop Drawings.

B. A copy of all Shop Drawing shall be submitted to ARCADIS.

C. Shop Drawings shall be submitted in proper sequence with due regard to the time required for the reviewing and transmittal.

D. CONTRACTOR may submit manufacturer's literature as a substitute for, or supplement to, the Shop Drawings, provided the literature is explicit with regard to details of the items to be furnished. Samples and/or visual representation of the material shall accompany product data whenever available. Drawings, specifications and manufacturers' literature shall bear the name and address of the manufacturer or fabricator, and be clear, detailed, and complete. Catalog numbers of materials or equipment will not suffice.

E. Shop Drawing submissions shall be made to OWNER and ARCADIS by CONTRACTOR only. Any data prepared by CONTRACTOR's subcontractors and suppliers shall be submitted through CONTRACTOR upon review by CONTRACTOR.

F. All Shop Drawings covering related items of equipment, material, and products or integrated systems of equipment, material, and products shall be submitted at the same time so that their complete installation can be adequately reviewed. No partial submissions will be considered. When it is necessary to meet the material delivery times required by the Contract, OWNER and/or ARCADIS will review partial submissions when accompanied by sufficient data to allow OWNER and/or ARCADIS to determine the effect on the final design of other facilities being furnished under this Contract.

G. Shop Drawings shall be submitted to OWNER and ARCADIS which have been checked and stamped with the approval of CONTRACTOR. CONTRACTOR's stamp shall include, but not be limited to, the submittal date, contract number, project name, submittal number, corresponding specification and paragraph number, and CONTRACTOR's name, signature and a notation that the Shop Drawing had been reviewed by CONTRACTOR and is in conformance with the referenced specification section. One copy of the Shop Drawings and data submitted by CONTRACTOR for review may be returned by OWNER to CONTRACTOR with comments such as, "Exceptions Noted", or "Returned for Resubmission". CONTRACTOR shall correct the original Drawings and data, if required, and resubmit one copy of the revised Shop Drawings and data. One copy of such revisions, reviewed by OWNER and/or ARCADIS, will be returned to CONTRACTOR.

1. Shop Drawings shall be numbered in chronological order utilizing 001, 002, etc., as the format.

2. All Shop Drawings, when practical, shall be limited in size to 24 inch x 36 inch, and have borderlines set back 1/2 inch on top, bottom, and right-hand side of the sheet. When the scale to which the Drawings must be made for clarity, and the size of the equipment assembly or arrangement make it impractical to prepare the Drawings in 22-inch x 34-inch format, larger sheet sizes may be used.

3. CONTRACTOR shall revise the original Shop Drawings to reflect any and all changes made to the equipment, materials, or products in the field during construction. When the equipment, materials or products have been finally accepted, CONTRACTOR shall submit two copies of any Shop Drawing or data which have been so corrected. These copies will be added by OWNER and/or ARCADIS to the bound sets or data submitted as specified below.

F. At the time of each submission, CONTRACTOR shall, in writing, notify OWNER and ARCADIS of any deviation that the Shop Drawings have from the requirements of the Specifications. Failure to note deviations shall not excuse CONTRACTOR from complying with the requirements of the Specifications.

G. No equipment, materials, or products for which Shop Drawings have been submitted for review shall be delivered to the job site or incorporated into the Work until CONTRACTOR has received copies of such reviewed Drawings or until OWNER has authorized CONTRACTOR in writing to do so.

H. OWNER's and/or ARCADIS's review of CONTRACTOR's submitted data is for general conformance only. Although OWNER may review submitted data in detail, such reviewing is an effort to discover errors and omissions in CONTRACTOR's submissions and to assist CONTRACTOR in coordinating and expediting the Work. It shall in no way relieve CONTRACTOR of its obligation and responsibility to coordinate the Work or to relieve CONTRACTOR of its responsibility in fulfilling the purpose and intent of the Contract.

2.05 CONSTRUCTION "AS-BUILT" DRAWINGS

A. CONTRACTOR shall maintain at the Work site a complete set of Drawings as issued with the Contract Documents. Drawings shall be marked by CONTRACTOR to show any and all deviations made by him during construction. These Drawings shall be labeled "RECORD" with 1/2-inch high block letters and submitted to OWNER and ARCADIS at the completion of the project. All such revisions shall be marked every week to keep the Drawing set current during the construction process and prior to any item becoming inaccessible for an "As-built" Drawing to be performed. An electronic ACAD version of the drawing shall also be provided to ARCADIS and OWNER.

B. CONTRACTOR's set of Drawings showing changes made during construction shall be available to OWNER throughout the construction period and shall be delivered to OWNER and ARCADIS according to the requirements of paragraph 2.05.A, above.

2.06 MISCELLANEOUS DATA

A. Any other submittal required by these Specifications but not directly addressed under this Section shall be submitted in accordance with the requirements for Shop Drawings.

PART 3 - EXECUTION

3.01 GENERAL

A. During the Pre-Construction Conference procedures for handling Shop Drawings and other submissions will be established.

3.02 ALTERNATIVES TO SPECIFIED PRODUCTS

A. The Specifications may indicate the name of a manufacturer, a trade name, or a material to be used in the Contract. Reference made to a particular product of the manufacturer is made to identify a particular design, quality, construction arrangement, or style.

B. Where CONTRACTOR proposes to use a substitute product for that specified, CONTRACTOR shall submit to OWNER and ARCADIS, for review, complete information on such substitute product including all necessary redesign of the structure, equipment, or any other part of the Specification requiring modification as a result of the use of the requested substitute. All such redesign and all new Drawings and detailing required as a result thereof shall be prepared by CONTRACTOR at CONTRACTOR's expense, including regulatory permit acquisition for the modifications. Requests for additional money for such substitution will not be considered.

C. If CONTRACTOR proposes to provide products as "equals" to those specified, it shall be his responsibility to furnish complete, specific, detailed information to OWNER and ARCADIS for review from the manufacturer or supplier of the product he proposes to provide in which the requirements of the Specifications are shown to be met. This shall consist of a point-by-point comparison of the Specification requirements which the product proposed to be provided. In the event the Specifications mention a manufacturer, a point-by-point comparison of the product specified and that proposed to be provided shall be furnished by CONTRACTOR. If incomplete or irrelevant data are submitted as evidence of compliance with this subparagraph, the request for approval to provide this specific substitute will not be considered.

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included

1. Where applicable in the Contract Documents, the minimum acceptable quality of equipment, materials, and Workmanship has been defined either by a manufacturer's name and product identification, or by reference to recognized industry standards.

2. If CONTRACTOR proposes to provide products as "equals" to those specified in the referencing Section on which the design is based, CONTRACTOR shall furnish complete, specific, detailed information to OWNER and ARCADIS for review, in which the requirements of the Contract Documents are shown to be met.

   a. These data shall be prepared or approved by the manufacturer of the proposed product, and shall include a point-by-point comparison between the features of the proposed product and the corresponding features of the product specified in the Contract Documents as the one on which the design is based. The features of the product specified shall be those of the manufacturer's model specified (including all standard catalog features and any specified options).

   b. If applicable, CONTRACTOR shall also furnish a description of the changes in structures and other equipment which will have to be made because of the proposed substitution.

   c. CONTRACTOR shall furnish these data.

   d. A request to furnish the substitute product will not be considered if incomplete or irrelevant data are submitted as evidence of compliance with the requirements.

1.02 QUALITY CONTROL

A. Qualification of Manufacturer

1. The manufacturer shall be regularly engaged in the business of manufacturing material and/or equipment of the type required by the referencing Section.

2. The manufacturer shall be one of those specified by name in the referencing Section, or must be specifically approved by OWNER and/or ARCADIS.

a.. OWNER and/or ARCADIS will notify CONTRACTOR, in writing, that OWNER has no objection to the manufacturer selected by CONTRACTOR; or will request further data to justify the selection. Upon notification, CONTRACTOR shall update the Materials List and submit this to OWNER and ARCADIS.

b. If acceptable evidence of satisfactory experience with the proposed material and/or equipment cannot be furnished, CONTRACTOR will not be allowed to install it.

i. The original material and/or equipment which has been replaced will become the property of CONTRACTOR, who shall promptly remove it from the site.

ii. CONTRACTOR will be given reasonable opportunity to modify the equipment furnished, if necessary, so that it will be acceptable to OWNER. Continuous operation in accordance with time for such modifications shall be maintained.

iii. The decision of OWNER and/or ARCADIS with respect to replacing unsatisfactory equipment shall be final.

c. Neither approval by OWNER/ARCAIS of CONTRACTOR's selection of a particular manufacturer or system supplier, nor accepting CONTRACTOR's selection together with the posting of a bond or deposit in lieu of satisfactory evidence of experience, shall obligate OWNER or ARCADIS to approve details on the Shop Drawing submissions from that manufacturer which are not in conformance with the requirements of the Contract Documents.

d. Neither approval by OWNER/ARCADIS of CONTRACTOR's selection of a particular manufacturer or equipment supplier, nor accepting CONTRACTOR's selection together with the posting of a bond or depositing lieu of satisfactory evidence of experience, shall relieve CONTRACTOR of CONTRACTOR's obligations to fulfill all requirements of the Contract Documents.

3. When so specified in the referencing Section, the manufacturer of the equipment or supplier of the system shall furnish, as requested by OWNER and/or ARCADIS and at no additional cost to OWNER, the services of a qualified Technical Representative, to advise OWNER/ARCADIS and CONTRACTOR in the installation and operation of the equipment or system; and to certify to OWNER/ARCADIS, in writing, that the equipment or system is properly installed and ready to be operated.

B. Qualifications of Installers

1. CONTRACTOR shall provide at least one person who shall be present at all times during the operation of the items of equipment furnished under the referencing Section, who is thoroughly familiar with the type of equipment and materials being

operated and with the manufacturer's recommended methods of operation; and who shall direct all the Work performed on the equipment item being operated at no additional cost to OWNER.

2. The Certificate of Compliance required by Section 01300 must be issued by the manufacturer of the equipment or supplier of the system.

C. Codes and Standards

1. Equipment and operation shall comply with all applicable local, state, and federal codes and regulations.

2. Materials, equipment, and installation shall comply with:

    a. The applicable standards of the governmental agency or industry standardizing organization publishing standards applicable to such Work.

    b. The requirements of specific standards listed in the referencing Section.

    c. Where the standards of several organizations (including the manufacturer's own published standards) are applicable to the same Work, the Work may be done in accordance with any such other standards that require an equal or higher quality construction for the specified service than those listed in the referencing Section. The selection of such an alternate standard to the one specified shall be subject to the review by the OWNER and/or ARCADIS.

3. Where any provisions of pertinent codes or standards are in conflict with the requirements of the Contract Documents, the provisions requiring greater safety or operability, or higher quality construction for the specified service, shall govern; unless specific exemptions to such provisions are made in the referencing Section. The final determination shall be made by OWNER and/or ARCADIS.

4. The codes and standards applicable to this Contract shall be, but not limited to, the codes in accordance with Section 01070.

PART 2 - PRODUCTS

2.01 DESIGN

A. The design of certain items in the facility, as shown in the Contract Documents, is based on the performance and dimensions of specific equipment items as furnished by particular manufacturers.

1. When the performance or dimensions of such items are proprietary, and furnished only by one particular manufacturer, the referencing Section will state the design is based on a particular model of that manufacturer.

a. CONTRACTOR may furnish and install/operate corresponding products produced by an alternate manufacturer; either one named as an alternate in the referencing Section, or any other one selected by CONTRACTOR and approved or accepted by OWNER on the basis of the information supplied as requested in Part 1 of this Section.

b. CONTRACTOR shall furnish OWNER and ARCADIS with those data on the particular model of the alternate manufacturer which are required to demonstrate that the proposed equipment or system is at least equivalent in performance in the specified service to the equipment or system on which the design is based. If CONTRACTOR proposes a modification to the Contract Price due to the substitute equipment, this will also be evaluated by OWNER and/or ARCADIS.

c. Approval by OWNER of the proposed substitution will not be unreasonably withheld.

d. The design of the facilities associated with the equipment or system for which a substitution is proposed, may be affected by such substitution. The size of the building or supporting structure, the size, and arrangement of piping and wiring, the specification for associated equipment, the necessary controls, and the service requirements will have to be reconsidered by CONTRACTOR. CONTRACTOR shall be completely responsible for the necessary redesign of all facilities affected by the substitution, and shall prepare the revisions to the Project Drawings required by such substitution. These revisions shall be submitted to OWNER and ARCADIS for review, in accordance with the provisions in Section 01300, including the specific notice as to the details in which the substitute design differs from the requirements of the Contract Documents. All such redesign and all new Drawings and detailing required as a result thereof shall be prepared by CONTRACTOR at no additional cost to OWNER. Requests for additional payment for such substitution will not be considered unless made a part of the final request for approval of the substitution itself.

2.02 MATERIALS

A. All materials, including those not specifically described or specified, but required for a complete and proper installation of the Work shall be new, first quality of their respective kinds, and subject to the review of OWNER and/or ARCADIS.

B. All materials shall be in accordance with details and samples as specified in the referencing Section; and submitted and reviewed in accordance with Section 01300 - SUBMITTALS.

2.03 INTERCHANGEABILITY

A. All products of the same size and type and performing the same function shall be, insofar as practical, the products of one manufacturer.

1. Details in the Shop Drawing submissions of the several equipment manufacturers shall be coordinated so that items such as lubricating fittings, for example, are identical on all equipment items requiring the same grade of lubricant.

PART 3 - EXECUTION

3.01 CONSTRUCTION CONDITIONS

A. Inspection

1. Prior to start of the Work, CONTRACTOR shall carefully inspect the existing and previously installed Work, and verify that all Work is in such a condition that the installation/operation of new Work may properly commence and be carried out to a proper and timely completion.

2. CONTRACTOR shall verify that each item of Work shall be installed/operated in accordance with all pertinent codes and regulations, the design, the work plan, and the referenced standards.

B. Discrepancies

1. In the event of discrepancies, CONTRACTOR shall immediately notify OWNER and ARCADIS, in writing, of such conditions.

2. CONTRACTOR shall not proceed with installation/operation in areas of discrepancy until such discrepancies have been corrected in a manner acceptable to OWNER and/or ARCADIS.

3.02 INSTALLATION

A. CONTRACTOR shall install and operate each equipment item in strict accordance with the manufacturer’s instructions, unless specifically designated in writing otherwise by OWNER/ARCADIS. CONTRACTOR shall not void the manufacturer’s guarantee.

B. In the event of discrepancies between the Contract Documents and the equipment manufacturer’s formal installation/operation instructions, as submitted for the actual units supplied; CONTRACTOR shall notify OWNER and ARCADIS, in writing, of such discrepancies. CONTRACTOR shall obtain the equipment manufacturer’s approval in writing, of any changes required to suit the job conditions, and so advise OWNER/ARCADIS.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Selection and Payment.

B. Quality Assurance.

C. Laboratory Responsibilities.

D. Laboratory Reports.

E. Limits on Testing Laboratory Authority.

F. CONTRACTOR Responsibilities.

G. Schedule of Inspections and Tests.

1.02 RELATED SECTIONS

A. 01300 – Submittals.

B. 02211 – Rough Grading.

C. 02222 – Excavating.

D. 02223 – Backfilling.

E. 02240 – Solidification.

1.03 REFERENCES

A. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. Tests shall be conducted in accordance with the methods specified in Table 1410-A, Schedule of Testing unless otherwise stated.

1.04 SELECTION AND PAYMENT

A. CONTRACTOR will subcontract and pay for services of an independent testing laboratory to perform specified inspection and testing.

1.05 QUALITY ASSURANCE

A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.

B. Laboratory: Analytical and/or geotechnical laboratory authorized to operate in State of Mississippi and/or approved by OWNER.

C. Laboratory Staff: Maintain a full time specialist on staff to review services.

D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

1.06 LABORATORY RESPONSIBILITIES

A. Test samples submitted by CONTRACTOR.

B. Provide qualified personnel at site.

C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify OWNER/ARCADIS and CONTRACTOR of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by OWNER/ARCADIS.

G. Attend pre-construction conferences and progress meetings.

1.07 LABORATORY REPORTS

A. After each inspection and test, promptly submit one copy of laboratory report to OWNER, ARCADIS and to CONTRACTOR.

B. The reports shall include the following information:

1. Date issued;
2. Project title and number;
3. Name of inspector;
4. Date and time of sampling or inspection;
5. Identification of product and specifications section;
6. Location in the project;
7. Type of inspection or test;
8. Date of test;
9. Results of test;
10. Conformance with Contract Documents; and
11. Test reports signed and sealed.

C. When requested by OWNER or ARCADIS, provide interpretation of test results.

1.08 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or expand on requirements of the Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

1.09 CONTRACTOR RESPONSIBILITIES

A. Collect and deliver, to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.

B. Cooperate with laboratory personnel, and provide access to the Work.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of Products to be tested, to facilitate tests and inspections, storage, and curing of test samples.

D. Notify OWNER and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

E. Arrange with laboratory and pay for additional samples and tests required by CONTRACTOR beyond specified requirements.

F. In addition to the testing required herein, CONTRACTOR shall sample and have analyzed sludge for any additional analysis required by the landfills in order to have the waste profiled.

Table 01410-A

Schedule of Testing
OWNER: HERCULES INCORPORATED
IMPOUNDMENT BASIN AND TANK DECOMMISSIONING

	Test Method	
Location	USEPA 9095A Solid Waste Paint Filter Method	Physical/Chemical Properties (See Tables 1410-B & 1410-C)
1. Solidified Soil and Sludge Material	1 per load of solidified material sent to landfill	1 per day of solidified material sent to landfill (D2216 only)
2. Solidification Agent(s)	N/A	Minimum of 1 per source
3. Backfill	N/A	Minimum of 1 per source
4. Topsoil	N/A	Minimum of 1 per source

N/A not applicable

Table 01410-B

Physical Properties for Backfill Materials
OWNER: HERCULES INCORPORATED
IMPOUNDMENT BASIN AND TANK DECOMMISSIONING

Property	ASTM Standard Number	Off-Site Backfill
Laboratory Determination of Water (Moisture) Content of Rock and Soil Aggregate Mixtures	D2216	--
Particle-Size Analysis of Soils	D422	ML/CL
Amount of Material in Soils Finer Than the No. 200 Sieve	D1140	>50%
Liquid Limit	D4318	<50%
Plasticity Index of Soil	D4318	<20%

Table 01410-C

Preconstruction Testing Frequency for Material From Borrow Locations
OWNER: HERCULES INCORPORATED
IMPOUNDMENT BASIN AND TANK DECOMMISSIONING

Material	Test	Frequency of Test
Physical Test		
Backfill	ASTM D1140, D2216, D4318, and D422	1 per material type minimum(1)
Chemical Test(2)		
Backfill/Topsoil (off site)	SW-846 Method 6010 (RCRA 8 list) SW-846 Method 8260B (Appendix IX list) SW-846 Method 8270C (Appendix IX list)	1 per material type minimum
Solidification Agent(s)	TCLP Metals (RCRA 8 list)	1 representative sample per agent

ASTM D1140	Amount of Material in Soils Finer than the No. 200 Sieve.
ASTM D2216	Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil Aggregate Mixtures.
ASTM 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soil.
ASTM D422	Particle size analysis.
Method 6010	Target Analyte List (RCRA metals).
Method 8260B	Target Compound List Volatile Organic Constituents (Appendix IX list)
Method 8270C	Target Compound List Semivolatile Organic Constituents (Appendix IX list).

Notes:

(1) Change in material type (i.e., physical characteristics) will require additional testing.

(2) Samples obtained for chemical tests will be analyzed in accordance with Test Methods For Evaluating Solid and Hazardous Waste (SW-846).

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Clean-Up

1. Upon completion of the Work and before a Certificate of Substantial Completion is issued by OWNER or ARCADIS to CONTRACTOR, the Work site and other areas occupied by CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by CONTRACTOR shall be removed by CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Base Bid.

B. Warranties and Guarantees

1. Upon completion of the Work and before a Certificate of Substantial Completion is issued by OWNER or ARCADIS to CONTRACTOR, all Warranties shall be submitted to OWNER.

2. CONTRACTOR shall warranty the work for a period of 1 year including:

   - Any potential settling of the backfilled impoundment basin to the extent that significant ponding or infiltration occurs.

   - Growth of successful vegetation planted per Section 2936 to the extent that erosion controls are no longer necessary per applicable rules and regulations.

C. “As-built” Drawings

1. Upon Completion of the Work and before a Certificate of Substantial Completion is issued by OWNER or ARCADIS to CONTRACTOR, all “As-built” Drawings shall be complete and submitted to OWNER and ARCADIS.

D. Retainage

1. Upon Hercules completion of all site activities the contractor is to remove all materials, equipment, and trash, and photo document the site. The contractor shall supply all project documentation including “As-built” drawings and photo documentation of final conditions. The contractor shall also provide documentation of release of subcontractors. A retainage of 2.5% of the Contract value will be withheld until the work is accepted by OWNER and the required documents are submitted to the satisfaction of Hercules.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 02066
BELOWGRADE PIPE DECOMMISSIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Belowgrade Pipe Scheduled for Decommissioning by CONTRACTOR.

B. Belowgrade Pipe Scheduled for Decommissioning by CONTRACTOR with Assistance from OPERATOR.

C. Belowgrade Pipe Scheduled for Decommissioning by OPERATOR.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 02073 - Decontamination

C. Section 02074 - Material Management

D. Section 02088 - Materials Transportation

E. Exhibit "A" - Facility Drawings

1.03 SUBMITTALS

A. Submit under the provisions of Section 01300.

B. Submit proposed methods for removing belowgrade pipe.

1.04 REGULATORY REQUIREMENTS

A. Conform to all federal and state occupational safety and health regulations.

B. Conform to requirements of all federal, state, and local regulatory agencies.

1.05 JOB CONDITIONS

A. Data: Relevant maps and facility drawings specific to this Section are provided for use with this Section. These items are provided in the Contract Documents for information only and the OWNER and ARCADIS assume no responsibility for any conclusions the CONTRACTOR may draw from such information. The CONTRACTOR shall investigate and determine existing building and site conditions under which the CONTRACTOR shall operate in performing the WORK. The CONTRACTOR shall be responsible for ALL items where specified.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01300.

B. Accurately record, label, and mark all quantities of materials to be disposed by OWNER and CONTRACTOR.

PART 2 - PRODUCTS

2.01 The CONTRACTOR shall provide all equipment and materials (caps, blinds, gaskets, cement, grout, etc.) necessary to effect belowgrade pipe disconnections specified in Part 3 of this Section. The CONTRACTOR shall provide materials to match the existing materials at the points of disconnection and in accordance with all applicable building codes and regulations.

2.02 The CONTRACTOR shall provide all equipment and materials necessary to permanently label each decommissioned belowgrade pipe as specified in Part 3 of this Section. The CONTRACTOR shall provide labels constructed of weatherproof materials (e.g., plastic or metal) and engraved with the following information:

Pipe Name or Designation “Flushed – Out of Service” Date Decommissioned	or	Pipe Name or Designation “Not Flushed – Out of Service” Date Decommissioned

2.03 ARCADIS and the OWNER shall review all belowgrade pipe capping and labeling materials.

PART 3 - EXECUTION

3.01 BELOWGRADE PIPE SCHEDULED FOR DECOMMISSIONING BY CONTRACTOR

A. General

1. The belowgrade pipe scheduled for decommissioning (flush, plug, and abandon in place) by the CONTRACTOR shall include all belowgrade pipe identified on the drawings in Exhibit A.

2. ARCADIS will determine when decontamination (flushing) activities are completed for the belowgrade pipe scheduled for decommissioning by the CONTRACTOR

3. If soil is excavated to decommission the pipes, the soil shall be placed in a container for proper characterization, profiling, and disposal by the CONTRACTOR.

3. CONTRACTOR shall decontaminate any pipe or other structures removed sufficient enough for proper disposal by the CONTRACTOR.

B. Belowgrade Pipe Decommissioning

1. The CONTRACTOR shall conduct all work in accordance with these Specifications and the Site Health and Safety Plan.

2. The CONTRACTOR shall disconnect all belowgrade pipes before initiating equipment decommissioning, if applicable.

3. The CONTRACTOR shall confirm that all utility shut-offs have been effected for any equipment connected to the below grade pipe scheduled for decommissioning. The CONTRACTOR shall notify OWNER/ARCADIS of all active utility lines. The CONTRACTOR shall not disconnect any active utility before the OWNER notifies the CONTRACTOR that coordination with the OPERATOR has been completed.

4. The CONTRACTOR shall not damage any belowgrade pipe subject to reuse or abandonment in-place. The items below will be conducted as directed by OWNER and ARCADIS.

    a. Before disconnection, the CONTRACTOR shall identify in the field all ends of each pipe. The CONTRACTOR shall select which end(s) of the pipe will be used for water injection and which end(s) of the pipe will be used for wastewater and washwater recovery.

    b. If the pipe end opposite of the IB can’t be located following collaboration with OWNER and ARCADIS, water injection shall be completed up into the pipe from the IB to wash out the end of the pipe entering the IB.

    c. The CONTRACTOR shall estimate the volume of the pipe based on available maps, construction drawings, and field inspection and shall ensure that adequate container volume is available to contain a minimum of one pipe volume of wastewater and one pipe volume of washwater.

    d. The CONTRACTOR shall flush each pipe with potable water or other water source approved by the OWNER. The CONTRACTOR shall employ methods in keeping with standard industry practices to control water pressure and flow rate and to prevent backflow. These methods may include, but are not limited to, the use of pressure gauges, pressure relief valves, control valves, and backflow preventers.

    e. The CONTRACTOR shall submit proposed methods for the control of water pressure, flow rate, and backflow.

    f. The CONTRACTOR shall flush each pipe with a sufficient volume of water to displace any wastewater remaining in the pipe. The CONTRACTOR shall continue flushing each pipe until water flow is observed from the downgradient end of the pipe.

g. The CONTRACTOR shall collect all wastewater removed from pipes and manage as specified in Section 02074. The CONTRACTOR shall not commingle petroleum products.

h. The CONTRACTOR shall collect all washwater from cleaning and transport the washwater to the washwater treatment system or other approved location as specified in Section 02074.

i. The CONTRACTOR shall exercise due care in keeping with standard industry practices to contain liquids and washwaters generated during decommissioning of belowgrade pipe.

5. The CONTRACTOR shall permanently cap each pipe using materials as specified in Paragraph 2.01 of this Section.

6. The CONTRACTOR shall permanently affix a label as specified in Paragraph 2.02 of this Section to each end of each decommissioned belowgrade pipe.

END OF SECTION

SECTION 02073
DECONTAMINATION & TANK/SUMP CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Decontamination and Tank Cleaning Methods

1.02 RELATED SECTIONS

A. Section 01014 - Work Sequence

B. Section 01300 - Submittals

C. Section 02074 - Material Management

D. Section 02088 - Materials Transportation

1.03 SUBMITTALS

A. Submit proposed decontamination and tank/sump cleaning procedures to be utilized.

PART 2 - PRODUCTS

2.01 DECONTAMINATION MATERIALS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:

A. Appropriate non-foaming detergents (e.g., Alconox^{TM}, Simple Green^{TM}, or similar) as approved by the ENGINEER and OWNER; and

B. Spill containment and control products including, but not limited to, plastic sheeting and absorbent materials.

PART 3 - EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall decontaminate each truck (i.e., the wheels, axles, and top rails) that is used to transport waste material to an off-site landfill. As needed, trucks shall be inspected by CONTRACTOR prior to exiting the facility. The CONTRACTOR shall make all reasonable efforts to eliminate waste material from any project and/or public road. CONTRACTOR will be responsible for the removal of waste material on any project and/or public road. Use of a temporary speed bump shall be considered to remove bulk material that may have accumulated on the vehicles before decontaminating. The CONTRACTOR is required to collect and properly dispose any material removed from the vehicles.

B. Following the removal of the free liquids and sludge, the CONTRACTOR shall clean tanks ET-10, ET-18, ET-19, K-210, K-268, K-269 and the secondary sump (i.e., inside walls and bottom). Tanks shall be cleaned using the wet cleaning methods described below or approved equivalent procedure. The intent of the cleaning is to remove gross solids to the extent that the entire bottom and sidewalls of the tanks can be photographed and inspected for integrity purposes. Collection of electronic photos to document acceptable cleaning shall be included in this item.

C. The CONTRACTOR shall make all reasonable efforts to minimize the volume of washwater generated during decontamination activities. Where decontamination criteria can be attained using more than one decontamination method, the CONTRACTOR shall select the method that will generate the least amount of washwater.

D. The CONTRACTOR shall manage all materials generated from decontamination activities in accordance with Section 02074.

E. The CONTRACTOR shall containerize washwater and notify OWNER/ARCADIS when such container is full. ARCADIS will sample and analyze the water for compliance with the existing facility's industrial sewer (MDEQ Water Pollution Control Permit No. MSP092186), as specified in Section 02074. With the approval of OWNER/ARCADIS, CONTRACTOR shall discharge the washwater to the permitted outfall at the rate provided by ARCADIS and CONTRACTOR shall have a means of determining compliance with this flow rate. The CONTRACTOR shall control the volume of washwater generated in each area in such a manner as to not exceed the available storage capacity.

F. The CONTRACTOR shall exercise due care in keeping with standard industry practices to control all liquids used for cleaning actions and to prevent the transfer of residuals from the surface being cleaned to another surface or material or to the environment. The CONTRACTOR shall be responsible for devising methods for control of the washwater to assure that residuals are not spread or released. To the extent practical, the CONTRACTOR may utilize existing sumps and containment structures for the control of washwater. The CONTRACTOR may also construct a decontamination pad for the containment of washwater at a location(s) approved by the OWNER/ARCADIS.

3.02 WET CLEANING METHODS

A. High Pressure Hot Water Washing

1. High pressure hot water washing shall consist of the high pressure application of a hot water and detergent solution through a nozzle for removing residuals from surfaces.

2. The CONTRACTOR shall use detergent as necessary and specified in Part 2 of this Section for cleaning impacted surfaces.

3. The CONTRACTOR shall clean each surface with high pressure hot water and detergent followed by rinsing each surface with high pressure hot water at a minimum.

4. The CONTRACTOR shall repeat cleaning activities as necessary for each unit until the inspection criteria specified in Paragraph 3.04 of this Section have been attained.

5. The CONTRACTOR shall make all reasonable efforts to minimize the volume of washwater generated.

B. High Pressure Steam Cleaning

1. Steam cleaning shall consist of the use of high pressure steam to physically remove oil, grease, and water soluble residuals from surfaces.

2. The CONTRACTOR shall clean each surface scheduled for steam cleaning as necessary to remove surface residues.

3. For equipment not subject to rinsate verification sampling, the CONTRACTOR shall repeat cleaning activities as necessary for each unit until the inspection criteria specified in Paragraph 3.04 have been attained.

4. The CONTRACTOR shall make all reasonable efforts to minimize the volume of washwater generated.

C. Belowgrade Piping

1. The CONTRACTOR shall clean belowgrade piping as specified in Section 02066 of these Specifications, if directed by ENGINEER.

2. The CONTRACTOR shall not damage belowgrade piping subject to abandonment in-place.

D. Pump Cleaning

1. The CONTRACTOR shall use appropriate tools and equipment in addition to the specified wet cleaning methods to ensure that interior surfaces of pumps subject to decontamination are adequately cleaned.

2. The CONTRACTOR may dismantle or cut pump components subject to disposal or recycling as necessary to facilitate cleaning.

3.03 REMOVAL OF SOLIDS AND DRY RESIDUES

A. Manual Removal of Solids

1. The CONTRACTOR shall use shovels, brushes, brooms, and other appropriate tools or equipment for the removal of solids and dry residues.

2. The CONTRACTOR shall manage all material or debris that is collected as a result of this method as specified in Section 02074.

3. The CONTRACTOR shall make all reasonable efforts to manually remove solids and residues prior to implementing the wet cleaning methods specified in Paragraph 3.02 of this Section.

B. Dry Vacuum Method

1. The CONTRACTOR may use an industrial vacuum cleaner with a High Efficiency Particulate Absorbing (HEPA) Filter to collect loose debris, particulate matter, and accumulated dust from surfaces and equipment subject to decontamination.

2. If accumulated adsorbed dust is not effectively removed by the nozzle velocity, then the CONTRACTOR shall utilize additional physical action such as brushing to remove the dust. The brush may be a nozzle brush or unattached.

3. The CONTRACTOR shall manage all material or debris that is collected as a result of this method as specified in Section 02074.

C. Wet Vacuum Method

1. The CONTRACTOR may use appropriate vacuuming equipment to collect loose debris, particulate matter, and accumulated dust as well as washwater from area surfaces and equipment subject to decontamination.

2. When collecting solids and washwater as specified herein, the CONTRACTOR shall utilize appropriate equipment to separate solids and liquids including, but not limited to, filters, cyclones, and screens.

3. The CONTRACTOR shall containerize washwater and notify OWNER/ARCADIS when such container is full. ARCADIS will sample and analyze the water for compliance with the existing facility’s industrial sewer (MDEQ Water Pollution Control Permit No. MSP092186), as specified in Section 02074. With the approval of OWNER/ARCADIS, CONTRACTOR shall discharge the washwater to the permitted outfall at the rate provided by ARCADIS and CONTRACTOR shall have a means of determining compliance with this flow rate. The CONTRACTOR shall control the volume of washwater generated in each area in such a manner as to not exceed the available storage capacity.

4. The CONTRACTOR shall manage all solid debris as specified in Section 02074.

3.04 INSPECTION OF DECONTAMINATED MATERIALS

A. Inspection Criteria

1. The CONTRACTOR shall remove all solid debris and surface residues to the extent practical from each unit subject to decontamination.

2. All units subject to decontamination shall be inspected by the ARCADIS prior to release for removal, disposal, or abandonment in-place. Each tank shall be inspected including the review of the photographs to confirm completion. The CONTRACTOR shall notify ARCADIS when cleaning activities have been completed for each unit.

END OF SECTION

SECTION 02074
MATERIAL MANAGEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Identification of anticipated materials and disposition

B. Material characterization

C. Instructions for container labeling

D. Instructions for container storage

E. Designation of off-site disposition facilities

F. Material tracking procedures

1.02 RELATED SECTIONS

A. Section 01014 - Work Sequence

B. Section 01300 - Submittals

C. Section 01700 - Contract Closeout

D. Section 02088 - Materials Transportation

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Accurately record on Material Tracking Forms, label, and mark all quantities of Materials to be recycled or disposed by OWNER, ARCADIS, or CONTRACTOR. Submit Material Tracking Forms to ARCADIS as specified in this Section.

C. Submit list of proposed recycling facilities in accordance with Paragraph 3.06 of this Section. Disposal of all other industrial waste shall be at the Pine Belt Regional Landfill, Ovett, Mississippi unless sludge or soil is identified to be hazardous by the OWNER.

1.04 PROJECT RECORD DOCUMENTS

A. Material Tracking Forms

B. CONTRACTOR is responsible for obtaining pre-printed Bills of Lading and/or manifest documentation from Pine Belt Regional Landfill and any other landfill used.

1.05 REGULATORY REQUIREMENTS

A. Mississippi Administrative Code for Solid Waste

B. Mississippi Department of Environmental Quality

C. Mississippi Department of Transportation

1.06 PERMITTING/REGISTRATION

A. USEPA Identification Number to be provided by OWNER.

PART 2 - PRODUCTS

2.01 PACKAGING MATERIALS AND PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING:

A. Bulk containers and containment structures appropriate for overland transport of dewatered and/or solidified sludge material;

B. 55-gallon steel drums, removable head, USDOT-approved (Identification Code 1A2 or similar);

C. 55-gallon polyethylene drums, removable head, USDOT-approved (Identification Code 1H2 or similar); and

D. Spill clean-up and containment materials including, but not limited to, brooms, shovels, plastic sheeting, and absorbent materials.

PART 3 - EXECUTION

3.01 GENERAL

A. The purpose of this Section is to provide for the proper handling and disposition of Material generated during the dewatering activities at the site. The special definitions that are applicable to this Section are found in the regulations that apply to the management of hazardous and nonhazardous wastes (40 CFR Parts 260 through 263 and 268, Mississippi Administrative Code for Solid Waste). Materials that may be generated during site activities include, but are not limited to, the following:

1. Free liquid, groundwater, and surface water from the tanks and/or IB
2. Class 1 Non-hazardous sludge/solids and/or Class 3 hazardous sludge/solids.
3. Class 2 Non-hazardous scrap metal;
4. Liquid effluent generated during dewatering;
5. Spent absorbents;

6. Personal protective equipment;

7. Washwater.

B. The CONTRACTOR shall work under the direction of the ARCADIS and OWNER to aid in the proper characterization and disposition of Material to ensure Material is disposed or recycled in a manner consistent with the applicable regulations.

C. The CONTRACTOR shall not mix or dilute any potentially hazardous waste with any other Material.

D. ARCADIOS and the OWNER shall reserve the right to modify the Material management procedures specified herein as necessary and as dictated by the classification of the Materials generated.

3.02 IDENTIFICATION OF ANTICIPATED WASTE STREAMS AND WASTE DISPOSITION

A. Non-hazardous and/or Hazardous Sludge and Solids

1. Process - related solids and sludge shall include the IB sludge, ET-10 sludge, ET-18 sludge, sludge from tank/sump cleaning operations, wood contained within the IB, approximately 6 inches of native soil below the sludge, material generated during the decommissioned pipes, and material generated during the removal of sludge behind the southeast wall of the IB. The tank sludge, IB sludge/soil (cells 1,3 & 7), IB sludge/soil (cells 2, 4, 5, 6 & 8), wood contained within the IB, and soil generated from outside the IB shall be containerized separately.

2. The CONTRACTOR shall drain and then solidify sludges such that the material passes the paint filter test (SW 846 9095A). The solidified sludge shall be tested by the CONTRACTOR for every material load transported offsite to the landfill as well as at the approved landfill site. Transportation of material from the facility must be in accordance with the Mississippi Department of Transportation rules and regulations.

3. The CONTRACTOR can live load and cover sludge for transport over Mississippi roads and highways to Pine Belt Regional Landfill (if determined non-hazardous) or an OWNER approved hazardous waste facility (i.e. IB Cells 1,3, & 7).

4. Prior to transport, solidified material that passes the paint filter test shall remain segregated from materials that do not pass the paint filter test.

5. The CONTRACTOR shall label each load as specified in Paragraph 3.04 of this Section.

B. Class 2 Nonhazardous Scrap Metal

1. Class 2 nonhazardous scrap metal shall include miscellaneous scrap metal that has not been chemically impacted or that has been cleaned to meet the criteria specified in Paragraph 3.05.A.1 of Section 02073.

2. The CONTRACTOR shall provide a water-tight, 20-yd^3 roll-off container, or other appropriate, USDOT-approved container, for the accumulation of Class 2 nonhazardous scrap metal.

3. The CONTRACTOR shall stage the roll-off container in the staging areas identified during the pre-bid meeting.

4. If the container is staged in an uncovered area, the CONTRACTOR shall provide a water-tight cover for the container. The CONTRACTOR shall maintain the cover on the container at all times except when scrap metal is being placed in the container. The CONTRACTOR shall cover the container immediately in the event of inclement weather.

5. The CONTRACTOR shall complete a Material Tracking Form for each container of Class 2 nonhazardous scrap metal that is generated.

6. The CONTRACTOR shall transport and provide for the recycling of Class 2 nonhazardous scrap metal in accordance with the requirements specified in Section 02088.

8. The CONTRACTOR may load Class 2 nonhazardous scrap metal bulk items directly to an appropriate transport vehicle if the scrap metal bulk items meet the criteria specified in Paragraph 3.05.A of Section 02073, and if the scrap metal bulk items have been released by the ENGINEER.

C. Free Liquids, Groundwater, Surface Water and Dewatering Liquid Effluent

1. The CONTRACTOR shall collect and transfer all liquid effluent generated during dewatering, groundwater and free liquids encountered in the IB, and surface water to on-site tanks (ET-10, ET-18, ET-19, DP-35, PS-45) or frac tanks as directed by ARCADIS. The liquid effluent shall be sampled by the ARCADIS for the analytical parameters contained in the facility's MDEQ Water Pollution Control Permit No. MSP091286.

2. CONTRACTOR shall ensure that the discharge water does not contain excessive solids that could foul the sewer system and therefore shall provide a container sufficiently sized and settling agents (if necessary) to ensure settling of solids prior to discharge. CONTRACTOR may consider filtering of the water prior to discharge as well.

2. The CONTRACTOR shall sequence the WORK as described in Section 01014 to ensure that sufficient capacity is present on-site to containerize the anticipated volume of generated liquid effluent.

3. The CONTRACTOR is responsible for providing storage capacity for generated free liquids, groundwater, surface water, and liquid effluent until ARCADIS directs CONTRACTOR to discharge generated liquid through the existing facility's permitted industrial sewer (MDEQ Permit No. MSP091286). However, it is anticipated that tanks ET-18, ET-19, DP-35, PS-45, K-210, K-269, and K268 will be available for storage provided they are cleaned in accordance with Section 02073 following use.

5. The CONTRACTOR shall discharge of all generated liquids through permitted outfall at a flow rate determined by the ARCADIS. The volume of free liquids and the volume of liquid effluent generated from each source shall be quantified with a flowmeter with an accuracy of +/- 2%.

6. If determined by ARCADIS that the concentrations in the liquids are too excessive for reasonable discharge through the permitted outfall, CONTRACTOR shall mobilize a water treatment system to sufficient remove constituents so that discharge to the permitted outfall can occur at a reasonable rate as determined by ARCADIS.

D. Spent Absorbents

1. Spent absorbents shall include spent spill booms, spill socks, absorbent pads, granular absorbents, and similar Materials.

2. The CONTRACTOR shall not commingle spent absorbents with other wastes or Materials except as directed by OWNER/ARCADIS.

3. The CONTRACTOR shall not commingle spent absorbents impacted by different Materials or Materials from different units or equipment except as directed by the OWNER/ARCADIS.

4. The CONTRACTOR shall transfer all spent absorbents generated during site activities to 55-gallon steel drums, as directed by the OWNER/ARCADIS.

5. The CONTRACTOR shall provide 55-gallon steel drums as specified in Part 2 of this Section for the accumulation of spent absorbents, as necessary.

6. The CONTRACTOR shall label each drum as specified in Paragraph 3.04 of this Section.

7. The CONTRACTOR shall stage containers in the staging areas identified during the pre-bid meeting.

8. The CONTRACTOR shall complete a Material Tracking Form for each drum of spent absorbents generated.

9. The CONTRACTOR shall transport and provide for the disposition of Class 2 spent absorbents in accordance with the requirements specified in Section 02088.

E. Personal Protective Equipment

1. Personal protective equipment (PPE) shall include spent protective clothing (gloves, disposable coveralls, disposable booties, etc.), spent respirator cartridges, and similar Materials.

2. The CONTRACTOR shall not commingle spent PPE with other wastes or Materials except as directed by the OWNER/ARCADIS.

3. The CONTRACTOR shall transfer all spent PPE generated during facility decommissioning activities to 55-gallon steel drums, as directed by the OWNER/ARCADIS.

4. The CONTRACTOR shall provide 55-gallon steel drums as specified in Part 2 of this Section for the accumulation of spent PPE, as necessary.

5. The CONTRACTOR shall label each drum as specified in Paragraph 3.04 of this Section.

6. The CONTRACTOR shall stage containers in a location designated by the ENGINEER as specified in Paragraph 3.05 of this Section.

7. The CONTRACTOR shall complete a Material Tracking Form for each drum of spent PPE generated.

8. The CONTRACTOR shall transport and provide for the disposition of Class 2 spent PPE in accordance with the requirements specified in Section 02088.

9. At the direction of the OWNER/ARCADIS, the CONTRACTOR shall manage Class 2 spent PPE as Class 2 nonhazardous waste solids.

F. Washwater

1. The CONTRACTOR shall collect and transfer all decontamination or washwater generated to on-site tanks (ET-10, ET-18, ET-19, DP-35, PS-45) or frac tanks as directed by ARCADIS. The liquid effluent shall be sampled by the ARCADIS for the analytical parameters contained in the facility's MDEQ Water Pollution Control Permit No. MSP091286.

2. CONTRACTOR shall ensure that the discharge water does not contain excessive solids that could foul the sewer system and therefore shall provide a container sufficiently sized and settling agents (if necessary) to ensure settling of solids prior to discharge. CONTRACTOR may consider filtering of the water prior to discharge as well.

3. The CONTRACTOR is responsible for providing storage capacity for generated washwater until ARCADIS directs CONTRACTOR to discharge generated liquid through the existing facility's permitted industrial sewer (MDEQ Permit No. MSP091286). However, it is anticipated that tanks ET-18, ET-19, DP-35, PS-45,

K-210, K-269, and K268 will be available for storage provided they are cleaned in accordance with Section 02073 following use.

4. The CONTRACTOR shall discharge of all generated liquids through permitted outfall at a flow rate determined by the ARCADIS. The volume of free liquids and the volume of liquid effluent generated from each source shall be quantified in some manner to confirm compliance with the specified flow rate.

3.03 MATERIAL CHARACTERIZATION AND LANDFILL APPROVAL

A. The CONTRACTOR shall provide characterization of any material suspected to contain hazardous or asbestos containing material, if encountered.

B. The CONTRACTOR shall make every attempt to complete and get approval of profiles for the sludge and soil to be solidified as a hazardous and as non-hazardous material at the specified landfills prior to solidification activities. The CONTRACTOR may utilized the pre-solidification sludge data provided in this RFP, however, any additional testing required by the landfills shall be obtain by the CONTRACTOR. In the event that the landfill will not approve the profile prior to the solidification activities, the contractor shall expedite approval based on the initial containers containing solidified sludge to avoid delays and excessive container demurrage.

C. If the selected landfill is different from the landfill's specified in Section 3.06, the proposed landfill location shall be reviewed and approved by OWNER for approval. CONTRACTOR shall provide all the requested information on the landfill to support this approval process. A list of hazardous waste vendors historically used by Hercules Incorporated and/or its parent company, Ashland Inc. is included in this RFP.

3.04 CONTAINER LABELING (DRUMS, BAGS, AND BULK CONTAINERS)

A. The CONTRACTOR shall label each container with a unique container tracking number. Permanently attached container inventory numbers may be used to track bulk containers.

B. The CONTRACTOR shall label each drum, bag, and bulk container with the container contents and as a "Hazardous Waste" or "Nonhazardous Waste", as directed by the OWNER/ARCADIS. For Materials that are pending analytical characterization, the CONTRACTOR shall label the container "Analytical Characterization Pending," until directed otherwise by the OWNER/ARCADIS.

C. The CONTRACTOR shall label each container with the date upon which the container was filled.

D. For hazardous wastes, the CONTRACTOR shall label each container with the appropriate USEPA waste codes as directed by the ENGINEER, OWNER, and/or the OWNER'S representative.

E. The CONTRACTOR shall label all containers with appropriate labels regarding fire and health risk criteria ("Flammable", "Corrosive", etc.) as directed by the ENGINEER. USDOT-approved chemical hazard labels may be used for this purpose.

F. The CONTRACTOR shall ensure that labeling is legible and clearly visible at all times. The CONTRACTOR shall label at least two (2) sides of each container.

3.05 CONTAINER STORAGE

A. Storm water accumulated in construction areas shall be managed by the CONTRACTOR as directed by the OWNER/ARCADIS.

B. The CONTRACTOR shall stage bulk containers in the staging areas identified during the pre-bid meeting. Should roll-off containers or frac tanks be staged in uncovered areas, the CONTRACTOR shall provide a water-tight cover for each container. The CONTRACTOR shall maintain the cover on the container at all times except when Materials are being placed in the container.

C. In the event that soil, IB wood walls, or IB wood baffles stored in a bulk container is identified to be hazardous by the CONTRACTOR, the CONTRACTOR shall transfer the material to an appropriate container acceptable for hauling such hazardous waste (in accordance with applicable rules and regulations) with controls to achieve odor performance criteria.

3.06 DESIGNATION OF OFF-SITE DISPOSAL

A. Class 3 hazardous waste solids shall be disposed of at a permitted landfill to be approved by OWNER. The CONTRACTOR is required to provide evident that the selected landfill is able to accept D018 waste and any other information required by the OWNER to approve such landfill.

B. Class 1 nonhazardous waste solids, construction debris, Class 2 spent absorbents, Class 2 PPE, and Class 2 miscellaneous solids and sludges shall be disposed by the CONTRACTOR at the Pine Belt Regional Landfill in Ovett, Mississippi.

C. Class 2 scrap metal shall be recycled by the CONTRACTOR.

D. The CONTRACTOR shall submit to the ARCAIS/OWNER in accordance with Section 01300 the names of all facilities at which off-site recycling is scheduled. The selection of off-site recycling facilities is subject to the approval of the OWNER.

3.07 MATERIAL TRACKING FORM

A. The CONTRACTOR shall complete a Material Tracking Form for each container including drums, bags, roll-offs, trucks, and other appropriate containers. The CONTRACTOR shall record the unique container tracking number, the name of the Material, the source of the Material, available characterization information, the date of Material generation, and any other appropriate information or comments on the Material Tracking Form.

B. The CONTRACTOR shall retain a copy of each Material Tracking Form on site throughout the duration of the WORK and shall submit the original Material Tracking Form to the ENGINEER on the day it is complete.

END OF SECTION

SECTION 02088
MATERIALS TRANSPORTATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Identification of Materials for transportation.

B. Packing, marking, labeling, and placarding containers for transportation.

C. Shipping documents.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 01700 - Contract Closeout

C. Section 02073 - Decontamination

D. Section 02074 - Material Management

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit Material Tracking Forms to OWNER/ARCADIS as specified in Section 02074.

C. Accurately complete all waste manifests, bills of lading, and related shipping documents and submit to ONWER/ARCADIS for review.

D. Submit final original copies of bills of lading as specified in Section 01700.

E. Submit list of proposed transport subcontractors.

1.04 PROJECT RECORD DOCUMENTS

A. Manifests

B. Bills of Lading (Weight Tickets)

B. Material Tracking Forms

1.05 REGULATORY REQUIREMENTS

A. Conform to the requirements of all federal, state, and local regulatory agencies including, but not limited to, the following:

1. Title 40, Code of Federal Regulations, Parts 264.314 and 265.315

1.06 PERMITTING/REGISTRATION/TRAINING

A. CONTRACTOR shall comply with all applicable federal and state transporter registration and permitting requirements.

PART 2 - PRODUCTS

Packaging materials and products including, but not limited to, the following:

A. 55-gallon steel drums, removable head, USDOT-approved (Identification Code 1A2 or similar);

B. 55-gallon polyethylene drums, removable head, USDOT-approved (Identification Code 1H2 or similar);

C. Indelible markers or paint pens for container labeling;

D. USDOT-approved chemical hazard labels; and

E. Mississippi Department of Transportation approved trucks and/or trailers.

PART 3 - EXECUTION

3.01 SHIPPING DOCUMENTS

A. MANIFESTS – The CONTRACTOR shall prepare waste manifests for all shipment of Class 3 hazardous wastes (benzene). The CONTRACTOR shall submit each manifest to the ARCADIS for review and signature in advance of shipping.

B. BILLS OF LADING - The CONTRACTOR shall prepare bills of lading for all shipments of Class 2 nonhazardous wastes (including scrap metal). The CONTRACTOR shall submit each bill of lading to ARCADIS for review and signature in advance of shipping.

C. WASTE PROFILES - The CONTRACTOR shall prepare the waste profile forms required by the designated disposal facility.

D. SHIPMENT REVIEW - The CONTRACTOR shall make all packaged and/or bulk loaded waste available to OWNER/ARCADIS for observation at the time the bill of lading is prepared. Between observation by the OWNER/ARCADIS and transport by the CONTRACTOR, the CONTRACTOR shall secure the waste to ensure that it is not changed in any way.

E. The CONTRACTOR shall submit the original, signed generator’s copy and one photocopy of each bill of lading to ARCADIS. ARCADIS shall submit the original, signed generator’s copy to the OWNER. The CONTRACTOR shall also submit the original, signed copy and one photocopy of each bill of lading signed by the receiving facility to ARCADIS. ARCADIS shall submit the original, signed copy to the OWNER.

F. Transport of site materials shall be conducted over paved roads and highways.

G. It is strongly suggested to execute left turns at red lights for the duration of transport activities conducted for this project.

END OF SECTION

DIVISION 2 - SITE WORK

SECTION 02205
SOIL MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A Existing On-Site Soil Materials.

B. Clean Backfill from an Off-Site Source.

C. Clean Topsoil from an Off-Site Source.

1.02 RELATED SECTIONS

A. Section 02211 - Rough Grading.

B. Section 02223 - Backfilling.

C. Section 02936 - Seeding.

1.03 REFERENCES

A. ASTM D2487 - Classification of Soils for Engineering Purposes.

B. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Backfill Material: Clean soil material graded, free of lumps larger than 3 inches, rocks larger than 2 inches, roots, and debris; conforming to ASTM D2487 Group Symbol CL or CH.

B. Topsoil Material: Soil used for backfill material shall be clean soil material graded, free of lumps larger than 3-inches, rocks larger than 2-inches, roots, and debris. The topsoil material shall be capable of supporting vegetative growth as specified in Section 02936 - Seeding.

2.02 SOURCE QUALITY CONTROL

A. Assessment and testing shall be performed under provisions of Section 01400 - Quality Control and Section 01410 - Testing Laboratory Services.

B. If tests indicate materials do not meet specified requirements, cease Work and notify ARCADIS and OWNER immediately.

PART 3 - EXECUTION

3.01 TEMPORARY STORAGE

A. All soil materials shall be hauled and placed. There are no temporary storage areas available on-site.

END OF SECTION

SECTION 02211
ROUGH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Cut, grade, fill, and rough grade the excess material located in and around the impoundment basin including staging areas identified during the pre-bid meeting as required for the CONTRACTOR to complete the scope of work.

B. Place and compact aggregate, as necessary, to temporarily create roadway surfaces as required for the CONTRACTOR to complete the scope of work.

C. Cut, grade, and fill for Site drainage and final grading of the impoundment basin and other miscellaneous areas of the site, as shown on the Project Drawings.

1.02 RELATED SECTIONS

A. Section 02222 - Excavating.

B. Section 02223 - Backfilling.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill as specified in Section 02205.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify Site conditions.

B. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities from damage.

D. Protect above and below grade utilities.

E. Protect bench marks, existing/remaining structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.03 BACKFILL

A. Excavate, transport, place, and compact excess material as shown on Project Drawings.

3.04 TOLERANCES

A. Elevations as shown on Project Drawings: ± 0.50 foot

3.06 FIELD QUALITY CONTROL

A. Field assessment and testing shall be performed under provisions of Section 01400.

3.07 SCHEDULES

A. Backfill

1. Maximum 6 inches compacted depth in impoundment basin.
2. A minimum of four passes in each direction with track equipment.

END OF SECTION

SECTION 02222
EXCAVATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Once nearly all if not all the sludge is removed from the IB, excavation of the top 6 inches of soil within the entire bottom of the IB.

B. Excavation of existing stockpiled soil for use as backfill material.

1.02 RELATED SECTIONS

A. Section 02211 - Rough Grading

B. Section 02223 - Backfilling

1.03 UNDERGROUND UTILITIES

A. Locate existing underground utilities before earthwork begins. Hand-dig exploratory pits where earthwork will occur near the utilities, and also at locations where offsets in utility lines are likely to exist. Have representative of respective utility and OWMER present during this exploratory work.

B. Comply with utility rules, permitting requirements, and directives for excavation work.

C. Protect exposed utility lines from damage.

D. Review on site Facility drawings showing utilities.

E. Walk through excavation activities with Facility personnel.

F. Utilize a utility locating company to mark utilities in the vicinity of the work.

G. Utilize the Mississippi ONE-CALL service at least 48 weekday working hours prior to excavation activities

1.04 FIELD MEASUREMENTS

A. Verify existing grades and dimensions. Should discrepancies exist between actual conditions and those shown, notify ENGINEER and clarify the discrepancies.

B. Grades and elevations indicated are not intended to represent a balance between cut and fill. Bring subgrades, when compacted, to the required grades and elevations.

1.05 PROTECTION

A. Protect benchmarks, existing structures, groundwater monitoring wells, fences, vegetation to remain in-place, and other site amenities from damage caused by CONTRACTOR’s equipment and vehicular traffic.

B. Protect above grade utilities which are to remain.

C. Notify ENGINEER of unexpected subsurface conditions and discontinue affected work in area until notified to resume Work.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, grades, and datum.

B. Locate, identify, and protect underground utilities from damage.

C. Protect existing structures from excavation equipment and vehicular traffic.

D. Length of excavation open at any one time shall be controlled by site conditions and are subject to any limits that may be prescribed by the ARCADIS or the OWNER.

E. Review on site Facility drawings showing utilities.

F. Walk through excavation activities with Facility personnel.

G. Utilize a utility locating company to mark utilities in the vicinity of the work.

H. Utilize the Mississippi ONE-CALL service at least 48 weekday working hours prior to excavation activities

3.02 EXCAVATION

A. Excavate the soil from the existing soil stockpiled area down to the surrounding grade.

B. Excavate sludge previously observed outside the IB walls on the southeast corner of the IB as directed by ARCADIS. Soils excavated during this effort will need to be sampled, analyzed, and profiled at the expense of the CONTRACTOR.

C. If required based on method determined by CONTRACTOR, excavate to decommission pipes entering IB below grade. Soils excavated during this effort will need to be sampled, analyzed and profiled at the expense of the CONTRACTOR.

D. Excavate the top 6 inches of soil at the bottom of the IB for live loading and disposal. Excavation shall be completed as quickly as possible following sludge removal to minimize the volume of potential groundwater infiltration.

E. If groundwater infiltration or surface water is encountered during excavation of the IB, a sump shall be created to capture the water and the water shall be managed in accordance with Section 02074.

F. No excavation materials shall be removed from the site or disposed of off-site by the CONTRACTOR and/or CONTRACTOR's subcontractors without prior approval from the OWNER.

G. Complete all excavation regardless of the type of materials encountered. CONTRACTOR shall make his own estimate of the kind and extent of the various materials, which will be encountered in the excavation.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Notify ARCADIS and OWNER of unexpected subsurface conditions and discontinue affected work in area until directed by ARCADIS/OWNER to resume work.

J. Correct areas over excavation in accordance with Section 02223.

3.03 FIELD QUALITY CONTROL

A. Field assessment shall be performed under the provisions of Section 01400 - Quality Control and Section 01410 - Testing Laboratory Services.

B. Provide for visual assessment of bearing surfaces.

3.04 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

END OF SECTION

SECTION 02223
BACKFILLING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section also consists of furnishing all materials, equipment, tools, and labor to backfill to grade with 1% minimum slope to promote positive drainage and prevent ponding.

1.02 RELATED SECTIONS

A. Section 02205 - Soil Materials.

B. Section 02222 - Excavating.

1.03 REFERENCES

A. ASTM D422 - Particle Size Analysis of Soils.

1.04 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 02205 - Soil Materials.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that areas to be filled are free of roots, organics, deleterious debris, water, or any obstructions that may hinder the proper placement and compaction of fill materials.

3.03 BACKFILLING

A. Place backfill materials to the lines and grades shown on the Project Drawings. Soil shall be placed in loose lifts approximately 8 inches thick. Compacted soil fill lift thickness (after compaction) shall not exceed 6 inches.

B. Compaction of lifts shall be performed with appropriately heavy tracked equipment (such as a CAT 815 or equivalent) subject to approval of the OWNER or his designated representative. CONTRACTOR shall build a ramp for equipment access as needed. The required number of passes shall be determined in the field based on visual assessment, but shall not be less than four passes. A pass is defined as one trip of the compacting equipment over the lift and back to the starting point by the compacting equipment.

C. The daily work area shall extend a distance so as to maintain moist soil conditions (facilitate bonding) and continuous operations as best possible. Desiccation and crusting of the lift surface shall be avoided as much as possible. If, in the judgment of the OWNER or his designated representative, desiccation and crusting of the lift surface occurs before placement of the next lift, this area shall be scarified to a sufficient depth to mix with moist materials, or sprinkled with water and then scarified. Compaction shall not proceed until this water in uniformly absorbed into the soil and the moisture content is in the specified range.

D. Place backfill soil in locations as specified on the Project Drawings.

E. Do not backfill over material that has become porous, wet, or spongy. If dewatering of the excavation containing infiltrating groundwater is not feasible (as agreed upon by the OWNER and ARCADIS), import gravel with the approval of the CLIENT to bridge the water and then expeditiously backfill and compact soil overtop of the gravel. Payment for imported gravel shall be in accordance with the bid form.

F. Employ a placement method that does not disturb or damage other Work.

G. Slope grades shall be a minimum of 1%.

H. Make gradual grade changes. Blend slope into level areas.

3.03 TOLERANCES

A. Rough Grade: ± 0.50 foot.

3.04 FIELD QUALITY CONTROL

A. Field assessment and testing shall be performed under provisions of Section 01400 - QUALITY CONTROL and Section 01410 - TESTING LABORATORY SERVICES.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at CONTRACTOR's expense until the compaction specification is achieved.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Reshape and recompact fills subject to vehicular traffic.

3.06 WARRANTY

A. CONTRACTOR shall warranty the backfilling operations for a period of 1 year from the OWNER's acceptance of the work and project closeout. Any settling during this 1 year period that results in low spots where ponding occurs or may occur or excessive infiltration may occur shall be filled with suitable topsoil, graded, and re-seeded at the CONTRACTOR's expense to the standards of the technical specifications.

3.07 SCHEDULE

A. Backfill

1. Soil type to finish grade. Lift thickness not to exceed 8 inches loose.

END OF SECTION

SECTION 02240
SLUDGE SOLIDIFICATION, REMOVAL AND LOADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, equipment and labor necessary for solidification of sludge from the IB, ET-10, and ET-18 and to the specified performance requirements.

B. Solidification of all sludge in the IB shall be completed within the IB's temporary enclosure.

C. The solidified sludge shall be removed from the IB and tanks in a manner that minimizes odors.

D. The solidification of sludge shall occur in two or three distinct phases, as follows:

1. Laboratory/Bench Study (if necessary);
2. Field Demonstration; and
3. Full-Scale Implementation.

1.02 RELATED WORK

A. Section 02088 – Materials Transportation

B. Section 02245 – Odor Mitigation and Monitoring

C. Section 13700 – Temporary Enclosure

1.03 REFERENCES

A. U.S. Environmental Protection Agency Test Method 9095A “Paint Filter Liquids Test”.

1.04 QUALITY ASSURANCE

A. All components of the solidification equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

B. All materials, procedures, operations, and methods shall be subjected to the quality control monitoring as detailed herein**.**

C. Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up, and service of full-scale solidification equipment, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract. The bidder shall submit data to substantiate the manufacturer's experience in accordance with the contract documents.

D. The CONTRACTOR shall comprehend and anticipate the construction quality assurance (CQA) activities and account for these activities in the installation schedule.

E. Equipment that is sealed to minimize escaping odors should be considered to avoid a potential off-site odor nuisance based on the presence of hydrogen sulfide.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit the solidification Work Plan to the OWNER and ARCADIS as described in Paragraph 3.02 of this Section.

B. CONTRACTOR shall submit laboratory analytical data for the solidification agent or agents for TCLP RCRA Metals prior to mobilization of such agents to the Facility. Solidification agents are subject to the approval of OWNER.

1.06 HEALTH AND SAFETY

A. The CONTRACTOR shall develop and implement the Contractor Health and Safety Plan (CHASP) for all solidification activities to protect on-site personnel. The CHASP shall be prepared in accordance with OWNER requirements provided as part of the Contract Documents.

B. The CONTRACTOR shall implement the CHASP and other safety requirements as required by other sections of the Contract Documents.

C. Work procedures shall conform with all applicable federal, state and local regulations (latest editions).

D. Reported compounds and concentrations and physical characteristics within various media are provided in this RFP.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered clean and free from debris and shall be handled to prevent contamination, segregation, or damage.

B. The storage location of all materials shall not interfere with construction activities and shall be approved by OWNER.

C. Solidification agents to include, but not limited to, polymer totes shall be stored in weather-tight enclosures to protect against dampness and contamination.

1.08 SLUDGE THICKNESS

A. Sludge thicknesses shown on Project Drawings were established by previous probing investigations conducted in April 2010.

1.09 PERFORMANCE REQUIREMENTS

A. Prior to solidification, CONTRACTOR shall implement procedures to dewater the sludge by mounding, pumping from sumps, and any other means determined appropriate by the CONTRACTOR to minimize the amount of water contained within the sludge prior to solidification. This effort is subject to the satisfaction of ARCADIS and the OWNER.

A. The sludge solidification equipment and materials shall be capable of meeting the following minimum performance criteria:

1. A solidified sludge material that passes the Paint Filter Test.
2. Bulking of sludge shall be kept to a maximum of 10 percent by weight.

B. It is the CONTRACTOR'S responsibility to ensure that solidified sludges meet the performance requirements of this Section. Any material that does not meet the standards of this section will be rejected by OWNER or its ENGINEER and shall be resolidified at no cost to OWNER.

C. All materials, procedures, operations, and methods shall be in conformance with the CONTRACTOR's Work Plan, Project Drawings, and Specifications and shall be subject to quality control monitoring as detailed herein.

PART 2 - MATERIALS

2.01 EQUIPMENT

A. Equipment used in the solidification of sludge shall be of the best quality and entirely suitable in every respect for the service required. Materials shall conform to the ASTM Specifications where such specifications exist and the use of such materials shall be based on continuous and successful use under similar conditions of service.

2.02 SOLIDIFICATION REAGENTS

A. All material used in the solidification process shall meet or exceed the standards defined in American Society for Testing and Materials (ASTM), or other standards as appropriate. CONTRACTOR shall provide a list of ASTM methods that apply to the selected reagent(s) to the ENGINEER as part of the Work Plan required in Paragraph 3.02 of this Section.

B. Water, for bidding purposes, shall be obtained from an on-site water supply designated by the OWNER. OWNER will designate hydrant locations on the site for water supply. CONTRACTOR shall be responsible for water connection and transport to the Work site.

C. The minimum percentage by weight of the solidification reagent(s) shall be designated by the CONTRACTOR. Reagent(s) and ratio(s) shall be submitted to the OWNER and ARCADIS as part of the Work Plan required in Paragraph 3.02 of this Section. Reagents shall be capable of meeting the performance criteria presented in Paragraph 3.03 of this Section.

C. Solidification reagent(s) shall be supplied from the same supplier/source for the duration of activities, unless an alternate supplier/source is submitted and acceptable to the OWNER or its ARCADIS. CONTRACTOR shall submit to the OWNER and ARCADIS for acceptance certified laboratory test results documenting that the material supplied by the alternate supplier/source shall meet performance criteria prior to changing suppliers.

D. Solidification reagent(s) shall tested per source for TCLP metals as required by Section 01410.

PART 3 - EXECUTION

3.01 SLUDGE CHARACTERIZATION

A. The sludges have been characterized through completion of a bench scale treatability study. Dewatering of representative sludge samples resulted in gravity dewatering producing a dewatered sludge capable of passing the Paint Filter Test (USEPA SW846 9095A). Performance criteria are presented in Paragraph 3.03 of this Section. CONTRACTOR may at their own cost take sludge samples and conduct verification testing of data provided in these specifications.

B. The in-place sludge volumes to be dewatered from the IB basin are listed below:

	Cubic yards	Color	Consistency
Upper Layer	3,800	Black	Liquidy
Lower Layer	911	Tan	Firm

Attachments to this RFP provide additional data on chemical and additional data on physical characteristics following a solidification evaluation.

C. The in-place sludge volumes to be solidified from tank ET-10are listed below:

	Cubic yards	Color	Consistency
ET-10	8,400	Black	Liquidy

Attachments to this RFP provides additional data on physical and chemical characteristics of the sludge for ET-10.

E. Approximately 302 cubic yards of sludge is expected at ET-18. No data is available for the sludge in tanks ET-18, however the physical characteristics are thought to be consistent with ET-10 sludge.

3.02 WORK PLAN

A. The CONTRACTOR shall submit a Work Plan to the OWNER and ARCADIS as part of the bid response. The CONTRACTOR's Work Plan shall describe the sludge solidification process including, but not limited to, equipment, reagent(s) with appropriate ASTM designations, ratio(s), mixing methods, storm water run-on and runoff controls, decontamination procedures, construction sequence, proposed schedule, and any other pertinent information deemed necessary to fully convey what solidification activities will be performed to the ARCADIS and OWNER. The Work Plan shall be specific to both solidification of sludge within the IB and the solidification of sludge from the tanks.

B. The CONTRACTOR's Work Plan shall describe the proposed demonstration to be completed prior to full scale implementation, including details such as the length of time the demonstration will be completed.

C. The CONTRACTOR shall establish a phasing schedule for the solidification of the sludges to ensure continuous operations. The OWNER or ARCADIS shall accept the phasing schedule before initiation of the full-scale implementation.

D. CONTRACTOR's Work Plan shall also include a drawing presenting the staging locations of the solidification equipment, and the proposed traffic patterns for off-site transport of solidified sludge.

3.03 INSPECTION

A. The CONTRACTOR is responsible for the collection of any samples necessary to conduct any bench scale tests. The CONTRACTOR shall verify the volume of sludges to be solidified. Method of measuring and calculating the volume shall be submitted to OWNER and ARCADIS prior to implementation. OWNER or ARCADIS shall be present for all field measurements. The CONTRACTOR shall notify OWNER and ARCADIS if volume exceeds 10 percent of estimated in-place volume or weight provided for bidding purposes.

B. At the beginning of each day's work, the CONTRACTOR shall inspect the previously solidified sludge and take whatever corrective action, if any, that the OWNER or ARCADIS deems appropriate, to meet performance criteria. These action(s) shall be performed at no extra cost to OWNER.

C. The CONTRACTOR shall verify at the end of each working day that the ground surface near the solidified sludge is free of potential moisture-trapping indentations and that surface drainage will be off of and away from the sludge.

3.04 FIELD DEMONSTRATION

A. The Field Demonstration is required to provide the CONTRACTOR with operational information, an opportunity to refine the sludge-reagent mix ratio, and ensure that the dewatering reagents, mixture methods and sludge characteristics are adequate to meet performance criteria. Solidfication reagents, equipment, and procedures for the Field Demonstration shall be the same as intended for the full-scale solidification of sludges present in the IB, ET-10 and ET-18 as presented in the CONTRACTOR's Work Plan. The Field Demonstration of the dewatering shall not be conducted in inclement weather.

B. The CONTRACTOR shall provide all personnel, equipment, and materials to perform dewatering during the Field Demonstration consistent with the CONTRACTOR's Work Plan. OWNER or ARCADIS shall be present to observe the sludge removal and dewatering process.

C. The Field Demonstration shall include the removal of sludge from the IB and the dewatering of the sludge in the building identified in the Contract Drawings or approved alternate location.

D. The CONTRACTOR shall document the methods, materials, and equipment used to remove and dewater the sludge during the Field Demonstration.

E. The CONTRACTOR shall evaluate the bulking characteristic of the solidified sludge to develop construction procedures for the full-scale implementation of solidification to meet performance criteria and to promote a continuous operation each working day.

F. The CONTRACTOR shall perform paint filter analysis for solidified sludge from the Field Demonstration. A sample from a minimum of two separate locations shall be collected and analyzed. The samples will be visually evaluated for mixing uniformity at the time of collection. Test data will be compared for two samples to confirm visual determination of uniformity in the treated sludge and performance criteria.

G. The CONTRACTOR shall control and monitor potentially noxious odors during the Field Demonstration in accordance with Section 02245.

H. The CONTRACTOR shall provide the results to the OWNER and ARCADIS for review prior to full-scale implementation. If the dewatered sludges do not meet required specifications, the CONTRACTOR shall review the procedures with OWNER and ARCADIS and perform another Field Demonstration to confirm performance criteria will be satisfied. The additional Field Demonstration shall be performed at no additional cost to the OWNER.

3.06 FULL-SCALE SLUDGE SOLIDIFICATION IMPLEMENTATION

A. The CONTRACTOR shall conduct solidifcation of sludge upon acceptable results from the Field Demonstration.

B. The CONTRACTOR shall provide all personnel, equipment, and materials to perform full-scale implementation of IB and tanks sludge solidification.

C. The CONTRACTOR shall solidify sludges in accordance with the construction sequence and schedule included in the CONTRACTOR's Work Plan and submitted to the OWNER and ARCADIS.

D. The CONTRACTOR shall solidify the sludges within the limits of the IB, ET-10, and ET-18 as delineated on the Project Drawings, unless an alternate approach is proposed and approved by OWNER.

E. The CONTRACTOR shall ensure control of noxious odors as specified in Section 02245. The CONTRACTOR in conjunction with the OWNER and ARCADIS shall evaluate the effectiveness of the applied odor control and may require additional action by the CONTRACTOR including the implementation of the contingency plan as included in the Odor Mitigation Plan.

E. The CONTRACTOR shall collect samples of the solidified sludge and place them in an appropriate apparatus for subsequent testing. The samples shall be collected in such a manner that the tested portions are representative of the majority of the solidified sludge material. The CONTRACTOR shall perform paint filter tests on the samples at the following frequency to confirm that the solidified sludge meet required specifications:

Parameter	ASTM Test Method	Frequency
Paint Filter Test	SW 846 9095A	At a minimum of once for every material load before being transported offsite and upon arrival at the landfill completed by CONTRACTOR.
Percent Solids	ASTM D2216	Minimum of one sample per day completed by CONTRACTOR.

The solidified sludge shall meet the performance criteria presented in Paragraph 1.09 of this Section.

G. The CONTRACTOR shall provide the results to the OWNER and ARCADIS for review as they are made available. If the solidified sludges do not meet performance criteria, the CONTRACTOR shall review the procedures with the OWNER and ARCADIS and reprocess the solidified sludges, as required. Additional samples will be collected, and analyzed for the paint filter test. The OWNER and ARCADIS shall review the results and verify that solidifying of the sludges has been achieved before the CONTRACTOR begins off-site transport. The reprocessing of the sludges and testing of additional samples shall be at no additional cost to the OWNER.

H. CONTRACTOR shall not begin off-site transport of solidified sludge from “hazardous” cells until results of the LDR parameters have been received and reviewed by the OWNER and ARCADIS. The CONTRACTOR shall not remove the solidified sludge from a “hazardous” cell from the site until the OWNER or ENGINEER reviews these analytical results and indicates whether the solidified sludge will require further treatment at an off-site disposal facility. ..

I. The CONTRACTOR shall obtain approval from the OWNER or ARCADIS that the solidification of the sludge has achieved the performance criteria before demobilizing equipment from the Site. Any additional solidification required will be conducted at no additional cost to the OWNER.

J.

3.07 SOLIDIFIED SLUDGE LOADING AND TRANSPORT

A. CONTRACTOR shall direct on-site truck traffic.

B. CONTRACTOR shall sequence the work so that trucks/containers will be live loaded to the extent possible.

C. CONTRACTOR shall determine the weight of each truck load prior to leaving the site. Refer to Section 02088 – Materials Transportation for additional requirements pertaining to off-site disposal of solidified sludge.

D. CONTRACTOR shall completely cover all materials transported from the site in a manner that promotes the safety of all on-site personnel. The loads shall be secured so that there is no material or dust being released from the vehicle at any time.

E. Tracking of any soil or construction debris is strictly prohibited. Should such material inadvertently be tracked, the CONTRACTOR shall be solely responsible for its immediate removal.

F. Any material that spills, leaks, is dropped from the vehicle, or is misplaced by the CONTRACTOR during transport shall be reported to the OWNER immediately and removed by CONTRACTOR.

G. CONTRACTOR shall be responsible for damage to equipment (beyond normal wear and tear) resulting from improper preparation of the material prior to loading, loading of non-conforming material, improper handling of equipment during loading, or overloading of the containers.

3.08 DECONTAMINATION

A. Equipment used for solidification shall remain dedicated for the duration of these activities and maintained within the exclusion zone.

B. Prior to the demobilization of the equipment, it shall be decontaminated in accordance with the procedures provided in the CONTRACTOR's Work Plan.

C. OWNER or ARCADIS shall be present for decontamination activities and shall be provided copies of all test results necessary to document effectiveness before removing equipment from the site.

D. Decontamination shall be performed at a location designated by the OWNER. If required, a temporary decontamination pad shall be constructed. Liquids will be collected and disposed of at a location designated by the OWNER.

3.09 WATER MANAGEMENT

A. Remove and manage storm and other accumulated water during solidification activities in accordance with CONTRACTOR's Work Plan developed by the CONTRACTOR. Accumulated storm water shall be filtered and discharged at an acceptable flow rate to the existing facility's industrial sewer in accordance with the MDEQ Water Pollution Control Permit No. MSP091286 and Section 02074. Sampling will be conducted by CONTRACTOR.

END OF SECTION

SECTION 02245
ODOR MITIGATION AND MONITORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for monitoring and controlling odors generated during Work of this Contract.

B. The Contractor is responsible for controlling hazardous odors and nuisance odors encountered or created during Work of this Contract, including odors associated with site sanitation.

C. The CONTRACTOR shall prepare an odor mitigation and monitoring plan including contingency procedures.

D. Odor mitigation and monitoring shall occur in two or three distinct phases (in conjunction with the dewatering demonstration), as follows:

1. Laboratory/Bench Study (if necessary);
2. Field Demonstration; and
3. Full-Scale Implementation.

E. **In the event that the performance standards are not being met, the CONTRACTOR will be required to shut down operations at their own expense until a successful resolution is implemented.** CONTRACTOR shall investigate (in cooperation with the OWNER and ARCADIS) odor complaints or any exceedances of the specified performance standards, ascertain the odor source, and promptly implement appropriate odor control measures and contingency procedures.

1.02 RELATED WORK

A. Section 01035 – Health and Safety Requirements

B. Section 02240 – Sludge Solidification, Removal and Loading.

C. Section 02222 – Excavating Support (Sheet Piling)

D. Section 13700 – Temporary Enclosure

1.03 REFERENCES

National Institute for Occupational Safety and Health (NIOSH)

Occupational Safety and Health Administration (OSHA)

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be subjected to the quality control monitoring as detailed herein. All monitoring equipment shall be calibrated daily at a minimum and checked for accuracy in accordance with the manufacturer’s instructions. Calibration and accuracy records shall be made available upon request by the OWNER or ENGINEER.

B. Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up, and service of full-scale odor mitigation equipment, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract. The bidder shall submit data to substantiate the manufacturer’s experience in accordance with the contract documents.

C. The CONTRACTOR shall comprehend and anticipate the construction quality assurance (CQA) activities and account for these activities in the schedule.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit the Odor Mitigation Plan (OMP) to the OWNER and ARCADIS as described in Paragraph 3.02 of this Section.

B. The CONTRACTOR is required to provide all monitoring data obtained as required by this specification and the OMP.

D. All materials, procedures, operations, and methods shall be in conformance with the OMP, Project Drawings, and Specifications and shall be subject to quality control monitoring as detailed herein.

1.06 HEALTH AND SAFETY

A. The CONTRACTOR shall develop and implement the Contractor Health and Safety Plan (CHASP) for all dewatering and odor mitigation activities to protect on-site personnel. The CHASP shall be prepared in accordance with OWNER requirements provided as part of the Contract Documents.

B. The CONTRACTOR shall implement the CHASP and other safety requirements as required by other sections of the Contract Documents.

C. Work procedures shall conform with all applicable federal, state and local regulations (latest editions).

E. Reported compounds and concentrations and physical characteristics within various media are provided in this RFP.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered clean and free from debris, in a state ready to be connected to a power source to begin operations, and shall be handled to prevent contamination, segregation, or damage.

B. The storage location of all materials shall not interfere with construction activities and shall be approved by OWNER.

1.08 APPLICABLE STANDARDS

A. The OSHA, Permissible Exposure Limit (PEL) for hydrogen sulfide is 20 parts per million (ppm) as a ceiling. The NIOSH recommended exposure limit (REL) for hydrogen sulfide is 10 ppmv as a 10 minute ceiling. According to the on-line NIOSH Pocket Guide to Chemical Hazards, hydrogen sulfide is a colorless gas with a strong odor of rotten eggs. The sense of smell becomes quickly fatigued to hydrogen sulfide.

B. The OSHA time-weighted average limit (TWA) for benzene is 1 ppm indicating that a site worker shall not be exposed to an airborne concentration of benzene in excess of 1 ppm as an 8-hour time-weighted average. The short-term exposure limit (STEL) for benzene is 5 ppm indicating that a site worker shall not be exposed to an airborne concentration of benzene in excess of 5 ppm averaged over any 15 minute period. The NIOSH REL as a 10-hour TWA is 0.1 ppm and as a 15 minute STEL is 1 ppm.

C. Hydrogen sulfide is the primary odor constituent based on the results of the odor characterization report. The detection concentration for H2S in the ambient environment ranges from 0.01 to 0.02, depending on the environmental conditions and the sensitivity of the individual.

PART 2 – MATERIALS

2.01 ODOR SUPPRESSION AGENTS (IF USED)

A. Odor suppression agents shall be water soluble, non-toxic, non-reactive, and non-volatile.

B. The use of petroleum based products for odor suppression is strictly prohibited in this Contract.

C. Odor suppression agents shall be stored in weather-tight enclosures to protect against contamination.

2.02 COVERS

A. Covers for excavated soils and stockpiled material shall be at least 10-mil thick polyethylene sheets.

B. All containers containing sludge shall be covered to the extent possible during filling and covered immediately and completely once filling operations cease for more than 10 minutes. At the IB, Contractor should consider to have filling operation be conducted within the temporary structure. Afterwards uncovering of the containers shall only be allowed for sampling by CONTRACTOR and ARCADIS or to resume filling operations.

2.02 EQUIPMENT AND STRUCTURES

A. All components of the odor mitigation and monitoring equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

B. All electrical equipment shall be designed, installed, and operated in accordance with the National Electric Code and the local applicable requirements. Lock-out/tag-out procedures shall be implemented.

C. All mechanical equipment (i.e. fans) shall have the appropriate safeguards against moving parts.

D. All structures shall be sound even under inclement weather conditions. Structures should be inspected daily and repairs shall be made promptly. Structure should be properly secured and/or partially dismantled if severe weather conditions (i.e. hurricane) are imminent.

E. Refer to section 13700 for specification related to the required temporary structure over the IB.

PART 3 - EXECUTION

3.01 ODOR CHARACTERIZATION

A. A brief odor characterization study was performed as presented in this RFP. The results of the odor characterization shall be used at the discretion of the CONTRACTOR. Characterization effort shall not be construed as representative of the actual proposed odor conditions during the implementation of the CONTRACTOR’s Work Plan.

3.02 ODOR MITIGATION PLAN

A. The CONTRACTOR shall submit an OMP to the OWNER and ARCADIS as part of the bid response. The OMP shall describe the proposed odor mitigation procedures (for the sludge removal locations and dewatering locations) including, but not limited to, equipment, structures, procedures, chemicals, monitoring equipment, construction sequence, proposed schedule, and any other pertinent information deemed necessary to fully convey what odor mitigation and monitoring activities will be performed to ARCADIS and OWNER.

B. OMP shall describe the proposed demonstration to be completed prior to full scale implementation, including details such as the length of time the demonstration will be completed.

C. OMP shall also include a drawing presenting the staging locations of the odor mitigation and monitoring equipment.

3.03 PERFORMANCE CRITERIA

A. In accordance with Mississippi regulations the public should be protected from unreasonable odors in ambient air. Hercules proposes the following as objective and measurable standards to address odors, vapors, and dust.

1. Field olfactometer readings (using Nasal Ranger) collected by ARCADIS from odors at the property boundary omitted by and downwind of the IB, ET-10 and ET-18 (as determined by a weather station) do not exceed 2 dilution to threshold (D/T).

2. Hydrogen sulfide concentrations collected by ARCADIS at the property boundary omitted by and downwind of the IB, ET-10 and ET-18 do not exceed 0.02 ppm.

3. Benzene concentrations collected by ARCADIS at the property boundary omitted by and downwind of the IB, ET-10 and ET-18 do not exceed 0.5 ppm

4. Dust concentrations in high traffic areas as measured by CONTRACTOR do not exceed 100 mg/m^3 above background.

B. In addition, the CONTRACTOR is required to protect site and construction workers from hazardous vapors, dust, and odor applicable standards and the CHASP. Criteria for the worker area as provided in the IB Interim Measures Work Plan are as follows.

1. Benzene concentrations in the worker area (either inside or outside the temporary structure) as measured by the CONTRACTOR do not exceed 1 ppm without appropriate PPE.

2. Hydrogen sulfide concentrations in the worker area (either inside or outside the temporary structure) as measured by the CONTRACTOR do not exceed 10 ppm without appropriate PPE.

3. Explosive conditions in the worker area (either inside or outside the temporary structure) as measured by the CONTRACTOR do not exceed 10% of the Lower Explosive Limit.

The above criteria are a minimum standard that should be established in the CHASP. CONTRACTOR is solely responsible for the safety of their workers.

3.04 INSPECTION

A. The CONTRACTOR is responsible for the collection of any samples necessary to conduct any bench or pilot scale odor tests.

B. Structures, equipment and safeguards should be inspected daily and repairs shall be made promptly.

C. At the beginning of each day’s work, the CONTRACTOR shall inspect the previous odor monitoring data and take whatever corrective action, if any, that the OWNER or ARCADIS deems appropriate, to meet performance criteria. These action(s) shall be performed at no extra cost to OWNER.

3.05 FIELD DEMONSTRATION

A. The Field Demonstration is required to provide the CONTRACTOR with operational information and ensure that the odor mitigation is adequate to meet performance criteria both where the sludge solidified and where it is removed. Odor mitigation reagents, equipment, and procedures for the Field Demonstration shall be the same as intended for the full-scale odor mitigation. The Field Demonstration of the odor mitigation shall be completed in conjunction with the solidification demonstrations at the IB and shall not be conducted in inclement weather.

B. The CONTRACTOR shall provide all personnel, equipment, and materials to perform odor mitigation during the Field Demonstration consistent with the CONTRACTOR's Work Plan. OWNER or its ENGINEER shall be present to observe the solidification process.

D. The CONTRACTOR shall provide at least 2 weeks notice prior to implementing the demonstrations to allow for the OWNER and MDEQ make arrangements to observe the demonstration.

E. The construction area for the Field Demonstration shall be located in agreement with the ARCADIS and OWNER.

F. The CONTRACTOR shall document the methods, materials, and equipment used to mitigate odor during the Field Demonstration.

G. The CONTRACTOR shall perform monitoring during the Field Demonstration as required by this specification and the OMP.

H. The CONTRACTOR shall provide the results to the OWNER and ARCADIS for review and approval prior to full-scale implementation. If the odor mitigation does not meet required specifications, the CONTRACTOR shall review the procedures with OWNER and ARCADIS and perform another Field Demonstration to confirm performance criteria will be satisfied. The additional Field Demonstration shall be performed at no additional cost to the OWNER.

I. The successful implementation of the Field Demonstration will be depending on the approval from Mississippi Department of Environmental Quality (MDEQ) and the United States Protection Agency. Any measures required by the MDEQ and USEPA that are in addition to the requirements of these technical specifications may be subject to a change order.

3.06 ODOR MONITORING REQUIREMENTS

A. Monitoring shall be performed within work areas per the CHASP however at a minimum shall include the following.

1. Hydrogen sulfide in the work area will be monitored with a RAEMultiRAE 4 (by RAE Systems Inc.), or approved equivalent. The monitor shall be equipped with an alarm

which will be initiated if a hydrogen sulfide concentration of 10 ppm is reached and procedures detailed in the CHASP shall be implemented.

2. Benzene will be monitored in the work area with an UltraRae 3000 (by RAE Systems) photo ionization detector (PID) set in the benzene specific mode, or approved equivalent. The Ultra Rae 3000 meter shall be capable of detecting benzene concentrations between 0.05 ppm and 200 ppm. The meter shall alarm if a reading exceeds the equivalent of 1 ppm benzene and procedures detailed in the CHASP shall be implemented.

3. A lower explosive limit (LEL) meter shall be used in the work area to monitor for potential explosive environments. If a reading greater than 10% LEL is observed, then sludge removal and dewatering activities shall cease until a remedy is determined to address the potentially explosive conditions.

4. Immediately downwind of the area with the highest truck traffic and or area of great dust potential shall be monitoring for dust. Dust monitoring instrument shall be used to monitor dust during the removal of the dewatered sludge from the site. If dust concentrations exceed 100 mg/m^3 traffic areas shall be watered down to control the dust at the expense of the CONTRACTOR. Watering shall not be excessive causing water run-off. If excessive dust has accumulated on the roadways, a roadway sweeper shall be used at the discretion of the OWNER as priced on the bid form.

B. Monitoring shall be conducted at a minimum as specified in the table below. CONTRACTOR is responsible for the quality control of these measurements (i.e. accuracy and verification).

Compound/Parameter	Threshold Concentration	Monitor Locations	Monitoring Device	Monitoring Frequency
Benzene	1 ppm	Work Area (inside and outside temporary structure)	UltraRae 3000 benzene specific PID or equivalent.	Continuous
Hydrogen Sulfide	10 ppm	Work Area (inside and outside temporary structure)	RAE MultiRAE 4 or equivalent	Continuous
Explosive Conditions	10% LEL	Work Area (inside and outside temporary structure)	To Be Determined	Continuous

Dust	>100 mg/m^3 above background	High Dust/Traffic Areas	To Be Determined	As needed during sludge hauling activities.

C. The CONTRACTOR shall provide the results to the OWNER and ARCADIS for review as they are made available. If the monitoring data does not meet performance criteria, the CONTRACTOR shall review the procedures with the OWNER and ARCADIS and implement the contingency plan and other corrective measures specified in the OMP at the CONTRACTOR’s expense until the performance criteria can be met.

3.07 ODOR MITIGATION REQUIREMENTS

A. The CONTRACTOR shall conduct odor mitigation within the sludge removal, solidification, and staging areas for the IB to meet the performance standards upon acceptable results from the Field Demonstration.

B. The CONTRACTOR shall provide all personnel, equipment, and materials to perform full-scale implementation of odor mitigation throughout the sludge removal, solidification, and staging process at the IB, ET-10 and ET-18.

C. The CONTRACTOR shall complete the solidification and removal activities at the IB within a temporary enclosure as specified in Section 13700.

D. Temporary enclosure shall be equipped with a ventilation system to ensure a negative pressure throughout the enclosure. Air removed with ventilation system shall be treated to ensure 100% treatment of volatile organic compounds. Air removed with ventilation system shall be treated for odorous constituents such as hydrogen sulfide to ensure that the odor criteria established at the property boundary are not exceeded.

3.08 WATER MANAGEMENT

A. CONTRACTOR is required to properly characterize and dispose of any materials used during odor mitigation and monitoring including treatment equipment such as granular activated carbon.

END OF SECTION

DIVISION 2 - SITE WORK

SECTION 02248
EXCAVATION SUPPORT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Designing, furnishing, installing, maintaining and subsequently removing temporary excavation support systems installed within the IB.

B. The CONTRACTOR shall be solely responsible for the design, construction, maintenance and subsequent removal of all elements of the temporary excavation support systems.

C. The CONTRACTOR shall provide all labor, materials, equipment, surveys and services necessary for or incidental to the following:

1. Designing steel sheet pile wall(s) capable of supporting the IB sidewalls during sludge removal and excavation to the required depths, and resisting soil and hydrostatic pressures and superimposed construction and equipment surcharges.

2. Designing steel sheet pile walls, or approved alternative, to segregate IB cells containing hazardous sludge/soil from IB cells containing non-hazardous sludge/soil. Sheet pile walls shall be capable of supporting cell sidewalls during sludge/soil removal to the required depths.

3. Furnishing, driving and removal of the temporary steel sheet piles without damaging existing structures, subsurface utilities and other improvements adjacent to the IB.

4. Prevent water leakage through the sheet pile interlocks by applying a sealant to sheet pile interlocks.

5. Removing and decontaminating/cleaning steel sheet piling.

1.02 RELATED SECTIONS

A. Section 01050 – Field Engineering

B. Section 02074 – Material Management

C. Section 02222 – Excavating

D. Section 02240 – Sludge Stabilization, Removal and Loading

1.03 REFERENCES

A. American Welding Society (AWS).

B. American Society for Testing and Materials (ASTM).

C. American Institute of Steel Construction (AISC).

1.04 QUALITY ASSURANCE

A. Driving and Erecting: Installer shall be regularly engaged in the driving and erection of steel piles.

B. Drilling operators and foreman shall have a minimum of three years experience installing steel sheet piles.

C. Qualifications of Welders: In accordance with the American Welding Society (AWS). Qualified within the past year.

1.05 DESIGN CRITERIA

A. Design excavation support systems to support earth and groundwater pressures, utility loads, equipment, applicable traffic and construction loads, and other surcharge loads in a manner which will allow the safe and expeditious removal of sludge/soil without movement or settlement of the ground and in a manner which will prevent settlement of and damage to, or movement of, adjacent structures, utilities or other facilities during the various stages of remedial activities.

B. Design each component to support the maximum loads which may occur during various stages of remedial activities.

C. Carry the toe of the support system to a depth below the bottom of the excavation as adequate to prevent lateral and vertical movement. Adequate embedment depth and/or other measures are to be provided to ensure adequate safety against excessive toe seepage.

D. Design sheet piling to minimize groundwater infiltration laterally and vertically into the IB and therefore minimize solidification volumes.

1.06 SUBMITTALS

A. Certifications and Qualifications:

1. Installer Certification: Provide documentation of installer qualifications. Include number of years continuously engaged in pile installation and summaries of representative Project experience. Provide resumes for key personnel, including project manager, onsite superintendent/foreman and equipment operators.

2. Professional Engineer’s Certification: The excavation support systems, Shop Drawings, calculations, and test reports shall be prepared, sealed, and signed by a professional engineer currently registered in the State of Mississippi. The CONTRACTOR shall select an engineer with experience in the design and construction of excavations and excavation support systems and shall submit the selected engineer’s resume demonstrating such experience.

B. Excavation Support Installation Plan:

1. Prepare and submit a written schedule and procedure, along with detailed drawings, of the proposed excavations and excavation support systems.

2. Include installation procedures and excavation sequence. The plan shall reference specific equipment makes/models and pile driving accessories, quality control measures, welding procedures, and protection measures for existing structures and facilities.

3. Identify contingency measures that the CONTRACTOR would employ in response to difficult subsurface conditions, including but not limited to, different hammer sizes and vibratory frequencies and attempts to partially extract and then re-advance a given sheet. Also, include contingency plans for excessive wall movements.

4. Plan shall also include the materials to be used during sealing activities and application techniques.

C. Shop Drawings: Submit Shop Drawings and specifications for support systems. Include the following:

1. Specific description of field quality control measures. Include description of equipment and means used to ensure that tight interlocking joints are maintained for minimizing water seepage through the sheet pile interlocks.

2. Details and specifications of template components used to ensure vertical and horizontal alignment is maintained during sheet pile installation. The template shall indicate the proposed sequence of driving of the piles.

3. Provide complete dimensions and details of sheet pile sections, including special fabrications.

4. Assembly and erection details of members and connections for the system.

D. Product Data:

1. Mill test documentation for piling and structural steel to be used on the Project.

2. Manufacturer’s data that indicates the structural properties of the piling and structural steel section(s) to be used, including I, S, moment capacity, thickness, and width/depth dimensions.

3. Certification that each pile hammer delivered to the site is suitable for the anticipated conditions and pile types, including with regard to impact energy, static weight, and overhead clearance.

4. Manufacturer’s data sheets on cranes and driving equipment.

E. Calculations: Submit appropriate design calculations so support Shop Drawings. Include maximum theoretical deflections of supporting members. Include calculations indicating the expected magnitude of lateral and vertical movement.

1.06 PROJECT CONDITIONS

A. It is the CONTRACTOR's responsibility to thoroughly review the removal areas and the available information concerning subsurface conditions. From this review, the OWNER anticipates that the CONTRACTOR will understand the scope of the sheet pile installation and the nature of the subsurface conditions that may be encountered during installation.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General:

1. All materials shall be new and undamaged, unless otherwise directed by the ARCADIS or OWNER, and shall conform to pertinent AISC, ANSI, ASTM or other industry standards.

2. All materials and work for structural steel and miscellaneous metal work shall be in conformance with applicable provisions of the latest edition of the AISC *Steel Construction Manual*.

3. All members and parts, as delivered and erected, shall be free of winds, warps, local deformations, or unauthorized bends. Holes and other provisions for field connections shall be accurate and shop checked, so that proper fit will result when the units are assembled in the field.

4. Structural steel and miscellaneous metal shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

B. Steel Sheet Piling

1. ASTM A572, Grade 50, continuous interlocking type, of sizes indicated on reviewed Shop Drawings, with suitable handling holes.

2. Sheet pile sections shall be without discontinuities that may affect the ability to drive vertical/plumb and water tightness.

3. Splicing of sheet piling is not permitted unless approved by the OWNER.

C. Components

1. Structural Plates and Shapes shall meet or exceed ASTM A36.Components

2. Welding Materials: AWS D1.1; type required for materials being welded.

D. Equipment for Sheet Pile Installation:

1. Vibratory hammer: Vibratory hammer shall be high frequency, variable moment and shall have sufficient energy to drive the sheet piles to the depths indicated on the reviewed Shop Drawings with the subsurface conditions that exist at the Site.

E. Polyurethane Waterstop Sealant

1. Gunnable single component hydrophilic mastic.

2. Swells to approximately 200% of its original volume when in contact with water and resists hydrostatic pressures of up to 492 feet of water column.

3. Sealant shall be Swellseal®WA as manufactured by De Neef Construction Chemicals, Inc. or approved equivalent.

4. Contractor shall confirm that the polyurethane sealant is compatible with the sludge encountered in the IB.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, dewatering, and other hazards that could develop during excavation support and protection system operations.

B. The CONTRACTOR shall identify the presence of underground utilities within the pathway of the proposed excavation support systems. All underground utilities located within the pathway shall be removed, relocated, protected, or abandoned to facilitate installation of the steel sheet pile.

C. Provide adequate clearance of support and protection systems within work areas to allow for proper installation/construction of required site features.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or leaks.

E. Damages to or destabilizing adjacent facilities, structures, pavement and/or earthen slope caused by activities associated with the installation or removal of the excavation support systems shall be promptly repaired at the CONTRACTOR's expense.

F. Determine layout of sheet piles by survey.

G. Locate and protect all underground utilities, piping, structures, etc.

H. Locate and protect all aboveground utilities, structures, etc.

3.02 INSTALLATION REQUIREMENTS

A. Install excavation support systems for safety and preservation of IB sidewalls and adjacent facilities.

B. Construct support systems in accordance with reviewed Shop Drawings and in a manner that will ensure that supported faces will be stabilized.

3.03 INSTALLATION OF SHEET PILING

A. Drive piles with equipment suitable for the conditions encountered. The method and equipment selected shall deliver the necessary energy to drive the piling to the required depths and minimize damage to each end of piling and adjacent interlocks. Suitable procedures must be employed to prevent damage to pile tops and joints. Methods of driving shall conform to reviewed Shop Drawings and procedures.

B. The CONTRACTOR shall remove any material that stops driving prior to continuation of driving, or develop an alternative methodology, reviewed by the ENGINEER, for completing sheet pile system installation.

C. Drive sheet piles in plumb position, with each pile interlocked with adjoining pile for its entire length so as to form a continuous diaphragm throughout the length of each run of wall. Drive to depth indicated on reviewed Shop Drawings.

D. Sheet piles shall be within one percent of pile length and within 2 inches of the plan location indicated on the reviewed Shop Drawings.

E. Sheet pile shall be constructed so as to keep the excavations free from earth or surface water runoff (into the excavation).

F. Sheet pile shall be installed using a template to maintain vertical and horizontal alignment during installation.

G. Sheet pile shall be constructed to meet all safety requirements.

H. All sheet piles interlocks shall be sealed. The CONTRACTOR shall minimize leakage through the sheet pile joints (and other locations as required) by water proofing the interlocks as described below. The CONTRACTOR is responsible for all delays, repairs, or additional work resulting from improper sealing of sheet pile interlocks at no cost to the Owner.

I. Apply polyurethane waterstop, gunnable sealant as follows:

1. Must not be applied at ambient temperatures below 40ºF.
2. The female interlock must be wire brushed clean and air blown so there is no scale, dust or debris in the annular space of the interlock. Immediately after cleaning by the

above procedure and prior to application of the sealant, the female joint must be heated by flame (using a propane torch, or similar) to evaporate any moisture.

3. Apply sealant into the female section and move the material such that it is has an even thickness within the interlock (by mean of a brush, or similar). The interlock should be coated but not over coated (to prevent the male section from dragging on the sealant during installation of the sheet pile). Use of an electric caulking gun (Albion or similar) is recommended for consistency and to increase productivity.

4. The 10.5 oz. caulk tubes will yield approximately 20 linear feet coverage, and the 20.0 oz. caulk tubes (used with the electric gun) will yield approximately 40 linear feet of coverage using an average annular space interlock joint.

5. Drive the sheet pile (immediately as needed) or store them up to one month (the joint must be kept dry prior to installation). Stored sheet pile must be protected from precipitation or other weather conditions that may react with sealant materials. Any sealant that has prematurely expanded prior to driving must be removed, the female interlock re-cleaned, and the sealant re-applied.

6. Check the maximum annular space in the interlock area to ensure that enough sealant is being applied.

J. Set Up Sheet Piles

1. Care should be maintained during pile pick-up to prevent damage due to excessive bending or twisting while positioning pile for driving. In the opinion of the ENGINEER, twisted or bent pile sections may be rejected from use.

2. Monitor, prevent, and correct any tendency of sheet piles to bend, twist or rotate, and to pull out of interlock. Care must be maintained throughout the installation process to ensure that piles do not declutch. The integrity of each pile and interlocked joint must be maintained during and after driving.

3. Piles damaged or driven outside the above tolerances shall be replaced. Any sheet pile ruptured in the interlock or otherwise damaged during driving shall be immediately pulled and replaced.

4. The CONTRACTOR shall take necessary precautions to ensure adjacent piles do not penetrate deeper during pile installation.

5. The CONTRACTOR shall pull any sheet pile that is known to have pulled out of interlock or is suspected of having tip or interlock damage.

3.04 RECORDS

A. Provide accurate records of each pile installed. Submitted records shall include the following information:

1. Pile identification number, along with location.

2. Date and time of driving, plus start and finish times and total driving time.

3. Model of hammer and energy rating.

4. Elevation at top of pile and elevation of existing grade.

5. Length of pile in the ground when driving is complete.

6. Sheet pile installation records that include rate of penetration in feet/minute, as well as changes in rate of penetration and depth at which change occurred.

7. Detailed remarks concerning alignment, obstructions, etc.

B. Mark identification number clearly visible on each pile with a waterproof marking device, within two feet of the top, before driving is initiated.

C. Spray paint all piles rejected from the work for any reason, at the time of rejection, with the letter “X” within three feet of both ends.

3.05 REJECTION

A. If excavation system components are rejected from the work because of deviation from location, plumbness requirement, excessive bending, twisting, pulling out of interlock, or other reasons, the CONTRACTOR shall take suitable corrective action at no additional cost to the Owner and such corrective action shall be reviewed by the ARCADIS. Suitable action includes extracting, furnishing, and driving of replacement piles, so that all piles installed meet the requirements of this Section and as indicated on the reviewed Shop Drawings.

3.06 EXTRACTION AND REPAIRS

A. Remove excavation support and protection systems when reviewed by ARCADIS and when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities; repair the above items as needed.

B. Once the sheet pile is extracted the sealant can be removed from the female joint by the hand peeling method (or wire brush as needed).

C. All sheet pile interlocks must be checked for damage and must be properly cleaned in accordance with the sealant manufacturer’s requirements prior to reuse.

3.07 PROVISIONS FOR REUSE OF PILING

A. Following extraction, the CONTRACTOR shall clean/decontaminate steel sheet piles and inspect for any damage that may have occurred while driving and/or extracting the piling.

B. Decontamination of all sheet piles shall be performed prior to demobilization from the site. Decontamination shall be performed in the identified decontamination area.

C. All piling must be review by ARCADIS for reuse prior to re-driving.

3.08 REMOVAL AND DECONTAMINATION OF SHEET PILING

A. CONTRACTOR shall remove all sheet piling and remove from the facility. Contractor shall provide a discount in the bid form if there is a cost savings to leave the sheet piling in place.

B. The CONTRACTOR shall decontaminate all equipment, vehicles and personnel that come into contact with impacted materials during sheet pile installation and/or removal. All cost associated with the decontamination and collection and containerization of decontamination water/sediments to be included in the cost of the sheet pile demobilization.

END OF SECTION

SECTION 02270
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, equipment, tools, and labor to construct temporary erosion and sediment control systems.

B. The Work to be performed includes, but is not limited to, sediment control structures (i.e., earthen dam), silt fences, diversion ditches, culverts, sedimentation baffles, and site surface drainage.

C. Maintain temporary erosion and sediment control structures throughout the life of construction activities, and in accordance with state and local rules and regulations.

D. Comply with the site Storm Water Pollution Prevention Plan (SWPPP) provided by OTHERS. Submit an equipment staging and arrangement drawing for review to be incorporated into the site SWPPP.

1.02 SUBMITTALS

A. Product data shall be submitted as indicated in Section 01300 - SUBMITTALS.

PART 2 - PRODUCTS

2.01 SURFACE-WATER CONTROL MATERIALS

A. Silt Fence

CONTRACTOR shall supply silt fence to control surface-water runoff and sediment. Acceptable silt fence material shall be as follows:

- Propex-Silt Shop;
- Mirafi 700X;
- Beltech 755; or
- An approved equal.

CONTRACTOR shall submit manufacturer’s product data to ARCADIS for approval.

B. Straw Bales

CONTRACTOR shall supply straw bales in sufficient quantities to be used for sedimentation control as needed.

C. Storm Sewers

CONTRACTOR shall evaluate the location of the site storm sewers and implement acceptable filtering techniques of any surface water in contact with project related disturbances that may reach the storm sewer. CONTRACTOR shall ensure that surface water in contact with project related disturbances is properly treated.

D. CONTRACTOR shall divert surface water from directly flowing into the IB via land surface. For instance, some surface water may be able to flow directly into the IB from the west.

PART 3 - EXECUTION

3.01 HANDLING

A. Materials shall be handled in such a manner as to prevent damage to the material. Materials shall not be dropped or dragged over the ground. Any materials damaged shall be replaced at no expense to the OWNER.

3.02 SURFACE-WATER CONTROL STRUCTURES

A. Silt Fence: CONTRACTOR shall install silt fence in accordance with the Specifications and installation instructions provided by the Manufacturer or on the Project Drawings or as directed by the ENGINEER.

3.03 MAINTENANCE

A. Silt fence and other structures will be checked weekly and after each rainfall event.

B. Repairs/replacement will be accomplished as required to keep Silt Fence and other structures in sound condition and function properly.

C. Excavation of trapped sediment will be accomplished to maintain hydraulic control. Sediment will be placed in stockpile area or as directed by ENGINEER.

3.04 REMOVAL

A. CONTRACTOR is required to remove silt fence and other erosion control structures until vegetation is adequately established in accordance with applicable rules and regulations and the site SWPPP.

END OF SECTION

SECTION 02936
SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section includes, but is not limited to, furnishing all equipment, tools, materials, and labor necessary for establishing temporary and permanent vegetative cover, e.g., seeding, fertilizing, and mulching, on all areas as designated by ARCADIS or the OWNER.

1.02 REFERENCES

A. The following publications of the issues listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

FEDERAL SPECIFICATION (Fed. Spec.)
O-F-241D Fertilizer, Mixed, Commercial

U.S. DEPARTMENT OF AGRICULTURE
Federal Seed Act of 9 August 1939 (53 Stat. 1275)

Soil Conservation Service (local office)

1.03 GENERAL REQUIREMENTS

A. The specified seed varieties and quantities shall be uniformly distributed over all ground areas disturbed by grading and/or trenching and not otherwise surfaced and in such manner that will produce an even stand of grass over the entire area seeded. The CONTRACTOR shall notify the OWNER at least 10 days prior to seeding operations.

1.04 SOIL TEST

A. The CONTRACTOR shall perform Agricultural Soil Tests to determine fertilizer requirements for permanent seeding. Test reports shall be submitted to the OWNER in accordance with paragraph 1.05 of this Section.

1.05 SUBMITTALS

A. Certificates of Compliance or Reports:

1. Seed;
2. Fertilizer;
3. Lime; and
4. Agricultural Soil Test Report.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. During delivery, seed shall be protected from any drying or contamination by detrimental material.

2. Seeding material shall be inspected upon arrival at the job-site. Unacceptable material shall be immediately removed from the job-site by the CONTRACTOR.

3. Fertilizer shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state and federal law.

B. Storage

1. Seed and fertilizer shall be stored in cool, dry locations away from contaminants.

2. Materials shall be stored in areas designated or approved by the OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed shall be a mixture of seed for all growing seasons and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed-seed content, and inert material. Labels shall conform with USDA Federal Seed Act, Rules & Regulations and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. The CONTRACTOR must contact the local office of the Soil Conservation Service to determine the best seed mixture and application.

B. Fertilizer shall be controlled-release, commercial grade, granular free flowing, uniform in composition, delivered in fully labeled sealed containers, and shall conform to applicable state and federal regulations. Fertilizer shall conform to Fed. Spec. O-F-241, and shall bear the manufacturer's guaranteed statement of analysis. Granular fertilizer shall be in accordance with the nutrient requirements identified by the soil test required in Paragraph 1.04.

C. Topsoil

Specified under Section 02223 BACKFILLING

D. Mulch

1. Straw Mulch shall be stalks from oats, wheat or rye that are free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50 percent by weight of the material to be 10 inches or longer. Straw shall be in an air-dry condition and suitable for placing with blower equipment.

2. Hydro Mulch Overspray Tackifier, if used, shall be the same as, or equal to, a recycled slick paper (containing wood cellulose and kaolinite clay), shall not contain any growth or germination-inhibiting factors, and shall be dyed an appropriate color to facilitate visual metering during application. Slick paper composition on air-dry weight basis: 8 percent moisture maximum, pH 4.5 - 6.5. When added to water, it shall form a homogenous slurry specifically for use in hydraulic mulching equipment. This material when sprayed on the straw mulch becomes a tackifier/binder and provides a stable bed for seed germination.

E. Water shall be of a quality suitable for irrigation.

PART 3 - EXECUTION

3.01 DATES FOR SEEDING

A. Temporary seeding shall be performed where exposed surfaces are not to be exposed from 30 days to 1 year, or as directed by the OWNER.

B. Permanent seeding shall be performed where exposed soil surfaces are not to be disturbed for greater than 1 year, or as directed by the OWNER, or upon completion of final grading activities.

3.02 PREPARATION OF SEEDBED

A. General

The CONTRACTOR shall place topsoil and establish finish grades.

B. Tillage

The soil shall be tilled to a depth of at least 4 inches by plowing, disking, harrowing, or rototilling. When drought, excessive moisture, or other unsatisfactory conditions prevail, the Work shall be stopped. The soil surface shall be leveled to meet finish grade requirements before seeding. Seedbed preparation shall be performed on the contour to reduce soil loss. On slopes 2 horizontal to 1 vertical (2:1) and steeper, minimum tillage depth shall be 2 inches.

C. Application of Fertilizer and Lime

Fertilizer shall be incorporated into the soil to a depth of 4 to 6 inches during seedbed preparation.

D. Fertilizer and Lime Rate

Fertilizer and lime shall be applied at a minimum of 16 percent nitrogen and 48 percent phosphoric acid or at the rate determined by the results of the CONTRACTOR's Agricultural Soil Test.

3.03 PLANTING SEED

A. Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate specified herein.

B. Seed planting shall be accomplished by one of the following methods:

1. Broadcast Seeding

The CONTRACTOR shall broadcast seed by hand or with approved gravity or cyclone types of spreading equipment. Broadcast seedings shall be covered to an average depth of 1/4 inch. Completed seeding shall be mixed into soil with a harrow or rake and compacted with a cultipacker-type roller providing 60 to 90 pounds weight per linear foot of roller, or by equivalent approved hand rolling or compacting methods. Broadcast seeding will not be permitted when wind velocity is such as to prevent uniform seed distribution.

2. Drill Seeding

The CONTRACTOR shall plant seed with a Brillon type grass seed drill equipped with seeding mechanisms, agitator, double disk furrow openers and packer wheels. The seed drill shall plant, cover and compact the seedbed in the same operation. The distance between drill rows shall not be more than 3 to 4 inches apart with planting depth of 1/4 - 1/2 inch. Drill seeding is recommended over broadcast for large areas of seeding.

3. Hydroseeding

If hydroseeding is used and the seed and fertilizer is mixed, they shall be mixed on site and the seeding shall be immediate and without interruption.

C. Mulching

The CONTRACTOR shall perform mulching on the same day as planting seed.

1. Applying Mulch

Straw mulch shall be spread uniformly in a continuous blanket over the seeded areas, using 2 tons of material per acre. The mulch shall be spread in such manner as to prevent bunching.

2. Securing Mulch

Immediately following (the same day) the spreading of the mulch, the material shall be anchored securely to the soil by use of the Hydro Mulch Overspray Tackifier material. The material shall be applied by a hydroseed blower. The material shall be applied in a raining technique to prevent bunching and displacement of the straw mulch.

3.04 PROTECTION AND CLEANUP

A. After seeding and mulching operations have been completed, barricades and approved warning signs shall be erected by the CONTRACTOR as required to provide protection against traffic and trespass. Excess material from seeding and mulching operations, and all debris, shall be cleaned up and disposed off site.

3.05 ESTABLISHMENT AND MAINTENANCE PERIOD

A. Establishment Period

The CONTRACTOR is responsible for the establishment and maintenance of permanent seeding for a minimum period of 365 days from the date of application.

B. Maintenance Period

The CONTRACTOR shall be responsible for maintenance of seeding until receiving the Certificate of Final Acceptance. Maintenance activities performed by the CONTRACTOR shall include:

1. Eroded or damaged seeding shall be repaired and reseeded by the CONTRACTOR.

END OF SECTION

DIVISION 2 - SITE WORK

SECTION 13700
TEMPORARY ENCLOSURE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish, obtain necessary permits, complete any design required, install, test, and place into satisfactory operating condition a temporary, pre-engineered, stressed membrane enclosure(s) over the IB prior to sludge solidification and removal activities.

B. Furnish, obtain all permits, and install a ventilation system for the temporary enclosure to induce a negative pressure within the structure to ensure that all vapors and odors emitted from the sludge during solidification and removal are captured and treated.

1.02 RELATED SECTIONS

A. Section 02240 – Sludge Removal and Mechanical Dewatering

B. Section 02245 – Odor Mitigation and Monitoring

1.03 REFERENCES

A. Underwriters Laboratory (UL)

B. American Society for Testing and Materials (ASTM)

C. National Fire Protection Association (NFPA)

D. Uniform Building Code (UBC)

1.04 QUALITY ASSURANCE

A. Stressed membrane enclosure supplier shall be a proven, established manufacturer and have a minimum of ten (10) years experience in the design, fabrication, and delivery of enclosures with the same specifications as outlined herein, with at least 20 existing installations in North America.

B, Upon completion of the temporary enclosure, furnish the Owner with two copies of the manufacturer’s guarantee for the following items.

1. The materials used in the temporary enclosure shall carry a guarantee against defects in composition, design, and workmanship for a period of six (6) months or the project duration, whichever is shorter.

2. The erection and installation of the temporary enclosure shall carry a guarantee against defects in workmanship for a period of six (6) months the project duration, whichever is shorter..

1.05 DESIGN CRITERIA

A. The following design criteria shall be followed in designing the temporary enclosure:

   1. Wind Load – 90 miles per hour exposure C.

   2. Seismic Design Criteria:

      a. Seismic Use Group: I
      b. Site Class: F

B. The building systems shall be designed and constructed in accordance with all applicable state and local building codes (latest editions).

C. If the temporary enclosure does not span the entire IB, the structure must be movable to ensure that the solidification working area of the IB is covered.

1.06 SUBMITTALS

A. Shop Drawings

   1. Submit detailed Shop and Erection Drawings showing all pertinent information necessary for the fabrication, anchoring and erection of the temporary enclosure system.

   2. All Shop Drawings shall be signed and sealed by a licensed Professional Engineer (P.E.) registered in the state of Mississippi.

B. Design Computations

   1. All design computations shall be signed and sealed by a licensed P.E. registered in the state of Mississippi.

   2. All loads and reactions for the proper design of the foundation shall be supplied by the system manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

   1. The structure shall be a stressed membrane enclosure sized to cover the limits of the IB, and allowing for sufficient space for sludge stabilization and removal activities.

2. The enclosure shall be equipped with leg extensions, cable bracing, based plates, double panel rolling doors, man doors, metal halide lights, ventilation system, and engineered stamped drawings.

3. The stressed membrane enclosure supplier shall guarantee the compatibility of the system components.

B. Structure

1. No exterior guy ropes or cables shall be used for anchoring the structure.

2. No external horizontal purlins shall be utilized.

3. The structure shall be completely clear-span with no interior supports of any description.

4. Any required miscellaneous steel components, such as anchor bolts, cable bracing, base assemblies, or attachment brackets, shall be zinc-plated or galvanized, with a minimum Grade 5 specification.

5. All aluminum components and main supports shall be a natural mill finish, unpainted and unanodized, to prevent scratching and chipping.

6. The main structural support beams shall be continuous from the base plate at grade to the peak and manufactured in such a way that no eave exists.

7. All major structural aluminum components shall have minimum structural and mechanical properties as determined by the Contractor’s design engineer.

C. Architectural Membrane

1. The architectural membrane in the structure shall be installed in the aluminum frame and tensioned both vertically and horizontally to prevent wear and abrasion. Horizontal tension shall be maintained mechanically with horizontal purlins or spreaders that require no ongoing maintenance.

2. The architectural membrane, when assembled and tensioned shall be absolutely wrinkle free, and shall remain so indefinitely in hot and cold temperatures.

3. The track system which holds the architectural membrane to the main structure support beams shall be removable to allow for quick interchangeability of membrane. The structure shall be designed so that any section of the architectural membrane may be removed or replaced within 15 minutes using a maximum of four workmen.

4. The structure shall be modular in design consisting of individual membrane panels which do not exceed 15 feet in width on the main center modules.

5. The individual architectural membrane panels on the center modules shall be one continuous section from one side, over the peak and down to the base at the other side, and manufactured in such a way that no eave will exist.

6. In order to provide the introduction of natural light for daytime use, a continuous section of highly translucent white architectural membrane (skylight) shall be incorporated into the membrane along the peak of the structure. To minimize internal solar gain in the structure, the balance of the exterior architectural membrane shall be Salem Blue/Granite Grey in color and complete with a blackout layer.

7. All exterior architectural membranes on the structure shall come complete with a protective exterior coating (polyurethane or Tedlar®) on the exterior surface of the membrane. The membrane shall possess the following minimum quality Specifications:

    a. Architectural membrane shall possess fire ratings that meet National Fire Protection Association-701, Underwriters' Laboratories, ASTM E84, ULC S109, and UBC 31-1.

D. Enclosure Accessories

1. Enclosure accessories, such as base plates, door openings, lighting, shall be compatible with system components.

2. All personnel doors and windows shall be installed in such a way that the vertical and horizontal tension on the architectural membrane is maintained at all times.

    a. All personnel doors must come complete with a protective all-weather hood system to shed rain away from in front of doors.

E. Ventilation System

1. Ventiliation system shall be comprised of fan, louvers, blowers that will provide a minimum number of air exchanges and treatment system components in the CONTRACTOR's approved Odor Mitigation Plan (as specified in Section 02245 – Odor Mitigation and Monitoring).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install temporary enclosure(s) in strict accordance with the manufacturer's installation instructions and approved Shop Drawings.

B. Arrange for the temporary enclosure supplier to furnish the services of a qualified technical consultant on site for the duration of the erection of the enclosure to provide information about the enclosure assembly and erection. All costs for this consultant shall be included in the bid price.

C. Enclosure supplier shall supply all specialized hand tools required for erection of the enclosure.

D. CONTRACTOR will be responsible for securing the temporary enclosure potentially including the removal of the architectural membrane if hazardous weather conditions are imminent such as a hurricane or tropical storm.

END OF SECTION

Appendix C

Sludge Core Logs, December 2014

SAMPLE / CORE LOG

Boring/Well: Cell #1 **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/18/2014 **Drilling Completed:** 12/18/2014

Land-Surface Elev.: NA **Surveyed:** _____ **Estimated:** _____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

〰 Fill
▨ Silty Clay
▥ Silt
▦ Sandy Silt
▦ Silty Sand
▮ Acetate Sleeve
▽ Water First Encountered
▧ Clay
▨ Sandy Clay
▧ Clayey Silt
░ Sand
▨ Clayey Sand
▩ Split Spoon
▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0									
1		0.67	〰	WATER FILL: Black sludge, loose, wet to soft					
2		3	〰	- moist from top to bottom of section				145	
3			〰						
4		0.33	〰	- gravel, dry, light gray with some subangular, medium to large				28.2	
5		2.5	〰	- sludge, moist, soft, waxy, light gray and black, some light brown and yellow throughout				1,065	
6			〰						
7		0.33	〰	- silty clay, very uniform, dry, medium stiff, gray - Total Depth 6.83 ft bls				66.1	
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #2A **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ______ **Estimated:** ______ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

Fill · Silty Clay · Silt · Sandy Silt · Silty Sand · Acetate Sleeve · ▽ Water First Encountered

Clay · Sandy Clay · Clayey Silt · Sand · Clayey Sand · Split Spoon · ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0		1.33		WATER					
1		1		FILL: Black sludge, loose, saturated					
2		0.5						9.9 77.0	
3				- dark gray with some white fill chuncks, sludge, soft, very moist					
4		2.5		- light brown with yellow striations, waxy sludge, very soft, very moist				50.8	
5				- Total Depth 5.33 ft bls					
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #2B **Project No.:** Hercules/LA002999.0023.00003 **Page** 1 **of** 1

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

〰 Fill ▧ Silty Clay ▥ Silt ▦ Sandy Silt ▤ Silty Sand ◧ Acetate Sleeve ▽ Water First Encountered

▨ Clay ▩ Sandy Clay ◫ Clayey Silt ⁘ Sand ▦ Clayey Sand ⊠ Split Spoon ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1			〰	FILL: Black sludge, loose, saturated					
2		0.5	〰					6.0	
3		1.5	〰	- dark gray, sludge, very soft, very moist				63.9	
			⁘	SAND: Fine to medium, well sorted, very moist, well consolidated, tan					
4			⁘	- medium to coarse, poorly sorted, moist with some large to very large subround pebbles, tan to brown				315	
5		3.5	⁘	- Total Depth 5.50 ft bls				12.3	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #2C **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▨ Sandy Silt	▨ Silty Sand	◧ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▨ Sand	▨ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H V	PID (ppm)	REMARKS
0				WATER				
1				FILL: Black sludge, loose, saturated				
2				- light gray, sludge, very soft, wet,				
3		3		- light brown, sludge, yellow, waxy, very soft, wet			181	
4				SAND: Fine sand, very moist, very well sorted, tan				
5								
6		2.5					214	
				- Total Depth 6.5 ft bls				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #2D **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

Fill	Silty Clay	Silt	Sandy Silt	Silty Sand	Acetate Sleeve	▽ Water First Encountered
Clay	Sandy Clay	Clayey Silt	Sand	Clayey Sand	Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0		1.25		WATER					
1		0.5		FILL: Black sludge, loose, saturated					
2				- light brown and yellow, waxy, sludge, very soft, very moist					
3		2						886	
4		1		SANDY SILT: Very fine sand and silt, moist, well sorted, tan				1,547	
5				SAND: Fine to medium sand, moist, well sorted, brown to light brown					
6		2						129.0	
7		0.5		SILTY CLAY: Light gray - Total Depth 7.25 ft bls				212.0	
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #3 **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/18/2014 **Drilling Completed:** 12/18/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◨ Acetate Sleeve	▽	Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	░ Sand	▦ Clayey Sand	▩ Split Spoon	▼	Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP		PID	REMARKS
						H	V	(ppm)	
0									
		1.67		WATER					
1									
2		1.5		Black sludge, loose, saturated					
3								19.8	
4		1.0		- gray, sludge, wet, soft with brown oily liquid oozing from section				169.0	
5		2.0		- black, gray, and white, sludge, moist, soft				411	
6									
		0.25		- silty clay, moist, stiff, light gray - Total Depth 6.42 ft bls				68.3	
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #4A **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▩ Sand	▦ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, black, shinny, trace of nodules, saturated, loose					
3				- sludge, black fiberous, granular material				120	
4				- yellow streaks, waxy, stiff, black, granular, wet				696	
5				- Total Depth 4.5 ft bls					
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #4B **Project No.:** Hercules/LA002999.0023.00003 **Page** 1 **of** 1

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

≋ Fill
▨ Silty Clay
▥ Silt
▦ Sandy Silt
▦ Silty Sand
◧ Acetate Sleeve
▽ Water First Encountered
▨ Clay
▨ Sandy Clay
▧ Clayey Silt
⁘ Sand
▨ Clayey Sand
⊠ Split Spoon
▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1				Sludge, black shinny, trace of nodules, saturated, loose					
2				- sludge, tan light yellow, waxy, some granular material, saturated, loose				21.2	
3			⁘	SAND: Very fine to fine grain, black, wet, loose				743	
4			⁘	- fine to medium grain, black to dark gray, wet, loose - medium to coarse grain pea gravel, wet, loose				282	
5				- Total Depth 5 ft bls				236	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #4C **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill ▨ Silty Clay ▥ Silt ▦ Sandy Silt ▦ Silty Sand ◧ Acetate Sleeve ▽ Water First Encountered

▨ Clay ▨ Sandy Clay ▥ Clayey Silt ⁘ Sand ▦ Clayey Sand ▩ Split Spoon ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, black, shinny, granular material, saturated, loose - waxy layer, wet, soft				21.2	
3			⁘	- sludge sand mix, dark gray, tan, light yellow SAND: Fine to medium grain, gray, pea gravel, wet, loose				743	
4			⁘	- 4 inch black layer, very fine grain - yellow layer				282	
5				- gray - Total Depth 5 ft bls				236	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #4D **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/17/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

Fill
Silty Clay
Silt
Sandy Silt
Silty Sand
Acetate Sleeve
▽ Water First Encountered
Clay
Sandy Clay
Clayey Silt
Sand
Clayey Sand
Split Spoon
▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP		PID (ppm)	REMARKS
						H	V		
				WATER					
1				Sludge, black, shinny, saturated, loose					
2								10.7 1,501	
3				- sludge, tan to light yellow, waxy, some granular material, sticky, wet, soft					
4			▨	- sludge, black, granular material, saturated, loose SILTY CLAY: Light gray with black streaks, damp to dry				240 141	
5				- Total Depth 5 ft bls					
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #5A **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ______ **Estimated:** ______ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill ▨ Silty Clay ▥ Silt ▦ Sandy Silt ▦ Silty Sand ◨ Acetate Sleeve ▽ Water First Encountered

▨ Clay ▨ Sandy Clay ▥ Clayey Silt ▩ Sand ▩ Clayey Sand ▦ Split Spoon ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2			▨	FILL: Dark gray sludge, some nodules, loose					
3			▨	- light gray sludge, slightly compacted				13.8	
4			▨	- dark black sludge, loose - brown to tan sludge, sticky, some nodules				26.7	
5				- Total Depth 5 ft bls					
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #5B **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Acetate Sleeve | ▽ Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2									
3									
4				FILL: Sludge, dark black, shinny, some light gray streaks, slightly compact					
5				- dark black sludge, loose, wet				186	
6				- Total Depth 6.5 ft bls				22.8	
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

SAMPLE / CORE LOG

Boring/Well: Cell #5C **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

- ≋ Fill
- ▨ Silty Clay
- ▥ Silt
- ▦ Sandy Silt
- ▦ Silty Sand
- ◧ Acetate Sleeve
- ▽ Water First Encountered
- ▨ Clay
- ▨ Sandy Clay
- ▥ Clayey Silt
- ░ Sand
- ▦ Clayey Sand
- ▩ Split Spoon
- ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2									
3									
4									
5									
6			≋	FILL: Sludge, black, very loose					
7			≋					16.8	
8			≋	- sludge, dark black (ice cream consistency), loose				21.6	
9				- Total Depth 9 ft bls					
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #5D **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

≋ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◨ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	░ Sand	▦ Clayey Sand	⊠ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, dark black, wet, loose					
3								165	
4				- brown, tan, sludge, soft, sticky					
5								275	
6			▨	- sludge, black, wet, loose SILTY CLAY: Light gray, dry, hard				545	
7				- Total Depth 7 ft bls				180	
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #6A **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

≋ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	▮ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	░ Sand	▦ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, dark black, shinny, sheen, saturated, loose					
3									
4				- sludge, black, granular material					
5				- 2 inch pale white layer					
6			▨	SILTY CLAY: Gray, trace of very fine grain in top, dry, loose - Total Depth 6 ft bls					
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #6B **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▦ Sand	▦ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, black, shinny, sheen, saturated, loose				68.1	
3				- sludge, brown to light brown, saw dust like material, dry, loose				175	
4			▨	- sludge, black, granular like material, wet, loose SILTY CLAY: Gray, dry, loose				256	
5				- Total Depth 4.5 ft bls				18.2	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #6C **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▒ Sand	▨ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP		PID (ppm)	REMARKS
						H	V		
0				WATER					
1									
2				Sludge, black, nodules, saturated, loose					
3								16.2	
4				- sludge, browns, trace of light yellow, saturated, (sawdust like), damp, loose				38.1	
5				- sludge, black, granular material, damp, loose - trace of silt at bottom				27.6	
6				- Total Depth 6 ft bls					
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #6D Project No.: Hercules/LA002999.0023.00003 Page 1 of 1

Site Location: Hattiesburg, Mississippi Drilling Started: 12/16/2014 Drilling Completed: 12/16/2014

Land-Surface Elev.: NA Surveyed: ____ Estimated: ____ Datum: NA

Drilling Fluid: None Drilling Method Used: Vibracore

Drilling Contractor: Devonian Driller: Alex Helper: Bronson

Prepared By: G. Cook/J. Radford Hammer Weight: NA Hammer Drop (inches): NA

▨ Fill	▨ Silty Clay	▥ Silt	▨ Sandy Silt	▨ Silty Sand	▮ Acetate Sleeve	▽	Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▨ Sand	▨ Clayey Sand	▩ Split Spoon	▼	Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1									
2				Sludge, black, shinny, sheen, nodules, saturated, loose					
3				- sludge, brown, tan, (sawdust like), damp, loose				38.1	
4				- sludge, black, granular, wet				797 36.1	
5			▨	SILTY CLAY: Gray, tan, loose - Total Depth 5 ft bls				10.1	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #7 **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/18/2014 **Drilling Completed:** 12/18/2014

Land-Surface Elev.: NA **Surveyed:** _____ **Estimated:** _____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▦ Sand	▦ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
2		3.33							
3			▨	FILL: Gray and light brown sludge, soft, very moist with some very fine sand and silt throughout					
4		0.92 0.42	▨	SILTY CLAY: Moist, stiff, light gray with some subround medium to large pebbles				219.0 332.0	
5				- Total Depth 4.67 ft bls					

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #8A **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

- ▨ Fill
- ▨ Silty Clay
- ▥ Silt
- ▦ Sandy Silt
- ▦ Silty Sand
- ◧ Acetate Sleeve
- ▽ Water First Encountered
- ▨ Clay
- ▨ Sandy Clay
- ▥ Clayey Silt
- ▒ Sand
- ▦ Clayey Sand
- ▩ Split Spoon
- ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0									
1									
				Sludge, dark black, trace of nodules, loose, wet					
2									
								43.4	
3									
				- tan, trace of light yellow, waxy, very soft					
4									
								217.0	
5				- sludge, black, shinny, some granular material, wet, loose					
			▨	SILTY CLAY: Light gray, pocket of dull green, soft				75.8	
				- Total Depth 5.5 ft bls				18.6	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #8B **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

≋ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽	Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▒ Sand	▨ Clayey Sand	▩ Split Spoon	▼	Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				WATER					
1				Sludge, black, some nodules, wet, loose					
2				- sludge, brown, trace of light yellow, waxy				31.6	
3									
4				- sludge, dark black, granular material, wet, loose				262	
5			▨	SILTY CLAY: Light gray, pocket of dull green, dry, stiff				63.8	
6				- Total Depth 5.5 ft bls				58.2	
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #8C **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

Fill	Silty Clay	Silt	Sandy Silt	Silty Sand	Acetate Sleeve	▽ Water First Encountered
Clay	Sandy Clay	Clayey Silt	Sand	Clayey Sand	Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP		PID	REMARKS
						H	V	(ppm)	
0				WATER					
1									
2									
3				Sludge, black, some nodules, saturated, loose					
4								93	
5				- sludge, tan, granular material, waxy, wet, loose				247	
6				- sand, black, shinny, saturated				156	
			▨	SILTY CLAY: Light gray, pockets of dull green, dry, soft				80	
7				- Total Depth 6.5 ft bls					
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: Cell #8D **Project No.:** Hercules/LA002999.0023.00003 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/16/2014 **Drilling Completed:** 12/16/2014

Land-Surface Elev.: NA **Surveyed:** ____ **Estimated:** ____ **Datum:** NA

Drilling Fluid: None **Drilling Method Used:** Vibracore

Drilling Contractor: Devonian **Driller:** Alex **Helper:** Bronson

Prepared By: G. Cook/J. Radford **Hammer Weight:** NA **Hammer Drop (inches):** NA

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Acetate Sleeve	▽	Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	▒ Sand	▨ Clayey Sand	▩ Split Spoon	▼	Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
				WATER					
1									
2									
3				Sludge, black and dark gray with light gray streaks, nodules, saturated, loose					
4				- sludge, tan and dark brown with light yellow streaks, waxy, with pockets of liquid				10	
5				- black, dark gray, nodules, trace of very fine grain sand, saturated				111	
6			▒	SAND: Very fine to fine, gray with black streaks, wet, loose				60	
7			▨	SILTY CLAY: Gray, black streaks with light gray streaks - Total Depth 7 ft bls				70 91.9	
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

ARCADIS

Appendix D

Sludge Treatability Analysis

APPENDIX D

Hercules, Inc.

Hattiesburg, Mississippi

Solidification and Odor Control Bench Test

Clean Harbors Environmental Services, Inc.

December 15-18, 2014

Clean Harbor Environmental Services, Inc. (CHES) performed field testing at the former Hercules Chemical plant in Hattiesburg, Mississippi (December 15-18, 2014). The testing was conducted using IB water and sludge, which were considered representative of the media in all structures.

1 Bench Test Objectives

The Solidification and Odor Control Bench Test (BT) had three objectives.

1. Identify additives (specifically Calciment [quick lime and Portland cement], cement kiln dust (CKD), lime, and/or zeolite) that will solidify partially dewatered IB sludge to a shippable and disposable consistency, e.g., the material will pass the Paint Filter Liquid Test (PFLT).
2. Identify additives (sawdust and polymer) that will solidify IB liquid to a shippable and disposable consistency, e.g., the material will pass the PFLT.
3. Identify if an oxidant (sodium percarbonate or potassium permanganate) can reduce the release, creation, or dispersal of unacceptable odors during water handling and treatment and during sludge handling, treatment, and curing.

2 Bench Test Tasks

The Bench Test tasks are summarized below.

2.1 Field Laboratory Mobilization

A field laboratory trailer was brought to the site. The enclosed, dual-axle trailer was placed adjacent to the IB at a location where potable water was available. A generator supplied electrical power. Equipment and furnishings of the laboratory trailer include:

1. A stainless steel table
2. A fume hood and lights above the table – The hood contained vapors and gases released by the sludge during storage, mixing, or treatment.
3. An exhaust fan, ducting, hoses, and valves would convey captured air and vapors through activated carbon or other media vessels.
4. Air intake at floor level – Used when sample containers were processed prior to bench testing.
5. Small and large capacity scales.
6. Testing and monitoring equipment and supplies, e.g., MiniRAE gas meter, infra-red thermometer.
7. Lights, louvers, vents, and heater
8. Desk and chair

2.2 Sludge Collection

Two CHES personnel collected samples from 5 of 8 areas within the IB on Tuesday, December 16. The workers wore Tyvek coveralls and nitrile and/or long rubber gloves in addition to Level D equipment. The areas sampled were:

- Cell 1 – Containing sludge to be disposed per hazardous waste regulations
- Cell 3 – Containing sludge to be disposed per hazardous waste regulations
- Cell 6 – Containing sludge to be disposed of as non-hazardous waste

- Cell 7 – Containing sludge to be disposed per hazardous waste regulations
- Cell 8 – Containing sludge to be disposed of as non-hazardous waste

Two methods of sludge collection were attempted. The most efficient involved a 10-foot length of 2-inch diameter, Schedule 40, polyvinylchloride (PVC) pipe. The pair of workers sampled from the concrete walk surrounding the IB. All samples for an area were collected from between the marks (placed by others) that designated each cell boundary.

The pipe was forced into the IB sludge at angles varying from 5-25 degrees from vertical by one CHES worker standing on the concrete surrounding the lagoon. He then withdrew the pipe sampler. Depending on the volume of sludge and water thought to be within the sampler by its weight and the effort required for sampler insertion and retrieval, the PVC pipe was inserted from 1 to 4 times at each sub-location within an single area. If more than one insertion occurred the pipe was not lifted above the surface of the water to minimize sample loss. The area from which the sampler was reinserted was typically 4 to 8 square feet.

After each insertion the open end of the 2-inch diameter PVC pipe above the water was closed with an expandable plug. The plug prevented the entry of air into the sampler, which maintained a slight vacuum and minimized the loss of its contents. The sampler was then raised above the surface of the water by the workers and the open end was positioned above the 5-gallon bucket assigned to that area. The expandable plug was then removed. The sampler was raised to a vertical position and shaken gently, which often loosened the sample and allowed it to fall into the bucket. If the shaking was not effective, the sampler was lowered to a near horizontal position with its open end above the bucket. A 10-foot length of 1-inch diameter PVC with its lower end capped, was inserted into the 2-inch diameter pipe pushing the sludge into the bucket. The 1-inch pipe was partially withdrawn and re-inserted between 5 and 10 times while the 2-inch pipe was rotated and shaken to maximize the transfer of sludge from the sampler to the bucket.

Twenty to thirty insertions of the sampler were necessary to recover approximately 4 gallons of sludge from each cell sampled. The 5-gallon bucket for the area was covered with a removable/re-sealable lid. All buckets were allowed to settle overnight.

2.3 Standing Water Sample Collection

Three (3), 200-milliliter (ml) clear glass bottles with removable/replaceable lids were filled with water from each of the five 5-gallon buckets on Wednesday, December 17. Each bottle was weighed first. Approximately 150 milliliters (mls) of water from a single bucket was transferred to each bottle using a plastic container filled via vacuum. This procedure minimized disturbance and re-suspension of the settled sludge. The lid was re-placed on each bucket as soon as the three bottles had been filled.

Each bottle was then re-weighed to determine its total weight. Specific information regarding each bottle is in Appendix 1.

2.4 Free Liquid Capture Testing

Five 200-ml bottles, each containing approximately 150 mls of water from one of the five areas of the IB, were tested. Waste Lock 770, a super-absorbent polymer (SAP), was added until there was no free liquid visible. An average of approximately 2.5 grams of Waste Lock was needed to gel each 150 ml aliquot of liquid. However, some bottles may have had a small amount of free phase organic liquid present among the expanded Waste Lock pellets.

Approximately 25 pounds of surface water from Area 7 of the IB was also tested. Six-tenths of a pound of Waste Lock770 was added at 8:40 AM on December 18, 2014. The mixture was stirred with a spoon for approximately 20 seconds. No free liquid was present at 9:02 AM. The gel passed the paint filter test.

2.5 Free Liquid-Waste Lock Gel Testing

The stability of the water-Waste Lock gels, created during free liquid capture testing, was evaluated. One reagent was added to one bottle of gel. The reagents and results are below.

- Calciment – Approximately 3 milliliters of Calciment “broke” the water-Waste Lock gel very quickly. Liquid water was the dominant phase after five minutes. No gel pellets remained.
- CKD – Two doses were applied. Approximately 3 and 10 mls of CKD were added to two different bottles. The lower dose did not break the gel as quickly as the same mass of Calciment. The higher dose broke the gel more quickly than the lower but not as quickly as Calciment.
- Zeolite – Approximately 3 mls of zeolite were added. The gel did not break though a small amount of free liquid was present after several hours.

The water-Waste Lock 770 gel produced in Section in 3.4 also was stability-tested. One pound of sawdust was added to the bucket containing the gel to determine if the sawdust broke the gel as the Calciment and CKD had.

Sawdust addition did not break the gel, further suggesting that abundant inorganic ions may prevent gel formation or weaken or destroy the water-Waste Lock gel. Sawdust also may adsorb liquid organic compounds that Waste Lock cannot.

Sawdust addition did reduce the average size of gel clumps to approximately one-half inch in diameter though handling of augmented gel may have had the same effect.

2.6 Free Liquid Sawdust Testing

The ability of dry sawdust to adsorb free liquid was also tested. Ninety-eight grams of sawdust was added to one hundred and thirty-eight grams of Area 3 liquid. No free liquid remained after thorough mixing (approximately five minutes).

The great majority of Area 3 liquid was believed to be water. Water would likely be just as well captured by sawdust or Waste Lock 770. However, sawdust may capture certain or all organics more efficiently than Waste Lock 770. This would make sawdust a more effective reagent for IB liquid, which likely has a variable organic compound content in various areas and at various depths based on information supplied by others, e.g., Arcadis.

2.7 Sludge Pre-test Processing

Each 5-gallon bucket of sludge was re-opened after all water replicates had been collected from all buckets. The free water above the sludge was removed via decanting. The bucket contents were then mixed with an electric drill and propeller stirrer. The lid of the bucket was replaced. The process was repeated until all five sludge samples had been mixed.

2.8 Sludge Solidification Testing (First Set)

Solidification testing was conducted in the hood to control odors and vapors. The main steps, after sub-sampling of each sludge type, are below.

Sludge sub-samples from each area were placed into separate buckets on Wednesday, December 17. The bucket were tared or weighed before and after sludge addition to determine the sludge weight. The sludge weight was used to calculate the mass of solidification reagent added to each bucket. The reagents used in one or more tests are below.

1. Calciment (quick lime and Portland cement)
2. CKD
3. Lime
4. Zeolite

The sludge sample weight, additive type and mass, and results of paint filter testing or visual evaluation are included in Table 1. Area 1 was sampled first. The sludge sample from this area was very wet compared to the other four samples.

The sludge sub-samples that did not or were judged unlikely to pass the paint filter test were subjected to a second round of additive addition on Thursday, December 18. The results of this round of amendment and evaluation are presented below. (All samples were 46-47 degrees Fahrenheit when evaluated.)

Table 1: Sludge Solidification Testing – Initial Conditions and Results

Area	Sample Mass (lbs)	First Reagent Concentration	First Result	Second Reagent Concentration	Second Result
1	10	6% Calciment	Failed	30%	Failed
1	10	12% Calciment	Failed	30%	Failed
1	5	15% CKD	Passed	NA	NA
3	10	8% Calciment	Failed	30%	Failed
3	10	15% CKD	Failed	20%	Failed
6	10	12% Calciment	Failed	30%	Failed
6	5	15% CKD	Passed	NA	NA
6	5	15% Lime	Failed	50%	Failed, barely
7	10	10% Calciment	Failed	20%	Failed
7	5	15% CKD	Passed	20%	NA
8	10	8% Calciment	Failed	30%	Failed

8	5	15% CKD	Failed	20%	Passed
8	5	15% Zeolite	Failed	35%	Failed

NA – Not Applicable

2.9 Sludge Solidification Testing (Second Set)

For most additives, the results of the first two rounds of solidification testing were disappointing because of the amount of reagent required or because a reagent did not appear able to solidify the sludge at all. This led to the decision to test sawdust as an additive.

- Forty-one grams of sawdust was added to a bottle containing 110 mls (115 grams) of Area 8 sludge. The bottle was capped and shaken several times. All liquid was quickly sorbed.
- Approximately two pounds of sawdust were added to seven pounds of Area 8 sludge. The mixture was stirred several times with a spoon. All free liquid was quickly sorbed.

2.10 Sludge Headspace Testing

A 1/4-inch diameter hole was drilled into the lid of each of the five 5-gallon pails of sludge on Wednesday, December 17. The tube of the MiniRAE was inserted into each pail and the hydrogen cyanide, hydrogen sulfide, and volatile organic compound concentrations read and recorded. The holes were then resealed with pieces of duct tape. The results of the headspace monitoring are below.

Item	Area 1	Area 3	Area 6	Area 7	Area 8
Hydrogen cyanide (ppm)	0	0	24	0	0
Hydrogen sulfide (ppm)	0	4	186	0	0
VOCs (ppm)	2,803	650	630	326	2,200

2.11 Sludge Oxidation Testing

The effect of two oxidants on vapors and gases released from sludge samples was tested. Two aliquots of sludge from the Area 1 and Area 6 5-gallon buckets were transferred to separate 200-ml. glass bottles. One of two oxidants was added to one of the two bottles of sludge from each bucket.

There was one significant difference between the oxidants.

- Sodium percarbonate – A 10% by weight dose of sodium percarbonate was added to bottle 1B. A large volume of bubbles were immediately regenerated through rapid reagent decomposition (likely the release of hydrogen peroxide), reaction with contaminants, or gas evolution from the sludge due to a temperature increase.
  The reagent dose for sample 6B was reduced to 5%. Similar bubbling occurred though the volume produced was much smaller.
  The bottle lids were replaced but tightened only to approximately 90% to allow evolved gases to escape. After 15 to 20 minutes the lids were tightened completely.
- Potassium permanganate – No violent reagent decomposition, reaction, or gas evolution was observed. The bottle lids were tightened in a manner similar to those for the sodium percarbonate treatments.

The next morning each of the four bottles was placed in a 1-gallon plastic Ziploc brand storage bag. The lid was removed and dropped into the bag by one worker while the other kept the opening of the bag as small as possible. The first worker then removed his hand and the second closed the opening. The four bags containing one bottle each were placed in the heated cab of a truck. After 35 minutes one end of the top closure was opened only enough so that the intake tube of the MiniRAE could be inserted. The maximum reading observed for each of four gases during the first thirty seconds after tube insertion was recorded. (Oxygen levels were consistently within the acceptable range and are not included in the table below.)

Information on each bottle and the results of the treatment are in the table below.

Item	Bottle 1 A	Bottle 1B	Bottle 6A	Bottle 6B
Sludge Weight (grams)	269	231	229	247
Reagent (grams)				
Potassium permanganate	5% (13.5 gms)	-	5% (11.5 gms)	-
Sodium percarbonate	-	10% (23.0 gms)	-	5% (12.4 gms)
Appearance (12/18/14)	Uniform brown black, no free liquid, 100% solids	Light brown majority, 30 ml black, 60% solids	Uniform brown black, 45% solids	Light gray, 90% solids
Original Gas Levels				
Hydrogen cyanide (ppm)	0	0	24	24
Hydrogen sulfide (ppm)	0	0	186	186
VOCs (via PID) (ppm)	2,803	2,803	630	630
Post-Treatment Levels				
Hydrogen cyanide (ppm)	0	0	0	0
Percent reduction	0	0	100	100
Hydrogen sulfide (ppm)	0	0	0	0
Percent reduction	0	0	100	100
VOCs (via PID) (ppm)	926	858	127	241
Percent reduction	67	69	80	62

2.12 Water Oxidation-Solidification Testing

Seven grams of potassium permanganate was added to one hundred and thirty-eight grams of Area 6 water in a 200-ml bottle to create an approximately 5% solution (weight to weight) at 12:15 PM. The reagent dissolved very quickly. The bottle was shaken for 10 to 20 seconds four times over the next three minutes to increase contact between the reagent and dissolved materials in the water. Two and a half grams of Waste Lock 770 was added to the bottle at 12:21 PM. The bottle was shaken several times. The water-Waste Lock mixture had not gelled after 15 minutes.

3 Analysis and Reporting

Information gathered during the BT was used during development of the full-scale work plan. The plan described full-scale operation including planned and contingency odor control measurements that may be required during sludge removal activities. This report recommends reagents and dosing rates. The additive recommendation considered their effectiveness as well as cost and availability.

4 CONCLUSIONS AND RECOMMENDATIONS

1) The nature of the sludge from each area varies widely based on visual, olfactory, and instrument values determined during the BT and previous investigations. Variables included:
    a. Relative abundance of free and sorbed organic compounds
    b. Percentage of solids, either organic or inorganic, in sludge samples
    c. Nature and abundance of hydrogen cyanide and hydrogen sulfide gas and volatile organic vapors in the headspace above sludge samples.
2) The physical variability of the sludge within the IB will likely necessitate modification of the additive dose at various areas as well as modifications in odor controls. However, the differences in dose and effort are presently anticipated to vary no more than 20% among areas.
3) The most cost-effective additive for both sludge and water thickening was dry sawdust. If the material is avaliable, the challenge will be the collection and transportation of 3,000,000 or more pounds of dry sawdust.
4) The second most cost-effective additive for sludge thickening was CKD.
5) Sufficient Waste Lock 770 sorbed all liquid water. However, the dramatic ability of inorganic ions to break the gel back to water was surprising. Incidental contact with inorganics during loading, transport to a landfill, and after placement could release the water and could create a challenge.
6) Potassium permanganate and sodium percarbonate were equally effective at reducing hydrogen sulfide concentrations in the sample off-gas however potassium permanganate was more effect at reducing VOC concentrations in the sample off-gas plus the reaction did not result in bubbling from the water like the sodium percarbonate.

Appendix E

Geotechnical Boring Logs

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-101 **Project No.:** Hercules/LA002999.0023.00002 Page 1 of 2

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/18/2014

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** ______

Prepared By: G. Cook **Hammer Weight:** 140 **Hammer Drop (inches):** 30

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	▮ Shelby Tube	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▨ Clayey Silt	░ Sand	▨ Clayey Sand	⊠ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0									
1				Utility line clearance using a 2 inch stainless steel hand auger to depth of 5 ft.					Blow Counts
2									
3									
4									
5				SILTY SAND: Light gray, grayish brown, ferrous stain, dry, loose					▼
6		1.5						1.9	
7				- damp					
8		1.5		- pockets of dull green				18.6	
9				- dry, loose - fine grain, light gray, wet					▽
10		1.5						49.3	5 8 10
11									
12		1.5		- slight increase in sand, wet				136	6 8 8
13				- ferrous stain CLAY: Greenish gray, trace of ferrous stain, dry, firm					
14		1.5				1.50		120	2 2 4
15									
16		1.5		- stiff		3.0		128	
17				SILTY CLAY: Greenish gray, dry, stiff					
18		1.5				2.0		52.0	
19				SANDY CLAY: Greenish gray, dry, stiff					
20		1.5				2.0		10.8	
21									
22		1.5		CLAY: Greenish gray, dry, stiff		2.5		9.6	
23									
24		1.5		- pockets of brown				1.5	
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-101 **Project No.:** Hercules/LA002999.0023.00002 **Page 2 of 2**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/17/2014 **Drilling Completed:** 12/18/2014

Land-Surface Elev.: ____ **Surveyed:** ____ **Estimated:** ____ **Datum:** ____

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** ____

Prepared By: G. Cook **Hammer Weight:** 140 **Hammer Drop (inches):** 30

〰 Fill ▨ Silty Clay ▥ Silt ▦ Sandy Silt ▦ Silty Sand ◧ Shelby Tube ▽ Water First Encountered

▨ Clay ▨ Sandy Clay ▥ Clayey Silt ░ Sand ▨ Clayey Sand ▩ Split Spoon ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
		1.5	▨						
27			▨	- crumbles when pressure is applied					
28		1.5	▨	- stiff		2.25		0.0	
29			▨						
30		1.5	▨	- very stiff		>4.0		0.1	
31			▨						
32		1.5	▨			>4.0		0.0	
33				- no recovery from 33 to 35 ft bls					
34		0							
35									
36		0		- 35-37 held for lab					
37				- Total Depth 37 ft bls					
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-103 **Project No.:** Hercules/LA002999.0023.00002 **Page 1 of 1**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/19/2014 **Drilling Completed:** 12/19/2014

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** ______

Prepared By: G. Cook **Hammer Weight:** ______ **Hammer Drop (inches):** ______

〰 Fill	▧ Silty Clay	▥ Silt	⁞ Sandy Silt	⁞ Silty Sand	◧ Shelby Tube	▽	Water First Encountered
▨ Clay	▨ Sandy Clay	◫ Clayey Silt	⁘ Sand	▨ Clayey Sand	☒ Split Spoon	▼	Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0			〰	FILL: Utility line clearance using a 2 inch stainless steel hand auger to depth of 5 ft.					
1			〰						Blow Counts
2			〰						
3			〰						
4			〰						
5	☒		⁞						▼
	☒		⁞	SILTY SAND: Dark brown, brownish gray, ferrous stain and nodules, streaks, black natural organics, damp					
6	☒	1.0	⁞						1
	☒		⁞						2
7	☒		⁞	- 2 inch sandy clay layer					4
	☒		▨	- wet					▽
8	☒	1.0	▨	CLAYEY SAND: Gray, plant material, wet, loose					1
	☒		▨						1
9	☒		⁘	- trace of silt					3
	☒		⁘	SAND: Fine grain, gray, saturated, loose					
10	☒	1.5	⁘						2
	☒		⁘						5
11				- black, fine grain, saturated, loose					10
				- Total Depth 11 ft bls. Sand locking up auger.					
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-103A **Project No.:** Hercules/LA002999.0023.00002 Page 1 of 2

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/23/2014 **Drilling Completed:** 12/23/2014

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** ______

Prepared By: L. Dunahee **Hammer Weight:** 140 **Hammer Drop (inches):** 30

≋ Fill	▧ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◨ Shelby Tube	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▧ Clayey Silt	░ Sand	▨ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0				Utility line clearance using a 2 inch stainless steel hand auger to depth of 5 ft.					
1									Blow Counts
5				Auger, soil/sediment same as B-103					
15	▩		▨	SANDY CLAY: Clay, some sand, green-gray, dry, stiff, firm					
16	▩	1.5	▨			2.0		16.9	3 6 11
17	▩		▨	SANDY CLAY: Clay, some, sand, green-gray, moist, stiff/firm, no pebbles					
18	▩	1.5	▨			2.0		10.9	3 6 8
19	▩		▨	- clay, some sand, green-gray, high plasticity, dry, firm to very firm, no dilatancy					
20	▩	1.5	▨			2.5		4.8	3 7 8
23				- no recovery					
25	◨		▨	SANDY CLAY: Clay, some sand, green-gray, dry, firm, high plasticity				1.9	

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-103A **Project No.:** Hercules/LA002999.0023.00002 **Page 2 of 2**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/23/2014 **Drilling Completed:** 12/23/2014

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** ______

Prepared By: L. Dunahee **Hammer Weight:** 140 **Hammer Drop (inches):** 30

▨ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Shelby Tube	▽ Water First Encountered
▧ Clay	▨ Sandy Clay	▥ Clayey Silt	░ Sand	▨ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP		PID (ppm)	REMARKS
						H	V		
27	■	1.5	▨	- clay, green-gray, low plasticity, crumbles under pressure				1.5	
28									
29				- no recovery					
30	▩		▨	SANDY CLAY: Clay, some sand, green-gray, dry, firm, low to no plasticity, very stiff					4
31	▩	1.5	▨					0.9	7 10
32				- Total Depth 32 ft bls					
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-104 **Project No.:** Hercules/LA002999.0023.00002 **Page 1 of 2**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/19/2014 **Drilling Completed:** 12/19/2014

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** Wayne

Prepared By: G. Cook **Hammer Weight:** ______ **Hammer Drop (inches):** ______

Fill | Silty Clay | Silt | Sandy Silt | Silty Sand | Shelby Tube | ▽ Water First Encountered

Clay | Sandy Clay | Clayey Silt | Sand | Clayey Sand | Split Spoon | ▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0–5				Utility line clearance using a 2 inch stainless steel hand auger to depth of 5 ft.					Blow Counts
5–7	Split Spoon	1.5	Fill	FILL: Silt, sand, dark brown, some orange, trace of asphault				0.8	▼ 1 2 1
7–9	Split Spoon	0.1	Fill / Silty Sand	SILTY SAND: Brown, damp				1.0	1 WOH ▽
9–11	Split Spoon	0		- no recovery				1.7	3 4 6
11–13	Split Spoon	1.5	Clay	CLAY: Grayish brown, ferrous nodules and stain, streaks, black natural organic stain, dry, stiff				2.0	3 4 6
13–15	Split Spoon	1.5	Clay / Sandy Clay	SANDY CLAY: Greenish gray, dry, stiff					2 6 8
15–17	Split Spoon	1.5	Sandy Clay / Silty Clay	SILTY CLAY: Greenish gray, wet, firm, stiff					3 4 10
17–19	Split Spoon	1.5	Silty Clay	- increase in clay					3 6 13
19–21	Shelby Tube			- collected in shelby tube held for lab					
21–23									
23–25	Split Spoon		Silty Clay	SILTY CLAY: Greenish gray, dry, firm, stiff				2.0	5 9 10

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-104 **Project No.:** Hercules/LA002999.0023.00002 **Page 2 of 2**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 12/19/2014 **Drilling Completed:** 12/19/2014

Land-Surface Elev.: ____ **Surveyed:** ____ **Estimated:** ____ **Datum:** ____

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** Wayne

Prepared By: G. Cook **Hammer Weight:** ____ **Hammer Drop (inches):** ____

≋ Fill	▨ Silty Clay	▥ Silt	▦ Sandy Silt	▦ Silty Sand	◧ Shelby Tube	▽ Water First Encountered
▨ Clay	▨ Sandy Clay	▥ Clayey Silt	░ Sand	▨ Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
27									
28 29 30	▩	1.5	▨	CLAY: Brownish gray, dry, very stiff				>4.0	9 11 17
31									
32									
33 34 35	▩	1.5	▨	CLAY: Brownish gray, dry, very stiff - Total Depth 35 ft bls				>4.0	5 11 14
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-106 **Project No.:** Hercules/LA002999.0023.00002

Site Location: Hattiesburg, Mississippi **Drilling Started:** 1/5/2015 **Drilling Completed:** 1/6/2015

Land-Surface Elev.: ______ **Surveyed:** ____ **Estimated:** ____ **Datum:** ______

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** Nicholas/Steven

Prepared By: G. Cook **Hammer Weight:** 140 **Hammer Drop (inches):** 30

Fill	Silty Clay	Silt	Sandy Silt	Silty Sand	Shelby Tube	▽ Water First Encountered
Clay	Sandy Clay	Clayey Silt	Sand	Clayey Sand	Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
0–5				Utility line clearance using a 2 inch stainless steel hand auger to depth of 5 ft.					Blow Counts ▼
5–7	Split Spoon	0.5	Silty Sand	SILTY SAND: Very fine to fine grain, gray, very loose, wet				0.6	▽ W.O.D.R. W.O.D.R. 4
10–12	Split Spoon	1.5	Silty Sand	SILTY SAND: Fine grain, gray, very loose, medium dense, wet				20.0	3 8 14
15–17	Split Spoon	1.5	Silty Sand	SILTY SAND: (10, 90) fine grain, saturated, very loose - 1 inch dark gray black layer				2.2	2 4 6
20–22	Split Spoon	1.5	Sandy Clay	SANDY CLAY: Greenish gray, damp, loose - 2 inch clayey sand layer		2.5		9.2	4 7 10
25	Split Spoon								

ARCADIS

SAMPLE / CORE LOG

Boring/Well: B-106 **Project No.:** Hercules/LA002999.0023.00002 **Page 2 of 2**

Site Location: Hattiesburg, Mississippi **Drilling Started:** 1/5/2015 **Drilling Completed:** 1/6/2015

Land-Surface Elev.: ____ **Surveyed:** ____ **Estimated:** ____ **Datum:** ____

Drilling Fluid: None **Drilling Method Used:** Hollow Stem Auger, 6.75" O.D.

Drilling Contractor: Pro-Tech **Driller:** Bill **Helper:** Nicholas/Steven

Prepared By: G. Cook **Hammer Weight:** 140 **Hammer Drop (inches):** 30

Fill	Silty Clay	Silt	Sandy Silt	Silty Sand	Shelby Tube	▽ Water First Encountered
Clay	Sandy Clay	Clayey Silt	Sand	Clayey Sand	▩ Split Spoon	▼ Water Level After 10 Minutes

SAMPLE DEPTH (ft)	SAMPLE TYPE	RECOVERY (ft)	SYMBOL	VISUAL DESCRIPTION	USCS (LL/PL/PI)	PP H	PP V	PID (ppm)	REMARKS
27	▩	1.5	▨	CLAY: Top 3 inches sandy clay, greenish gray, dry, medium dense - clay, greenish gray, trace of ferrous stain, dry, very stiff		>4.00		3.8	4 9 11
28									
29									
30	▩		▨	CLAY: Greenish gray, dry, very stiff					
31	▩	1.5	▨			>4.00		2.9	5 8 11
32									
33									
34									
35	▩		▨	CLAY: Greenish gray, dry, very stiff					
36	▩	1.5	▨			>4.00		0.0	5 8 9
37									
38									
39									
40	▩		▨	SILTY CLAY: Greenish gray, dry, stiff					
41	▩	1.5	▨			2.5		0.0	5 8 9
42									
43									
44									
45	▩		▨	SILTY CLAY: (Increase in silt) greenish gray, dry, firm					
46	▩	1.5	▨			1.5			4 8
47				- damp, soft, firm		1.0			10
48									
49									
50	▩		▨	SILTY CLAY: Greenish gray, dry, firm					
51	▩	1.5	▨	- Total Depth 52 ft bls. W.O.D.R.-Weight of Dril Rod. Background PID 0.0 ppm.		1.25			5 9 11

Appendix F

Geotechnical Laboratory Report

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	---	Sample Type:	---	Tested By:	jek
Sample ID:	---	Test Date:	01/08/15	Checked By:	mcm
Depth :	---	Test Id:	319467		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content, %
B-101	- --	35-37 ft	Moist, light gray clay	24.9
B-101	- --	7-11 ft	Moist, light gray silty sand	16.2
B-103	- --	5-7 ft	Moist light brown silty sand	15.1
B-103A	- --	19-21 ft	Moist, light gray clay	26.2
B-104	- --	19-21 ft	Moist, gray clay	25.5

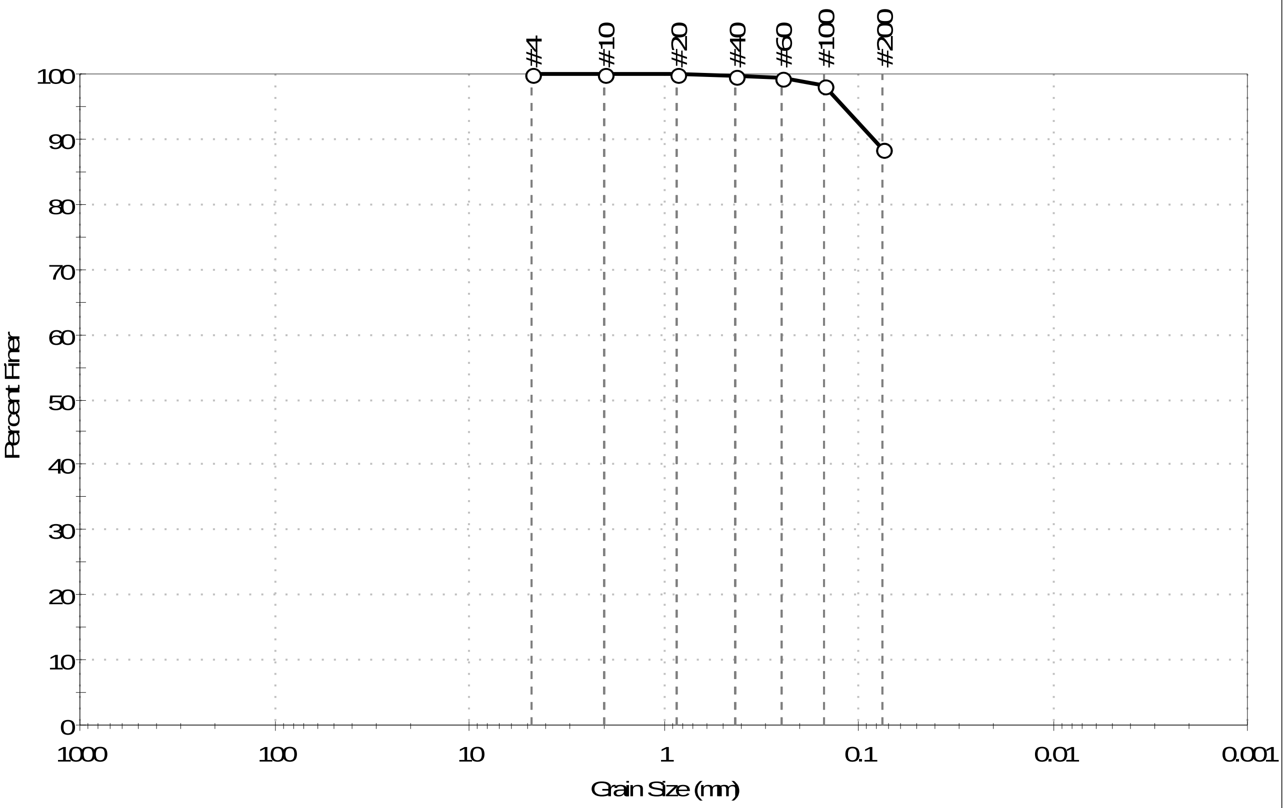
Notes: Temperature of Drying : 110º Celsius

printed 1/12/2015 3:37:14 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-101	Sample Type:	tube	Tested By:	jbr
Sample ID:	---	Test Date:	01/09/15	Checked By:	mcm
Depth :	35-37 ft	Test Id:	319474		

Test Comment: ---
Sample Description: Moist, light gray clay
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	11.4	88.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	98		
#200	0.075	89		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay (CL)

AASHTO Clayey Soils (A-6 (15))

Sample/Test Description

Sand/Gravel Particle Shape : ---

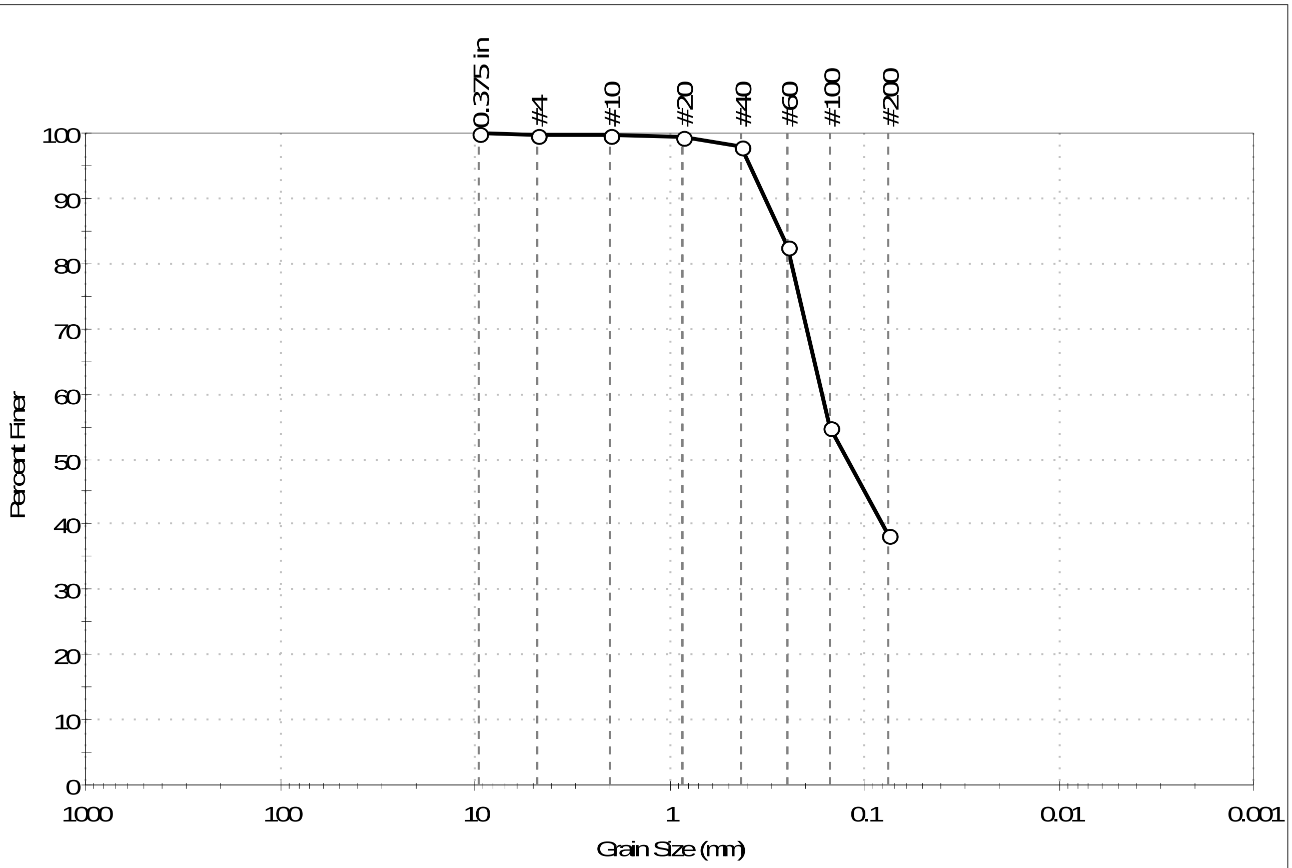
Sand/Gravel Hardness : ---

printed 1/12/2015 3:35:57 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-101	Sample Type:	bag	Tested By:	jbr
Sample ID:	---	Test Date:	01/09/15	Checked By:	mcm
Depth :	7-11 ft	Test Id:	319475		

Test Comment: ---
Sample Description: Moist, light gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	0.2	61.4	38.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	98		
#60	0.25	83		
#100	0.15	55		
#200	0.075	38		

Coefficients

D_{85} =0.2719 mm	D_{30} =N/A
D_{60} =0.1648 mm	D_{15} =N/A
D_{50} =0.1221 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

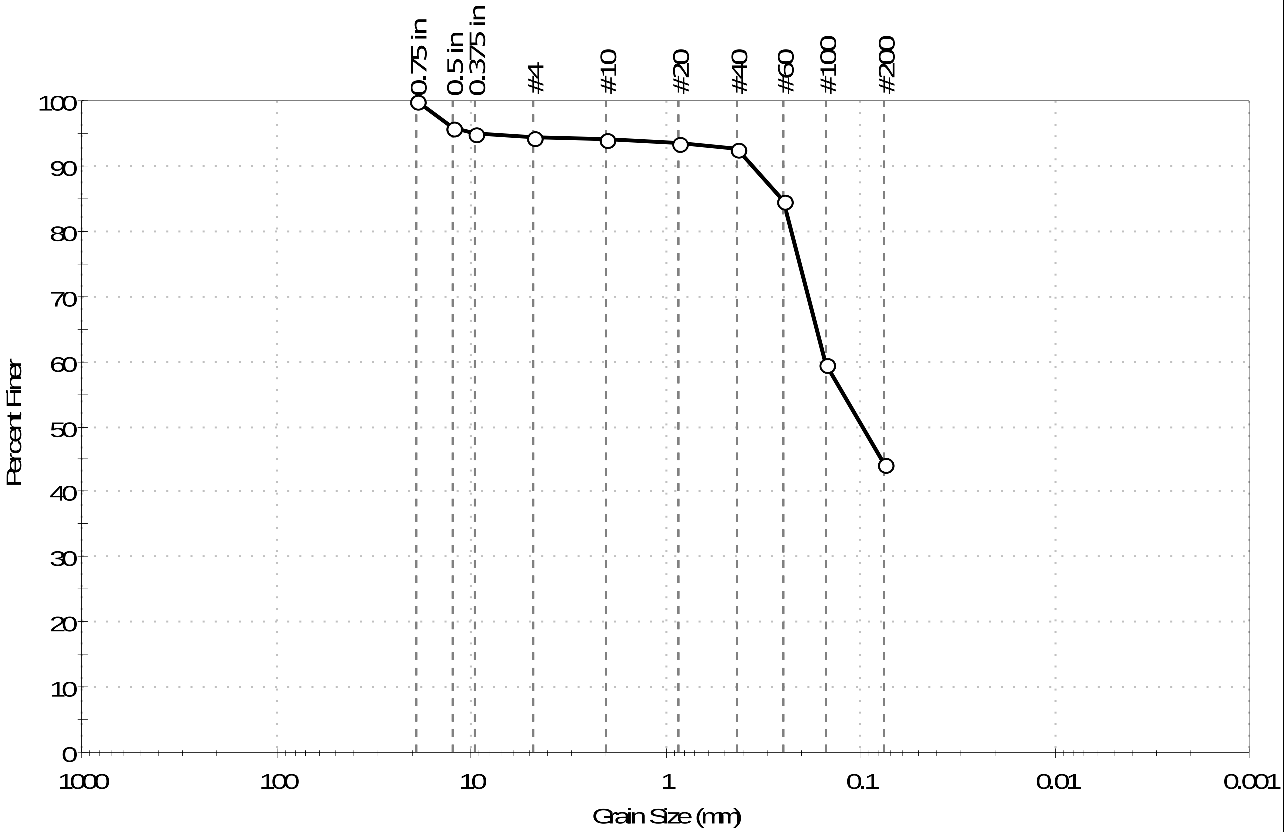
Sand/Gravel Hardness : ---

printed 1/12/2015 3:35:58 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-103	Sample Type:	bag	Tested By:	jbr
Sample ID:	---	Test Date:	01/09/15	Checked By:	mcm
Depth :	5-7 ft	Test Id:	319476		

Test Comment: ---
Sample Description: Moist light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	5.5	50.3	44.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	95		
#4	4.75	94		
#10	2.00	94		
#20	0.85	94		
#40	0.42	93		
#60	0.25	85		
#100	0.15	60		
#200	0.075	44		

Coefficients

D_{85} =0.2579 mm	D_{30} =N/A
D_{60} =0.1509 mm	D_{15} =N/A
D_{50} =0.0973 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

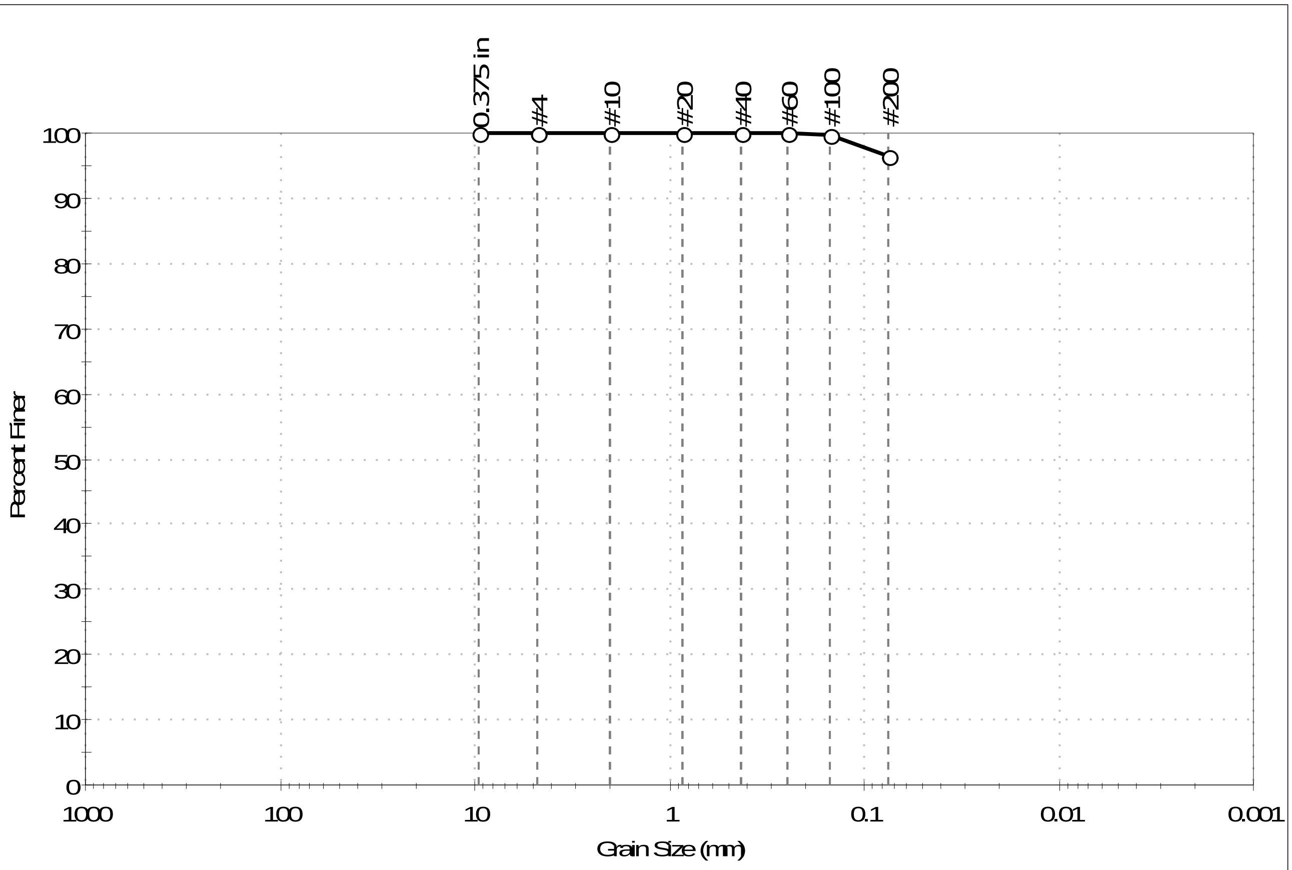
printed 1/12/2015 3:36:00 PM

Client: Arcadis - U.S., Inc.
Project: IB Closure
Location: Hattiesberg, MS
Project No: GTX-302718

Boring ID: B-103A
Sample Type: bag
Tested By: jbr
Sample ID: ---
Test Date: 01/09/15
Checked By: mcm
Depth : 19-21 ft
Test Id: 319477

Test Comment: ---
Sample Description: Moist, light gray clay
Sample Comment: ---

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	0.1	3.5	96.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.075	96		

Coefficients

D_{85} =N/A	D_{30} =N/A
D_{60} =N/A	D_{15} =N/A
D_{50} =N/A	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM	Lean clay (CL)
AASHTO	Clayey Soils (A-6 (20))

Sample/Test Description

Sand/Gravel Particle Shape : ---

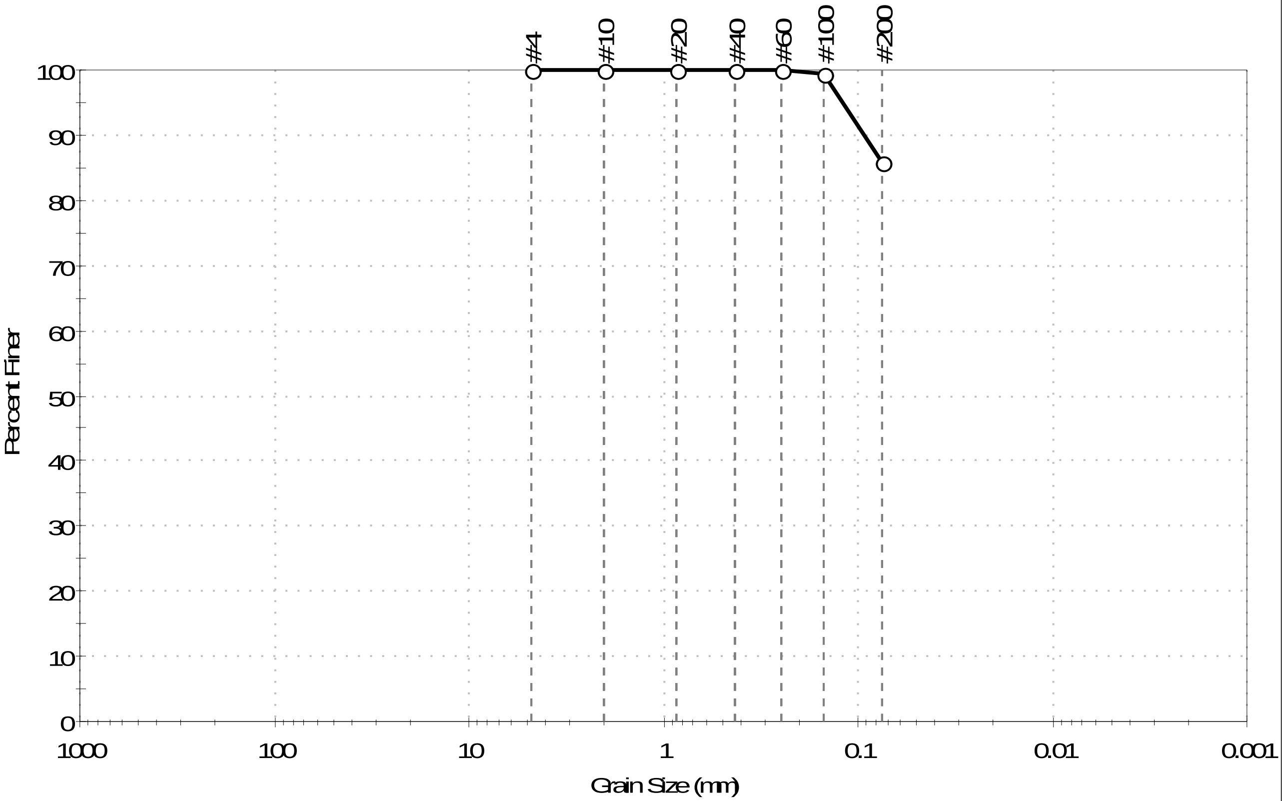
Sand/Gravel Hardness : ---

printed 1/12/2015 3:36:01 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-104	Sample Type:	tube	Tested By:	jbr
Sample ID:	---	Test Date:	01/09/15	Checked By:	mcm
Depth :	19-21 ft	Test Id:	319479		

Test Comment: ---
Sample Description: Moist, gray clay
Sample Comment: ---

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	0.0	14.2	85.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.075	86		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean clay (CL)

AASHTO Clayey Soils (A-6 (18))

Sample / Test Description

Sand/Gravel Particle Shape : ---

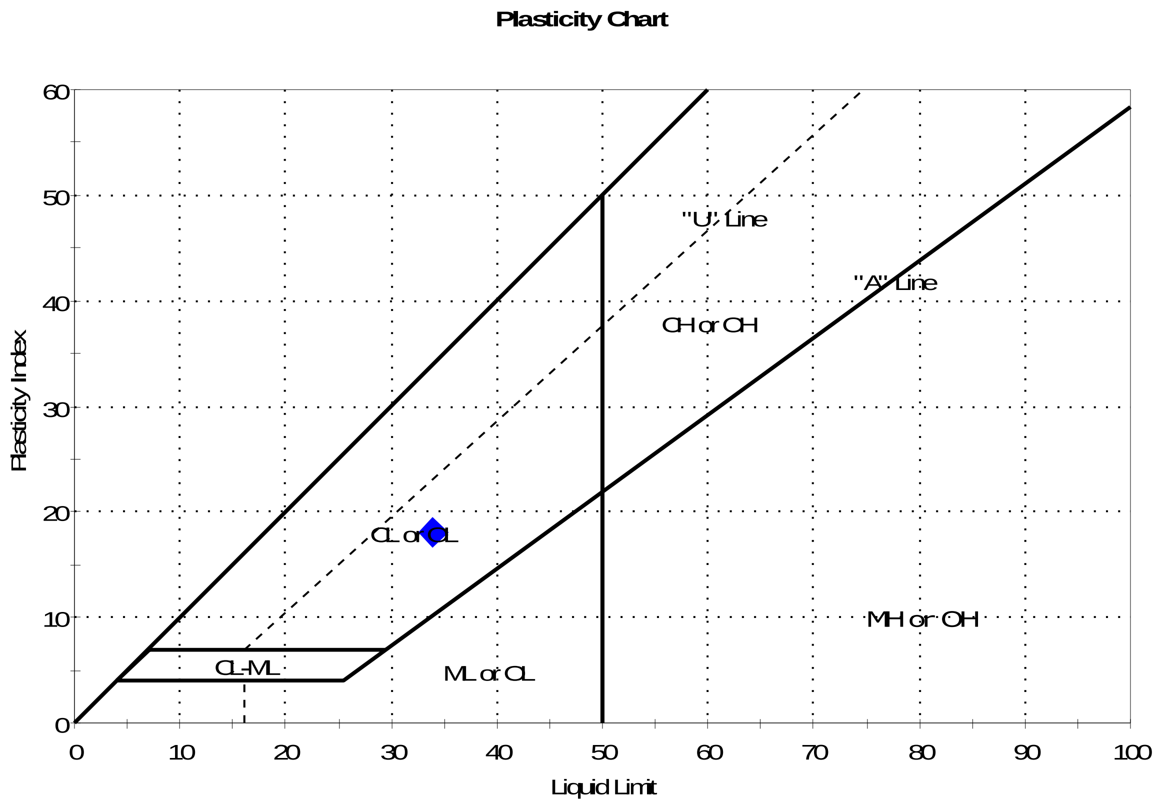
Sand/Gravel Hardness : ---

printed 1/12/2015 3:36:02 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-101	Sample Type:	tube	Tested By:	cam
Sample ID:	---	Test Date:	01/12/15	Checked By:	mcm
Depth :	35-37 ft	Test Id:	319486		

Test Comment: ---
Sample Description: Moist, light gray clay
Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	---	B-101	35-37 ft	25	34	16	18	0.5	Lean clay (CL)

Sample Prepared using the WET method

0% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilatancy: SLOW

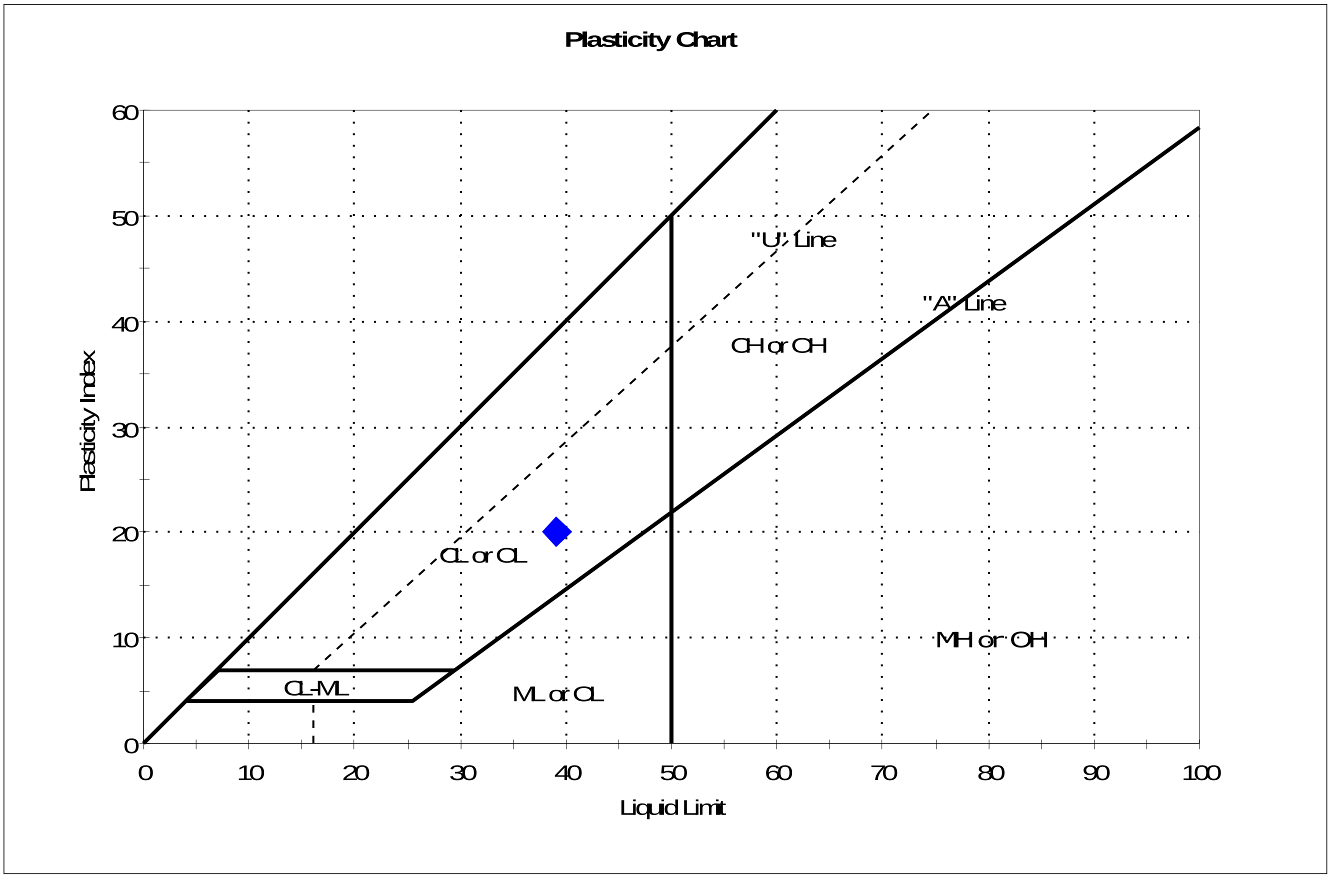
Toughness: LOW

printed 1/12/2015 3:29:42 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-103A	Sample Type:	bag	Tested By:	cam
Sample ID:	---	Test Date:	01/12/15	Checked By:	mcm
Depth :	19-21 ft	Test Id:	319487		

Test Comment: ---
Sample Description: Moist, light gray clay
Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	---	B-103A	19-21 ft	26	39	19	20	0.4	Lean clay (CL)

Sample Prepared using the WET method

0% Retained on #40 Sieve

Dry Strength: VERY HIGH

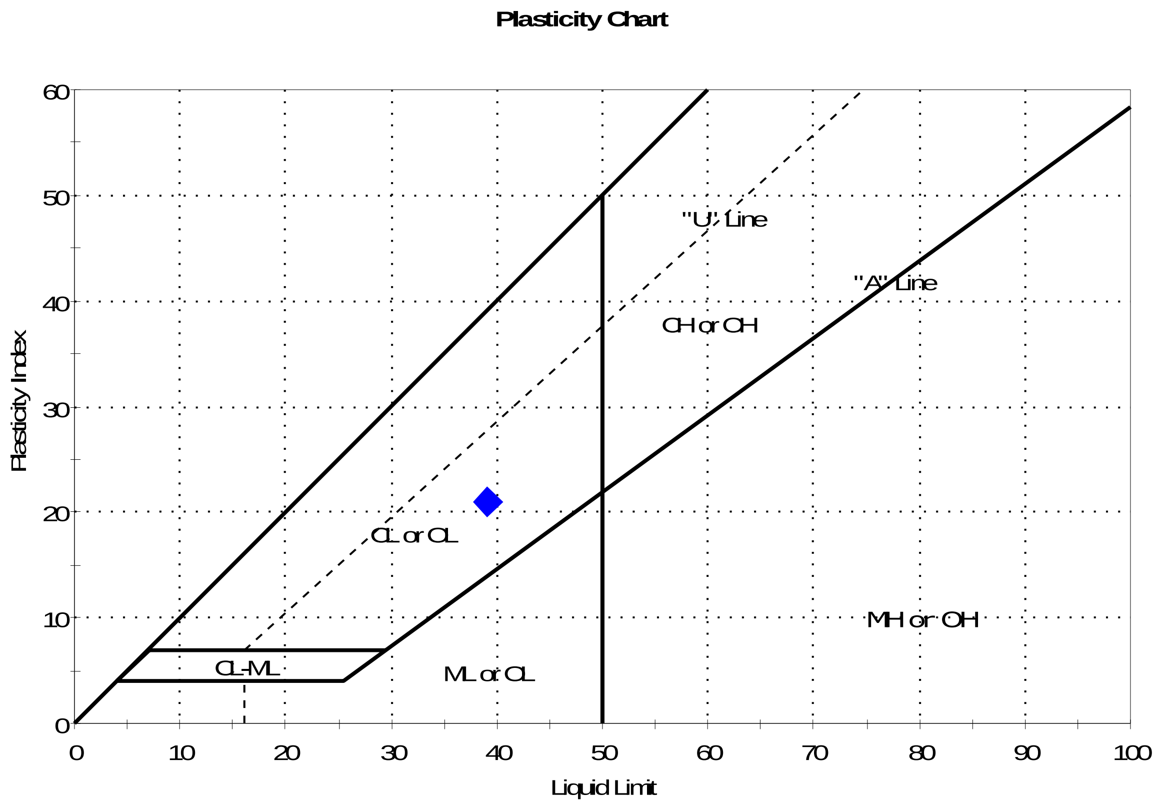
Dilatancy: SLOW

Toughness: LOW

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	B-104	Sample Type:	tube	Tested By:	cam
Sample ID:	---	Test Date:	01/12/15	Checked By:	mcm
Depth :	19-21 ft	Test Id:	319489		

Test Comment: ---
Sample Description: Moist, gray clay
Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	---	B-104	19-21 ft	25	39	18	21	0.4	Lean clay (CL)

Sample Prepared using the WET method

0% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

printed 1/12/2015 3:29:43 PM

Client:	Arcadis - U.S., Inc.				
Project:	IB Closure				
Location:	Hattiesberg, MS			Project No:	GTX-302718
Boring ID:	---	Sample Type:	---	Tested By:	jek
Sample ID:	---	Test Date:	01/12/15	Checked By:	mcm
Depth :	---	Test Id:	319485		

Specific Gravity of Soils by ASTM D854

Boring ID	Sample ID	Depth	Visual Description	Specific Gravity	Comment
B-101	---	35-37 ft	Moist, light gray clay	2.65	
B-101	---	7-11 ft	Moist, light gray silty sand	2.65	
B-103	---	5-7 ft	Moist light brown silty sand	2.66	
B-103A	---	19-21 ft	Moist, light gray clay	2.69	
B-104	---	19-21 ft	Moist, gray clay	2.69	

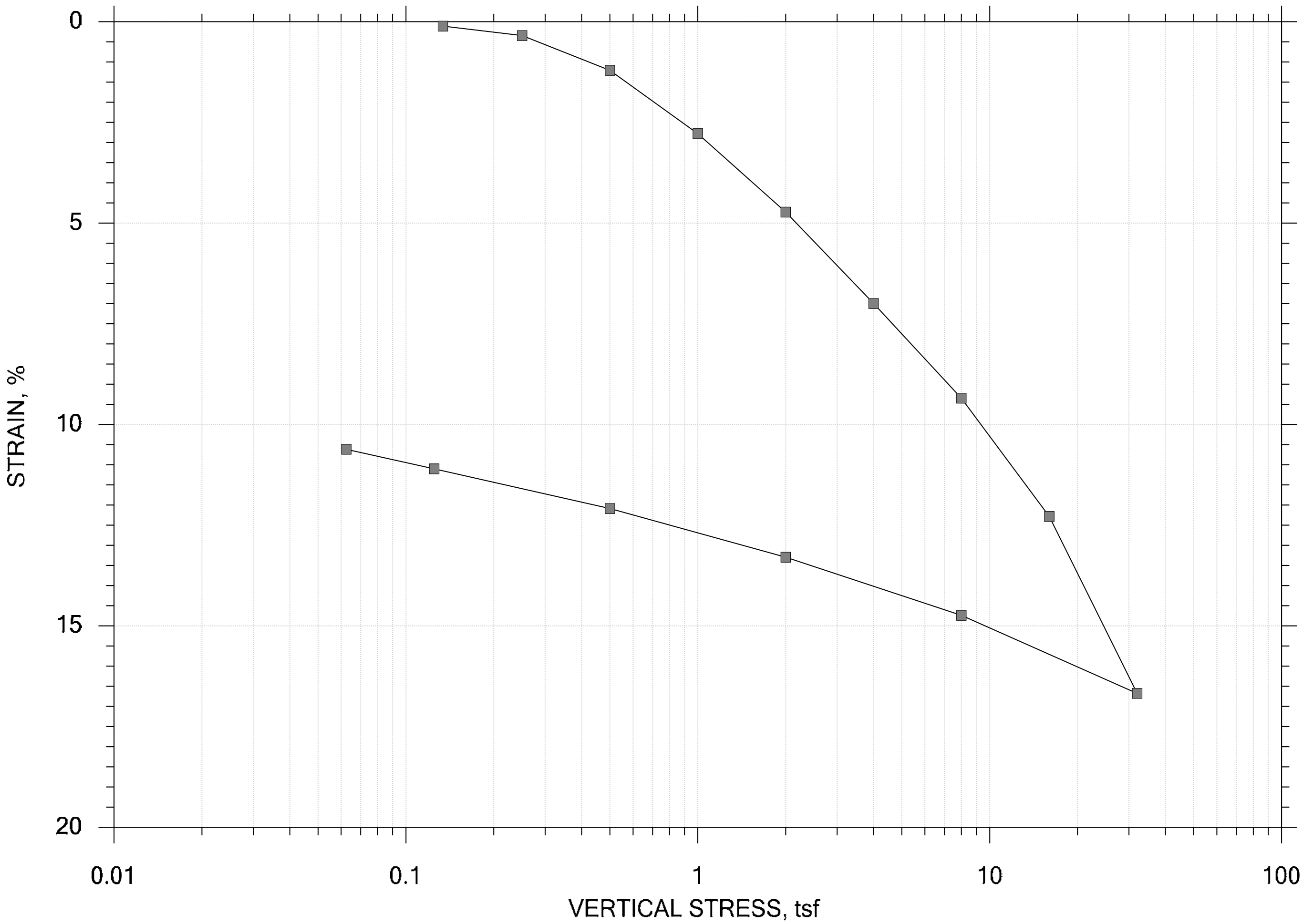
Notes: Specific Gravity performed by using method B (moist specimens) of ASTM D854

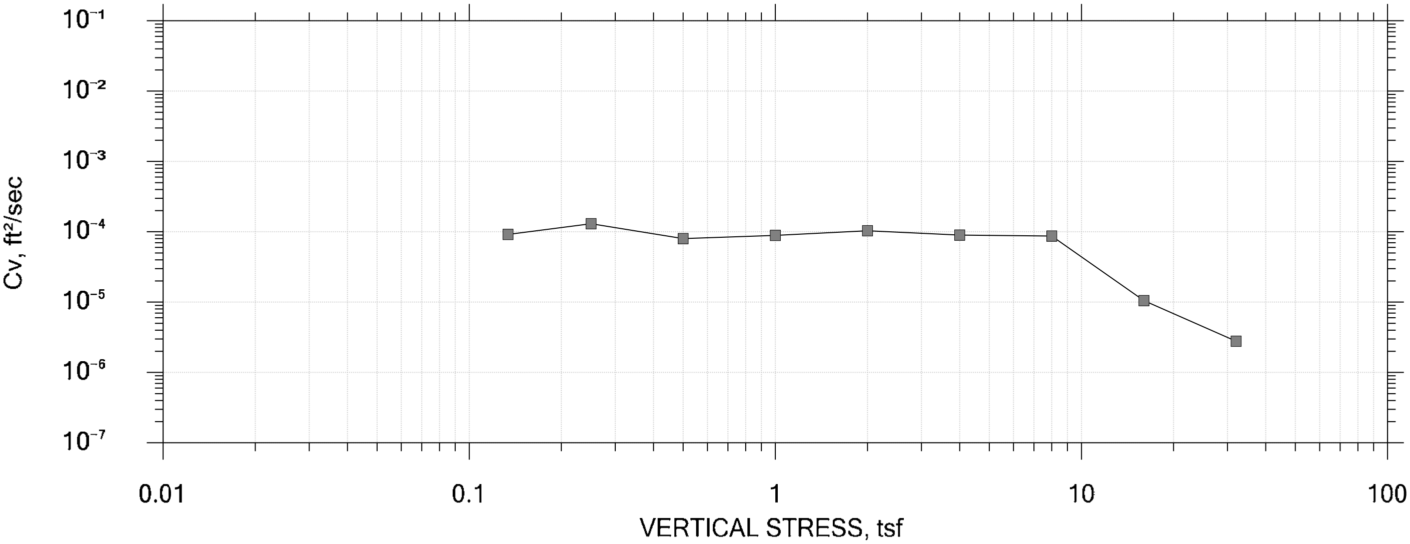
Moisture Content determined by ASTM D2216.

printed 1/12/2015 3:39:12 PM

One-Dimensional Consolidation by ASTM D2435 - Method B

SUMMARY REPORT





Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.:	Test Date: 01/06/15	Test No.: IP-1
Depth: 35-37 ft	Sample Type: intact	Elevation: ---

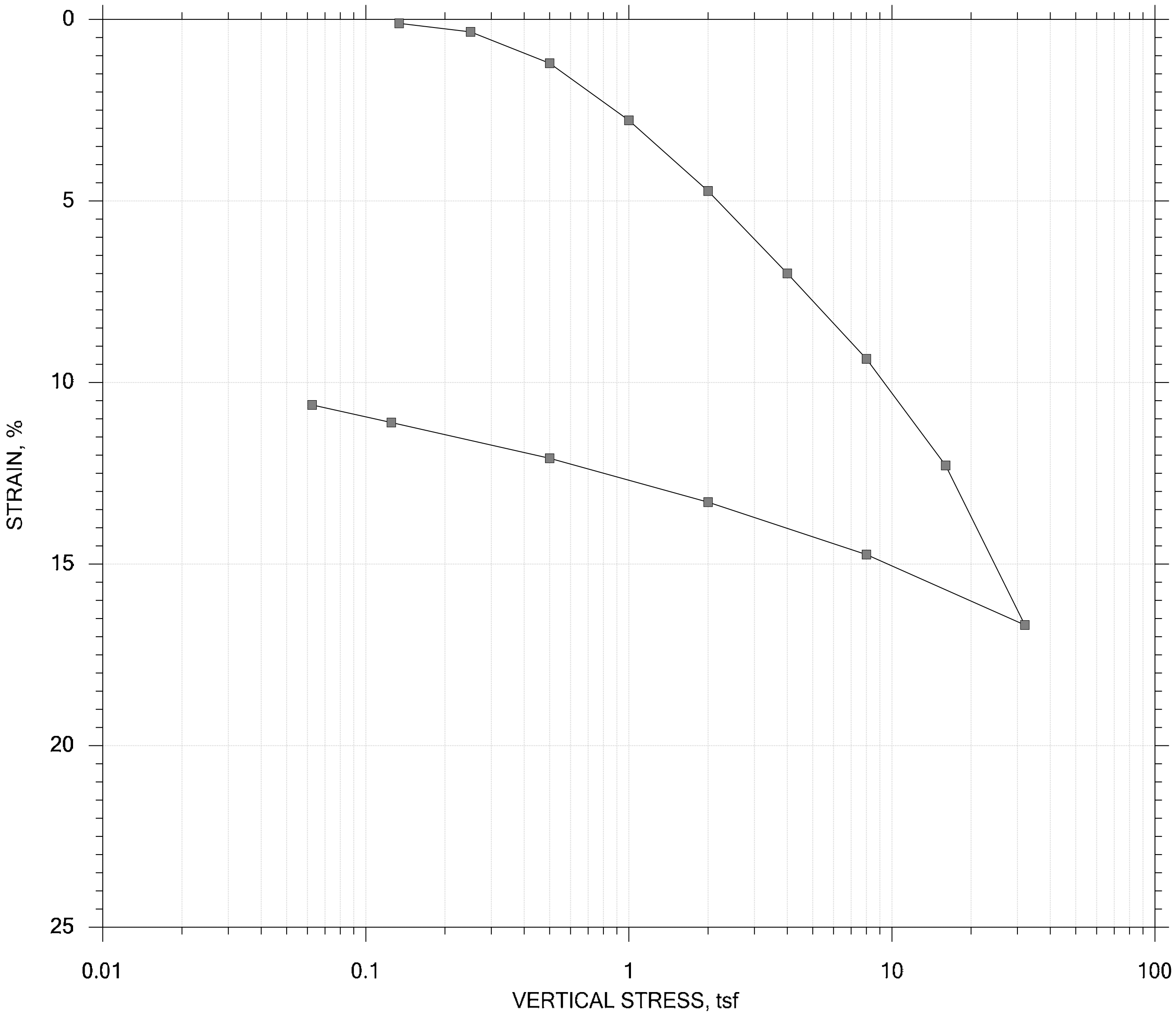
Description: Awaiting index test results

Remarks: System V, Swell Pressure = 0.134 tsf

Displacement at End of Increment

One-Dimensional Consolidation by ASTM D2435 - Method B

SUMMARY REPORT



					Before Test	After Test
Current Vertical Effective Stress: ---				Water Content, %	20.08	19.26
Preconsolidation Stress: ---				Dry Unit Weight, pcf	100.37	112.29
Compression Ratio: ---				Saturation, %	77.67	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.71	0.53
LL: ---	PL: ---	PI: ---	GS: 2.75			

GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		
	Displacement at End of Increment		

```
                                              One-Dimensional Consolidation by ASTM D2435 - Method B

Project: IB Closure                       Location: Hattiesberg MS                  Project No.: GTX-302718
Boring No.: B-101                         Tested By: md                             Checked By: jdt
Sample No.:                               Test Date: 01/06/15                       Depth: 35-37 ft
Test No.: IP-1                            Sample Type: intact                       Elevation: ---

Soil Description: Awaiting index test results
Remarks: System V, Swell Pressure = 0.134 tsf

Estimated Specific Gravity: 2.75       Liquid Limit: ---                      Specimen Diameter: 2.50 in
Initial Void Ratio: 0.712              Plastic Limit: ---                     Initial Height: 1.00 in
Final Void Ratio: 0.530                Plasticity Index: ---                  Final Height: 0.89 in

                                             Before Consolidation                   After Consolidation
                                         Trimmings       Specimen+Ring       Specimen+Ring           Trimmings

Container ID                               14415                RING                                   16388

Wt. Container + Wet Soil, gm              103.92              155.30              154.23              162.28
Wt. Container + Dry Soil, gm              88.480              129.33              129.33              137.41
Wt. Container, gm                         8.3100             0.00000             0.00000              8.2600
Wt. Dry Soil, gm                          80.170              129.33              129.33              129.15
Water Content, %                           19.26               20.08               19.26               19.26
Void Ratio                                   ---               0.712               0.530                 ---
Degree of Saturation, %                      ---               77.67              100.00                 ---
Dry Unit Weight, pcf                         ---              100.37              112.29                 ---


Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end
      of the test. Therefore, values may not represent actual values for the specimen.
```

One-Dimensional Consolidation by ASTM D2435 - Method B

Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.:	Test Date: 01/06/15	Depth: 35-37 ft
Test No.: IP-1	Sample Type: intact	Elevation: ---

Soil Description: Awaiting index test results
Remarks: System V, Swell Pressure = 0.134 tsf

Displacement at End of Increment

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft²/sec	Mv 1/tsf	k ft/day
1	0.134	0.001070	0.710	0.107	0.252	9.71e-005	7.99e-003	2.09e-003
2	0.250	0.003444	0.706	0.344	0.231	1.06e-004	2.04e-002	5.84e-003
3	0.500	0.01205	0.691	1.21	0.409	5.90e-005	3.44e-002	5.48e-003
4	1.00	0.02779	0.664	2.78	0.388	6.07e-005	3.15e-002	5.15e-003
5	2.00	0.04724	0.631	4.72	0.363	6.27e-005	1.95e-002	3.29e-003
6	4.00	0.06995	0.592	7.00	0.383	5.68e-005	1.14e-002	1.74e-003
7	8.00	0.09346	0.552	9.35	0.380	5.45e-005	5.88e-003	8.63e-004
8	16.0	0.1228	0.501	12.3	2.000	9.76e-006	3.67e-003	9.66e-005
9	32.0	0.1668	0.426	16.7	6.294	2.85e-006	2.75e-003	2.11e-005
10	8.00	0.1474	0.459	14.7	0.353	4.94e-005	8.09e-004	1.08e-004
11	2.00	0.1329	0.484	13.3	38.155	4.75e-007	2.40e-003	3.08e-006
12	0.500	0.1209	0.505	12.1	81.074	2.31e-007	8.04e-003	5.00e-006
13	0.125	0.1110	0.522	11.1	131.976	1.45e-007	2.63e-002	1.03e-005
14	0.0625	0.1062	0.530	10.6	0.000	0.00e+000	7.74e-002	0.00e+000

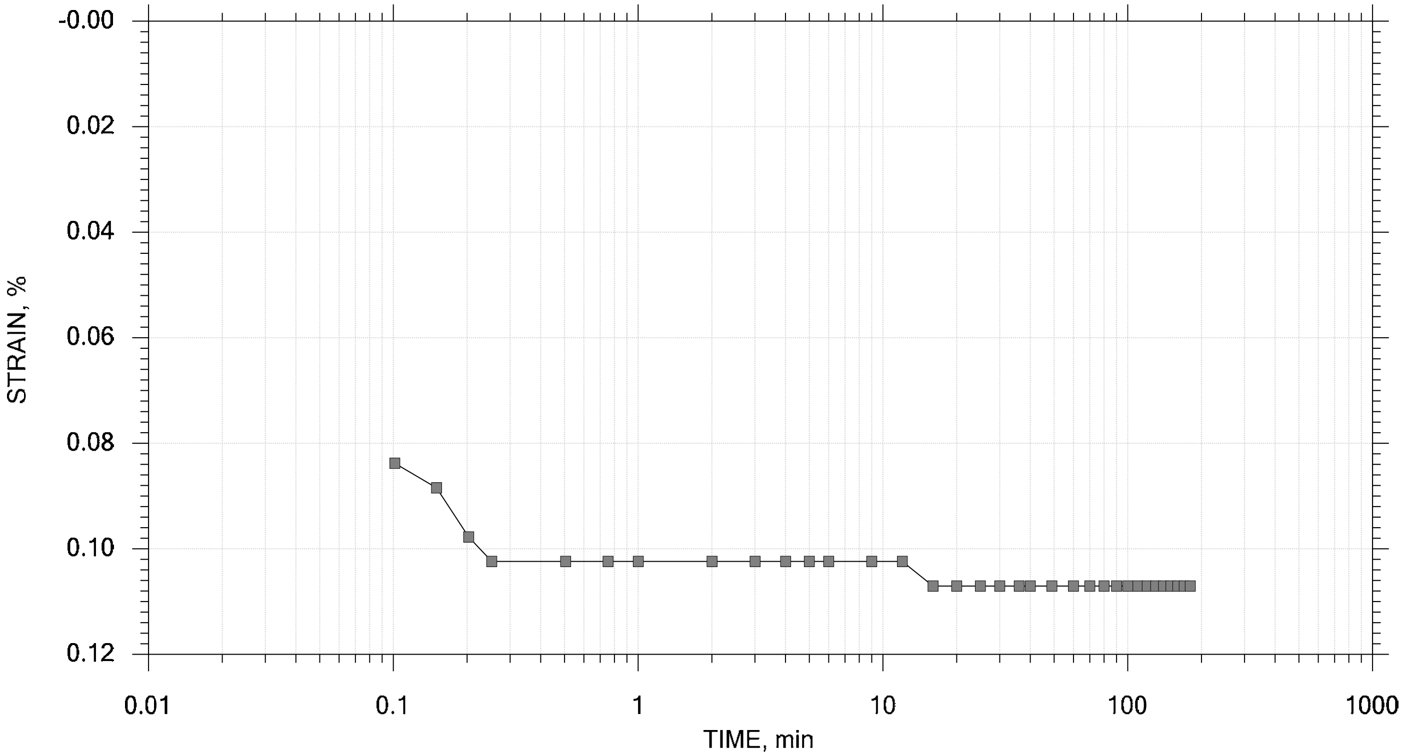
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/sec	Mv 1/tsf	k ft/day	Ca %
1	0.134	0.001070	0.710	0.107	0.000	0.00e+000	7.99e-003	0.00e+000	0.00e+000
2	0.250	0.003444	0.706	0.344	0.000	0.00e+000	2.04e-002	0.00e+000	0.00e+000
3	0.500	0.01205	0.691	1.21	0.000	0.00e+000	3.44e-002	0.00e+000	0.00e+000
4	1.00	0.02779	0.664	2.78	0.000	0.00e+000	3.15e-002	0.00e+000	0.00e+000
5	2.00	0.04724	0.631	4.72	0.000	0.00e+000	1.95e-002	0.00e+000	0.00e+000
6	4.00	0.06995	0.592	7.00	0.000	0.00e+000	1.14e-002	0.00e+000	0.00e+000
7	8.00	0.09346	0.552	9.35	0.000	0.00e+000	5.88e-003	0.00e+000	0.00e+000
8	16.0	0.1228	0.501	12.3	0.000	0.00e+000	3.67e-003	0.00e+000	0.00e+000
9	32.0	0.1668	0.426	16.7	0.000	0.00e+000	2.75e-003	0.00e+000	0.00e+000
10	8.00	0.1474	0.459	14.7	0.000	0.00e+000	8.09e-004	0.00e+000	0.00e+000
11	2.00	0.1329	0.484	13.3	0.000	0.00e+000	2.40e-003	0.00e+000	0.00e+000
12	0.500	0.1209	0.505	12.1	0.000	0.00e+000	8.04e-003	0.00e+000	0.00e+000
13	0.125	0.1110	0.522	11.1	0.000	0.00e+000	2.63e-002	0.00e+000	0.00e+000
14	0.0625	0.1062	0.530	10.6	0.000	0.00e+000	7.74e-002	0.00e+000	0.00e+000

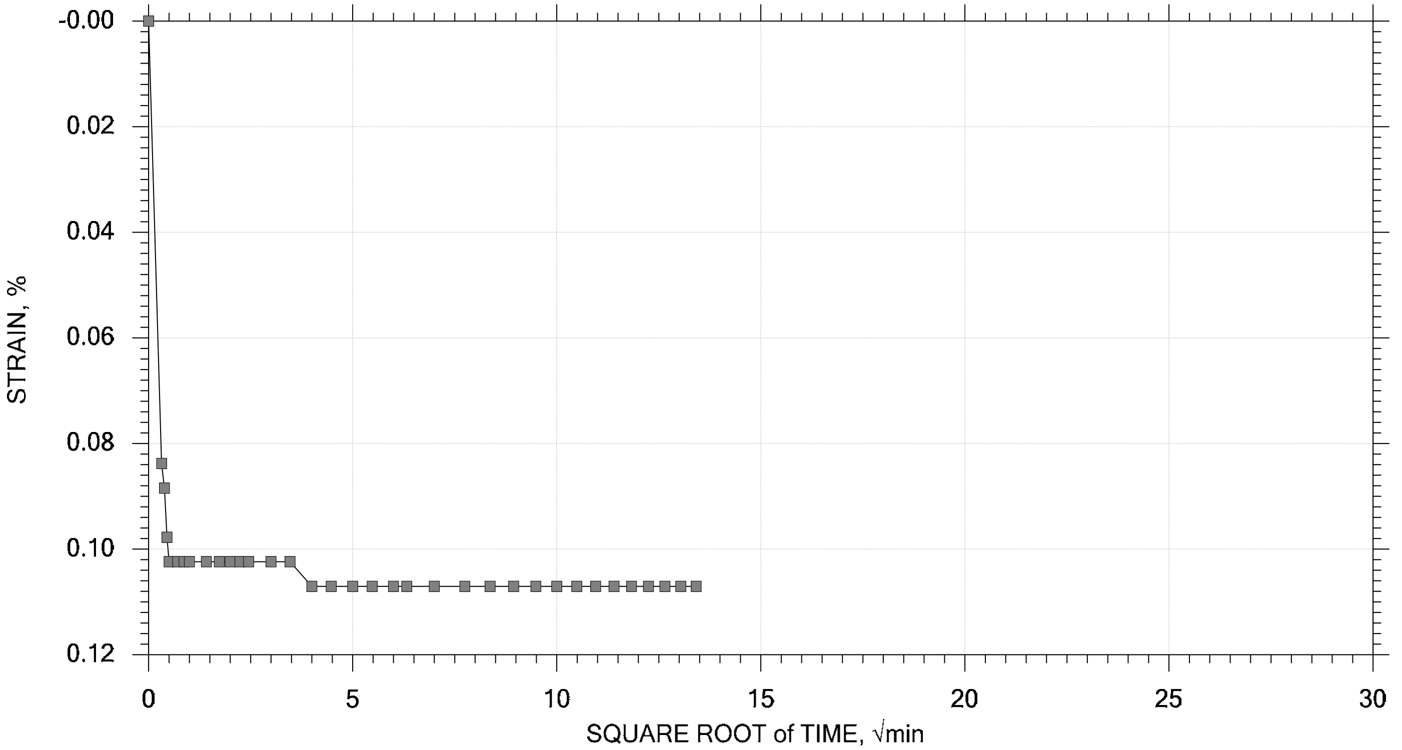
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Volume Step 1 of 14

Stress: 0.13391 tsf





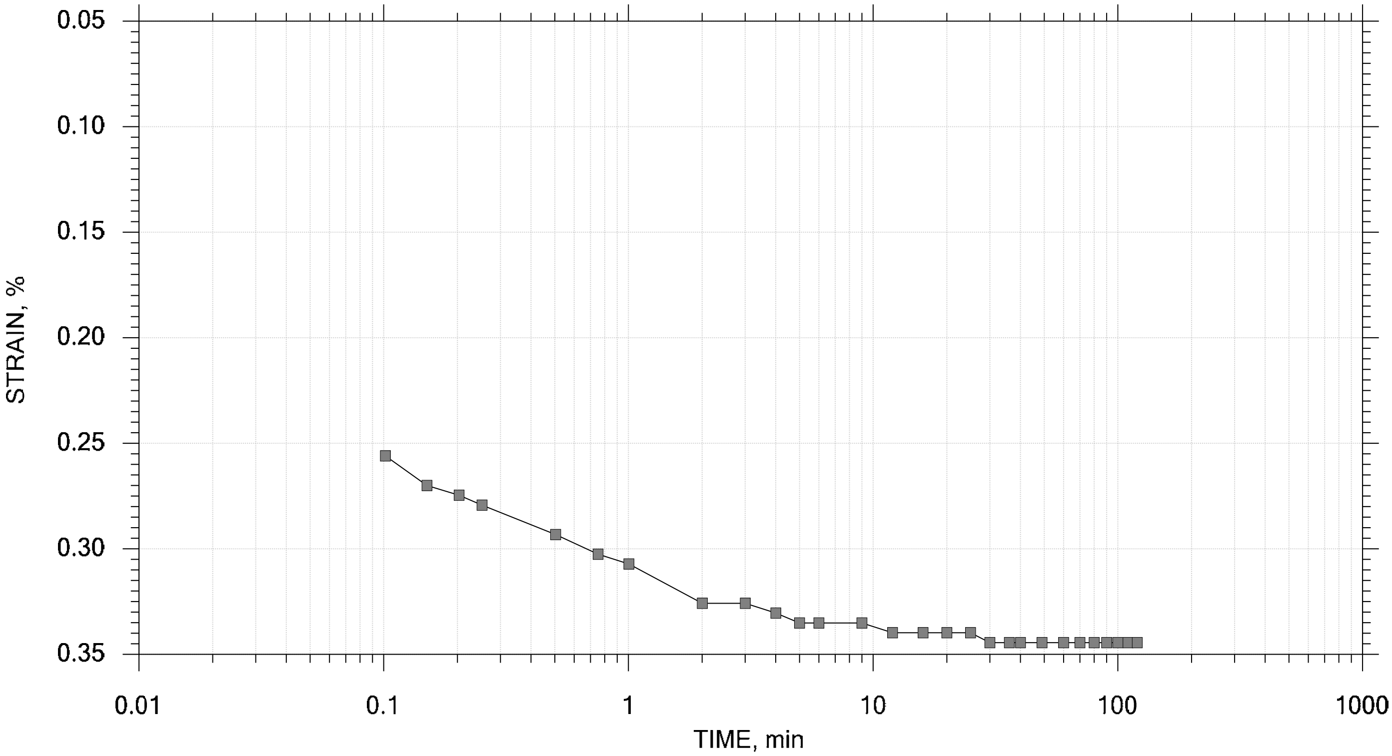
	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
GeoTesting EXPRESS	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

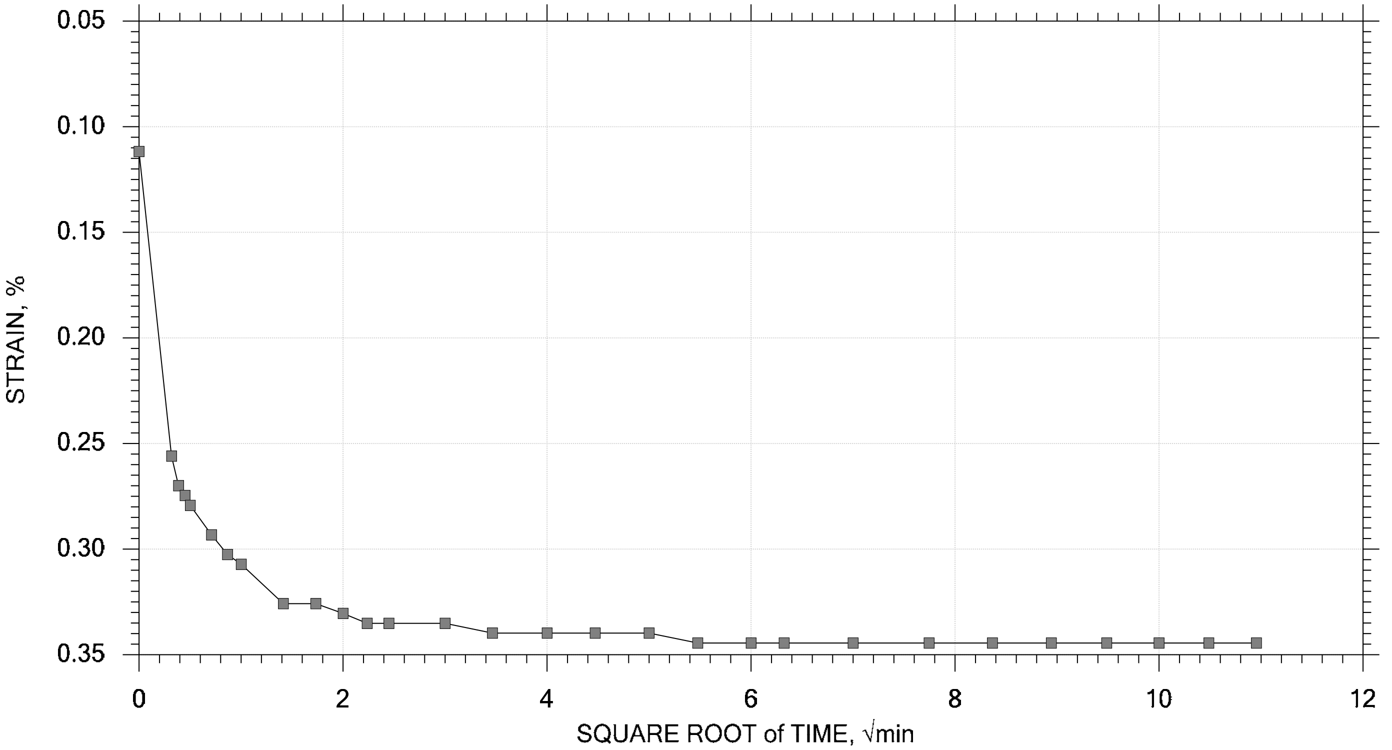
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 2 of 14

Stress: 0.25 tsf





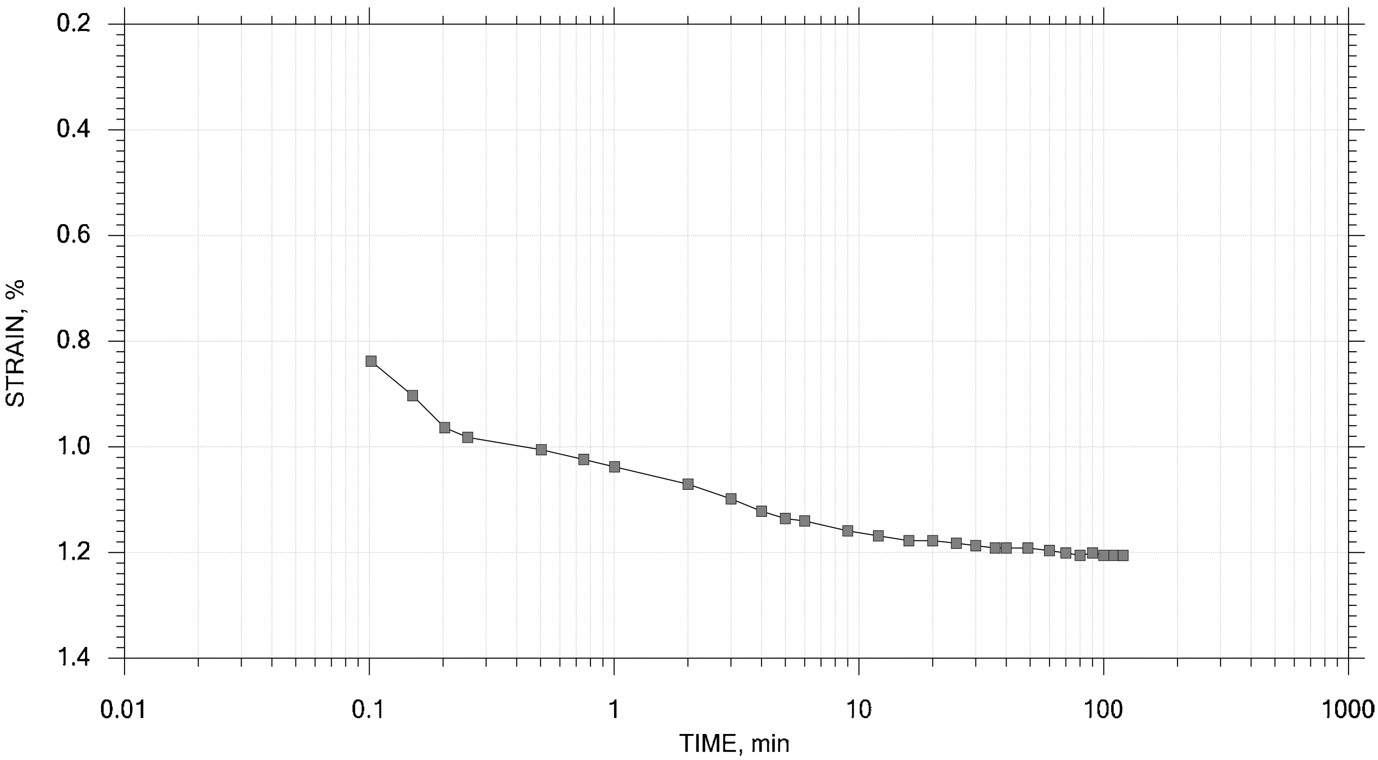
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

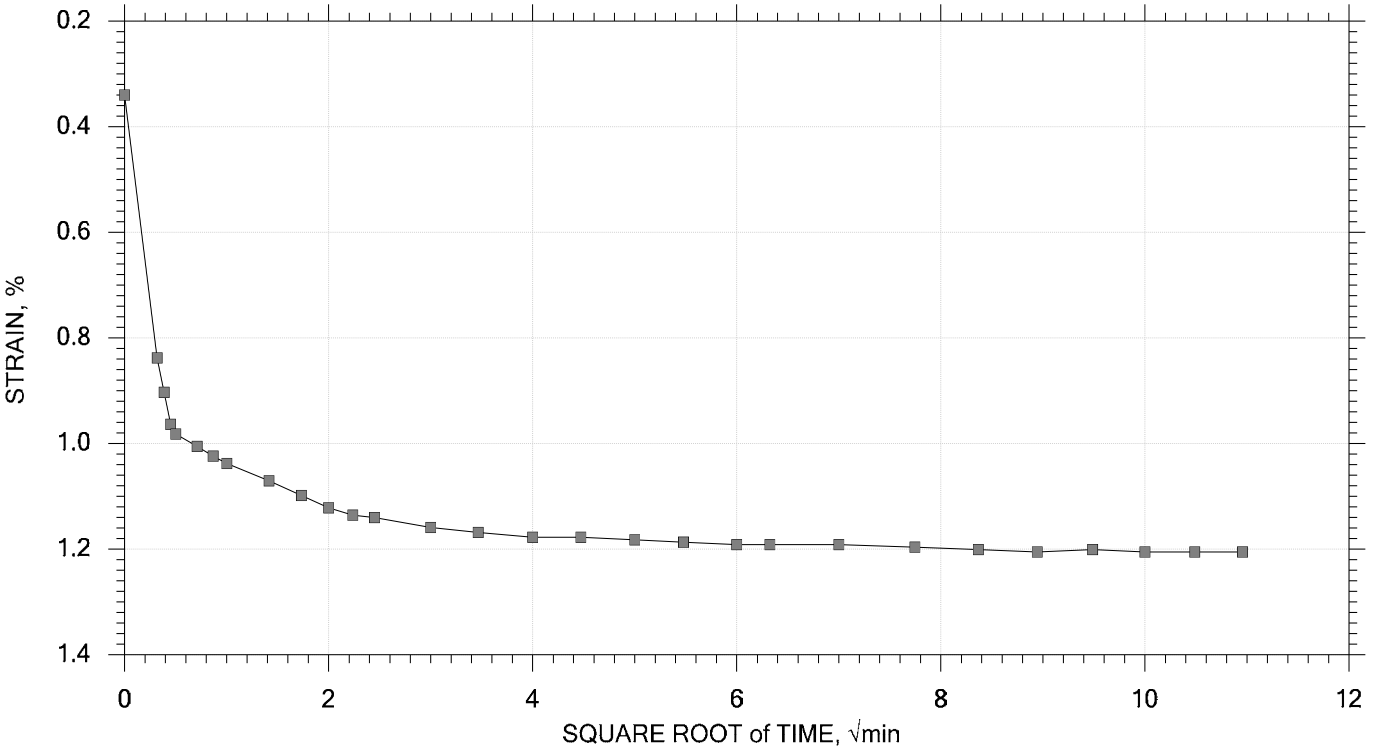
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 3 of 14

Stress: 0.5 tsf





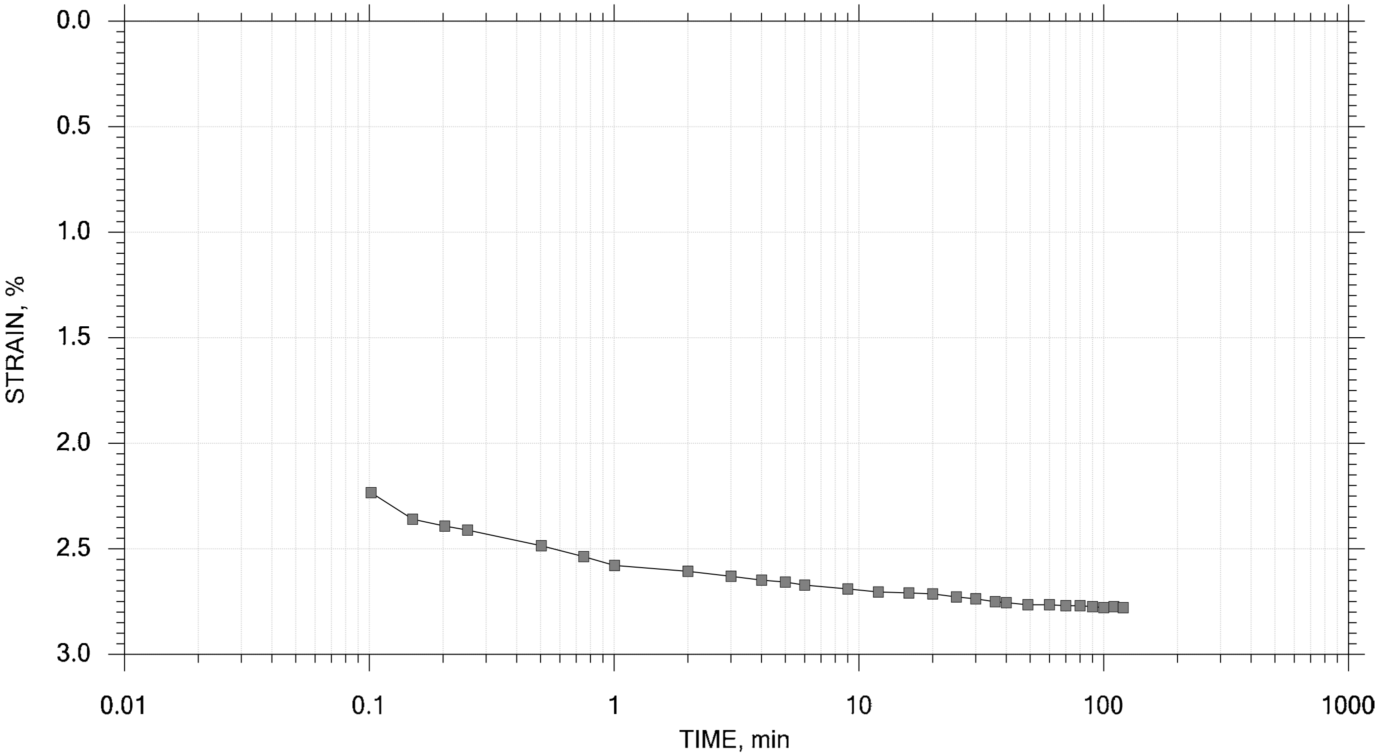
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

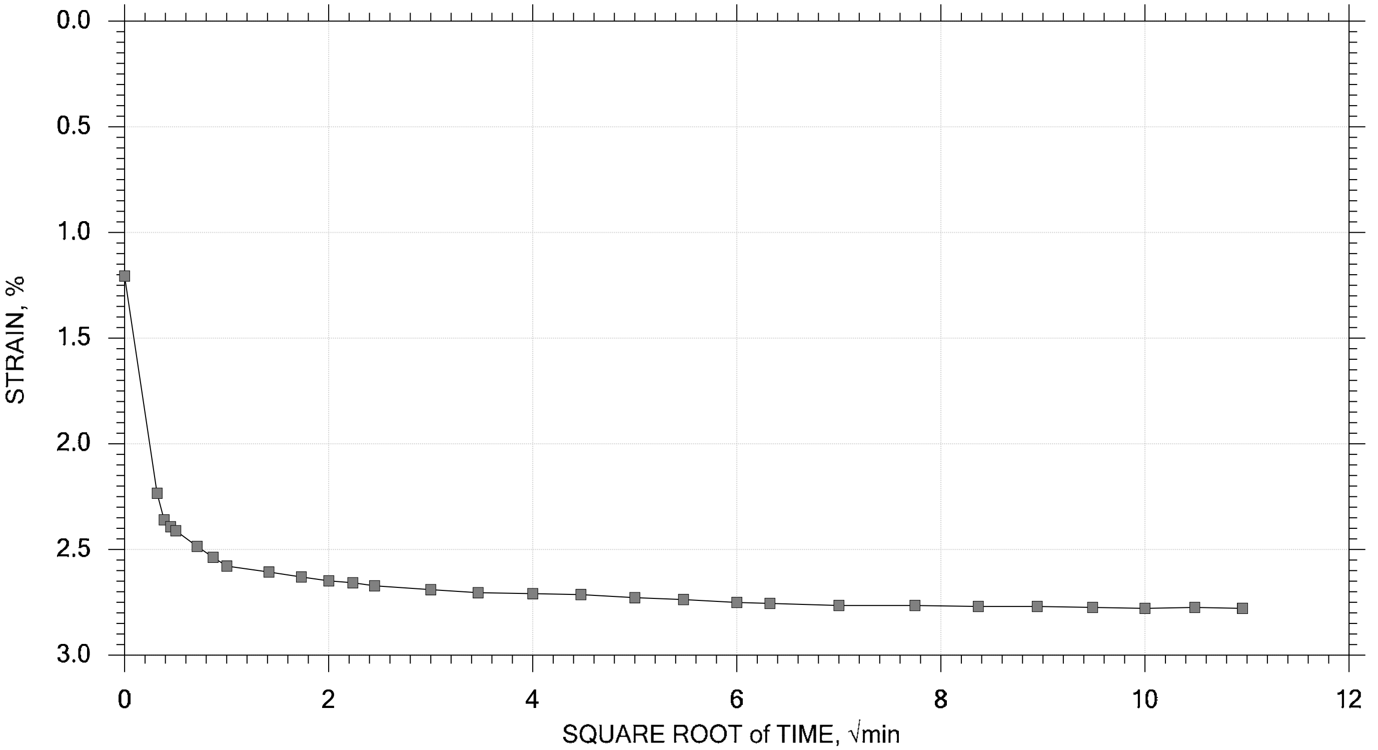
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 4 of 14

Stress: 1 tsf





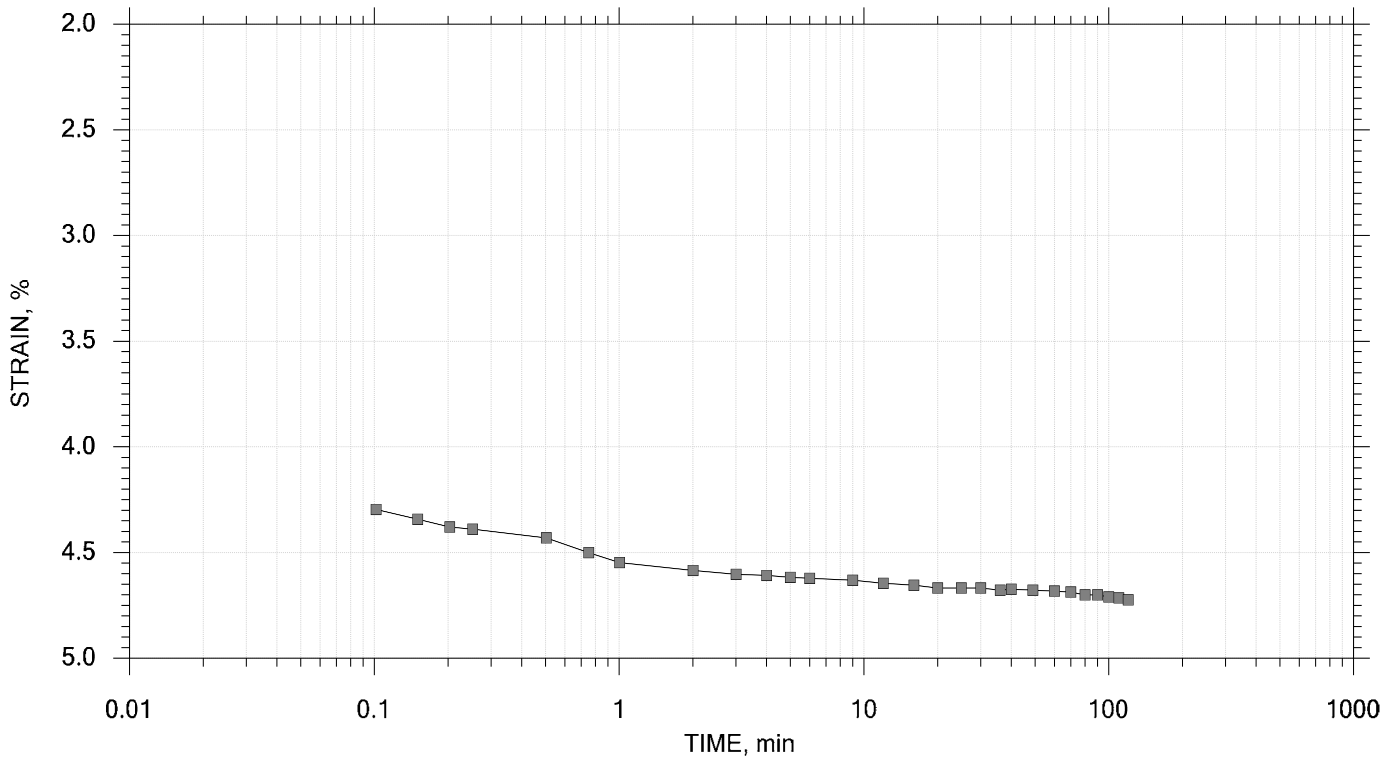
Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
Depth: 35-37 ft	Sample Type: intact	Elevation: ---
Description: Moist, light gray clay		
Remarks: System V, Swell Pressure = 0.134 tsf		

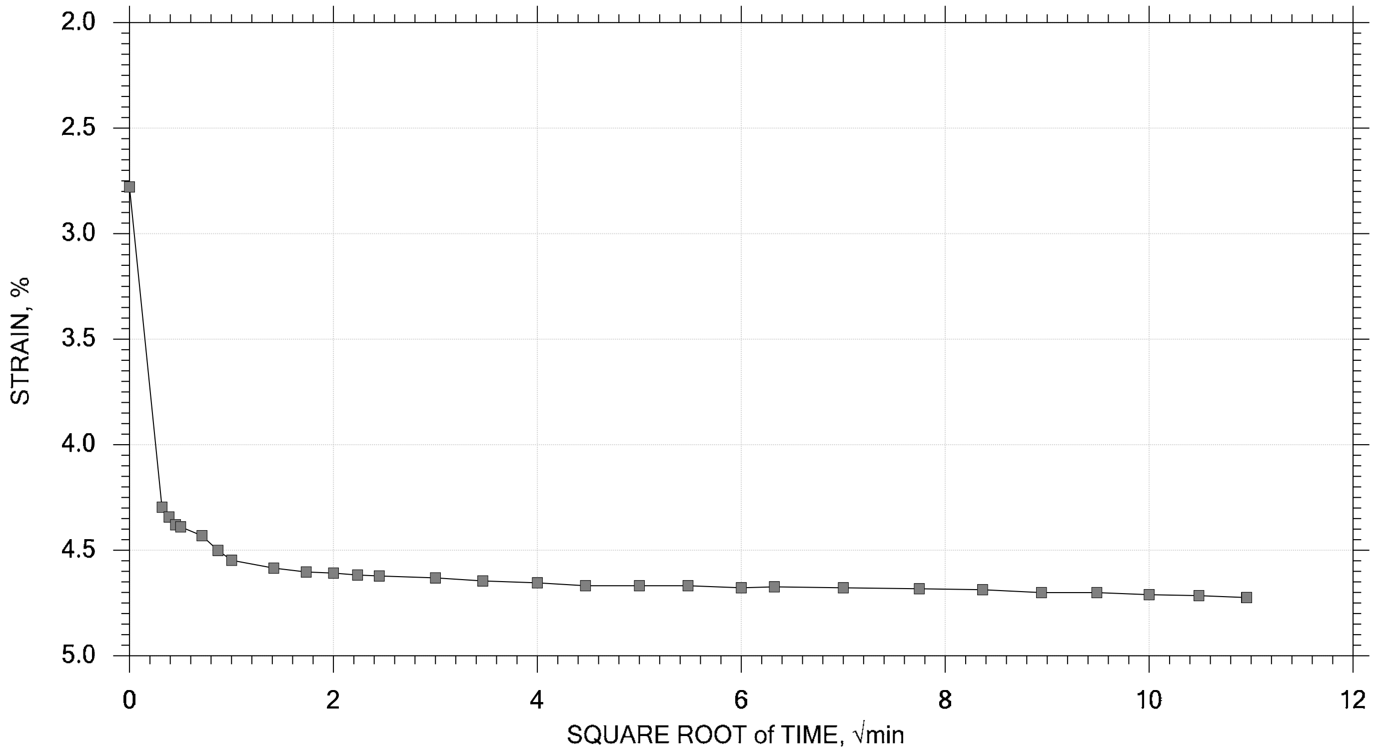
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 5 of 14

Stress: 2 tsf





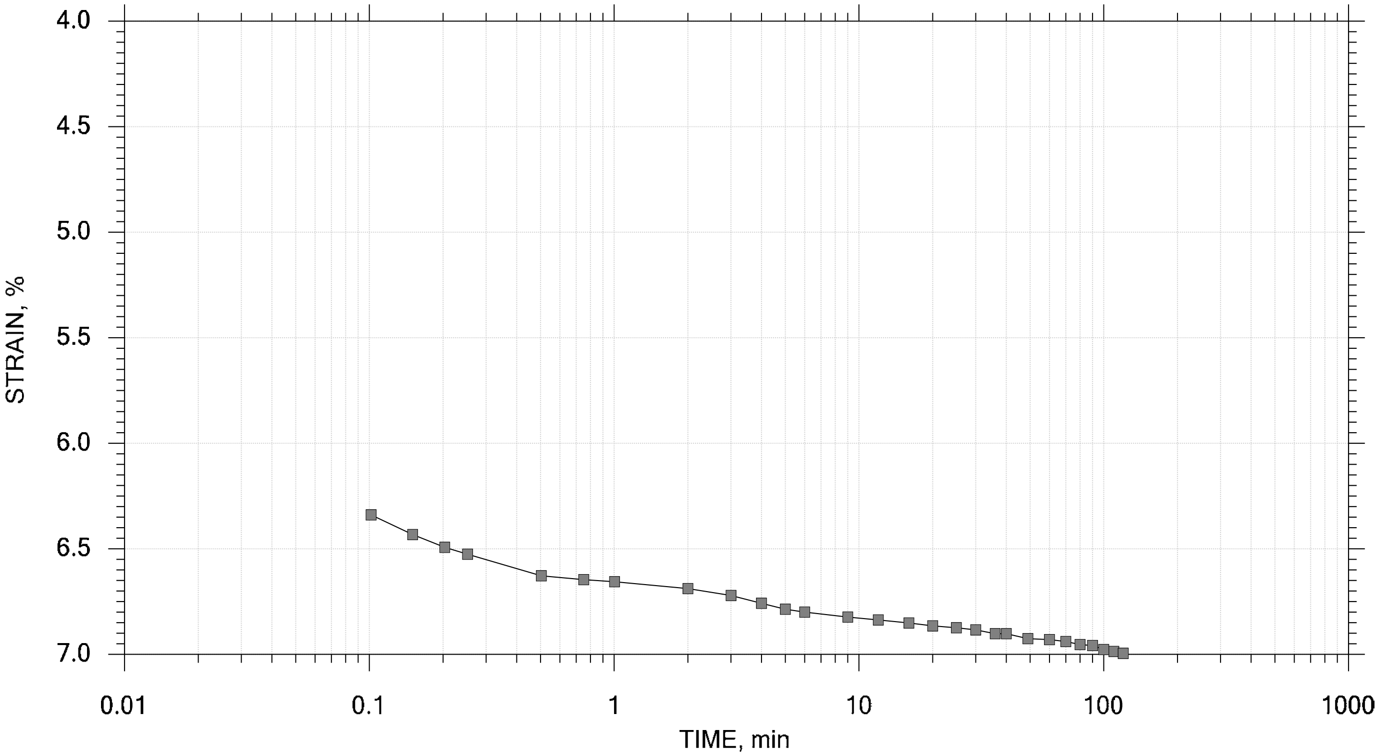
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

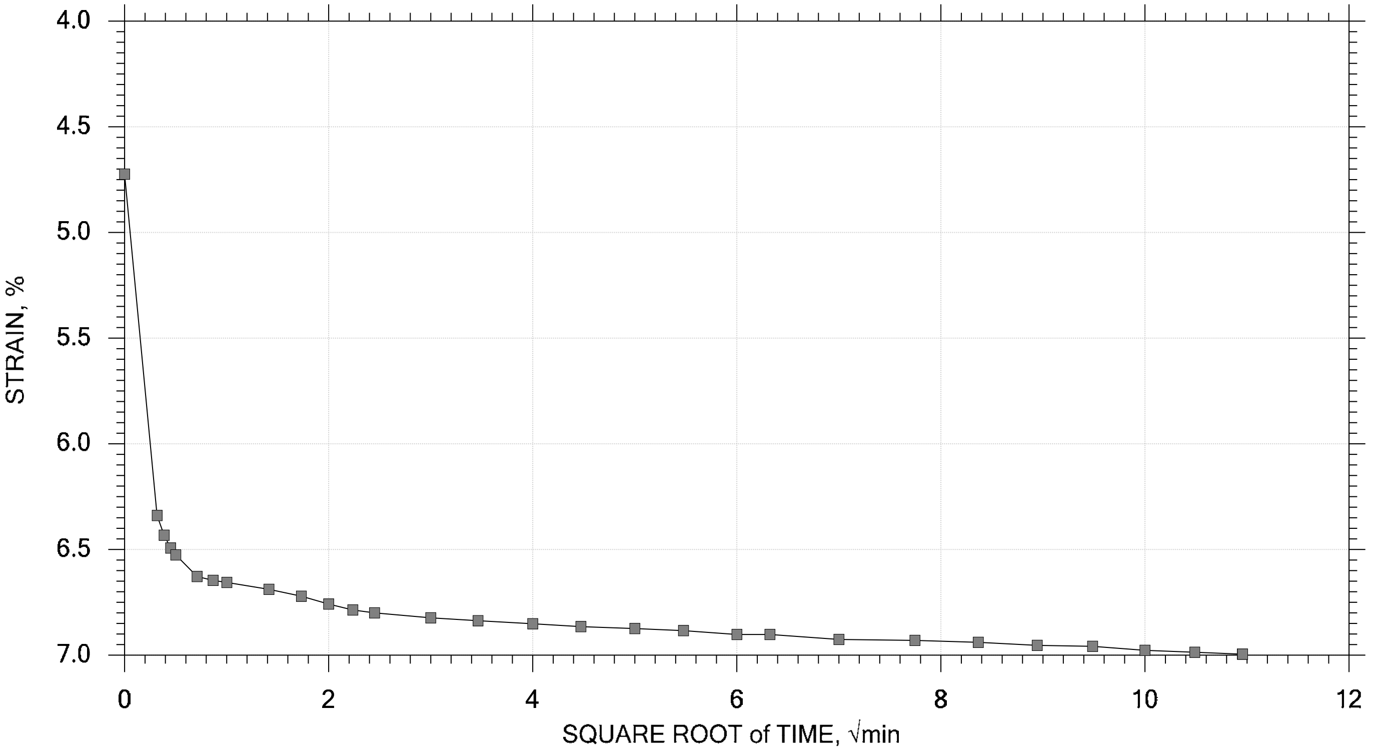
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 6 of 14

Stress: 4 tsf





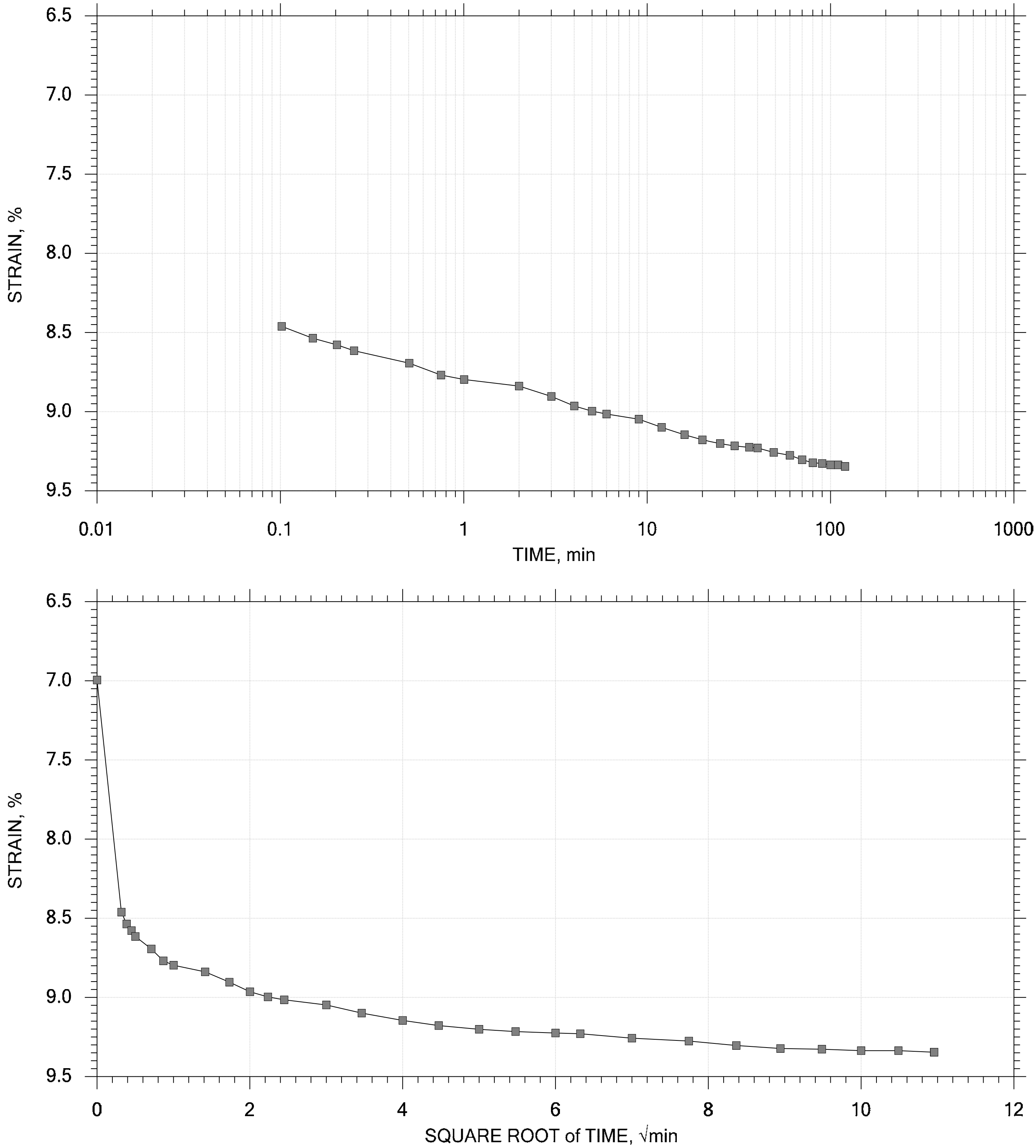
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 7 of 14

Stress: 8 tsf



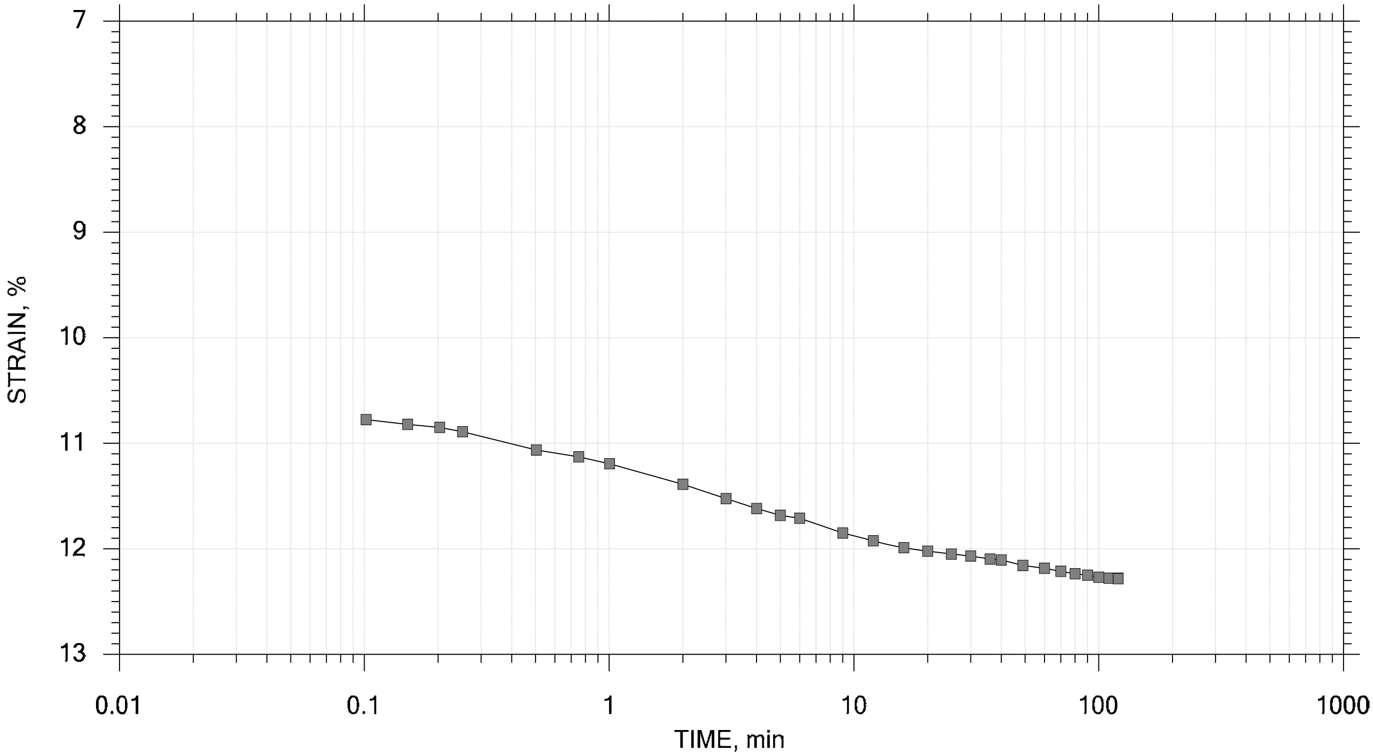
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

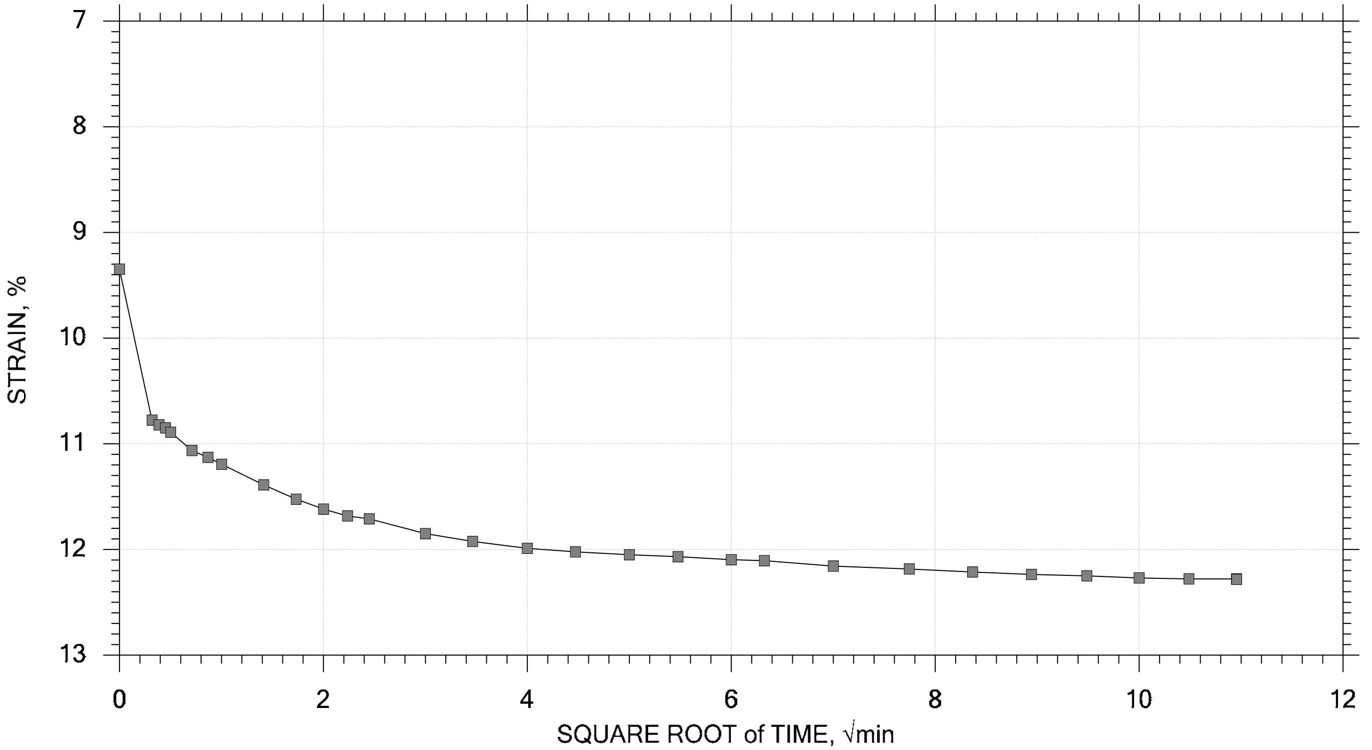
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 8 of 14

Stress: 16 tsf





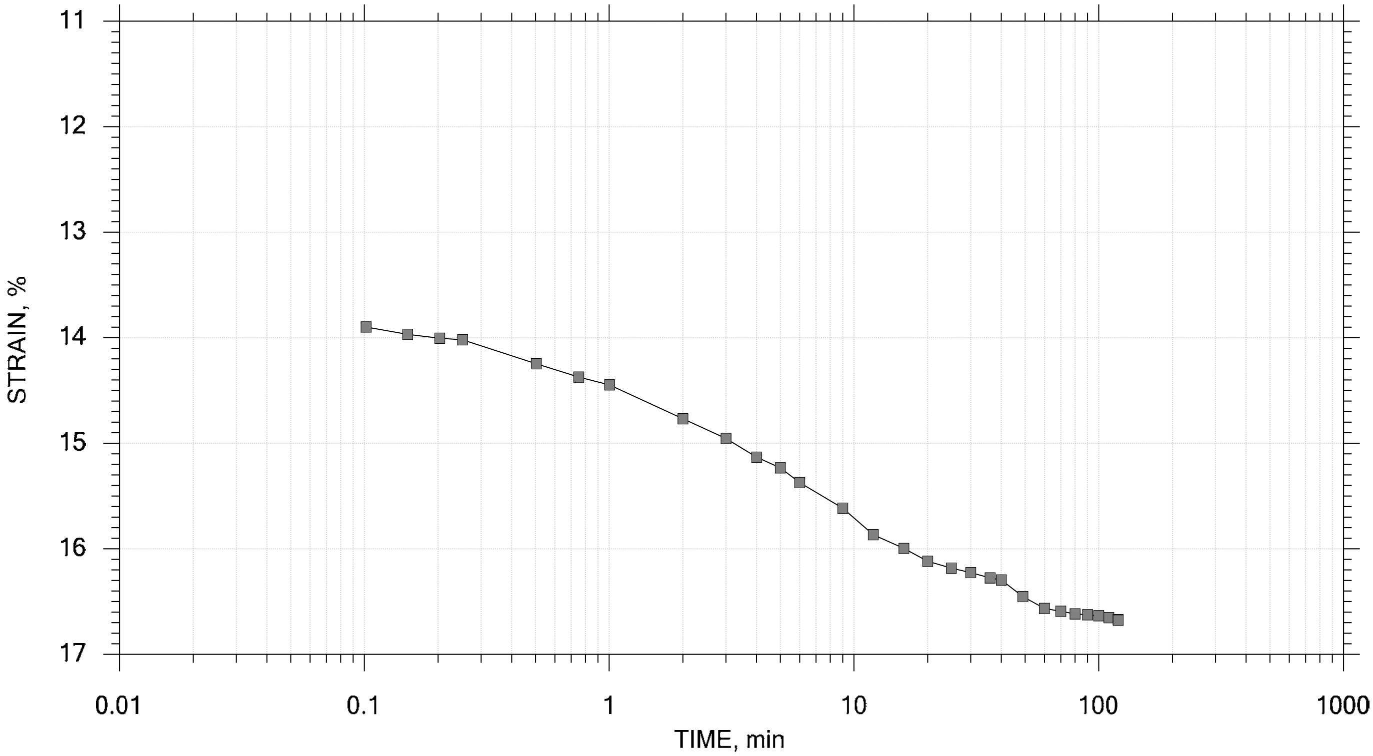
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

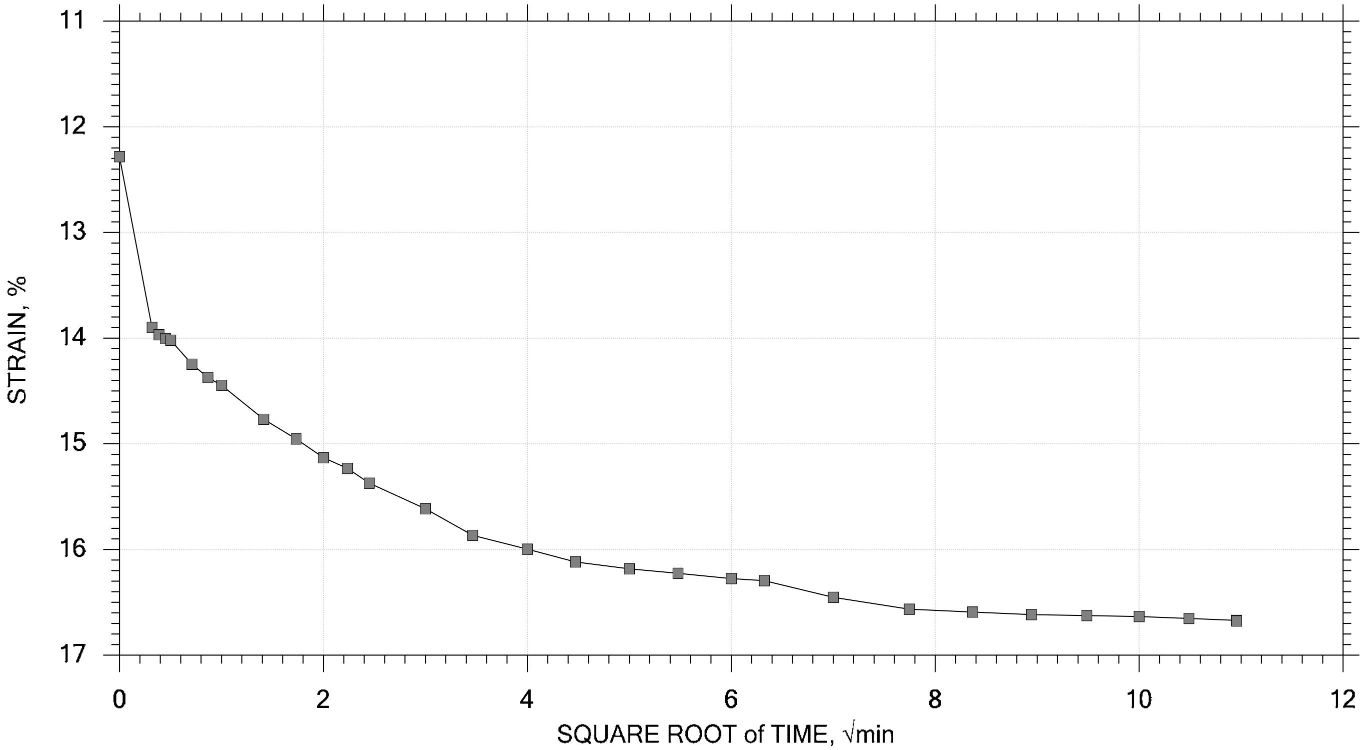
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 9 of 14

Stress: 32 tsf





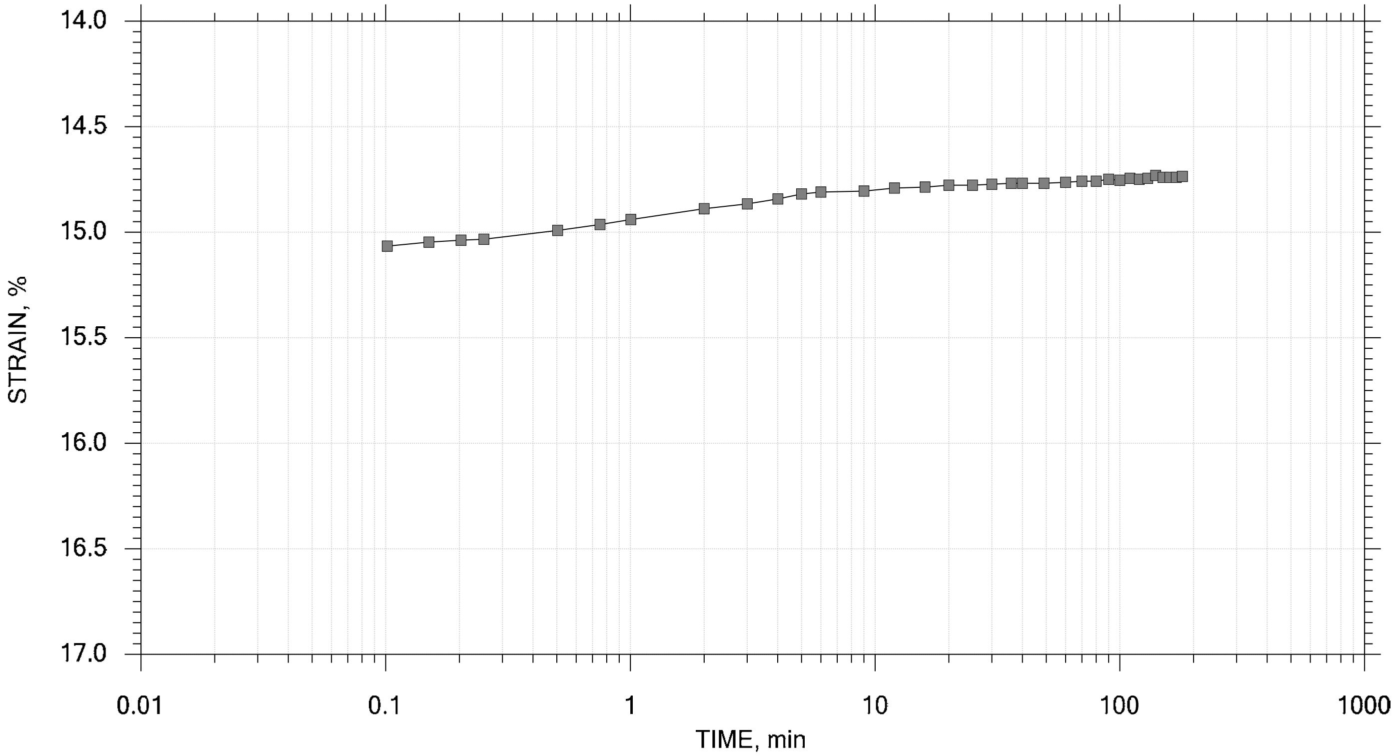
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

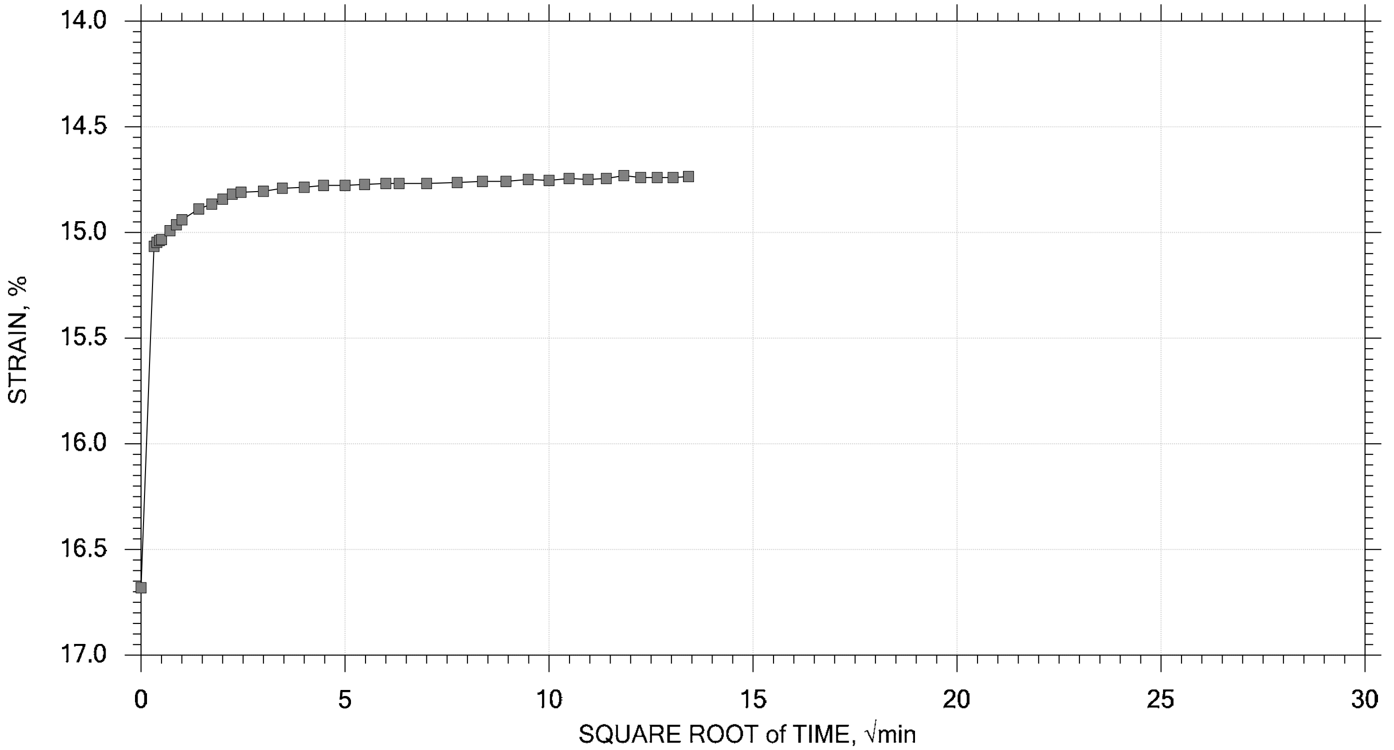
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 10 of 14

Stress: 8 tsf





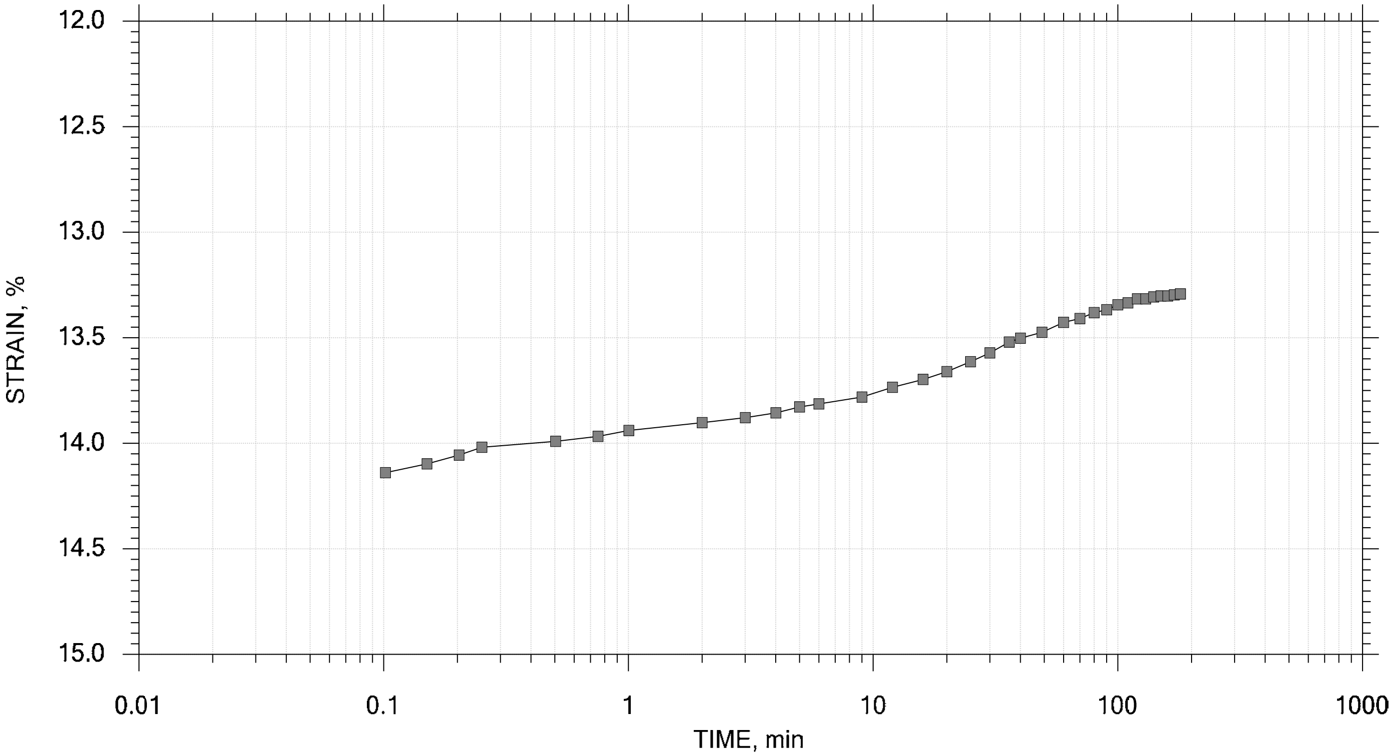
Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
Depth: 35-37 ft	Sample Type: intact	Elevation: ---
Description: Moist, light gray clay		
Remarks: System V, Swell Pressure = 0.134 tsf		

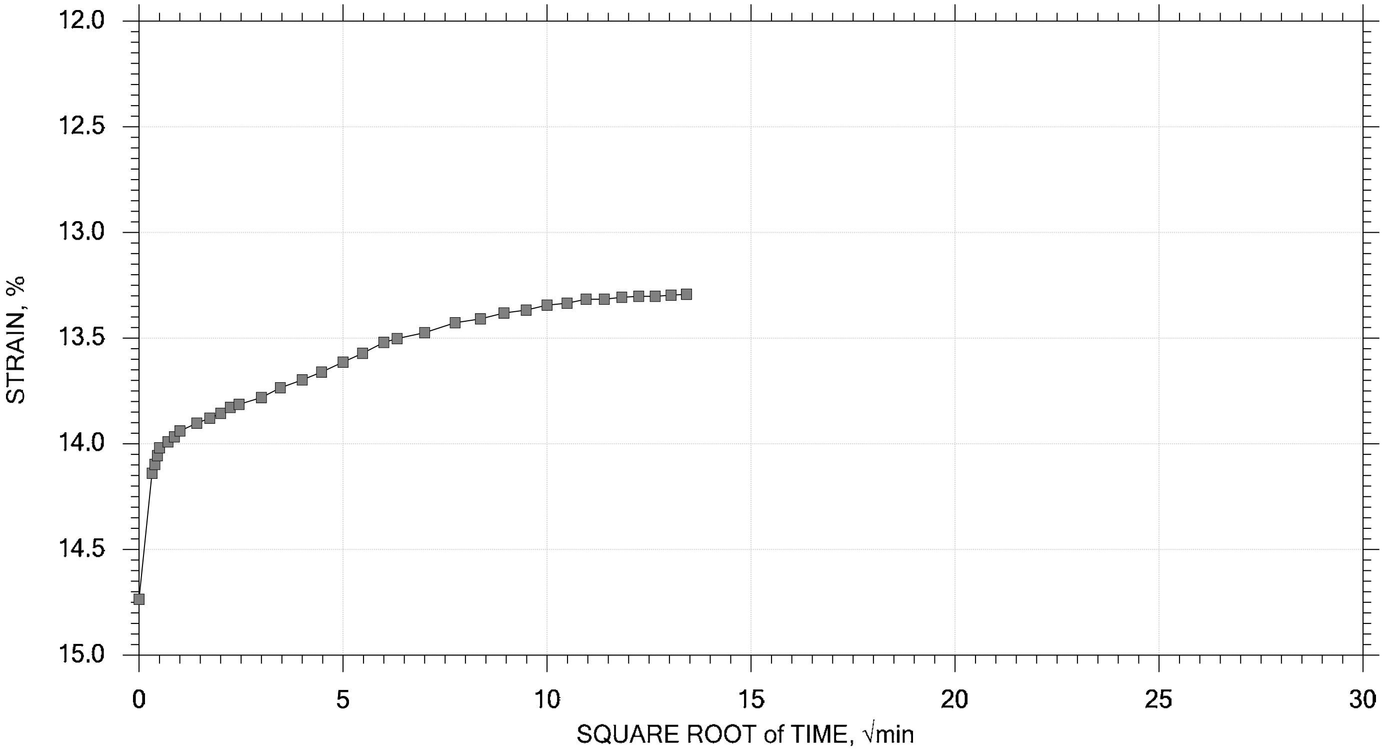
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 11 of 14

Stress: 2 tsf





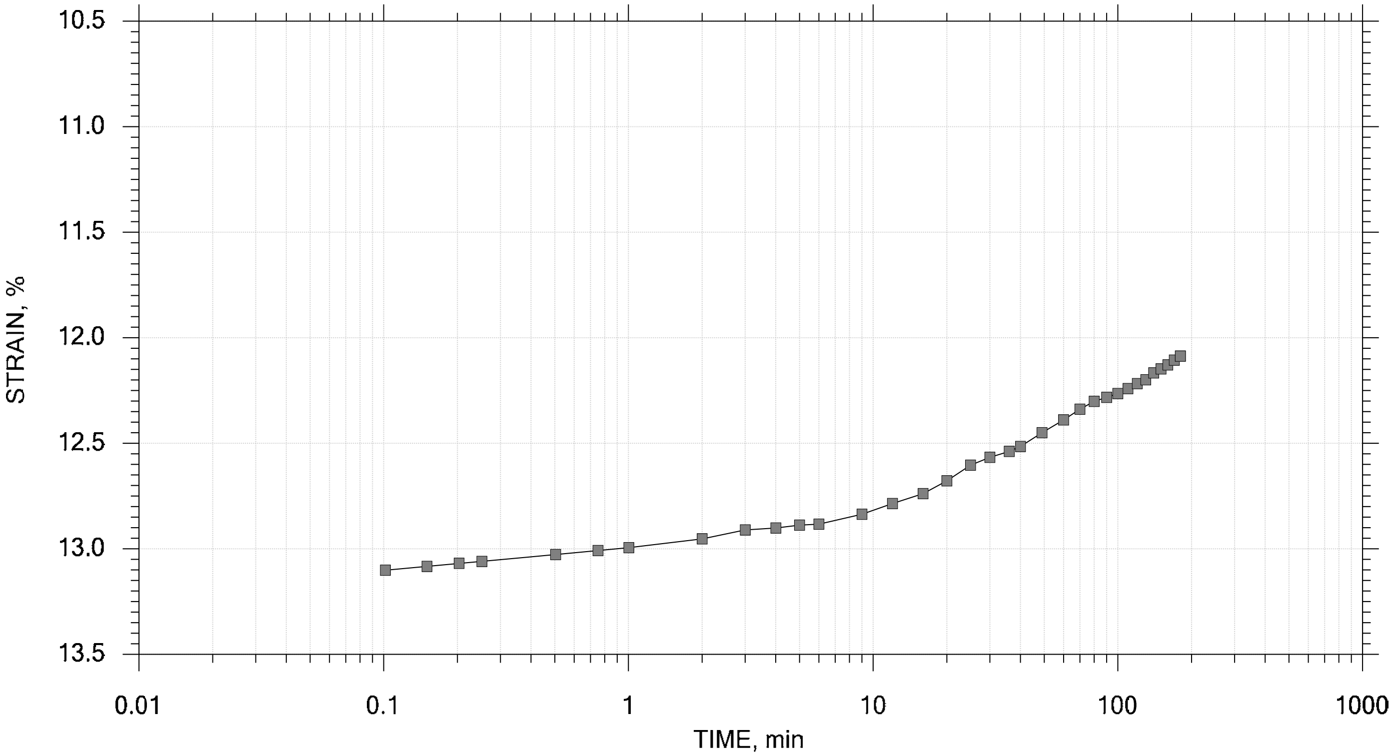
Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
Depth: 35-37 ft	Sample Type: intact	Elevation: ---
Description: Moist, light gray clay		
Remarks: System V, Swell Pressure = 0.134 tsf		

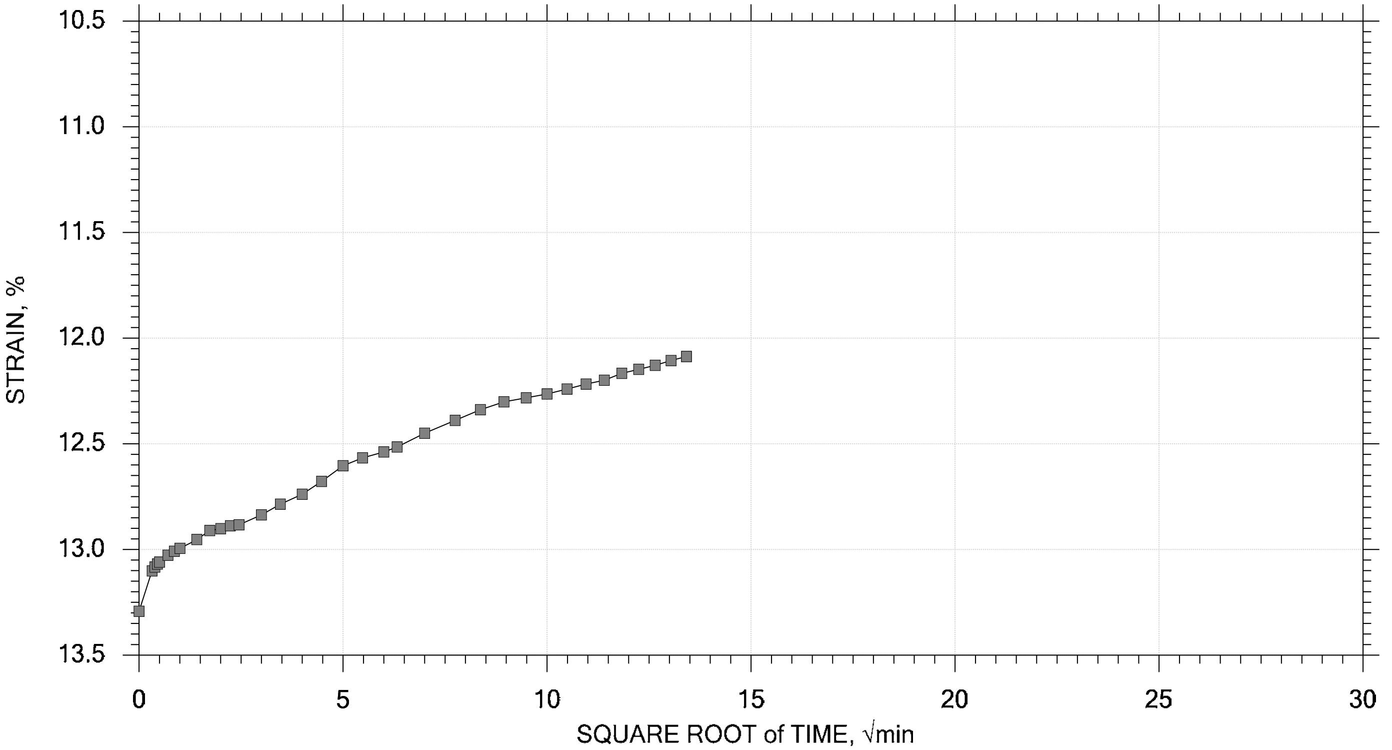
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 12 of 14

Stress: 0.5 tsf





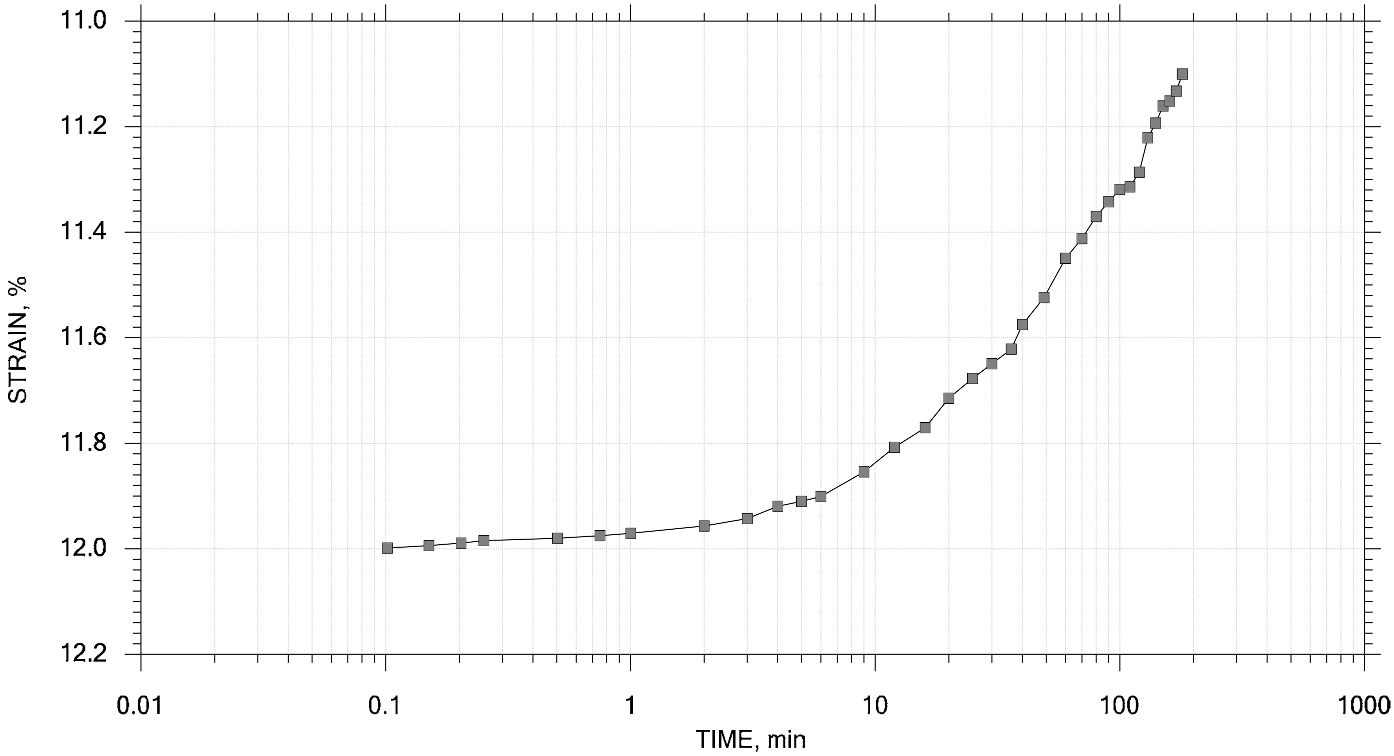
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

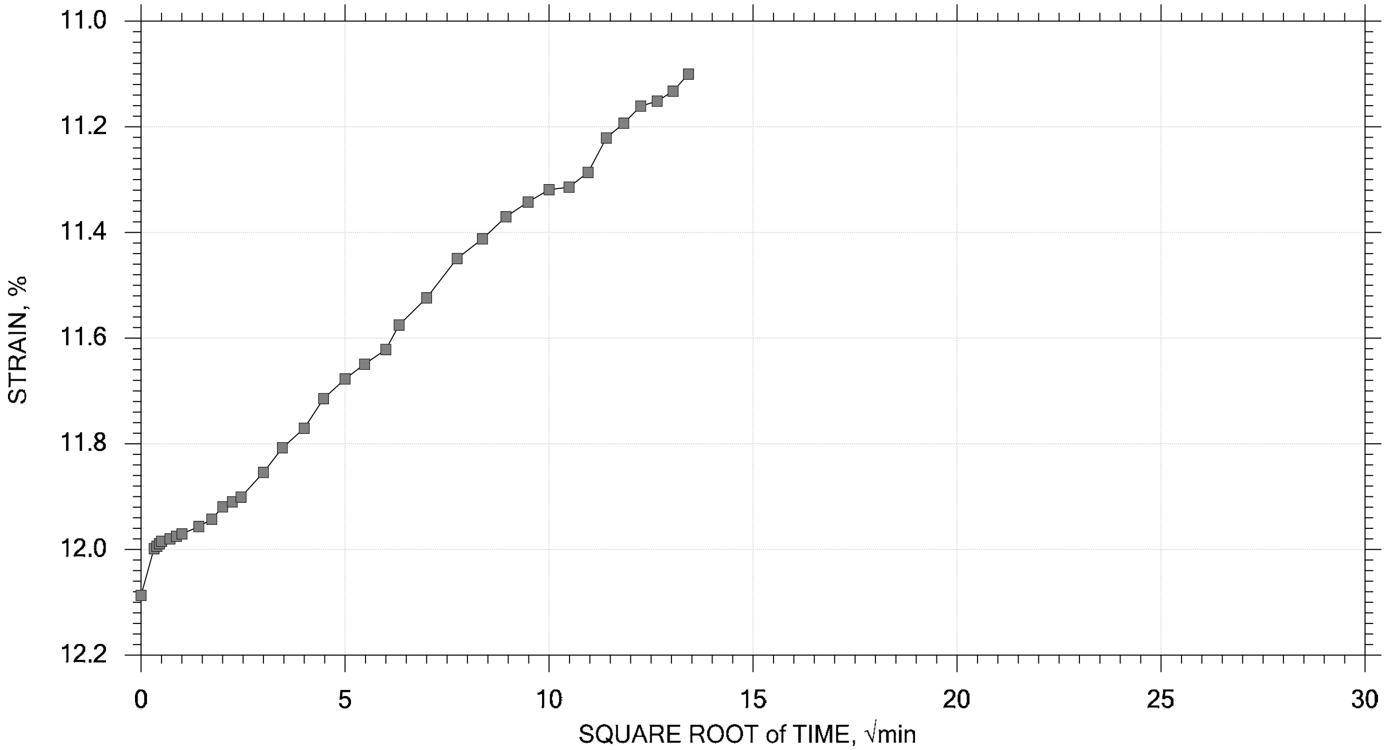
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 13 of 14

Stress: 0.125 tsf





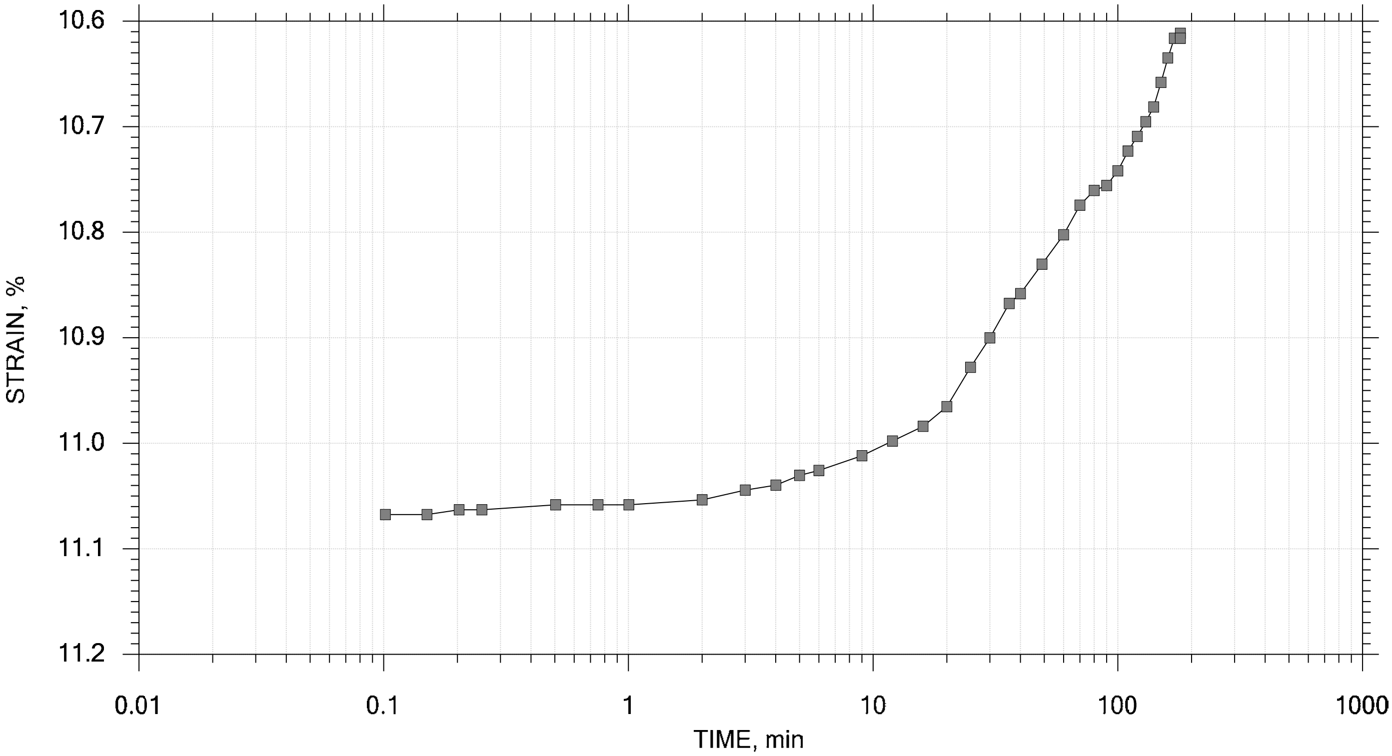
Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Tested By: md	Checked By: jdt
Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
Depth: 35-37 ft	Sample Type: intact	Elevation: ---
Description: Moist, light gray clay		
Remarks: System V, Swell Pressure = 0.134 tsf		

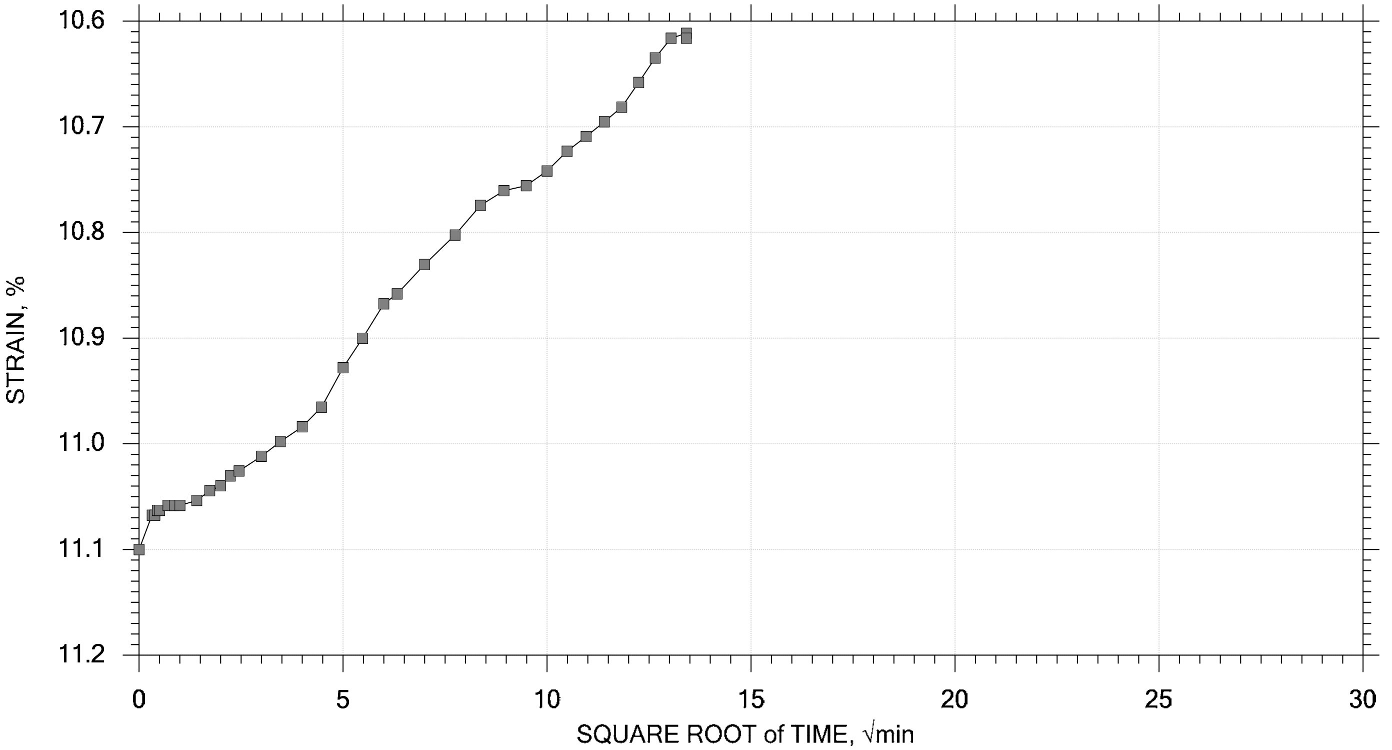
One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 14 of 14

Stress: 0.0625 tsf



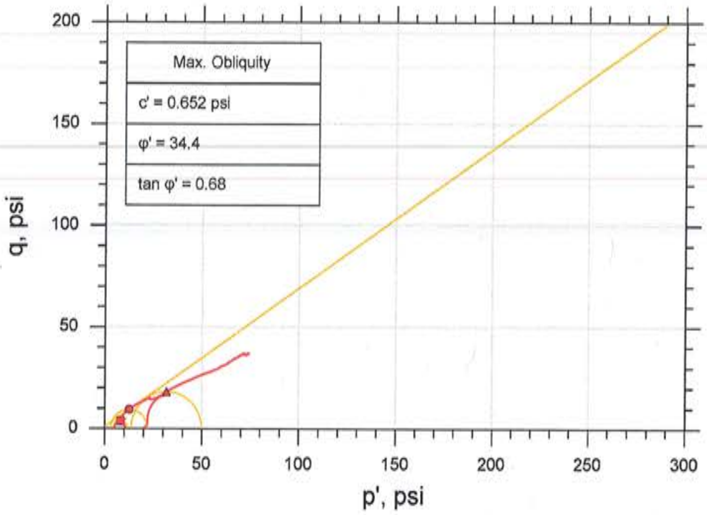


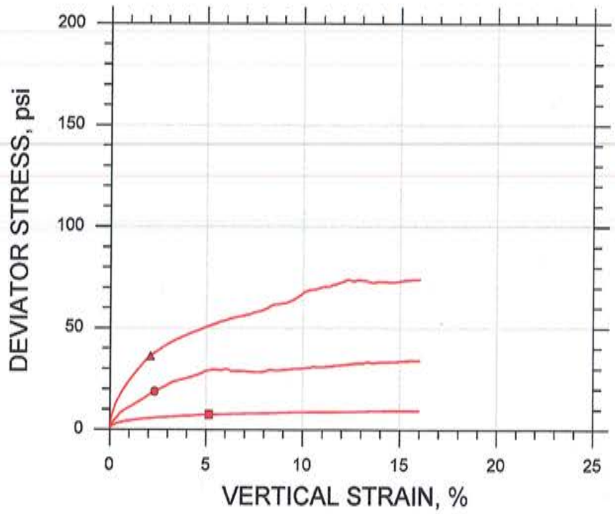
GeoTesting EXPRESS	Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
	Boring No.: B-101	Tested By: md	Checked By: jdt
	Sample No.: ---	Test Date: 01/06/15	Test No.: IP-1
	Depth: 35-37 ft	Sample Type: intact	Elevation: ---
	Description: Moist, light gray clay		
	Remarks: System V, Swell Pressure = 0.134 tsf		

GeoTesting EXPRESS

Client: Arcadis - US., Inc.
Project Name: IB Closure
Project Location: Hattiesberg MS
Project Number: GTX-302718
Tested By: md
Checked By: jdt
Boring ID: B-104
Preparation: intact
Description: Moist, gray clay
Classification: Lean clay
Group Symbol: CL
Liquid Limit: 39
Plastic Limit: 19
Plasticity Index: 20
Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





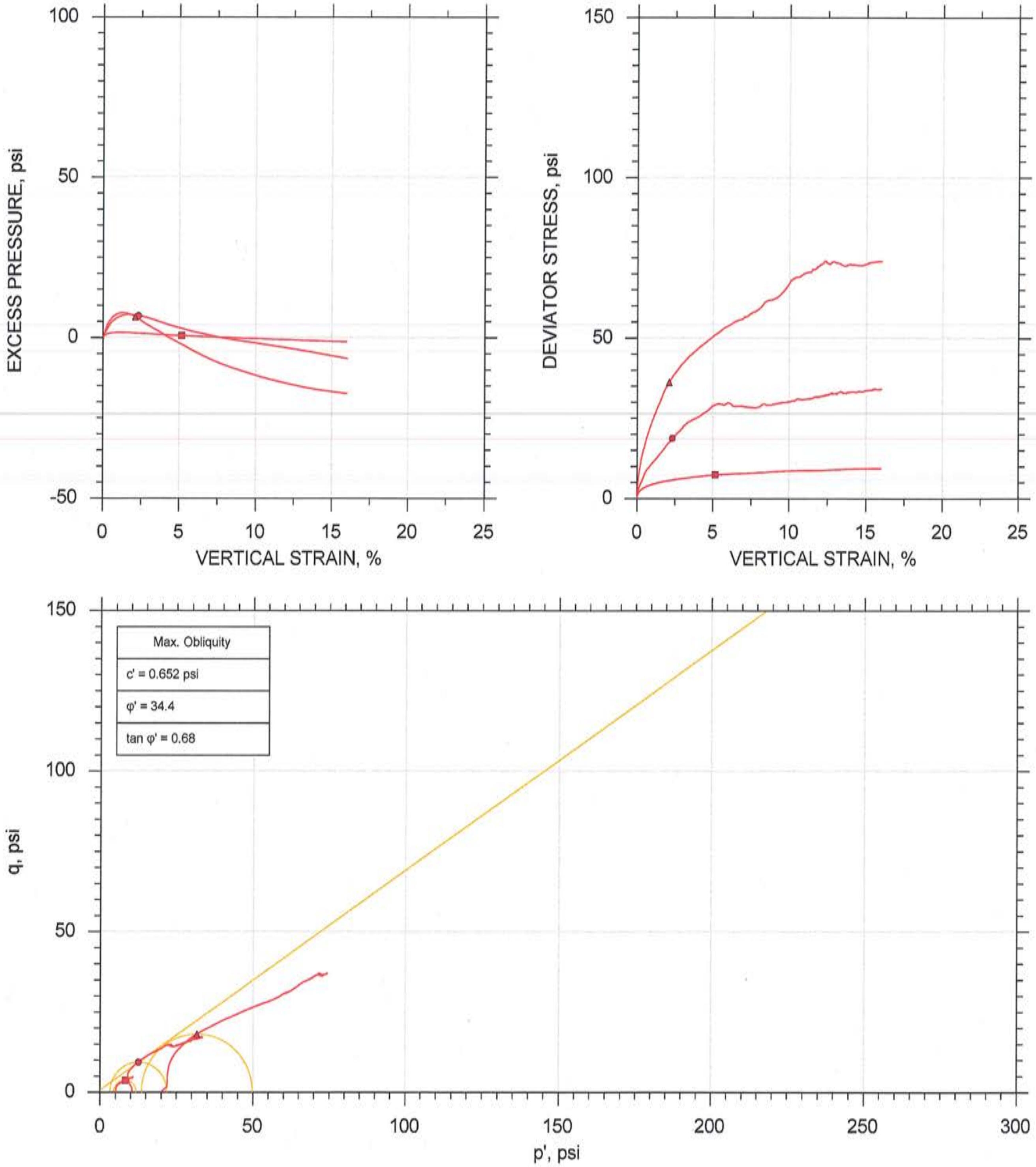
Symbol		■	●	▲	
Sample ID		---	---	---	
Depth, ft		19-21 ft	19-21 ft	19-21 ft	
Test Number		CU-1-1	CU-1-2	CU-1-3	
Initial	Height, in	4.300	4.300	4.200	
	Diameter, in	2.010	2.030	2.040	
	Moisture Content (from Cuttings), %	30.1	22.6	24.3	
	Dry Density, pcf	92.6	100.	97.9	
	Saturation (Wet Method), %	98.9	89.7	91.1	
	Void Ratio	0.820	0.679	0.721	
Before Shear	Moisture Content, %	28.8	22.5	28.4	
	Dry Density, pcf	94.9	105.	95.4	
	Cross-sectional Area (Method A), in²	3.107	3.159	3.400	
	Saturation, %	100.0	100.0	100.0	
	Void Ratio	0.777	0.608	0.766	
	Back Pressure, psi	129.0	138.8	140.9	
Vertical Effective Consolidation Stress, psi		5.009	9.959	19.94	
Horizontal Effective Consolidation Stress, psi		4.993	9.995	20.01	
Vertical Strain after Consolidation, %		0.1416	0.8379	0.9317	
Volumetric Strain after Consolidation, %		1.896	1.122	-3.977	
Time to 50% Consolidation, min		5.060	0.3600	0.1600	
Shear Strength, psi		3.709	9.380	18.11	
Strain at Failure, %		5.15	2.32	2.10	
Strain Rate, %/min		0.01600	0.01600	0.01600	
Deviator Stress at Failure, psi		7.417	18.76	36.21	
Effective Minor Principal Stress at Failure, psi		4.405	3.185	13.57	
Effective Major Principal Stress at Failure, psi		11.82	21.95	49.78	
B-Value		0.96	0.95	0.96	

Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

Remarks:

System O

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



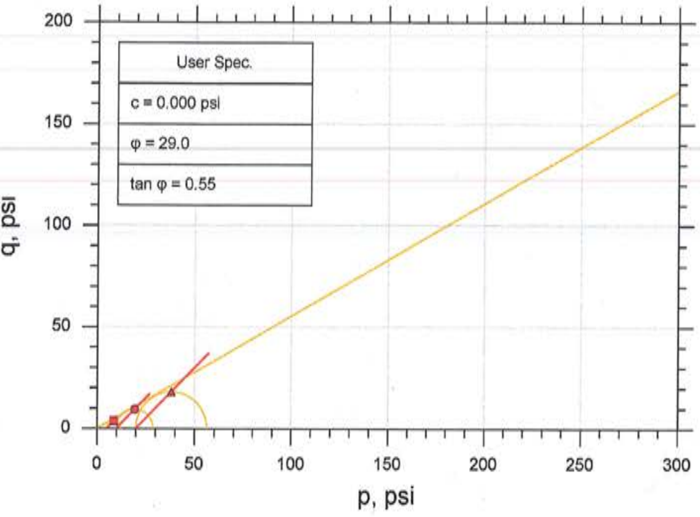
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	---	CU-1-1	19-21 ft	md	01/05/15	jdt	1/13/15	302718-CU-1-1m.dat
●	---	CU-1-2	19-21 ft	md	01/05/15	jdt	1/13/15	302718-CU-1-2m.dat
▲	---	CU-1-3	19-21 ft	md	01/05/15	jdt	1/13/15	302718-CU-1-3m.dat

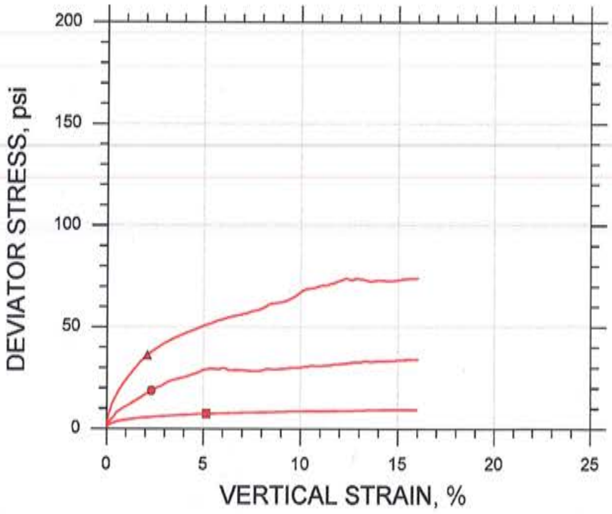
GeoTesting EXPRESS

Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-104	Sample Type: intact	
Description: Moist, gray clay		
Remarks: System O		

Client: Arcadis - US., Inc.
Project Name: IB Closure
Project Location: Hattiesberg MS
Project Number: GTX-302718
Tested By: md
Checked By: jdt
Boring ID: B-104
Preparation: intact
Description: Moist, gray clay
Classification: Lean clay
Group Symbol: CL
Liquid Limit: 39
Plastic Limit: 19
Plasticity Index: 20
Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





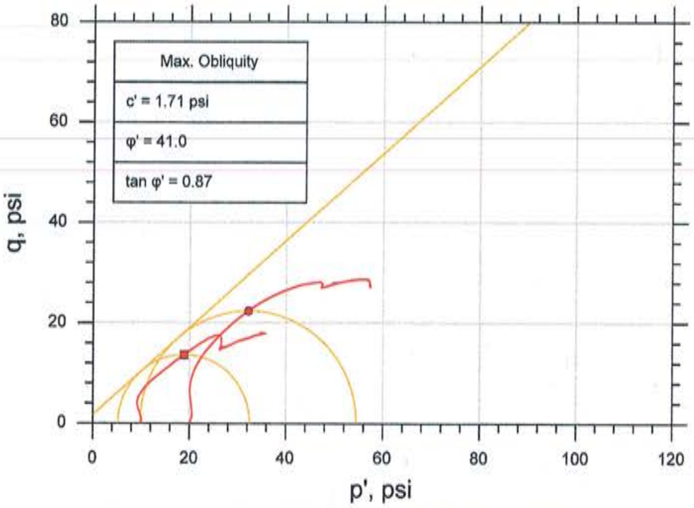
Symbol		■	●	▲	
Sample ID		---	---	---	
Depth, ft		19-21 ft	19-21 ft	19-21 ft	
Test Number		CU-1-1	CU-1-2	CU-1-3	
Initial	Height, in	4.300	4.300	4.200	
	Diameter, in	2.010	2.030	2.040	
	Moisture Content (from Cuttings), %	30.1	22.6	24.3	
	Dry Density, pcf	92.6	100.	97.9	
	Saturation (Wet Method), %	98.9	89.7	91.1	
	Void Ratio	0.820	0.679	0.721	
Before Shear	Moisture Content, %	28.8	22.5	28.4	
	Dry Density, pcf	94.9	105.	95.4	
	Cross-sectional Area (Method A), in²	3.107	3.159	3.400	
	Saturation, %	100.0	100.0	100.0	
	Void Ratio	0.777	0.608	0.766	
	Back Pressure, psi	129.0	138.8	140.9	
Vertical Effective Consolidation Stress, psi		5.009	9.959	19.94	
Horizontal Effective Consolidation Stress, psi		4.993	9.995	20.01	
Vertical Strain after Consolidation, %		0.1416	0.8379	0.9317	
Volumetric Strain after Consolidation, %		1.896	1.122	-3.977	
Time to 50% Consolidation, min		5.060	0.3600	0.1600	
Shear Strength, psi		3.709	9.380	18.11	
Strain at Failure, %		5.15	2.32	2.10	
Strain Rate, %/min		0.01600	0.01600	0.01600	
Deviator Stress at Failure, psi		7.417	18.76	36.21	
Effective Minor Principal Stress at Failure, psi		4.405	3.185	13.57	
Effective Major Principal Stress at Failure, psi		11.82	21.95	49.78	
B-Value		0.96	0.95	0.96	
Notes: - Before Shear Saturation set to 100% for phase calculation. - Moisture Content determined by ASTM D2216. - Atterberg Limits determined by ASTM D4318. - Deviator Stress includes membrane correction. - Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.					
Remarks:					

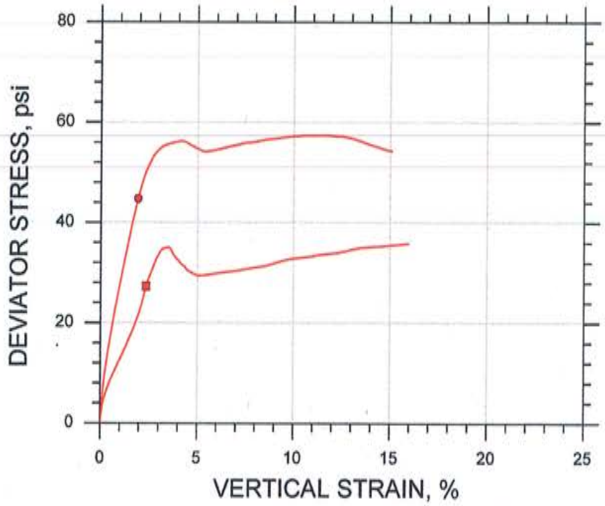
System O

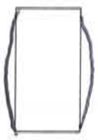
GeoTesting EXPRESS

Client: Arcadis - US., Inc.	
Project Name: IB Closure	
Project Location: Hattiesberg MS	
Project Number: GTX-302718	
Tested By: md	Checked By: jdt
Boring ID: B-101	
Preparation: intact	
Description: Moist, light gray clay	
Classification: Lean clay	
Group Symbol: CL	
Liquid Limit: 39	Plastic Limit: 18
Plasticity Index: 21	Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

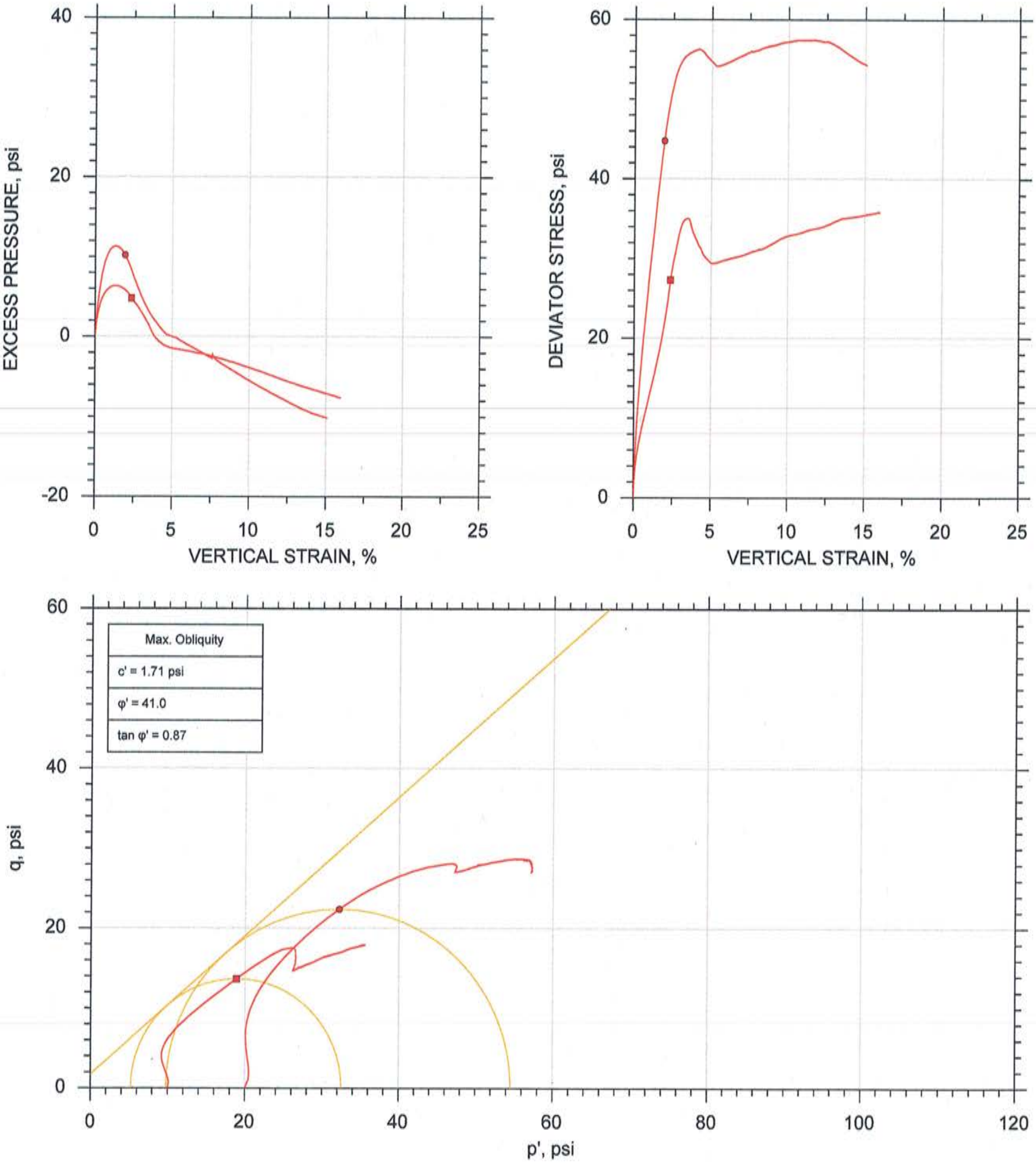




Symbol		■	●		
Sample ID		---	---		
Depth, ft		35-37 ft	35-37 ft		
Test Number		CU-2-1	CU-2-2		
Initial	Height, in	6.380	6.160		
	Diameter, in	2.850	2.850		
	Moisture Content (from Cuttings), %	18.4	18.7		
	Dry Density, pcf	108.	107.		
	Saturation (Wet Method), %	88.2	86.6		
	Void Ratio	0.563	0.582		
Before Shear	Moisture Content, %	19.7	17.4		
	Dry Density, pcf	110.	115.		
	Cross-sectional Area (Method A), in²	6.298	6.085		
	Saturation, %	100.0	100.0		
	Void Ratio	0.531	0.470		
	Back Pressure, psi	134.8	92.99		
Vertical Effective Consolidation Stress, psi		9.981	19.95		
Horizontal Effective Consolidation Stress, psi		9.998	20.01		
Vertical Strain after Consolidation, %		0.4088	0.9702		
Volumetric Strain after Consolidation, %		0.9273	2.312		
Time to 50% Consolidation, min		12.25	35.00		
Shear Strength, psi		13.66	22.39		
Strain at Failure, %		2.35	1.93		
Strain Rate, %/min		0.01600	0.01600		
Deviator Stress at Failure, psi		27.31	44.77		
Effective Minor Principal Stress at Failure, psi		5.206	9.791		
Effective Major Principal Stress at Failure, psi		32.52	54.56		
B-Value		0.95	0.98		
Notes: - Before Shear Saturation set to 100% for phase calculation. - Moisture Content determined by ASTM D2216. - Atterberg Limits determined by ASTM D4318. - Deviator Stress includes membrane correction. - Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions. Remarks:					

System B

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	---	CU-2-1	35-37 ft	md	01/06/15	jdt	1/13/15	302718-CU-2-1m.dat
●	---	CU-2-2	35-37 ft	md	01/06/15	jdt	1/13/15	302718-CU-2-2m.dat

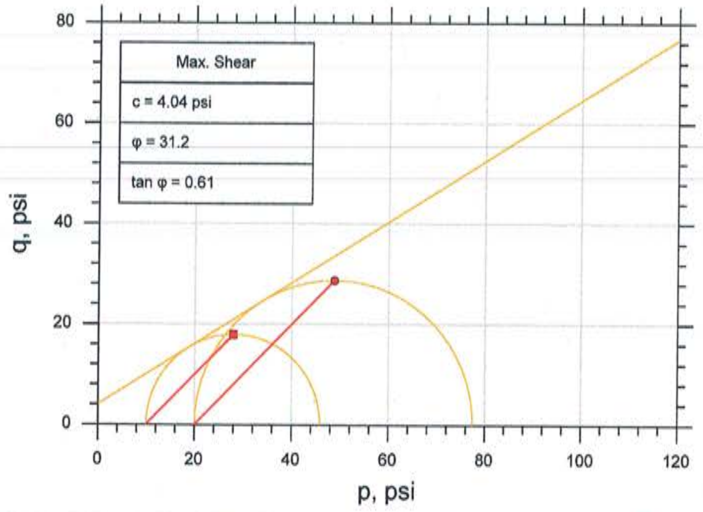
GeoTesting EXPRESS

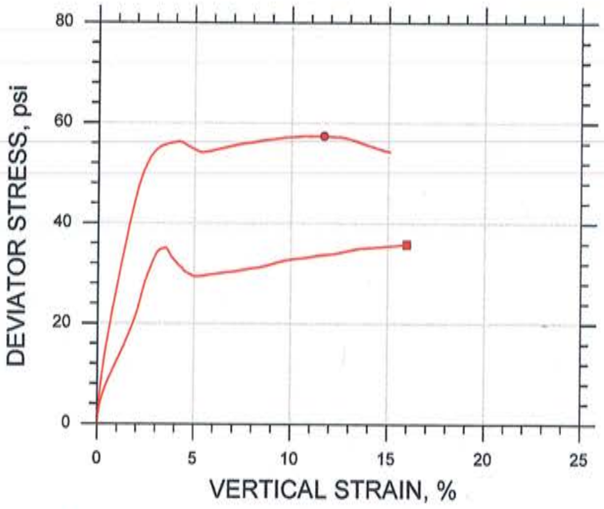
Project: IB Closure	Location: Hattiesberg MS	Project No.: GTX-302718
Boring No.: B-101	Sample Type: intact	
Description: Moist, light gray clay		
Remarks: System B		

GeoTesting EXPRESS

Client: Arcadis - US., Inc.	
Project Name: IB Closure	
Project Location: Hattiesberg MS	
Project Number: GTX-302718	
Tested By: md	Checked By: jdt
Boring ID: B-101	
Preparation: intact	
Description: Moist, light gray clay	
Classification: Lean clay	
Group Symbol: CL	
Liquid Limit: 39	Plastic Limit: 18
Plasticity Index: 21	Estimated Specific Gravity: 2.7

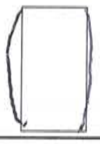
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

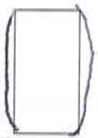




Symbol		■	●		
Sample ID		---	---		
Depth, ft		35-37 ft	35-37 ft		
Test Number		CU-2-1	CU-2-2		
Initial	Height, in	6.380	6.160		
	Diameter, in	2.850	2.850		
	Moisture Content (from Cuttings), %	18.4	18.7		
	Dry Density, pcf	108.	107.		
	Saturation (Wet Method), %	88.2	86.6		
	Void Ratio	0.563	0.582		
Before Shear	Moisture Content, %	19.7	17.4		
	Dry Density, pcf	110.	115.		
	Cross-sectional Area (Method A), in²	6.298	6.085		
	Saturation, %	100.0	100.0		
	Void Ratio	0.531	0.470		
	Back Pressure, psi	134.8	92.99		
Vertical Effective Consolidation Stress, psi		9.981	19.95		
Horizontal Effective Consolidation Stress, psi		9.998	20.01		
Vertical Strain after Consolidation, %		0.4088	0.9702		
Volumetric Strain after Consolidation, %		0.9273	2.312		
Time to 50% Consolidation, min		12.25	35.00		
Shear Strength, psi		17.94	28.73		
Strain at Failure, %		16.0	11.7		
Strain Rate, %/min		0.01600	0.01600		
Deviator Stress at Failure, psi		35.87	57.46		
Effective Minor Principal Stress at Failure, psi		17.62	27.29		
Effective Major Principal Stress at Failure, psi		53.49	84.75		
B-Value		0.95	0.98		

Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.





Remarks:

System B

Appendix G

Sheet Pile Design

Structural Calculations

Hercules Impounding Basin
Hattiesburg, MS
March 12, 2015

SSR Project 15640090

18775

3-12-15

SSR Smith Seckman Reid, Inc.

2650 Thousand Oaks Blvd., Suite 3200
Memphis, TN 38118
Phone: (901) 683-3900

Table of Contents

SSR Smith
Seckman
Reid, Inc.

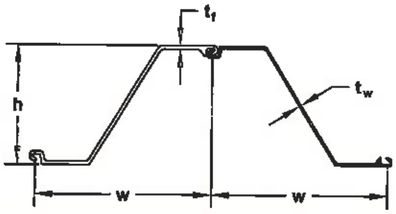
March 12, 2015

The following pages depict the analytical design of the temporary sheet pile retaining wall to be utilized in the Hercules Impounding Basin. This page is intended to layout our design assumptions and provide a brief summary of the results.

To begin, we assumed the Skyline sheet pile AZ 19-700 section in 30 ft. lengths would be used to construct the temporary wall. The required height of earth to be retained was set at 8 ft which left 22 ft. for embedment. Our geotechnical information is based on borings provided to us as part of the RFP. We reviewed the provided information and decided on a normalized soil profile to be used for the design of the sheet pile wall. The soil parameters for the normalized section used in design can be found on page 6. In addition, a 250 psf surcharge was considered behind the wall to account for any heavy equipment. This load should not approach closer than 8 ft. to the existing concrete cap to limit any lateral loads onto the existing retaining structure. The groundwater level is assumed to be located at 4 ft. down from grade in accordance with groundwater locations noted in the borings. This wall is designed as a temporary structure and the length of time associated with that assumption is approximately six months.

The calculations that follow are for the 8 ft. cantilevered and 22 ft. embedment scenario described above. The safety factor on the wall embedment is approximately 1.5. The AZ 19-700 sheet pile is adequate for bending and shear with a DCR of 0.42 and 0.04 respectively. The lateral deflection at the top of the wall if fully loaded is expected to be around 1.2 inches. Overall, the temporary sheet pile cantilever wall system proves to be an efficient, conservative system that should satisfy the demands of this project.

AZ Hot Rolled Steel Sheet Pile



SECTION	Width (w) in (mm)	Height (h) in (mm)	THICKNESS		Cross Sectional Area in²/ft (cm²/m)	WEIGHT		SECTION MODULUS		Moment of Inertia in⁴/ft (cm⁴/m)	COATING AREA	
			Flange (t_f) in (mm)	Web (t_w) in (mm)		Pile lb/ft (kg/m)	Wall lb/ft² (kg/m²)	Elastic in³/ft (cm³/m)	Plastic in³/ft (cm³/m)		Both Sides ft²/ft of single (m²/m)	Wall Surface ft²/ft² (m²/m²)
AZ 12-700	27.56 700	12.36 314	0.335 8.5	0.335 8.5	5.82 123.2	45.49 67.7	19.81 96.7	22.4 1205	26.3 1415	138.3 18880	5.61 1.71	1.22 1.22
AZ 13-700	27.56 700	12.40 315	0.375 9.5	0.375 9.5	6.36 134.7	49.72 74.0	21.65 105.7	24.3 1305	28.6 1540	150.4 20540	5.61 1.71	1.22 1.22
AZ 13-700-10/10	27.56 700	12.42 316	0.394 10.0	0.394 10.0	6.63 140.4	51.85 77.2	22.58 110.2	25.2 1355	29.8 1600	156.5 21370	5.61 1.71	1.22 1.22
AZ 14-700	27.56 700	12.44 316	0.413 10.5	0.413 10.5	6.90 146.1	53.96 80.3	23.50 114.7	26.1 1405	31.0 1665	162.5 22190	5.61 1.71	1.22 1.22
AZ 12-770	30.31 770	13.52 343.5	0.335 8.50	0.335 8.50	5.67 120.1	48.78 72.60	19.31 94.30	23.2 1245	27.5 1480	156.9 21430	6.10 1.86	1.20 1.20
AZ 13-770	30.31 770	13.54 344.0	0.354 9.00	0.354 9.00	5.94 125.8	51.14 76.10	20.24 98.80	24.2 1300	28.8 1546	163.7 22360	6.10 1.86	1.20 1.20
AZ 14-770	30.31 770	13.56 344.5	0.375 9.50	0.375 9.50	6.21 131.5	53.42 79.50	21.14 103.20	25.2 1355	30.0 1611	170.6 23300	6.10 1.86	1.20 1.20
AZ 14-770-10/10	30.31 770	13.58 345	0.394 10.0	0.394 10.0	6.48 137.2	55.71 82.9	22.06 107.7	26.1 1405	31.2 1677	177.5 24240	6.07 1.85	1.20 1.20
AZ 18	24.80 630	14.96 380.0	0.375 9.50	0.375 9.50	7.11 150.4	49.99 74.40	24.19 118.10	33.5 1800	39.1 2104	250.4 34200	5.64 1.72	1.35 1.35
AZ 17-700	27.56 700	16.52 419.5	0.335 8.50	0.335 8.50	6.28 133.0	49.12 73.10	21.38 104.40	32.2 1730	37.7 2027	265.3 36230	6.10 1.86	1.33 1.33
AZ 18-700	27.56 700	16.54 420.0	0.354 9.00	0.354 9.00	6.58 139.2	51.41 76.50	22.39 109.30	33.5 1800	39.4 2116	276.8 37800	6.10 1.86	1.33 1.33
AZ 19-700	27.56 700	16.56 420.5	0.375 9.50	0.375 9.50	6.88 145.6	53.76 80.00	23.41 114.30	34.8 1870	41.0 2206	288.4 39380	6.10 1.86	1.33 1.33
AZ 20-700	27.56 700	16.58 421	0.394 10.0	0.394 10.0	7.18 152.0	56.11 83.5	24.43 119.3	36.2 1945	42.7 2296	299.9 40960	6.10 1.86	1.33 1.33
AZ 26	24.80 630	16.81 427.0	0.512 13.00	0.480 12.20	9.35 198.0	65.72 97.80	31.79 155.20	48.4 2600	56.9 3059	406.5 55510	5.91 1.80	1.41 1.41
AZ 24-700	27.56 700	18.07 459.0	0.441 11.20	0.441 11.20	8.23 174.1	64.30 95.70	28.00 136.70	45.2 2430	53.5 2867	408.8 55820	6.33 1.93	1.38 1.38
AZ 26-700	27.56 700	18.11 460.0	0.480 12.20	0.480 12.20	8.84 187.2	69.12 102.90	30.10 146.90	48.4 2600	57.1 3070	437.3 59720	6.33 1.93	1.38 1.38
AZ 28-700	27.56 700	18.15 461.0	0.520 13.20	0.520 13.20	9.46 200.2	73.93 110.00	32.19 157.20	51.3 2760	60.9 3273	465.9 63620	6.33 1.93	1.38 1.38
AZ 24-700N	27.56 700	18.07 459.0	0.492 12.5	0.354 9.0	7.71 163.3	60.28 89.7	26.26 128.2	45.3 2435	52.3 2810	409.3 55890	6.30 1.92	1.37 1.37
AZ 26-700N	27.56 700	18.11 460	0.531 13.5	0.394 10.0	8.33 176.4	65.11 96.9	28.37 138.5	48.4 2600	56.1 3015	437.8 59790	6.30 1.92	1.37 1.37
AZ 28-700N	27.56 700	18.15 461	0.571 14.5	0.433 11.0	8.95 189.5	69.95 104.1	30.46 148.7	51.4 2765	59.9 3220	466.5 63700	6.30 1.92	1.37 1.37
AZ 36-700N	27.56 700	19.65 499.0	0.591 15.00	0.441 11.20	10.20 216.0	79.70 118.60	34.61 169.00	66.8 3590	76.5 4110	656.2 89610	6.76 2.06	1.47 1.47
AZ 38-700N	27.56 700	19.69 500.0	0.630 16.00	0.480 12.20	10.87 230.0	84.94 126.40	37.07 181.00	70.6 3795	81.1 4360	694.5 94840	6.76 2.06	1.47 1.47
AZ 40-700N	27.56 700	19.72 501.0	0.669 17.00	0.520 13.20	11.53 244.0	90.18 134.20	39.32 192.00	74.3 3995	85.7 4605	732.9 100080	6.76 2.06	1.47 1.47
AZ 42-700N	27.56 700	19.65 499.0	0.709 18.00	0.551 14.00	12.22 259.0	95.49 142.1	41.57 203.00	78.2 4205	90.3 4855	766.0 104930	6.76 2.06	1.47 1.47
AZ 44-700N	27.56 700	19.69 500.0	0.748 19.00	0.591 15.00	12.89 273.0	100.73 149.9	43.83 214.00	81.9 4405	94.9 5105	804.1 110150	6.76 2.06	1.47 1.47
AZ 46-700N	27.56 700	19.72 501.0	0.787 20.00	0.630 16.00	13.55 287.0	105.97 157.7	46.08 225.00	85.7 4605	99.5 5350	842.2 115370	6.76 2.06	1.47 1.47
AZ 46	22.83 580	18.94 481.0	0.709 18.00	0.551 14.00	13.76 291.2	89.10 132.60	46.82 228.60	85.5 4595	98.5 5295	808.8 110450	6.23 1.90	1.63 1.63
AZ 48	22.83 580	18.98 482.0	0.748 19.00	0.591 15.00	14.48 306.5	93.81 139.60	49.28 240.60	89.3 4800	103.3 5553	847.1 115670	6.23 1.90	1.63 1.63
AZ 50	22.83 580	19.02 483.0	0.787 20.00	0.630 16.00	15.22 322.2	98.58 146.70	51.80 252.9	93.3 5015	108.2 5816	886.5 121060	6.23 1.90	1.63 1.63

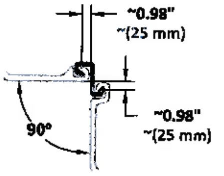
AZ

AZ Hot Rolled Steel Sheet Pile

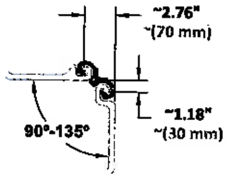
Available Steel Grades											
AMERICAN			CANADIAN			EUROPEAN			AMLoCor**		
ASTM	YIELD STRENGTH		CSA G40.21	YIELD STRENGTH		EN 10248	YIELD STRENGTH			YIELD STRENGTH	
	(ksi)	(MPa)		(ksi)	(MPa)		(ksi)	(MPa)		(ksi)	(MPa)
A 328	39	270	Grade 260 W	38	260	S 240 GP	35	240	Blue 320	46	320
A 572 Gr. 42	42	290	Grade 300 W	43	300	S 270 GP	39	270	Blue 355	51	355
A 572 Gr. 50	50	345	Grade 350 W	51	355	S 320 GP	46	320	Blue 390	57	390
A 572 Gr. 55	55	380	Grade 400 W	58	400	S 355 GP	51	355			
A 572 Gr. 60	60	415				S 390 GP	57	390			
A 572 Gr. 65	65	450				S 430 GP	62	430			
A 690	50	345				S 460 AP	67	460			
A 690*	57	390									

*Not available for AZ 36-700N and larger. ** Corrosion resistant steel, check for availability

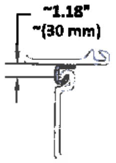
Corner Piles



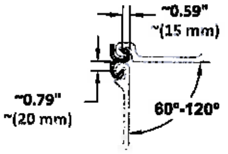
C 14
Grade: S 355 GP
Weight: 9.68 lb/ft
(14.4 kg/m)



Omega 18
Grade: S 430 GP
Weight: 12.10 lb/ft
(18.0 kg/m)



E 22
Grade: S 355 GP
Weight: 6.87 lb/ft
(10.2 kg/m)



Delta 13
Grade: S 355 GP
Weight: 8.73 lb/ft
(13.0 kg/m)

Delivery Conditions & Tolerances

	ASTM A 6		EN 10248	
Mass	± 2.5%		± 5%	
Length	+ 5 inches	– 0 inches	± 200 mm	
Height			± 7 mm	
Thickness			≤ 8.5 mm	± 0.5 mm
			> 8.5 mm	± 6%
Single Pile Width			± 2%	
Double Pile Width			± 3%	
Straightness			0.2% of the length	
Ends out of Square			2% of the width	

Delivery Forms

Single Pile
Position A

Double Pile
Form I Standard

Single Pile
Position B

Double Pile
Form II on Request

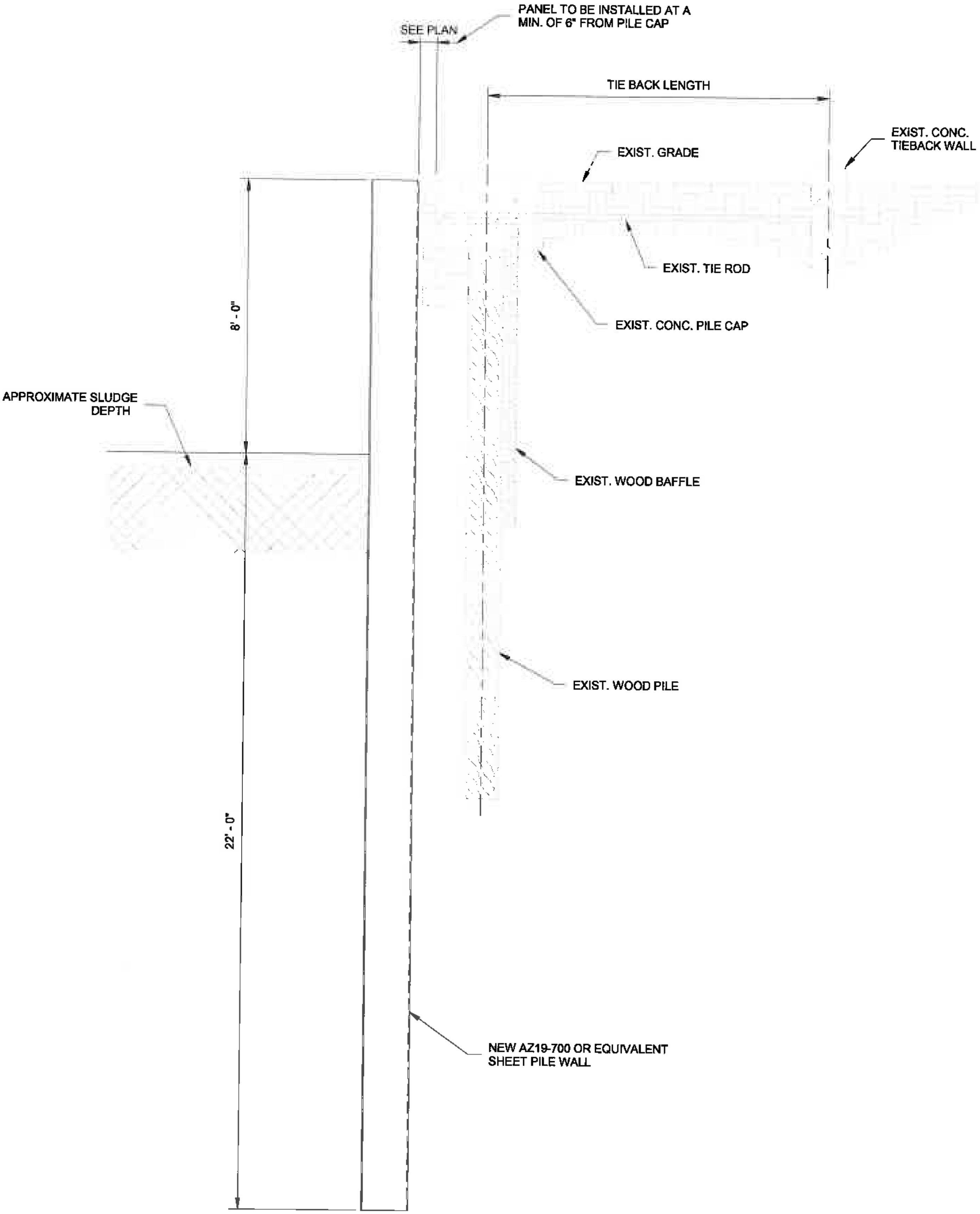
Maximum Rolled Lengths*

AZ	101.7 feet	(31.0 m)
E 22	59.1 feet	(18.0 m)
C 14	59.1 feet	(18.0 m)
Delta 13	55.8 feet	(17.0 m)
Omega 18	52.0 feet	(16.0 m)

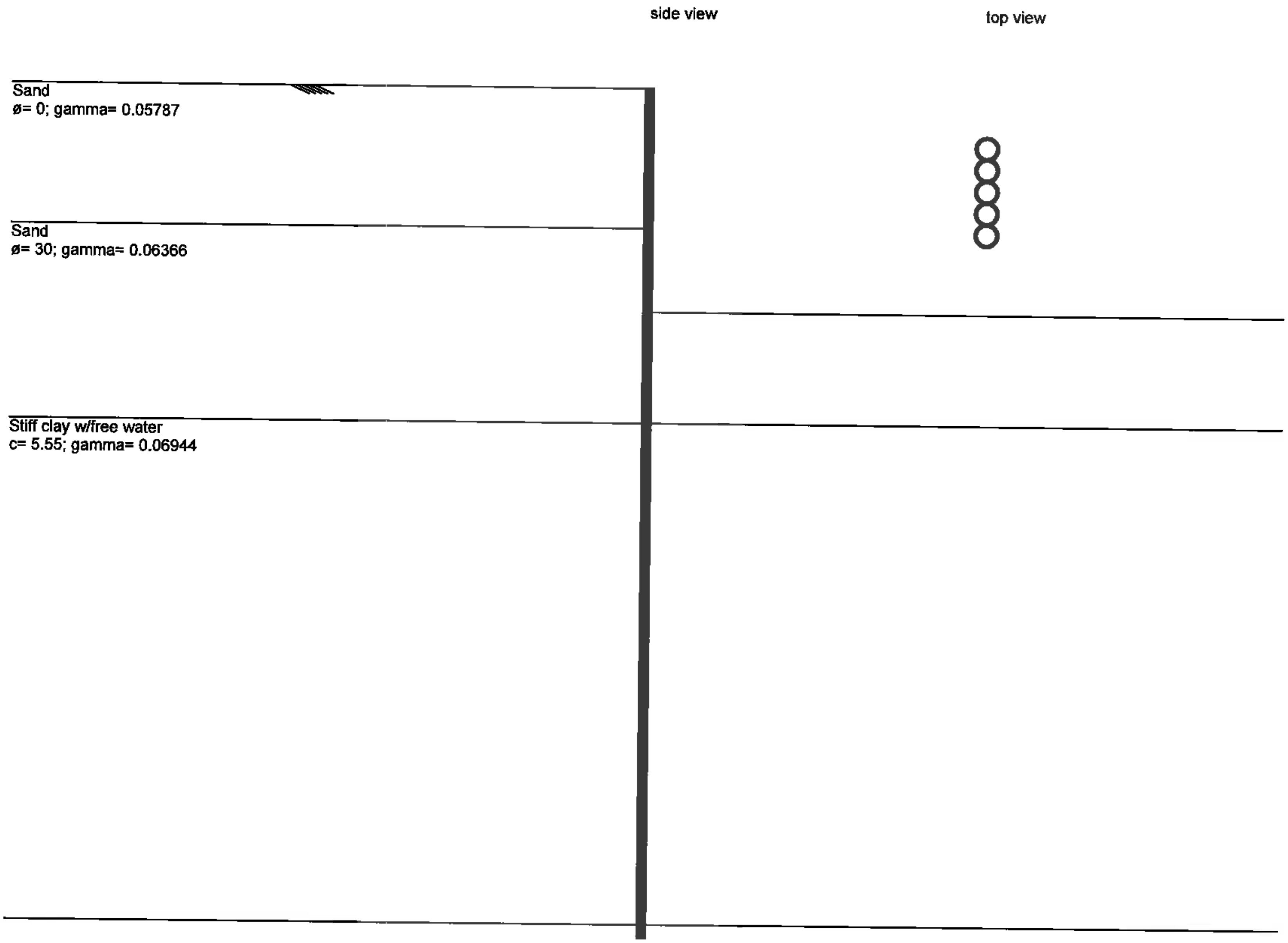
* Longer lengths may be possible upon request.

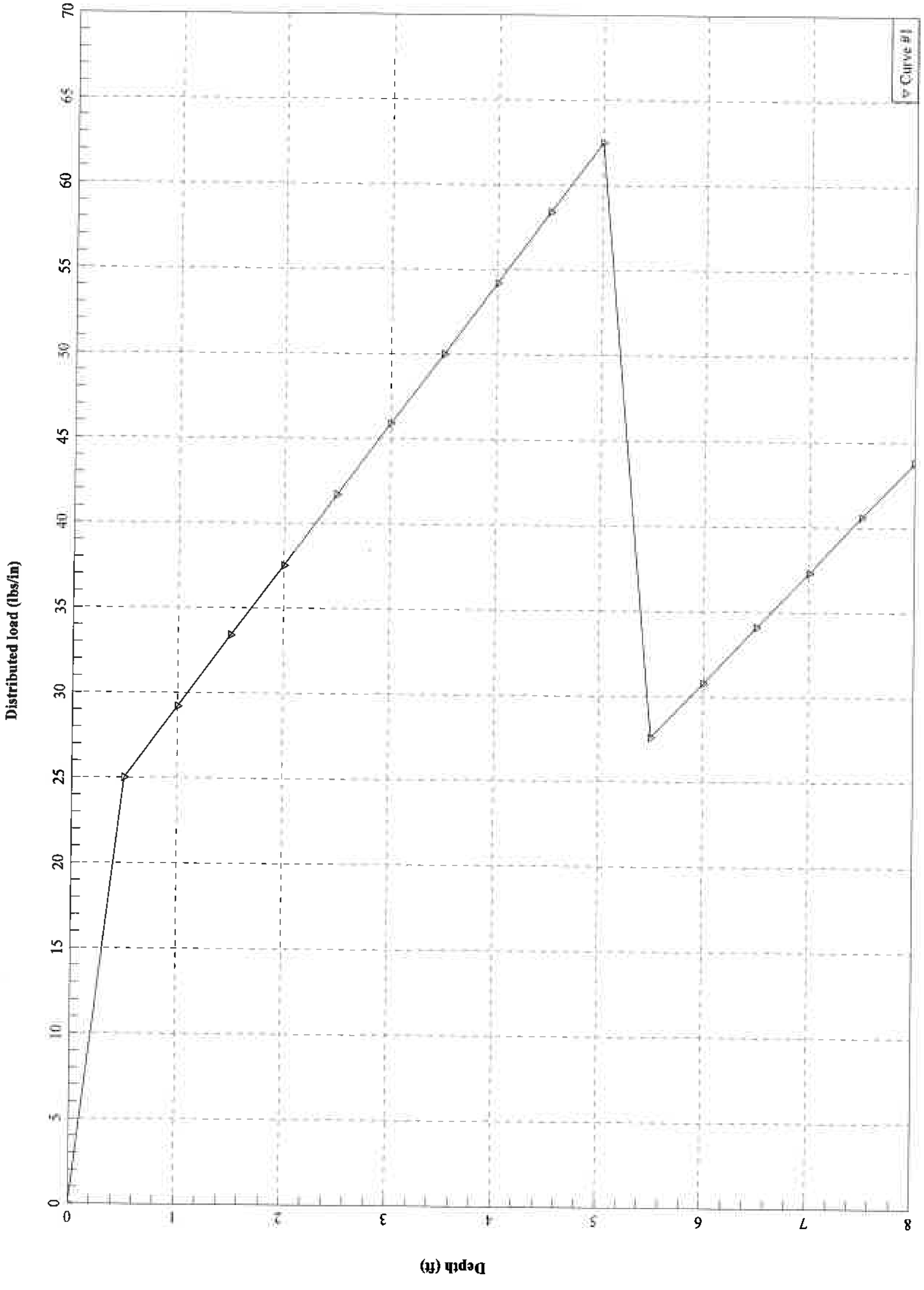
SOIL PARAMETERS FOR EXCAVATION SUPPORT SYSTEM ANALYSIS

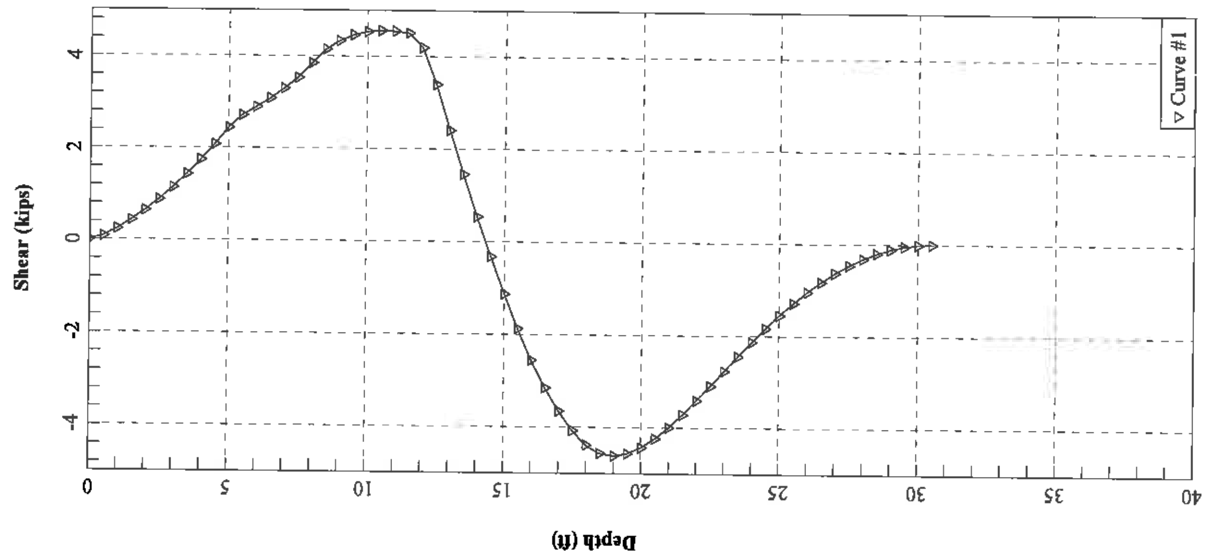
Zone	Soil Type	Elevation (feet)		Total Unit Weight (pcf)	Shear Strength Parameters					
					Undrained (Short Term)		Drained (Long Term)			Static
		From	To		Cohesion C (psf)	ϕ (°)	Cohesion C'(psf)	ϕ' (°)	E50	K(py) lbs/in^3
1	Loose Sand	164	157	100	0	0	0	0	0	0
2	Loose Sand	157	152	100	0	30	0	30	NA	20
3	CL	152	130	120	800	0	0	30	0.01	100
4	CL	130	120	120	1,200	0	0	30	0.007	500
5	CL	120	112	120	1,000	0	0	30	0.01	100

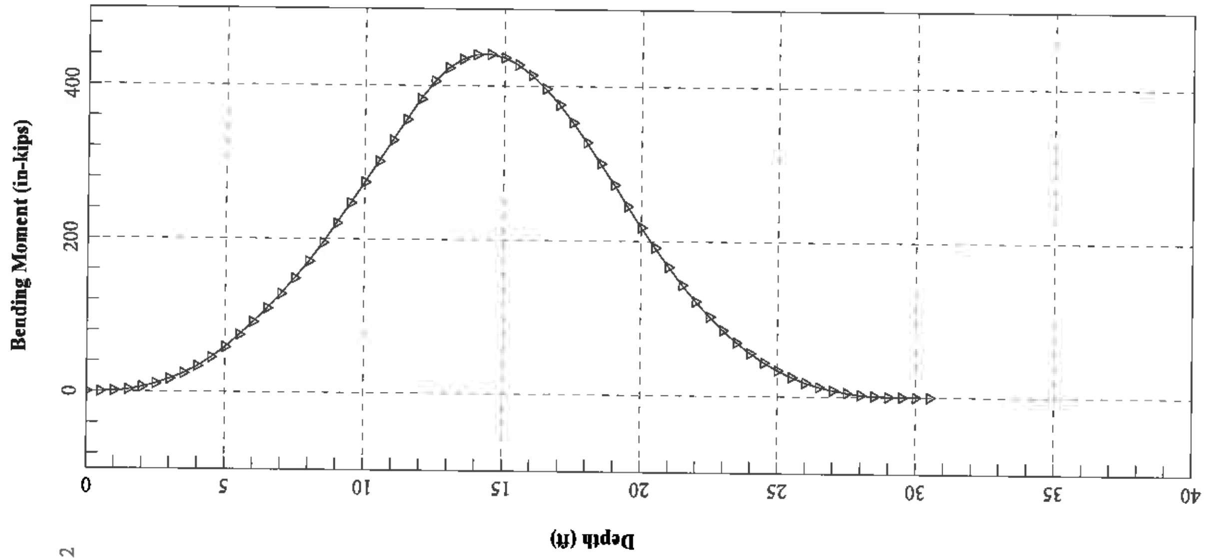


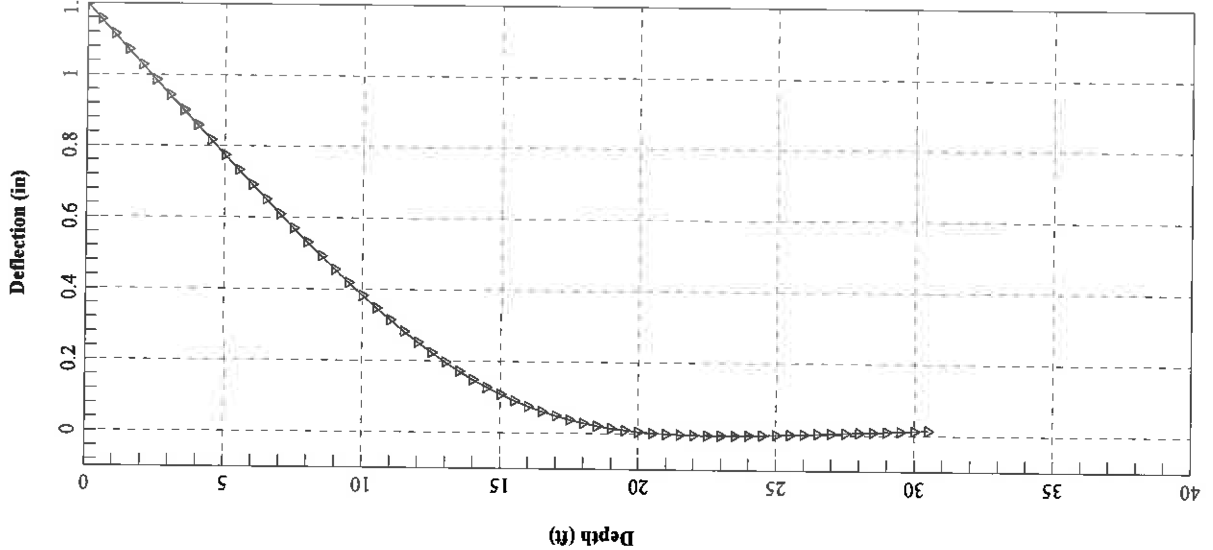
SHEET PILE WALL SECTION


side view
top view
Sand
ø= 0; gamma= 0.05787
Sand
ø= 30; gamma= 0.06366
Stiff clay w/free water
c= 5.55; gamma= 0.06944


Distributed load (lbs/in)
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
0
1
2
3
4
5
6
7
8
▿ Curve #1


▽ Curve #1
Shear (kips)
4
2
0
-2
-4
0
5
10
15
20
25
30
35
40
Depth (ft)


Bending Moment (in-kips)
400
200
0
0
5
10
15
20
25
30
35
40
Depth (ft)


Deflection (in)
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
40
Depth (ft)

```
Hercules Temp. Wall

**************************************************
*         PROGRAM CONTROL PARAMETERS             *
**************************************************

NO OF POINTS FOR SPECIFIED DEFLECTIONS AND SLOPES  =  0
NO OF POINTS FOR WALL STIFFNESS AND LOAD DATA      =  1
GENERATE EARTH PRESSURE INTERNALLY                 =  1
GENERATE SOIL RESISTANCE (P-Y) CURVES INTERNALLY   =  1
NO OF P-Y MODIFICATION FACTORS FOR GEN. P-Y CURVES =  0
NO OF USER-SPECIFIED SOIL RESISTANCE (P-Y) CURVES  =  0
NUMBER OF INCREMENTS                               =  61
INCREMENT LENGTH                                   =    6.000 IN
FREE HEIGHT OF WALL                                =   96.000 IN
MAXIMUM ALLOWABLE DEFLECTION                       =  100.000 IN
DEFLECTION CLOSURE TOLERANCE                       =   .00001 IN



**************************************************
*         STIFFNESS AND LOAD DATA                *
**************************************************
EI - FLEXURAL RIGIDITY,  Q - TRANSVERSE LOAD,
S - STIFFNESS OF TRANSVERSE RESISTANCE,
T - TORQUE,              P - AXIAL LOAD,
R - STIFFNESS OF TORSIONAL RESISTANCE.

FROM TO CONTD     EI         Q          S          T          R          P

              LBS-IN**2     LBS      LBS/IN     IN-LBS     IN-LBS      LBS
  0   61  0   .836E+10  .000E+00  .000E+00  .000E+00  .000E+00  .000E+00

**************************************************
*                WALL INFORMATION                *
**************************************************

FREE HEIGHT OF WALL          =   .960E+02
DEPTH TO THE WATER TABLE     =   .480E+02
UNIT WEIGHT OF WATER         =   .360E-01
SLOPE OF THE BACKFILL        =   .000E+00


**************************************************
*             SURCHARGE INFORMATION              *
**************************************************

UNIFORM SURFACE PRESSURE        =   .174E+01
POINT LOAD                      =   .000E+00
LINE LOAD                       =   .000E+00
STRIP LOAD                      =   .000E+00
WIDTH OF THE STRIP LOAD         =   .000E+00
HORIZONTAL DISTANCE BETWEEN     =   .000E+00
THE WALL AND SURCHARGE
```

```
****************************************************
*                SOIL INFORMATION                  *
****************************************************


          TOTAL                           TOTAL UNIT
 LAYER THICKNESS COHESION   PHI    WEIGHT    DRAINED  ZTOP
 NO.                        DEG              T OR F
   1      48.0         .0     .0     .058       T       .00
   2      12.0         .0     .0     .058       T     48.00
   3      36.0         .0   30.0     .064       T     60.00
   4      48.0         .0   30.0     .064       T     96.00
   5     216.0        5.5     .0     .069       F    144.00

****************************************************
*            EFFECTIVE OVERBURDEN STRESS           *
****************************************************

          DEPTH                          STRESS

        .000E+00                       .174E+01
        .480E+02                       .452E+01
        .600E+02                       .478E+01
        .960E+02                       .578E+01
        .144E+03                       .106E+02

****************************************************
* ACTIVE AND PASSIVE EARTH PRESSURE COEFFICIENT    *
****************************************************

  LAYER          ACTIVE EARTH      PASSIVE EARTH
   NO.           COEFFICIENT       COEFFICIENT
    1             .100E+01          .100E+01
    2             .100E+01          .100E+01
    3             .333E+00          .300E+01
    4             .333E+00          .300E+01
    5             .100E+01          .100E+01

****************************************************
*      ACTIVE EARTH PRESSURE OF EACH LAYER         *
****************************************************

 LAYER    PA1      Z1        PA2     Z2          PA3      Z3          PA4
  NO

 1       83.52  24.00      66.67  32.00          .00     .00          .00
 2       54.21  54.00       1.57  56.00          .00     .00          .00
 3       57.36  78.00       5.97  84.00          .00     .00          .00
   DEPTH          ACTIVE EARTH PRESSURE
    IN                  LBS/IN
  --------        -----------------------
 .000E+00              .000E+00
 .600E+01              .250E+02
 .120E+02              .292E+02
 .180E+02              .334E+02
 .240E+02              .375E+02
 .300E+02              .417E+02
 .360E+02              .459E+02
```

```
 .420E+02                .500E+02
 .480E+02                .542E+02
 .540E+02                .584E+02
 .600E+02                .625E+02
 .660E+02                .276E+02
 .720E+02                .308E+02
 .780E+02                .341E+02
 .840E+02                .373E+02
 .900E+02                .406E+02
 .960E+02                .438E+02


**************************************************
*         SOIL LAYERS AND STRENGTH DATA          *
**************************************************


   X AT THE SURFACE OF EXCAVATION SIDE      =       96.00 IN

   2 LAYER(S) OF SOIL

   LAYER  1
   THE SOIL IS A SAND
   X AT THE TOP OF THE LAYER          =      96.00 IN
   X AT THE BOTTOM OF THE LAYER       =     144.00 IN
   MODULUS OF SUBGRADE REACTION       =    .200D+02 LBS/IN**3

   LAYER  2
   THE SOIL IS A STIFF CLAY BELOW THE WATER TABLE
   X AT THE TOP OF THE LAYER          =     144.00 IN
   X AT THE BOTTOM OF THE LAYER       =     360.00 IN
   MODULUS OF SUBGRADE REACTION       =    .100D+03 LBS/IN**3


   DISTRIBUTION OF EFFECTIVE UNIT WEIGHT WITH DEPTH
                      4 POINTS

            X,IN    WEIGHT,LBS/IN**3
         96.0000       .2766D-01
        144.0000       .2766D-01
        144.0000       .3344D-01
        360.0000       .3344D-01


   DISTRIBUTION OF STRENGTH PARAMETERS WITH DEPTH
                      4 POINTS

            X,IN      C,LBS/IN**2      PHI,DEGREES     E50
           96.00      .0000D+00          30.000       -----
          144.00      .0000D+00          30.000       -----
          144.00      .5550D+01            .000     .1000D-01
          360.00      .5550D+01            .000     .1000D-01

  P-Y CURVES DATA


   AT THE EXCAVATION SIDE


       DEPTH BELOW GS       DIAM       PHI      GAMMA           A          B         PCT
PCD
```

```
                  IN                 IN                LBS/IN**3
                  .10              12.00     30.00    .28D-01         2.82       2.13       .89E-01
 .95E+00

                                 Y                     P
                                 IN                    LBS/IN
                                .000                  -43.840
                                .017                  -43.822
                                .033                  -43.805
                                .050                  -43.787
                                .067                  -43.769
                                .083                  -43.760
                                .100                  -43.756
                                .117                  -43.752
                                .133                  -43.749
                                .150                  -43.746
                                .167                  -43.744
                                .183                  -43.741
                                .200                  -43.739
                                .450                  -43.707
                              12.450                  -43.707
                              24.450                  -43.707
                              36.450                  -43.707

                     P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

           AT THE BACKFILL SIDE

            DEPTH BELOW GS       DIAM       PHI     GAMMA          A          B          PCT
 PCD
                  IN                 IN                LBS/IN**3
                 96.10             12.00     30.00    .28D-01        .88        .50       .57E+03
 .92E+03

                                 Y                     P
                                 IN                    LBS/IN
                                .000                   43.840
                                .017                   60.792
                                .033                   77.744
                                .050                   94.696
                                .067                  111.648
                                .083                  128.600
                                .100                  143.386
                                .117                  153.167
                                .133                  162.413
                                .150                  171.215
                                .167                  179.642
                                .183                  187.744
                                .200                  195.562
                                .450                  310.871
                              12.450                  310.871
                              24.450                  310.871
                              36.450                  310.871

                     P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

           AT THE EXCAVATION SIDE

            DEPTH BELOW GS       DIAM       PHI     GAMMA          A          B          PCT
```

```
 PCD
              IN              IN              LBS/IN**3
            15.84           12.00     30.00    .28D-01         1.89      1.37       .27E+02
.15E+03

                                     Y                  P
                                     IN              LBS/IN
                                    .000             -43.840
                                    .017             -41.046
                                    .033             -38.251
                                    .050             -35.457
                                    .067             -32.663
                                    .083             -29.869
                                    .100             -27.843
                                    .117             -27.077
                                    .133             -26.383
                                    .150             -25.748
                                    .167             -25.160
                                    .183             -24.611
                                    .200             -24.097
                                    .450             -16.605
                                  12.450             -16.605
                                  24.450             -16.605
                                  36.450             -16.605

                      P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

           AT THE BACKFILL SIDE

           DEPTH BELOW GS      DIAM       PHI      GAMMA           A         B        PCT
 PCD
                IN              IN              LBS/IN**3
              111.84           12.00     30.00   .28D-01          .88       .50      .76E+03
.11E+04

                                     Y                  P
                                     IN              LBS/IN
                                    .000              43.840
                                    .017              63.568
                                    .033              83.297
                                    .050             103.026
                                    .067             122.754
                                    .083             142.483
                                    .100             162.211
                                    .117             181.940
                                    .133             201.082
                                    .150             212.756
                                    .167             223.931
                                    .183             234.675
                                    .200             245.042
                                    .450             397.956
                                  12.450             397.956
                                  24.450             397.956
                                  36.450             397.956

                      P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

           AT THE EXCAVATION SIDE
```

```
                                   Combined Parameters with cohesion.pyo
              DEPTH BELOW GS          DIAM        PHI      GAMMA             A         B         PCT
  PCD
                    IN                 IN                 LBS/IN**3
                  31.68              12.00       30.00     .28D-01         1.18       .82      .81E+02
 .30E+03

                                           Y                 P
                                           IN             LBS/IN
                                          .000            -43.840
                                          .017            -38.251
                                          .033            -32.663
                                          .050            -27.075
                                          .067            -21.486
                                          .083            -18.139
                                          .100            -16.413
                                          .117            -14.865
                                          .133            -13.452
                                          .150            -12.150
                                          .167            -10.937
                                          .183             -9.800
                                          .200             -8.728
                                          .450              6.913
                                        12.450              6.913
                                        24.450              6.913
                                        36.450              6.913

                     P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

          AT THE BACKFILL SIDE

              DEPTH BELOW GS          DIAM        PHI      GAMMA             A         B         PCT
  PCD
                    IN                 IN                 LBS/IN**3
                 127.68              12.00       30.00     .28D-01          .88       .50      .98E+03
 .12E+04

                                           Y                 P
                                           IN             LBS/IN
                                          .000             43.840
                                          .017             66.363
                                          .033             88.885
                                          .050            111.408
                                          .067            133.931
                                          .083            156.454
                                          .100            178.976
                                          .117            201.499
                                          .133            224.022
                                          .150            246.545
                                          .167            269.067
                                          .183            288.542
                                          .200            301.836
                                          .450            497.913
                                        12.450            497.913
                                        24.450            497.913
                                        36.450            497.913

                     P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

          AT THE EXCAVATION SIDE
```

```
                         Combined Parameters with cohesion.pyo
            DEPTH BELOW GS      DIAM      PHI     GAMMA         A        B        PCT
 PCD
                 IN              IN              LBS/IN**3
                47.90           12.00     30.00   .28D-01       .90      .53     .16E+03
.46E+03

                                    Y              P
                                    IN           LBS/IN
                                  .000          -43.840
                                  .017          -35.390
                                  .033          -26.941
                                  .050          -22.554
                                  .067          -18.857
                                  .083          -15.553
                                  .100          -12.532
                                  .117           -9.727
                                  .133           -7.094
                                  .150           -4.604
                                  .167           -2.234
                                  .183             .033
                                  .200            2.210
                                  .450           34.253
                                12.450           34.253
                                24.450           34.253
                                36.450           34.253
                    P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

        AT THE BACKFILL SIDE

            DEPTH BELOW GS      DIAM      PHI     GAMMA         A        B        PCT
 PCD
                 IN              IN              LBS/IN**3
               143.90           12.00     30.00   .28D-01       .88      .50     .12E+04
.14E+04

                                    Y              P
                                    IN           LBS/IN
                                  .000           43.840
                                  .017           69.224
                                  .033           94.608
                                  .050          119.992
                                  .067          145.376
                                  .083          170.760
                                  .100          196.144
                                  .117          221.528
                                  .133          246.912
                                  .150          272.295
                                  .167          297.679
                                  .183          323.063
                                  .200          348.447
                                  .450          613.074
                                12.450          613.074
                                24.450          613.074
                                36.450          613.074
                    P-Multiplier =    .529E+00 Y-Multiplier =    .100E+01

        AT THE EXCAVATION SIDE
```

```
 DEPTH BELOW GS       DIAM         C           CAVG       GAMMA          E50
       IN              IN      LBS/IN**2   LBS/IN**2   LBS/IN**3
      48.10          12.000     .55D+01     .55D+01     .28D-01      .1000D-01
                                .000             -43.840
                                .036              47.796
                                .072             106.313
                                .108             131.093
                                .144             147.185
                                .180             158.175
                                .216             165.517
                                .252             170.039
                                .288             172.277
                                .324             172.603
                                .360             171.290
                                .396             168.545
                                .432             164.530
                                .720             106.462
                               1.008              48.308
                               1.296              -9.846
                              14.400              -9.846

AT THE BACKFILL SIDE

 DEPTH BELOW GS       DIAM         C           CAVG       GAMMA          E50
       IN              IN      LBS/IN**2   LBS/IN**2   LBS/IN**3
     144.10          12.000     .55D+01     .55D+01     .28D-01      .1000D-01
                                .000              43.840
                                .036             150.014
                                .072             193.992
                                .108             218.773
                                .144             234.864
                                .180             245.855
                                .216             253.196
                                .252             257.719
                                .288             259.957
                                .324             260.283
                                .360             258.969
                                .396             256.224
                                .432             252.210
                                .720             194.142
                               1.008             135.988
                               1.296              77.834
                              14.400              77.834

AT THE EXCAVATION SIDE

 DEPTH BELOW GS       DIAM         C           CAVG       GAMMA          E50
       IN              IN      LBS/IN**2   LBS/IN**2   LBS/IN**3
     119.28          12.000     .55D+01     .55D+01     .31D-01      .1000D-01
                                .000             -43.840
                                .036              62.334
                                .072             106.313
                                .108             131.093
                                .144             147.185
                                .180             158.175
                                .216             165.517
                                .252             170.039
```

```
                         Combined Parameters with cohesion.pyo
                              .288              172.277
                              .324              172.603
                              .360              171.290
                              .396              168.545
                              .432              164.530
                              .720              106.462
                             1.008               48.308
                             1.296               -9.846
                            14.400               -9.846

 AT THE BACKFILL SIDE


 DEPTH BELOW GS       DIAM        C          CAVG        GAMMA         E50
       IN              IN     LBS/IN**2  LBS/IN**2  LBS/IN**3
     215.28          12.000    .55D+01    .79D+01     .31D-01     .1000D-01
                              .000               43.840
                              .036              150.014
                              .072              193.992
                              .108              218.773
                              .144              234.864
                              .180              245.855
                              .216              253.196
                              .252              257.719
                              .288              259.957
                              .324              260.283
                              .360              258.969
                              .396              256.224
                              .432              252.210
                              .720              194.142
                             1.008              135.988
                             1.296               77.834
                            14.400               77.834

 AT THE EXCAVATION SIDE


 DEPTH BELOW GS       DIAM        C          CAVG        GAMMA         E50
       IN              IN     LBS/IN**2  LBS/IN**2  LBS/IN**3
     190.56          12.000    .55D+01    .12D+02     .32D-01     .1000D-01
                              .000              -43.840
                              .036               62.334
                              .072              106.313
                              .108              131.093
                              .144              147.185
                              .180              158.175
                              .216              165.517
                              .252              170.039
                              .288              172.277
                              .324              172.603
                              .360              171.290
                              .396              168.545
                              .432              164.530
                              .720              106.462
                             1.008               48.308
                             1.296               -9.846
                            14.400               -9.846

 AT THE BACKFILL SIDE
```

```
DEPTH BELOW GS        DIAM          C          CAVG       GAMMA          E50
      IN               IN      LBS/IN**2  LBS/IN**2  LBS/IN**3
    286.56           12.000     .55D+01    .11D+02    .32D-01     .1000D-01
                                .000            43.840
                                .036           150.014
                                .072           193.992
                                .108           218.773
                                .144           234.864
                                .180           245.855
                                .216           253.196
                                .252           257.719
                                .288           259.957
                                .324           260.283
                                .360           258.969
                                .396           256.224
                                .432           252.210
                                .720           194.142
                               1.008           135.988
                               1.296            77.834
                              14.400            77.834

AT THE EXCAVATION SIDE

DEPTH BELOW GS        DIAM          C          CAVG       GAMMA          E50
      IN               IN      LBS/IN**2  LBS/IN**2  LBS/IN**3
    263.90           12.000     .55D+01    .14D+02    .32D-01     .1000D-01
                                .000           -43.840
                                .036            62.334
                                .072           106.313
                                .108           131.093
                                .144           147.185
                                .180           158.175
                                .216           165.517
                                .252           170.039
                                .288           172.277
                                .324           172.603
                                .360           171.290
                                .396           168.545
                                .432           164.530
                                .720           106.462
                               1.008            48.308
                               1.296            -9.846
                              14.400            -9.846

AT THE BACKFILL SIDE

DEPTH BELOW GS        DIAM          C          CAVG       GAMMA          E50
      IN               IN      LBS/IN**2  LBS/IN**2  LBS/IN**3
    359.90           12.000     .55D+01    .13D+02    .32D-01     .1000D-01
                                .000            43.840
                                .036           150.014
                                .072           193.992
                                .108           218.773
                                .144           234.864
                                .180           245.855
                                .216           253.196
                                .252           257.719
                                .288           259.957
```

```
                         Combined Parameters with cohesion.pyo
                                     .324              260.283
                                     .360              258.969
                                     .396              256.224
                                     .432              252.210
                                     .720              194.142
                                    1.008              135.988
                                    1.296               77.834
                                   14.400               77.834

   Hercules Temp. Wall


  RESULTS -- ITERATION  6
  --------------------

STA I       X          DEFL.        SLOPE        MOMENT       SHEAR      NET REACT/STA.
           IN           IN                      LBS- IN        LBS          LBS
------     ----        ----         -----       ------        -----      ---------
   0    .000E+00     .120E+01    -.709E-02     .000E+00     .000E+00     .000E+00
   1    .600E+01     .116E+01    -.709E-02     .000E+00     .751E+02     .150E+03
   2    .120E+02     .111E+01    -.709E-02     .902E+03     .238E+03     .175E+03
   3    .180E+02     .107E+01    -.709E-02     .286E+04     .426E+03     .200E+03
   4    .240E+02     .103E+01    -.708E-02     .601E+04     .638E+03     .225E+03
   5    .300E+02     .986E+00    -.708E-02     .105E+05     .876E+03     .250E+03
   6    .360E+02     .944E+00    -.707E-02     .165E+05     .114E+04     .275E+03
   7    .420E+02     .901E+00    -.705E-02     .242E+05     .143E+04     .300E+03
   8    .480E+02     .859E+00    -.703E-02     .336E+05     .174E+04     .325E+03
   9    .540E+02     .817E+00    -.700E-02     .451E+05     .208E+04     .350E+03
  10    .600E+02     .775E+00    -.697E-02     .586E+05     .244E+04     .375E+03
  11    .660E+02     .733E+00    -.692E-02     .743E+05     .271E+04     .165E+03
  12    .720E+02     .692E+00    -.686E-02     .911E+05     .289E+04     .185E+03
  13    .780E+02     .651E+00    -.679E-02     .109E+06     .308E+04     .204E+03
  14    .840E+02     .610E+00    -.670E-02     .128E+06     .329E+04     .224E+03
  15    .900E+02     .570E+00    -.660E-02     .149E+06     .353E+04     .244E+03
  16    .960E+02     .531E+00    -.649E-02     .170E+06     .385E+04     .394E+03
  17    .102E+03     .493E+00    -.636E-02     .195E+06     .415E+04     .208E+03
  18    .108E+03     .455E+00    -.621E-02     .220E+06     .433E+04     .154E+03
  19    .114E+03     .418E+00    -.604E-02     .247E+06     .446E+04     .105E+03
  20    .120E+03     .382E+00    -.586E-02     .274E+06     .454E+04     .479E+02
  21    .126E+03     .348E+00    -.565E-02     .301E+06     .456E+04    -.310E+01
  22    .132E+03     .315E+00    -.542E-02     .328E+06     .454E+04    -.276E+02
  23    .138E+03     .283E+00    -.518E-02     .356E+06     .451E+04    -.442E+02
  24    .144E+03     .252E+00    -.491E-02     .382E+06     .419E+04    -.591E+03
  25    .150E+03     .224E+00    -.463E-02     .406E+06     .339E+04    -.100E+04
  26    .156E+03     .197E+00    -.433E-02     .423E+06     .241E+04    -.970E+03
  27    .162E+03     .172E+00    -.403E-02     .435E+06     .146E+04    -.933E+03
  28    .168E+03     .149E+00    -.371E-02     .441E+06     .544E+03    -.890E+03
  29    .174E+03     .127E+00    -.340E-02     .441E+06    -.320E+03    -.837E+03
  30    .180E+03     .108E+00    -.308E-02     .437E+06    -.113E+04    -.785E+03
  31    .186E+03     .903E-01    -.277E-02     .428E+06    -.188E+04    -.712E+03
  32    .192E+03     .746E-01    -.247E-02     .414E+06    -.256E+04    -.647E+03
  33    .198E+03     .606E-01    -.218E-02     .397E+06    -.316E+04    -.546E+03
  34    .204E+03     .484E-01    -.190E-02     .376E+06    -.366E+04    -.455E+03
  35    .210E+03     .378E-01    -.164E-02     .353E+06    -.407E+04    -.380E+03
  36    .216E+03     .288E-01    -.139E-02     .327E+06    -.439E+04    -.246E+03
  37    .222E+03     .211E-01    -.117E-02     .300E+06    -.456E+04    -.110E+03
  38    .228E+03     .147E-01    -.963E-03     .273E+06    -.462E+04     .227E+01
  39    .234E+03     .954E-02    -.778E-03     .245E+06    -.457E+04     .941E+02
  40    .240E+03     .540E-02    -.612E-03     .218E+06    -.444E+04     .167E+03
  41    .246E+03     .220E-02    -.465E-03     .192E+06    -.424E+04     .224E+03
  42    .252E+03    -.177E-03    -.336E-03     .167E+06    -.400E+04     .266E+03
  43    .258E+03    -.183E-02    -.225E-03     .144E+06    -.372E+04     .295E+03
  44    .264E+03    -.287E-02    -.129E-03     .122E+06    -.341E+04     .314E+03
```

```
 45     .270E+03   -.338E-02   -.485E-04    .103E+06   -.310E+04    .323E+03
 46     .276E+03   -.345E-02    .189E-04    .852E+05   -.277E+04    .324E+03
 47     .282E+03   -.316E-02    .744E-04    .695E+05   -.245E+04    .319E+03
 48     .288E+03   -.256E-02    .119E-03    .558E+05   -.214E+04    .308E+03
 49     .294E+03   -.172E-02    .155E-03    .439E+05   -.184E+04    .293E+03
 50     .300E+03   -.700E-03    .183E-03    .337E+05   -.155E+04    .275E+03
 51     .306E+03    .470E-03    .204E-03    .252E+05   -.129E+04    .254E+03
 52     .312E+03    .175E-02    .220E-03    .183E+05   -.104E+04    .232E+03
 53     .318E+03    .311E-02    .231E-03    .127E+05   -.825E+03    .208E+03
 54     .324E+03    .452E-02    .238E-03    .835E+04   -.630E+03    .183E+03
 55     .330E+03    .596E-02    .243E-03    .512E+04   -.460E+03    .157E+03
 56     .336E+03    .743E-02    .246E-03    .284E+04   -.315E+03    .131E+03
 57     .342E+03    .892E-02    .247E-03    .134E+04   -.197E+03    .105E+03
 58     .348E+03    .104E-01    .248E-03    .472E+03   -.105E+03    .788E+02
 59     .354E+03    .119E-01    .248E-03    .784E+02   -.393E+02    .525E+02
 60     .360E+03    .134E-01    .248E-03   -.806E-09   -.654E+01    .131E+02
 61     .366E+03    .149E-01    .248E-03    .403E-09    .672E-10   -.269E-09


  END OF ANALYSIS
```

Project: 15640090 - Hercules Impounding Basin

Subject: Sheet Pile Wall DCR

Properties:

$S_x := 34.8\ \mathbf{in}^3$

$F_y := 50\ \mathbf{ksi}$

$A := 6.88\ \mathbf{in}^2$

$C_v := 1.0$

$\Omega_b := 1.67$

$\Omega_v := 1.67$

Design Forces:

$M := 441000\ \mathbf{in} \cdot \mathbf{lbf}$

$V := 4620\ \mathbf{lbf}$

Capacities:

$$M_a := \frac{S_x \cdot F_y}{\Omega_b} = 1041916\ \mathbf{in} \cdot \mathbf{lbf}$$

$$V_a := \frac{0.6 \cdot F_y \cdot A \cdot C_v}{\Omega_v} = 123593\ \mathbf{lbf}$$

Demand to Capacity Ratios (DCR)

$$DCR_M := \frac{M}{M_a} = 0.42$$

$$DCR_V := \frac{V}{V_a} = 0.04$$

WADIT

A PilePro Group Company

Overview

WADIT® is a purpose-built and globally proven sheet piling interlock sealant system. The creators of WADIT® know first-hand the installation and long-term challenges faced when sealing all types of hot rolled or cold formed sheet piling interlocks.

With an unmatched success rate in real-world applications, WADIT® delivers robust water -stop protection. WADIT® exceeds the performance of hydrophilic sealants as an all-natural, environmentally friendly sealant.

For any application where water leakage presents a problem, from dewatering cofferdams to barrier and cutoff walls for site remediation, WADIT® is the smart sheet pile sealant of choice.

Benefits

TESTED AND CERTIFIED

WADIT® fortifies your project. This real-world and lab-tested sealant keeps water out, protects against hazardous substances and can withstand five bars (~70 psi) of differential water pressure (Case Studies and Technical Documents at www.WADIT.com).

HIGHLY DURABLE

WADIT® performs in every environment, from the tropics to the arctic, where high pressure sealing is required with extreme temperature ranges. The longevity of your sheet pile project is guaranteed with this durable sealant.

EXTREMELY FLEXIBLE

WADIT® has exceptional memory rebound properties. Conventional materials may harden like glass in temperatures of just 50°F. WADIT®, on the other hand, remains extremely flexible even in groundwater.

NON-PROPRIETARY

Made by and for sheet pile professionals, WADIT® can be installed in any interlock system or used with U-, Z-, or O-type of walls or combined SSP.

ENVIRONMENTALLY FRIENDLY

WADIT® is non-toxic and made from sustainable, natural raw materials. Internationally lab-tested and certified, WADIT is safe and can be used without any restriction in sheet pile wall interlocks for ground and surface water use (see sidebar on page 28 for further test results).

IMPERVIOUS TO WEATHER

No matter the climate, WADIT can be applied, transported and stored in any weather condition, ensuring a fast and problem-free sealant application.

PROFESSIONALLY INSTALLED

Certified technicians professionally install the WADIT® Sealant System to ensure the perfect seal every time. You can be confident that the quality of your project will never be compromised.

WADIT®: A Professionally Installed Sealant System

WADIT®'s unmatched success rate is the result of professional application. Applied by trained and tested WADIT® installation crews, the WADIT Sealant System guarantees an effective, durable, sheet pile interlock seal every time. WADIT® is sold pre-installed into any sheet pile type on a per foot or per metre of interlock basis.

We install WADIT® anywhere; teams are available globally.

WADIT® is great solution for any project where water leakage through the wall presents a problem.

Internationally Lab-Tested and Certified

WADIT® has been repeatedly proven as a safe material for use in potable water projects. The Bavaria State Trade Department (LGA), the German equivalent of the EPA, has certified WADIT® for use in areas with potable water.

Landesgewerbeanstalt Bayern
17.04.1897
LGA NÜRNBERG
Prüf-Nr.: UUA 9730105
Institut für Umweltgeologie und Altlasten

"The reports by the LGA come to the conclusion that WADIT® sealant can be used without any restrictions in sheet pile wall interlocks in ground and surface water areas. There are no fears of harmful effects if it is used in the area of drinking water extraction systems."

A Note from Achim Wuensch

"As steel sheet pile professionals, we understand the importance of an effective and durable interlock seal, especially when the safety of a community is at stake. WADIT® is the only sealant on the market made specifically for sheet pile interlocks and applied by sheet piling professionals.

So when the **U.S. Army Corp of Engineers specified WADIT®** for a project related to the [post-Katrina] flood defenses in New Orleans, it was a big deal for us. Every high-capacity retaining structure project demands accountability, but none more so than in New Orleans."

ACHIM WUENSCH, PILEPRO® ENGINEER

WADIT

Recent International WADIT® Jobs

Ijlst, The Netherlands
PAU 2240

Amsterdam, The Netherlands
PZC 18

Leeuward en, The Netherlands
Hoesch 1807/2507/2607

Gouda, The Netherlands
PZC-26

Groningen, The Netherlands
PZC-18

Groningen, The Netherlands
PZC-13

Voorst, The Netherlands
PZC-13 / H1707

Australian Alps
AZ 12 to AZ 50 and HZ 775 and 975

Taranto, Italy
H 1707

Groningen, The Netherlands
L603K

Amsterdam, The Netherlands
H 2607

Bridisi, Italy
H 2607

La Spezia, Italy
H3707

Napoli, Italy
L716

La Spezia, Italy
H2607


Amsterdam, The Netherlands


Amsterdam, The Netherlands


Austrian Alps


Austrian Alps


Leeuward en, The Netherlands


Brindisi, Italy


Brindisi, Italy

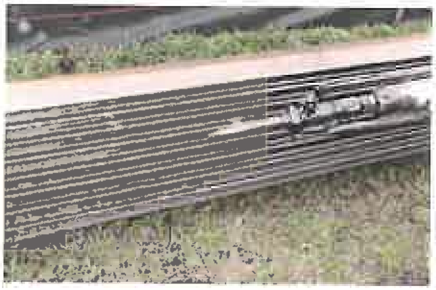

La Spezia, Italy


La Spezia, Italy

Recent Domestic WADIT® Jobs

Mobile, Alabama, Material Spec: PZ-35

Lake Village, Indiana, Material Spec: PZC-18



New Orleans, LA, Material Spec: PZ-22

Houston, TX, Material Spec: H-2607

- **WADIT®**

WADIT®

- Sheet piling sealants of the new generation
- Tested groundwater-compatible hot sealing compound for sheet piling rocks

Applications

- Sealing of steel sheet piling walls in conjunction with pile driving work in water-bearing formations. Sealing of concrete and steel components.
- Sealing of the edge interlocks of sheet piling walls to prevent penetration of soil constituents and, thus, seizing during pile driving.

Product description

WADIT is based on naturally grown raw materials, free of ingredients harmful to the environment and, thus, optimally environmentally compatible so that its use in groundwater-bearing strata poses no problems. Sealing compound residues may be left in the ground for an indefinite period of time.

Processing informtion

The industrial safety regulations for handling hot liquid building materials must be observed. The containers may be melted open together with the packing. Make sure that the packing is clean and dry.

For heating WADIT, we recommend using a thermostat-controlled heater indirectly healed with thermal oil as this will
normally avoid local overheating of the sealing compound. While WADIT is being poured into the sheet piling locks, the sheet piles must be in a perfectly horizontal position.

In order 10 achieve a reliable bond between sealing compound and steel, special care should be taken to ensure that the steel sections are clean, dry and free of grease. The 'rolling skin' clinging to new steel sections (which partially consists of grease and oil) should be removed by means of a rotating brush. Using a torch, briefly soften sealant residues in sheet piling locks. The consumption of WADIT is largely determined by the condition of the sheet piling locks (new or used, tolerances). During the cold season, steel sections which are sealed at the open air must always first be lightly preheated with a torch in order to avoid a cold shock (which would certainly lead to the formation of a moisture film on the steel).

Furthermore parts in storage which have not yet been sealed should always be protected against moisture. Atmospheric precipitation shall be sufficient reason to stop all sealing works on site.

The applicable codes of recommended practice for processing bituminuos materials must be observed.

However, if outside temperatures necessitate the addition of WADIT FLEX (see following table for dosing instructions), than this shall be added directly into the heater immediately after the Introduction of WADIT.

The amounts of WAD IT FLEX to be added depend on the outside temperature at the time of the pile driving operation.

Dosing Instructions for WADIT FLEX

Outside Temperature	Amount of WADIT FLEX to be added to 25 kg of WADIT
Above 10° C	No addition required
+5° C to +10° C	Normally, no addition required. In sppecial cases; 2 litres
0° C to +5° C	2 to 4 litres
Below 0° C	4 to 6 litres

Important:
Overheating may substantially impair the quality of the sealing compound and must therefore be avoided at air events. The temperature must be kept between 130° C and a maximum of 170° C and should be regularly checked with a thermometer. During the heating phase, the sealing compound must be stirred at regular intervals. If WADIT emits a dense whitish - yellow fog during healing, the sealing compound has been overheated and probably already damaged. A sealing compound which has been damaged in this manner should no longer be used. To avoid thermal damage, WADIT should not be melted more than twice at the most.

Cleaning of tools and treatment of residual compound

WADIT is soluble in organic solvents, such as while spirit and xylene or diesel, As particularly environment-friendly solvents we recommend rape oil and rape oil methyl ester (bio diesel), Dissolved in the latter, WADIT can be mixed with lime or cement to form a paste which may be dumped on rubbish tips in small amounts.

Containers and storage (25 kg containers)

For prolonged periods of time, the containers should be stored indoors at temperatures under +30°C.

Recommended action in the event of accidents/burns

Skin burns caused by unworkmanlike handling of WADIT should be treated immediately by cooling the area affected with cold water for several minutes. Do not peel adhering material from the skin or remove it with solvents! Cooled WADIT acts like a sterile bandage and drops off with the scab.
In any case, also see a doctor!

Although WADIT as such is in no way harmful to the skin, any direct contact should be avoided for general hygienic reasons. Inhaling hot vapors that form when the material is healed should definitely be avoided. The vapors may cause slight nausea, but do not constitute a toxid hazard.

GENERAL NOTES:

CODES AND STANDARDS

THE FOLLOWING CODES AND STANDARDS SHALL BE UTILIZED BY THE CONTRACTOR TO ESTABLISH MINIMUM LEVELS OF QUALITY AND CONSTRUCTION TECHNIQUES.

1. STRUCTURAL STEEL:

A. AMERICAN INSTITUTE OF STEEL CONSTRUCTION, "MANUAL OF STEEL CONSTRUCTION" FOURTEENTH EDITION.

B. AMERICAN WELDING SOCIETY, "STRUCTURAL WELDING CODE AWS D 1.1".

DESIGN CRITERIA

THE SHEET PILE WALL HAS BEEN DESIGNED USING THE FOLLOWING SOIL STRENGTH PARAMETERS:

SOIL PARAMETERS FOR EXCAVATION SUPPORT SYSTEM ANALYSIS										
		Elevation (FEET)		Total Unit Weight (PCF)	SHEAR STRENGTH PARAMETERS					
Zone	Soil Type				Undrained (Short Term)		Drained (Long Term)			Static
		From	To		Cohesion C (PSF)	Φ (°)	Cohesion C' (PSF)	Φ' (°)	E50	K(PY) LBS/IN^3
1	Loose Sand	164	157	100	0	0	0	0	0	0
2	Loose Sand	157	152	100	0	30	0	30	NA	20
3	CL	152	130	120	800	0	0	30	0.01	100

STRUCTURAL STEEL

1. MATERIALS

A. WELDING ELECTRODES - E70XX

B. SHEET PILES - ASTM A572, GRADE 50

2. STRUCTURAL STEEL DESIGN, FABRICATION AND ERECTION SHALL CONFORM TO:

A. AISC, "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL BUILDINGS."

B. AISC, "CODE OF STANDARD PRACTICE", INCLUDING COMMENTARY.

3. WELDING SHALL CONFORM TO AWS D 1.1 "STRUCTURAL WELDING CODE" AND BE PERFORMED BY CERTIFIED WELDERS. WELDS SHOWN ON STRUCTURAL DRAWINGS ARE MINIMUM DESIGN REQUIREMENTS. MINIMUM FILLET WELD SIZE SHALL BE 3/16" OR AISC TABLE J2.4 WHICHEVER IS GREATER.

4. REMOVE RUST, DIRT AND PAINT FROM STEEL PRIOR TO WELDING.

5. PROVIDE AND MAINTAIN CROSS BRACING OF ALL STRUCTURAL STEEL ERECTION UNTIL STRUCTURAL WORK IS SECURELY INCORPORATED INTO CONSTRUCTION TO ENSURE PLUMB AND SQUARE ALIGNMENT AND STABILITY.

MISCELLANEOUS

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND JOB SITE CONDITIONS PRIOR TO BEGINNING WORK. STRUCTURAL ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCY.

2. CONTRACTOR SHALL HAVE SOLE RESPONSIBILITY FOR THE SAFETY OF ERECTION BRACING (IF REQUIRED). THE STRUCTURE IS DESIGNED FOR A COMPLETED CONDITION ONLY AND THEREFORE MAY REQUIRE ADDITIONAL SUPPORT TO MAINTAIN STABILITY BEFORE COMPLETION.

3. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILTY FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS, FOR DIMENSIONS TO BE CONFIRMED AT THE JOB SITE, FOR FABRICATION PROCESSES, FOR SAFE CONDITIONS AT THE JOB SITE, AND FOR THE MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES OF CONSTRUCTION.

4. NO SUBSTITUTIONS OF MATERIAL WILL BE ALLOWED WITHOUT WRITTEN PERMISSION FROM THE ENGINEER.

5. DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER BEFORE CONTINUING WITH CONSTRUCTION.

6. CONTRACTOR SHALL COMPLY WITH LOCAL, STATE, FEDERAL AND OEWNERS SAFETY REGULATIONS WHILE WORKING. ENGINEER DOES NOT ASSUME ANY RESPONSIBILTY FOR CONSTRUCTION SITE SAFETY.

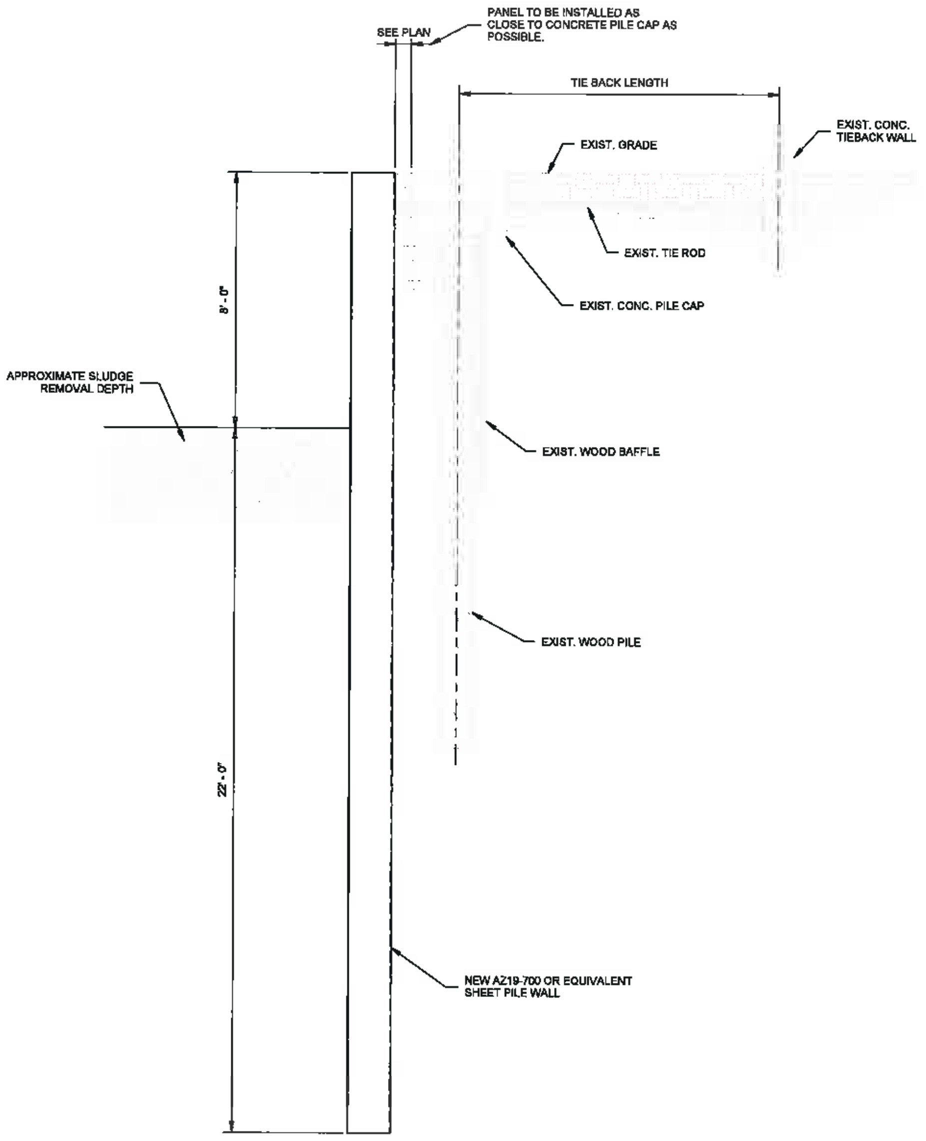
7. PROVIDE ALL TEMPORARY BRACING, GUYING OR OTHER MEANS TO AVOID EXCESSIVE STRESSES AND TO HOLD STRUCTURAL ELEMENTS IN PLACE DURING CONSTRUCTION. THE STRUCTURE SHOULD NOT BE CONSIDERED STABLE UNTIL ALL STRUCTURAL ELEMENTS HAVE BEEN CONSTRUCTED.

8. THE STRUCTURAL ENGINEER SHALL NOT HAVE CONTROL OR BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, PROCEDURES OR SEQUENCES. FOR THE ACTS OR OMISSIONS OF THE CONTRACTOR, OR ANY OTHER PERSONS PERFORMING THE WORK, OR FOR THE FAILURE OF ANY OF THEM TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

9. GENERAL CONTRACTOR MUST REVIEW AND APPROVE SHOP DRAWINGS PRIOR TO SUBMITTAL TO ARCHITECT/ENGINEER. SUBMITTALS WHICH DO NOT CONTAIN THE CONTRACTORS SHOP DRAWING OR STAMP OR HAVE BEEN MERELY "RUBBER STAMPED" SHALL BE RETURNED WITHOUT REVIEW.

10. WATERTIGHT SEALANT FOR SHEET PILES BY OTHERS.

11. SHEET PILE LAYOUT SHOWN IS CONCEPTUAL. FINAL LAYOUT WILL BE BASED ON FIELD CONDITIONS.



① SHEET PILE WALL SECTION
3/8" = 1'-0"

Smith Seckman Reid, Inc.
2650 Thousand Oaks Boulevard,
Suite 3200
Memphis, TN 38118
(901) 683-3900
FAX: (901) 683-3990
www.ssr-inc.com

15775
3-13-15

No.	Date	Description

HERCULES INCORPORATED

IMPOUNDING BASIN

401 PROVIDENCE ST.
HATTIESBURG, MS

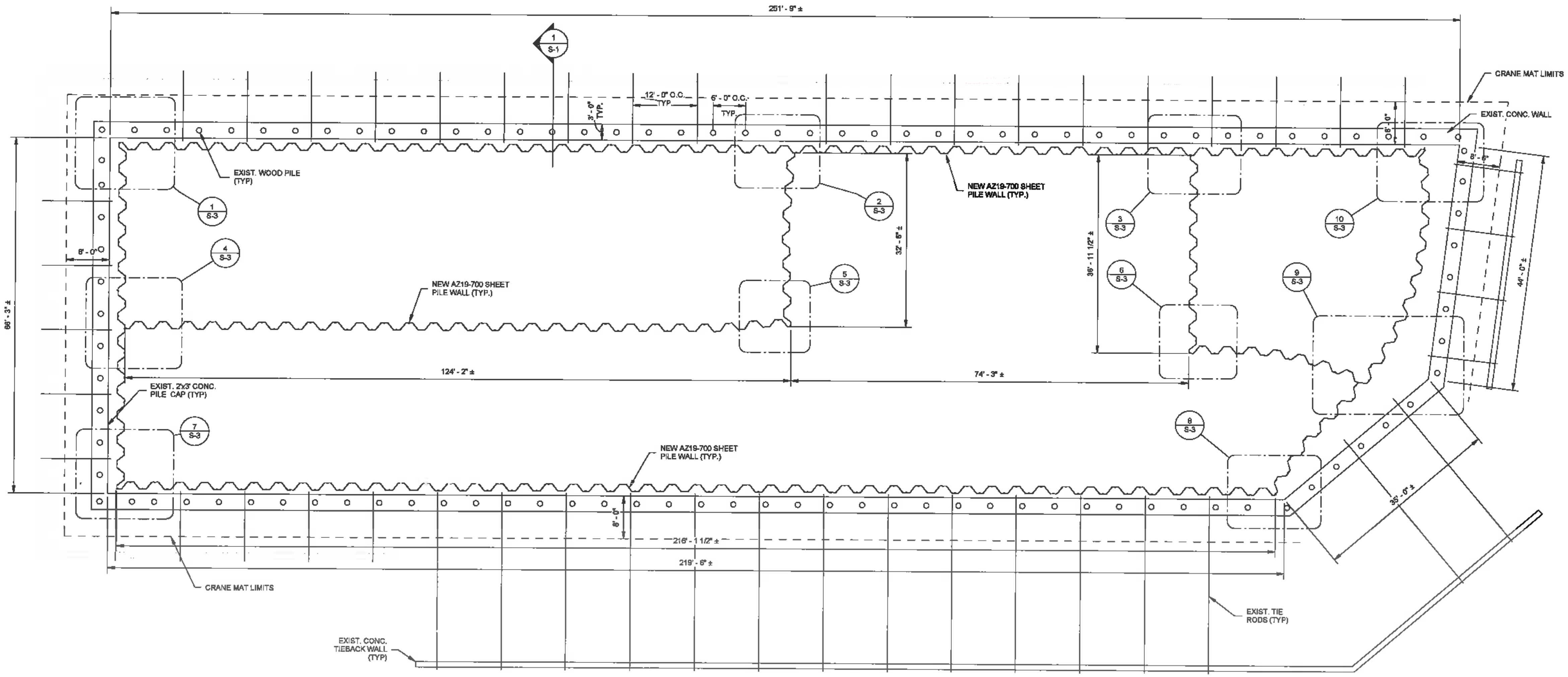
GENERAL NOTES AND SECTION

DRAWN BY: MAC
DESIGNED BY: DJS
CHECKED BY: ICE

JOB NO.: 15640090
PHASE:
DATE: 01/19/15
DRAWING NO: S-1

3/13/2015 8:26:33 AM
C:\Users\tcrawford\Documents\Hercules Impounding Basin_Central_2015_tcrawford.rvt
MAC

3/13/2015 8:26:35 AM C:\Users\tcrawford\Documents\Hercules Impounding Basin_Central_2015_tcrawford.rvt MAC



① IMPOUNDING BASIN PLAN
3/32" = 1'-0"

NOTE: ALL EXISTING DIMENSIONS FROM PLANS PROVIDED IN RFP. ACTUAL DIMENSIONS TO BE FIELD VERIFIED.

Smith
Seckman
Reid, Inc.
2650 Thousand Oaks Boulevard,
Suite 3200
Memphis, TN 38118
(901) 683-3900
FAX: (901) 683-3990
www.ssr-inc.com

19776
3-13-15

No.	Date	Description

HERCULES
INCORPORATED

IMPOUNDING
BASIN

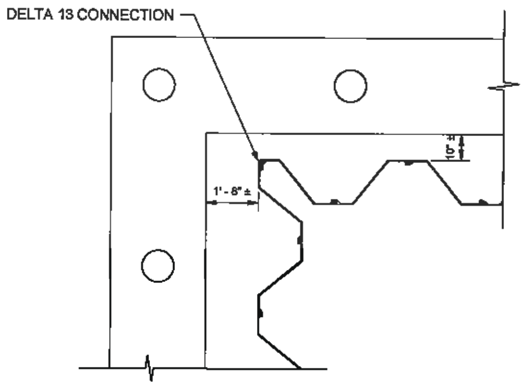
401 PROVIDENCE ST.
HATTIESBURG, MS

IMPOUNDING BASIN
PLAN

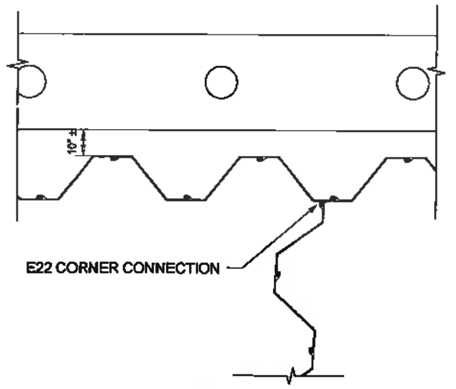
DRAWN BY: MAC
DESIGNED BY: DJS
CHECKED BY: ICE

JOB NO.:
PHASE:
DATE: 01/19/15

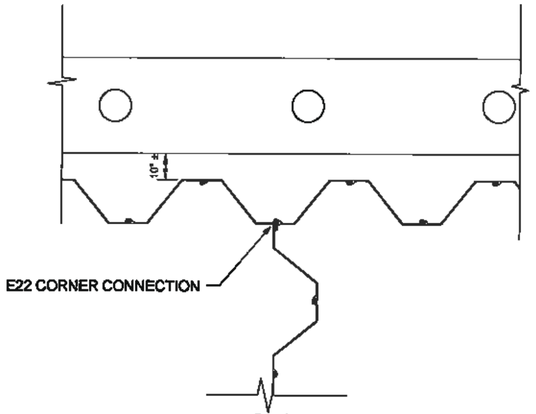
DRAWING NO:
S-2



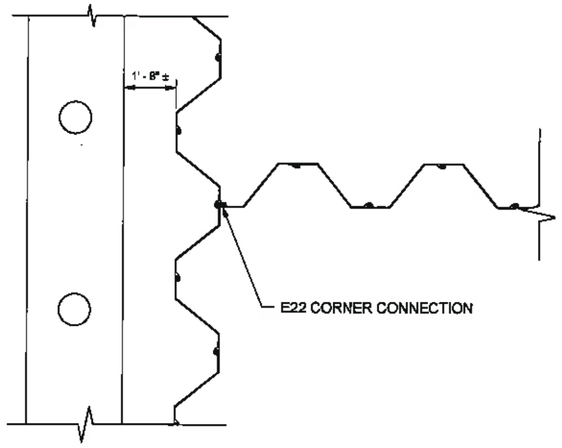
① Detail 1
3/8" = 1'-0"



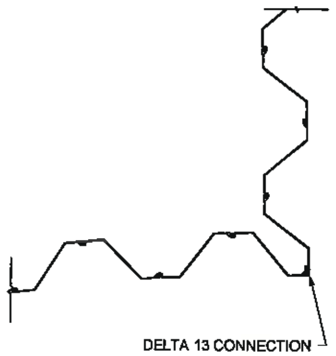
② Detail 2
3/8" = 1'-0"



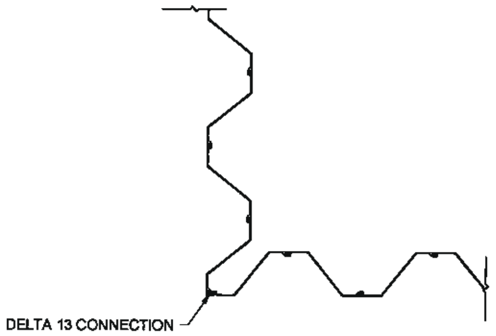
③ Detail 3
3/8" = 1'-0"



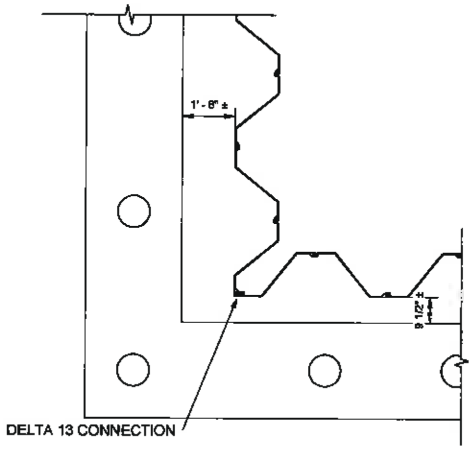
④ Detail 4
3/8" = 1'-0"



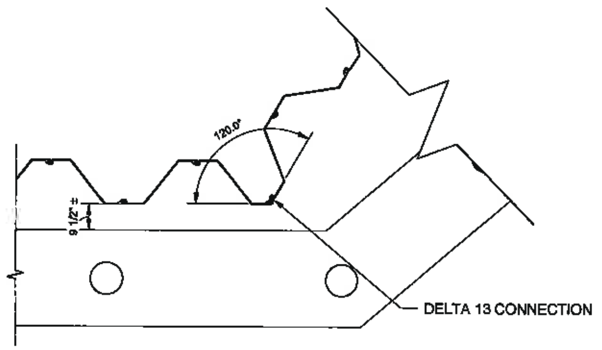
⑤ Detail 5
3/8" = 1'-0"



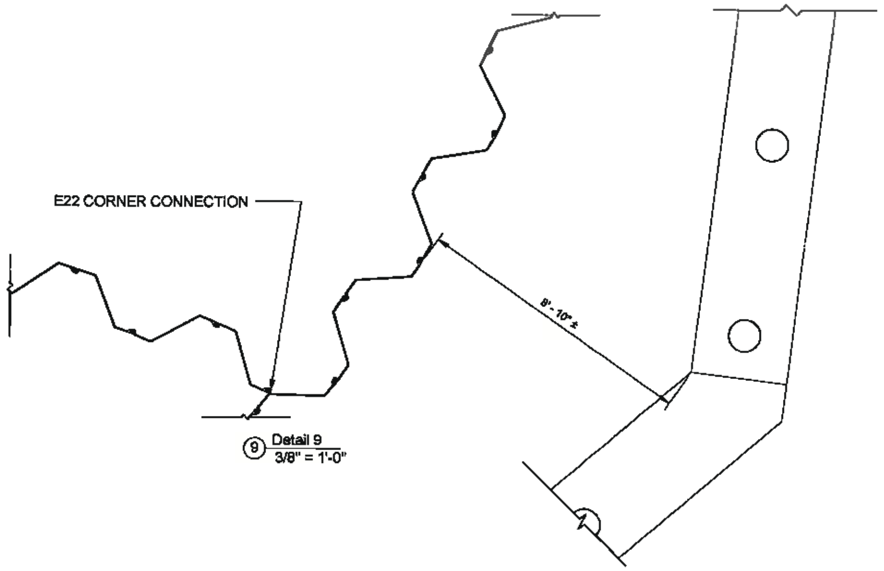
⑥ Detail 6
3/8" = 1'-0"



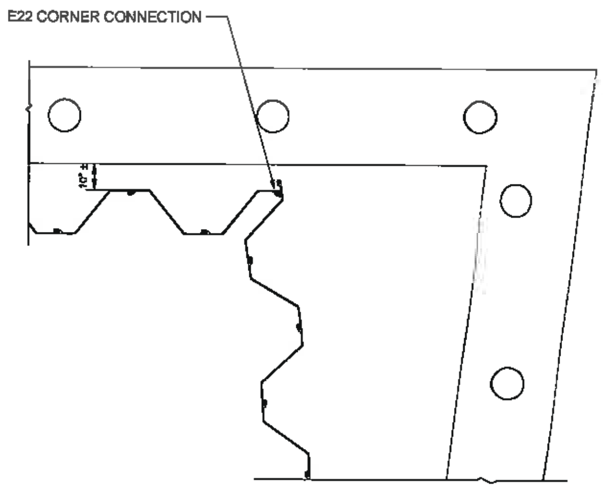
⑦ Detail 7
3/8" = 1'-0"



⑧ Detail 8
3/8" = 1'-0"



⑨ Detail 9
3/8" = 1'-0"



⑩ Detail 10
3/8" = 1'-0"

3/13/2015 8:26:37 AM C:\Users\lcrawford\Documents\Hercules Impounding Basin_Central_2015_lcrawford.rvt MAC

SSR Smith Seckman Reid, Inc.
2650 Thousand Oaks Boulevard,
Suite 3200
Memphis, TN 38118
(901) 683-3900
FAX: (901) 683-3990
www.ssr-inc.com

16775
3-13-15

No.	Date	Description

HERCULES
INCORPORATED

IMPOUNDING
BASIN

401 PROVIDENCE ST.
HATTIESBURG, MS

DETAIL SHEET

DRAWN BY: MAC
DESIGNED BY: DJS
CHECKED BY: ICE

JOB NO.: 15640090
PHASE:
DATE: 01/19/15
DRAWING NO: S-3

Appendix H

Temporary Structure Design

Mahaffey Fabric Structures
4161 Delp Street
Memphis, TN 38118

MTS 40M x 90M

Tensioned Fabric Frame Structure

Structural calculation of the MTS tensioned fabric structure
according to
2012 International Building Code

Evaluated for use in the following conditions:
Risk Category I
120 mph basic wind speed
Exposure C terrain
Seasonal Use - Snow Load not considered
5.0M (16' 4-7/8") bay spacing
Mean recurrence interval = 2 yr

STRUCTURAL ONLY

ROBERT V. NANGIA
LICENSED PROFESSIONAL ENGINEER
18734
STATE OF MISSISSIPPI
3/9/15

ROBERT V. NANGIA P.E.
7423 HOLLOW RIDGE DR.
HOUSTON, TX 77095

This drawing was produced
by and/or under my
direct supervision

The professional engineer seal on this cover page refers to the calculation sheets contained within this document and to any Appendix or Table sheets that support this document. Any other drawings and documents may require a separate seal for coverage not provided here.

Certification of this document only shows that the Professional Engineer of that particular state is in agreement with the report's contents. It does not, however, imply that the structure is generally suitable for use within that state, or that every installation is covered by this report.

The information and illustrations contained within this document remain the sole property of Mahaffey Fabric Structures and are to be treated as confidential.

The professional engineer's seal, affixed on this document, signifies a responsibility for the structural adequacy of the design of the structure in the completed project. The content contained within this document does not encompass means, methods and safety of erection.

All data, designs, technical representations, engineering calculations and illustrations whether written or implied may not be reproduced in whole or in part nor distributed, used in manufacturing, design or display without the express written consent of Mahaffey Fabric Structures. Retention of this document shall constitute acceptance of these terms and conditions.

Page Intentionally Left Blank

Table of Contents

Revision Log

Rev	Rev. Date	Description
0	06 Mar 15	- Original Issue

Page Intentionally Left Blank

1. Introduction

This document describes the structural design calculations for a MTS style Tension Fabric Structure. The length of the structure can reach any value as long as it's a multiple of the bay distance.

Distance between two arches : $L_{bay} = 5\ m$

For a length of 40 m or less, two bays with bracing cables are needed. If the length is higher than 40 m, an additional bay with steel bracing cables is needed. The maximum distance between two bays with bracing cables is 30 m. There should always be a bay with bracing cables at both ends of the structure.

The external loadings on the fabric like wind, rain and snow are transmitted directly to the main arch.
The function of the purlin is to keep the distance between the arches and to ensure the longitudinal stability in combination with the cable bracing system.

The calculation is based on the finite element method and uses nodes which are connected by beams.
The connections of the arches with the base plates are considered as hinges. The connections of the cables as well as the connection of the purlins to the arches are considered as hinges.

The profile is calculated as being continuous. The splices are checked with the results from the general arch calculation.

The computational analysis is performed by the VisualAnalysis 10.0 computer program. The presentation calculations are done with the MathCAD computer program.

The design is also governed by the following codes and guides:

- ASCE 7-10 (American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, 2010, by reference)
- Aluminum Design Manual, Specifications & Guidelines for Aluminum Structures (The Aluminum Association, 2005)
- AISC ASD 13th edition (American Institute of Steel Construction, Manual of Steel Design, 2005)

Page Intentionally Left Blank

2. Project Parameters

Building Geometry

Building length:	$L_{length} = 295.28 \cdot ft$	$L_{length} = 90\,m$
Building width:	$L_{width} = 133.86 \cdot ft$	$L_{width} = 40.8\,m$
Bay spacing:	$L_{bay} = 16.4 \cdot ft$	$L_{bay} = 5\,m$
Purlin spacing:	$L_{purlin} = 6.56 \cdot ft$	$L_{purlin} = 2\,m$
Peak height:	$z = 49.05 \cdot ft$	$z = 14.95\,m$
Eave height:	$h_e = 17.83 \cdot ft$	$h_e = 5.43\,m$
Mean roof height:	$h := 0.5 \cdot \left(z + h_e\right) = 33.44 \cdot ft$	$h = 10.19 \cdot m$
Roof slope:	$\theta_t := \operatorname{atan}\left[\frac{2 \cdot \left(z - h_e\right)}{L_{width}}\right] = 25 \cdot deg$	

Page Intentionally Left Blank

3. Determination of Loads

Dead Load :

The structure dead loads consist of the self weight of the structure's components with addition of uniform distributed loads for fabric roofing, side wall materials, and minor components. Various calculated weights are shown below for reference and use in the static computer model analysis.

Weight of the roof and liner : $AreaWt_{fabric} = 24.00 \cdot oz\ per\ sq\ yard$ $UnitWt_{fabric} = 0.23 \cdot pli$

$AreaWt_{liner} = 16.00 \cdot oz\ per\ sq\ yard$ $UnitWt_{liner} = 0.15 \cdot pli$

Weight of the insulation : $AreaWt_{insul} = 0.45 \cdot psf$ $UnitWt_{insul} = 0.61 \cdot pli$

Weight of std. purlins : $Weight_{e097} := A_{g_{e097}} \cdot \gamma_{6061}$ $Weight_{e097} = 0.11 \cdot pli$

$Weight_{e088} := A_{g_{e088}} \cdot \gamma_{6061}$ $Weight_{e088} = 0.11 \cdot pli$

$Weight_{e133} := A_{g_{e133}} \cdot \gamma_{6061}$ $Weight_{e133} = 0.27 \cdot pli$

There are 14 heavy purlins (ALU 129), 0 small purlins (ALU 97), and 1 peak purlin (ALU 133) per bay.

$$Weight_{purlins} := L_{bay} \cdot \left(14 \cdot Weight_{e129} + 0 \cdot Weight_{e097} + 1 \cdot Weight_{e133}\right) = 53.96 \cdot lbf$$

This weight is divided by the total length of the arch. $L_{arch} = 53.67\,m$ $L_{arch} = 2113 \cdot in$

Total Uniform weight : $Weight_{uniform} := UnitWt_{fabric} + UnitWt_{liner} + UnitWt_{insul} + \dfrac{Weight_{purlins}}{L_{arch}} = 1.020 \cdot pli$

Local loadings are the weight of the peak splice and connection splices.

$Weight_{peak\_splice} = 80 \cdot lbf$

$Weight_{connection\_splice} = 65 \cdot lbf$

A general hanging load is assumed for electrical and mechanical fixtures (lighting, HVAC, suspended items, etc.) totaling 1,000 lbs per frame and suspended 500 lb from the peak and 250 lb midway down each rafter.

Ridge Load hanged at peak : $P_{peak} = 500 \cdot lbf$

Rafter Load hanged at midway : $P_{rafter} = 250 \cdot lbf$

Collateral Loads :

The structure is designed to support the loads shown in this calculations. It may, or may not, be capable of supporting additional collateral loads. The owner of the structure shall not hand, or otherwise affix, additional loads to this structure without a review by an engineer qualified to make said review. Additionally, prior to adding load to this structure, the owner shall get a written confirmation by the qualified engineer as to the magnitude and location of the load, or loads, being applied.

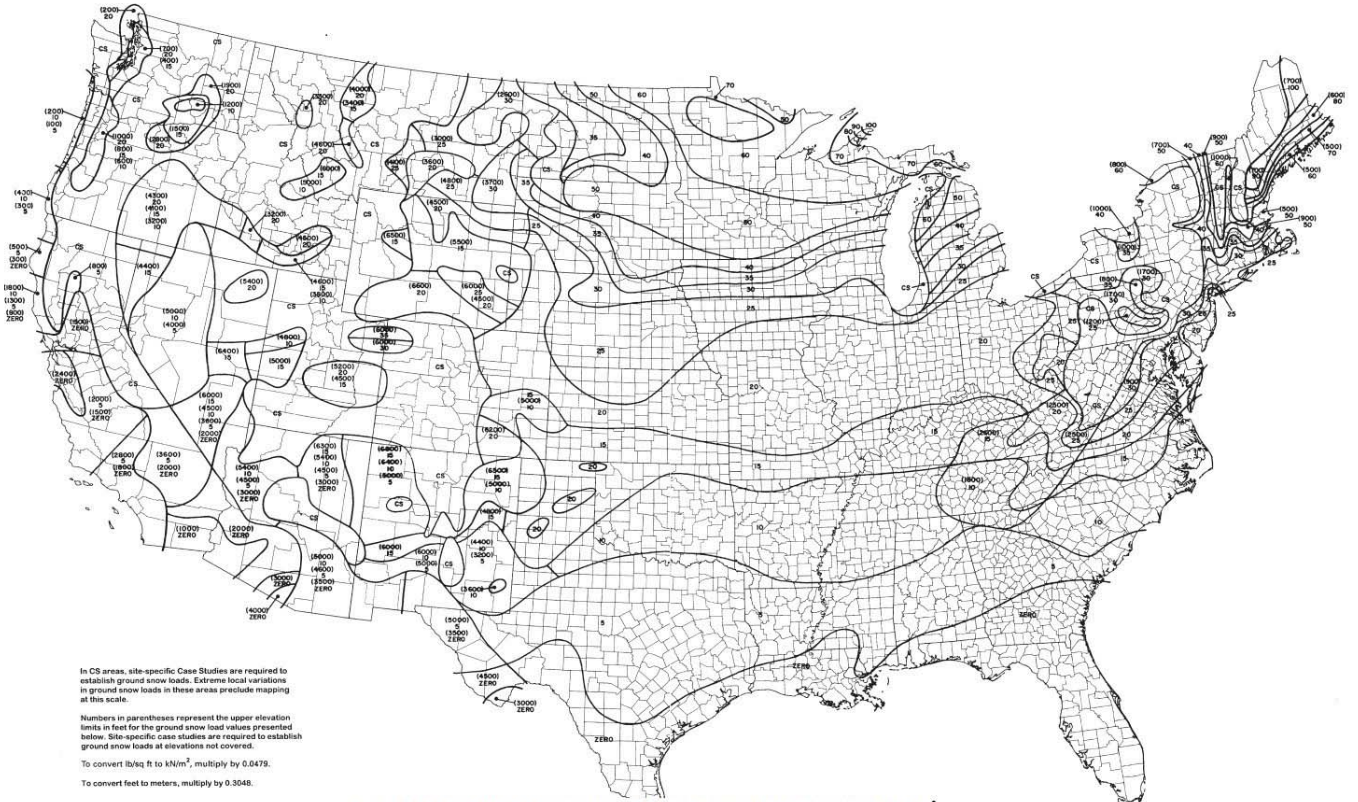
Roof Live Load :

Based on performance and function of this building style, only short duration of the roof live load is expected on the fabric roof of the structure. If repairs are needed, usually one worker with a light equipment would suffice. Assume maximum concentrated load of 500 lbf to be used as a Roof Live Load.

$L_r := 500 \cdot lbf$

Snow Load - ASCE 7-10 Chapter 7

Design Parameters



In CS areas, site-specific Case Studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.

To convert lb/sq ft to kN/m², multiply by 0.0479.

To convert feet to meters, multiply by 0.3048.

ASCE 7-10 FIGURE 7-1 Ground Snow Loads, P_g, for the United States (Lb/Ft²)

Ground Snow Load :	$p_g = 0 \cdot psf$	*[Fig. 7-1, Table 7-1]*
Terrain Category:	Exposure = "C"	*[Section 26.7]*
Exposure Factor :	$C_e = 0.9$	*[Table 7-2]*

Description of exposure type = "Roof exposure condition = Fully Exposed"

Thermal Factor :	$C_t = 1$	*[Table 7-3]*

Description of thermal condition = "Thermal Condition = All structures except as indicated in Table 7-3"

Building Risk Category:	Cat = "I"	*[Table 1.5-1]*

Occupancy of Building = "Buildings and other structures that represent a low risk to human life in the event of failure"

Importance Factor :	$I_s = 0.8$	*[Table 1.5-2]*

Flat Roof Snow Load :

$p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g$ $\qquad$ $p_f = 0 \cdot psf$

Minimum Snow Load for Low-Slope Roofs :

Per ASCE 7-10 Section 7.3.4, minimum roof snow load, p_m, shall only apply to monoslope, hip and gable roofs with slopes less than 15°, and to curved roofs where the vertical angle from the eaves to the crown is less than 10°. This minimum roof snow load is a separate uniform load case. It need not be used in determining or in combination with drift, sliding, unbalanced, or partial loads.

Check for Minimum Snow Load = "minimum values for low-slope roof need not to be considered "

Sloped Roof Snow Load

Roof Slope Factor : $C_s = 0.69$ *[Figure 7-2a]*

Sloped Roof Load : $p_s = C_s \cdot p_f$ *[Eq. 7.4-1]*

$p_s = 0 \cdot psf$

Rain-on-Snow Surcharge Load:

Per ASCE 7-10 Section 7.10, for locations where p_g is 20 psf or less, but not zero, all roofs with slopes (in degrees) less than W/50 with W in feet shall include a 5 psf rain-on-snow surcharge load. This additional load applies only to the sloped roof (balanced) load case and need not be used in combination with drift, sliding, unbalanced, minimum, or partial loads.

Rain-on-Snow Surcharge Load = "surchage load need not be applied" *[Section 7.10]*

Design Balanced Snow Load :

$S_1 = p_s \cdot L_{bay}$ $S_1 = 0 \cdot pli$

Design Unbalanced Snow Load :

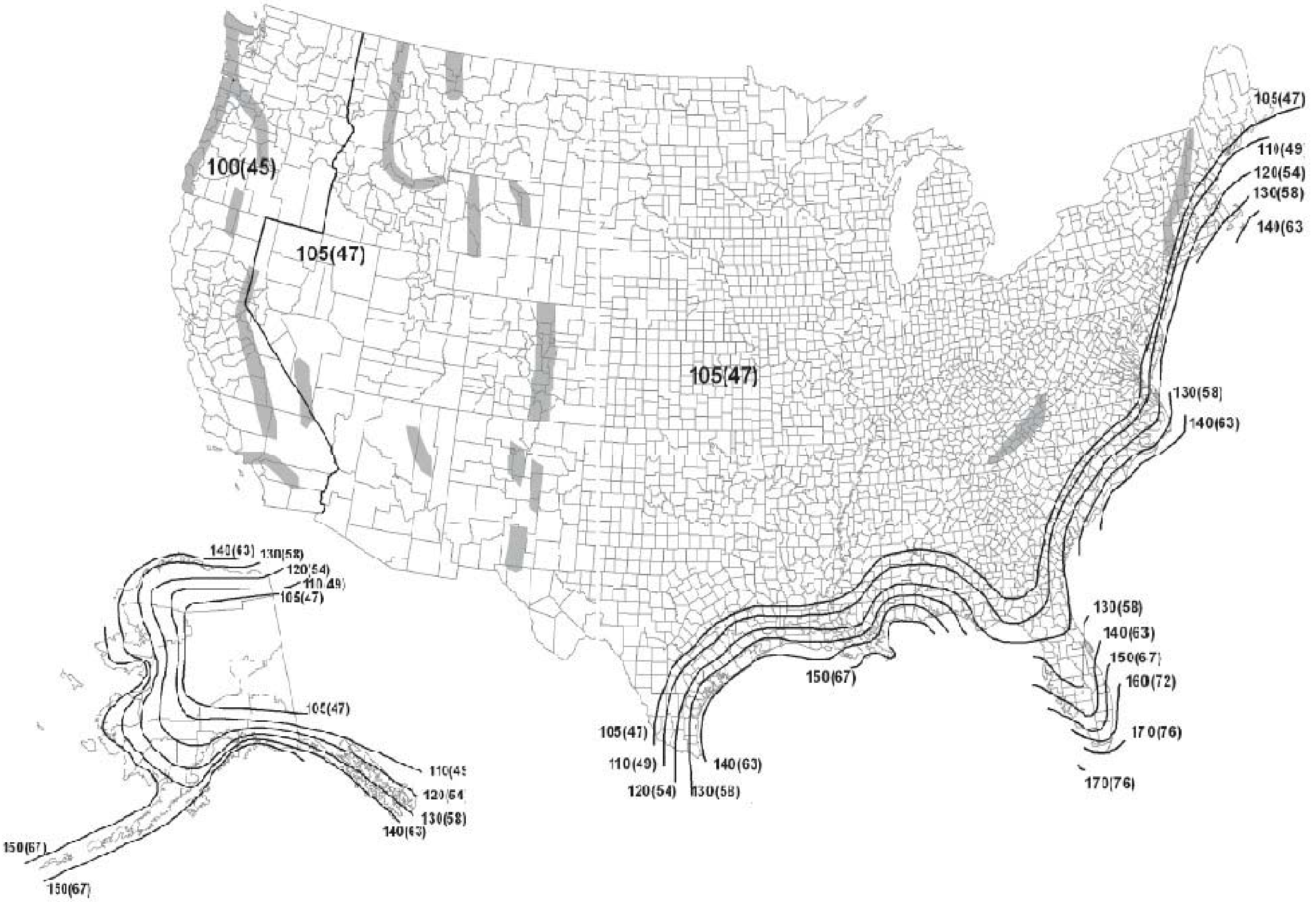
Per ASCE 7-10 Section 7.6.1, for hip and gable roofs with a slope exceeding 7 on 12 (30.2°) or with a slope less than 2.38° ($^1/_2$ on 12) unbalanced snow loads are not required to be applied.

$\theta_{roof} = 25.01 \cdot deg$

Check unbalanced load requirement = "unbalanced loads need to be considered" *[Section 7.6.1]*

Wind Loads - Low Rise Buildings

Design Parameters



General Requirements

Risk Category: Cat = "I" *[Table 1.5-1]*

Occupancy of Building = "Buildings and other structures that represent a low risk to human life in the event of failur

Basic wind speed: $V = 120 \cdot mph$ *[Section 26.5.1]*

Wind directionality factor: $K_d = 0.85$ *[Section 26.6]*

Exposure category: Exposure = "C" *[Section 26.7]*

Topographic factor: $K_{zt} = 1$ *[Section 26.8]*

Gust effect factor: $G = 0.85$ *[Section 26.9]*

Mean recurrence interval: $MRI = 2 \cdot yr$

Reduction factor for 'other' MRI: $R_n = 0.68$

Effective wind speed: $V_r = 81.6 \cdot mph$

Per ASCE 7-10 Section 26.9.1 & 26.9.2, the gust-effect factor for Low-Rise Buildings as defined in Section 26.2, are permitted to be taken as 0.85.

Envelope Procedure for Low Rise Buildings - ASCE 7-10 Chapter 28

Per ASCE 7-10 Section 26.2, buildings with mean roof height *h* less than or equal to 60 ft, and with mean roof height *h* dose not exceed least horizontal dimension are considered as low-rise building.

Check Low Rise Criteria = "both low-rise conditions are satisfied"

Per ASCE 7-10 Section 28.1.4, no reduction to the velocity pressure is taken due to apparent shielding.

Velocity Pressure :

$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V_r^2$ velocity pressure evaluated at peak height

$q_h = 0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot V_r^2$ velocity pressure evaluated at mean roof height

[Section 28.3.2; Equation 28.3-1]

where :

for $15\text{ft} \le z \le z_g$ for $z \le 15\text{ft}$

$K_z = 2.01 \cdot \left(\frac{z}{z_g}\right)^{\frac{2}{\alpha}}$ $K_z = 2.01 \cdot \left(\frac{15\text{ft}}{z_g}\right)^{\frac{2}{\alpha}}$ *[Table 28.3-1]*

*Note: z shall not be taken less than 30 feet in exposure B.

$z_g = 900 \cdot \text{ft}$ *[Table 26.9.1]*

$K_z = 1.09$ velocity pressure exposure coefficient evaluated at peak height ($z = 49.05 \cdot \text{ft}$)

$K_h = 1$ velocity pressure exposure coefficient evaluated at mean roof height ($h = 33.44 \cdot \text{ft}$)

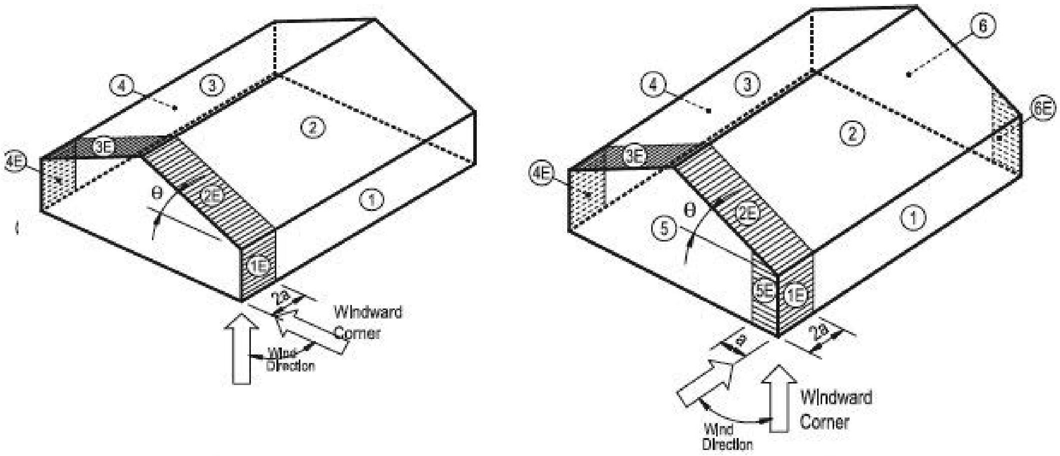
$q_z = 15.78 \cdot \text{psf}$ velocity pressure evaluated at building height, z

$q_h = 14.56 \cdot \text{psf}$ velocity pressure evaluated at mean roof height, h

Design Wind Pressure

$p = q_h \cdot \left[\left(GC_{pf} \right) - \left(GC_{pi} \right) \right]$ *[Equation 28.4-1]*

External Pressure Coefficients (GC_{pf})



Load Case A **Load Case B**

ASCE 7-10 FIGURE 28.4-1 External Pressure Coefficients (GC_{pf})

Transverse Direction (Load Case A)

$GC_{pf.A} =$

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
0.55	-0.24	-0.45	-0.4	0.74	-0.4	-0.61	-0.56

$a = 13.38 \cdot ft$

$2 \cdot a = 26.75 \cdot ft$

(interpolated to the roof slope at: $\theta_{roof} = 25.01 \cdot deg$)

Longitudinal Direction (Load Case B)

$GC_{pf.B} =$

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-0.45	-0.69	-0.37	-0.45	0.4	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

Application of Pressures on Building Surfaces 2 and 3

Per note 8 in ASCE 7-10 Fig. 28.4-1, the roof pressure coefficient (GCpf), when negative in Zone 2 and 2E, shall be applied in Zone 2/2E for a distance from the edge of the roof equal to 0.5*horizontal dimension of the building parallel to the direction of the MWFRS being designed or 2.5* the eave height at the windward wall, whichever is less; the remainder of Zone 2/2E extending to the ridge line shall use the pressure coefficient (GCpf) for Zone 3/3E.

$\text{Zone 2/2E Distance}_{CaseA} = 44.58 \cdot ft$

$\text{Zone 2/2E Distance}_{CaseB} = 44.58 \cdot ft$

Internal Pressure Coefficients (GC_{pi})

Enclosure Classification = "The building qualifies as an Enclosed Building (See ASCE 7-10 Section 26.2)"

$GC_{pi} =$

	0	1
0	"Overpressure"	0.18
1	"Underpressure"	-0.18

[Table 26.11-1]

Wind at Transverse Direction (Load Case A)

$p_A =$

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
5.31	-6.11	-9.25	-8.44	8.23	-8.43	-11.50	-10.77
10.56	-0.87	-4.00	-3.20	13.47	-3.19	-6.26	-5.53

$\cdot psf$

*top line = overpressure, bottom line = underpressure

Wind at Longitudinal Direction (Load Case B)

$p_B =$

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-9.17	-12.67	-8.01	-9.17	3.2	-6.84	-9.61	-18.2	-10.34	-9.61	6.26	-8.88
-3.93	-7.43	-2.77	-3.93	8.45	-1.6	-4.37	-12.96	-5.1	-4.37	11.5	-3.64

$\cdot psf$

*top line = overpressure, bottom line = underpressure

Design Wind Pressure on Gable

$p_{gable} =$

"5"	"6"	"5E"	"6E"
3.2	-6.84	6.26	-8.88
8.45	-1.6	11.5	-3.64

$\cdot psf$

Minimum Design Wind Loads

Per ASCE 7-10 Section 28.4.4, the wind load to be used in the design of the MWFRS for an enclosed or partially enclosed building shall not be less than 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction.

$\text{Minimum Wall Pressure} = 10.94 \cdot pli$

$\text{Minimum Roof Pressure} = 5.47 \cdot pli$

Design Wind Loads

The wind pressure on one bay must be supported by one arch. The total wind load per arch equals :

$WL \mathbf{=} p \cdot L_{bay} \quad L_{bay} = 16.4 \cdot ft$

Wind at Transverse Direction (Load Case A)

$WL_A =$

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
7.27	-8.35	-12.64	-11.54	11.25	-11.53	-15.72	-14.73
14.43	-1.18	-5.47	-4.38	18.41	-4.36	-8.56	-7.56

$\cdot pli$

top line = overpressure, bottom line = underpressure

Wind at Longitudinal Direction (Load Case B)

$WL_B =$

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-12.54	-17.32	-10.95	-12.54	4.38	-9.36	-13.14	-24.88	-14.13	-13.14	8.56	-12.14
-5.37	-10.15	-3.78	-5.37	11.54	-2.19	-5.97	-17.72	-6.97	-5.97	15.72	-4.98

$\cdot pli$

top line = overpressure, bottom line = underpressure

Design Wind Loads for First Arch from End

$WL_{A1} =$ ·pli

"1E"	"2E"	"3E"	"4E"
5.62	-5.77	-7.86	-7.36
9.21	-2.18	-4.28	-3.78

$WL_{B1} =$ ·pli

"1E"	"2E"	"3E"	"4E"
-6.57	-12.44	-7.07	-6.57
-2.99	-8.86	-3.48	-2.99

Design Wind Loads for Second Arch from End

$WL_{A2} =$ ·pli

"1/1E"	"2/2E"	"3/3E"	"4/4E"
11.25	-11.53	-15.72	-14.73
18.41	-4.36	-8.56	-7.56

$WL_{B2} =$ ·pli

"1/1E"	"2/2E"	"3/3E"	"4/4E"
-13.14	-24.88	-14.13	-13.14
-5.97	-17.72	-6.97	-5.97

Design Wind Loads for All Other Arches

$WL_{A3} =$ ·pli

"1"	"2"	"3"	"4"
7.79	-8.77	-13.04	-11.96
14.95	-1.6	-5.88	-4.79

$WL_{B3} =$ ·pli

"1"	"2"	"3"	"4"
-12.62	-18.31	-11.36	-12.62
-5.45	-11.14	-4.2	-5.45

* top line = overpressure
bottom line = underpressure

Torsional Load Cases

Per note 5 in ASCE 7-10 Figure 28.4-1, one story buildings with h less than or equal to 30 ft, buildings two stories or less framed with light frame construction, and buildings two stories or less designed with flexible diaphragms need not be designed for the torsional cases.

Check Torsional Load Case = "Torsional load cases need not to be designed"

4. ASD Load Combinations :

SYMBOLS AND NOTATION

D = dead load
Di = weight of ice
E = earthquake load
F = load due to fluids with well-defined pressures and maximum heights
Fa = flood load
H = load due to lateral earth pressure, ground water pressure, or pressure of bulk materials
L = live load
Lr = roof live load
R = rain load
S = snow load
T = self-straining force
W = wind load
Wi = wind-on-ice determined in accordance with Chapter 10

COMBINING NOMINAL LOADS USING ALLOWABLE STRESS DESIGN

1605.3.1 : Basic Load Combinations. Where allowable stress design (working stress design) is used, structures and portions thereof shall resist the most critical effects from the following combination of loads:

1. D + F
2. D + H + F + L + T
3. D + H + F + (Lr or S or R)
4. D + H + F + 0.75(L + T) + 0.75(Lr or S or R)
5. D + H + F + (W or 0.7E)
6. D + H + F + 0.75(W or 0.7E) + 0.75L + 0.75(Lr or S or R)
7. 0.6D + W + H
8. 0.6D + 0.7E + H

Symbols as used in calculations

D_1 = dead load;
D_2 = collateral;
L_r = roof live load;
S_1 = balanced snow
S_2 = unbalanced snow

W_1 = lateral wind (perpendicular to ridge line with overpressure)
W_2 = lateral wind (perpendicular to ridge line with overpressure)
W_3 = longitudinal wind (parallel to ridge line with underrpressure)
W_4 = longitudinal wind (parallel to ridge line with underpressure)

Combinations as applied in calculations :

1 a. D_1
b. $D_1 + D_2$

5 a. $D_1 + 0.6W_1$
b. $D_1 + 0.6W_2$
c. $D_1 + 0.6W_3$
d. $D_1 + 0.6W_4$
e. $D_1 + D_2 + 0.6W_1$
f. $D_1 + D_2 + 0.6W_2$
g. $D_1 + D_2 + 0.6W_3$
h. $D_1 + D_2 + 0.6W_4$

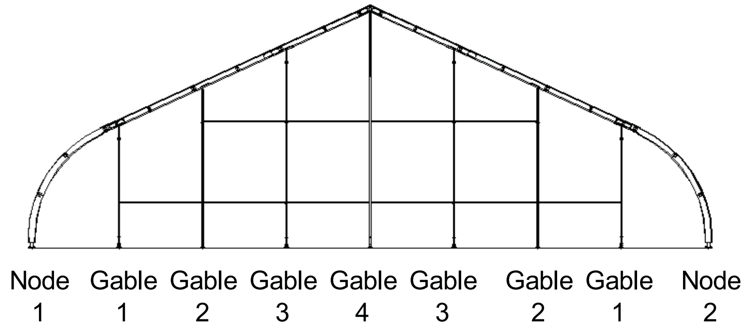
3 a. $D_1 + L_r$
b. $D_1 + S_1$
c. $D_1 + S_2$
d. $D_1 + D_2 + L_r$
e. $D_1 + D_2 + S_1$
f. $D_1 + D_2 + S_2$

7 a. $0.6D_1 + 0.6W_1$
b. $0.6D_1 + 0.6W_2$
c. $0.6D_1 + 0.6W_3$
d. $0.6D_1 + 0.6W_4$
e. $0.6D_1 + 0.6D_2 + 0.6W_1$
f. $0.6D_1 + 0.6D_2 + 0.6W_2$
g. $0.6D_1 + 0.6D_2 + 0.6W_3$
h. $0.6D_1 + 0.6D_2 + 0.6W_4$

6 a. $D_1 + 0.75L_r + 0.75(0.6W_1)$
b. $D_1 + 0.75L_r + 0.75(0.6W_2)$
c. $D_1 + 0.75L_r + 0.75(0.6W_3)$
d. $D_1 + 0.75L_r + 0.75(0.6W_4)$
e. $D_1 + 0.75S_1 + 0.75(0.6W_1)$
f. $D_1 + 0.75S_1 + 0.75(0.6W_2)$
g. $D_1 + 0.75S_1 + 0.75(0.6W_3)$
h. $D_1 + 0.75S_1 + 0.75(0.6W_4)$
i. $D_1 + 0.75S_2 + 0.75(0.6W_1)$
j. $D_1 + 0.75S_2 + 0.75(0.6W_2)$
k. $D_1 + 0.75S_2 + 0.75(0.6W_3)$
l. $D_1 + 0.75S_2 + 0.75(0.6W_4)$
m. $D_1 + D_2 + 0.75L_r + 0.75(0.6W_1)$
n. $D_1 + D_2 + 0.75L_r + 0.75(0.6W_2)$
o. $D_1 + D_2 + 0.75L_r + 0.75(0.6W_3)$
p. $D_1 + D_2 + 0.75L_r + 0.75(0.6W_4)$
q. $D_1 + D_2 + 0.75S_1 + 0.75(0.6W_1)$
r. $D_1 + D_2 + 0.75S_1 + 0.75(0.6W_2)$
s. $D_1 + D_2 + 0.75S_1 + 0.75(0.6W_3)$
t. $D_1 + D_2 + 0.75S_1 + 0.75(0.6W_4)$
u. $D_1 + D_2 + 0.75S_2 + 0.75(0.6W_1)$
v. $D_1 + D_2 + 0.75S_2 + 0.75(0.6W_2)$
w. $D_1 + D_2 + 0.75S_2 + 0.75(0.6W_3)$
x. $D_1 + D_2 + 0.75S_2 + 0.75(0.6W_4)$

5. Support Reactions

Unfactored Support Reactions



Nodal Reactions

Node	Result Case Name	FX lb	FY lb	FZ lb
1	DL - Dead load	1970	3062	-NA-
″	Lr - Roof Live Load	267	250	-NA-
″	W1 - Lateral +	-10618	-8525	-NA-
″	W3 - Longitudinal +	-5733	-15607	*
2	DL - Dead load	-1969	3062	-NA-
″	Lr - Roof Love Load	-267	250	-NA-
″	W1 - Lateral +	2308	-10643	-NA-
″	W3 - Longitudinal +	9176	-14268	*

+FX = Horiz. to Right, +FY = Vert. up, -FY = Indicates Uplift, FZ = toward or away from viewer

* : 2,740 lbs; in the longitudinal direction of the building; applicable only in the tension cable side of braced bays supports. In typical bays, apply the value of 0 lbs. Also, an additional ±5,590 lbs must be added to the FY in each arch adjacent to the wind braced bay (uplift in tension cable side).

There are no allowances for collateral loads applied to this structure.

Since the arch substantially supports the gable structure, foundation loads for the gables are primarily due to wind loads alone. Shear loads are applied perpendicular to the gable wall, either inward, or outward.

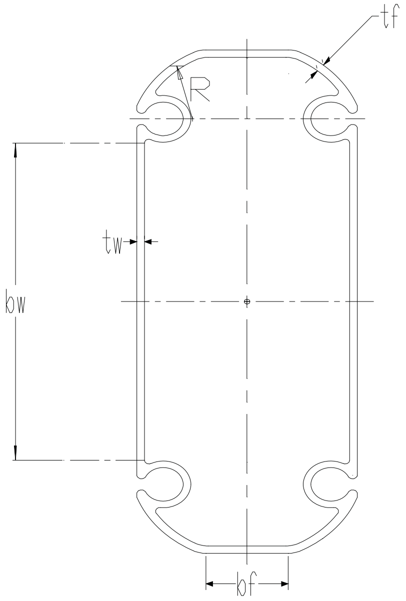
Gable Reactions

Node	**Result Case Name**	**FX** ***lb***	**FY** ***lb***	**FZ** ***lb***
Gable 1	DL - Dead load	0	170	-NA-
″	W1 - Lateral	0	0	960
″	W3 - Longitudinal	0	0	-1100 / 890
Gable 2	DL - Dead load	0	215	-NA-
″	W1 - Lateral	0	0	1410
″	W3 - Longitudinal	0	0	-1610 / 1305
Gable 3	DL - Dead load	0	255	-NA-
″	W1 - Lateral	0	0	1870
″	W3 - Longitudinal	0	0	-2140 / 1735
Gable 4	DL - Dead load	0	300	-NA-
″	W1 - Lateral	0	0	2345
″	W3 - Longitudinal	0	0	-2670 / 2170

+FY = Vert. up, +FZ = toward building interior.

6a. Main Profile Design

Section Properties :



Extrusion : 380

$E = 10100 \cdot ksi$	Table 3.3-1	
$n_u = 1.95$	Table 3.4-1	
$A_g = 11.224 \cdot in^2$	Cross-sectional area of Shape	
$b_w = 10.039 \cdot in$	Web length of Shape	
$t_w = 0.197 \cdot in$	Web thickness	
$b_f = 2.673 \cdot in$	Flat flange	
$R = 1.320 \cdot in$	Mid-thickness radius of the Curved Flange	
$t_f = 0.197 \cdot in$	Flange thickness	
$I_x = 304.93 \cdot in^4$	$I_y = 80.62 \cdot in^4$	Moment of inertia
$S_x = 40.76 \cdot in^3$	$S_y = 24.67 \cdot in^3$	Section Modulus
$r_x = 5.21 \cdot in$	$r_y = 2.68 \cdot in$	Radius of Gyration
$J = 179.77 \cdot in^4$		Torsional constant
$K_x := 1.0$	$K_y := 0.7$	Factor for buckling
$L_x = 428.5 \cdot in$	$L_y = 118.11 \cdot in$	Length for buckling
$L_b := L_y$		Length restrained from twisting or moving laterally

Selected Ratios :

$$\frac{b_w}{t_w} = 51 \qquad \frac{b_f}{t_f} = 13.6 \qquad \frac{R}{t_f} = 6.7 \qquad \frac{K_x \cdot L_x}{r_x} = 82.2 \qquad \frac{K_y \cdot L_y}{r_y} = 30.8 \qquad \frac{L_b \cdot S_x}{0.5\sqrt{I_y \cdot J}} = 80$$

Allowable Axial Stress:

The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Specification 3.4.1 - Tension, axial: $F_{aT} := 19 \cdot ksi$
Any tension member.

Specification 3.4.7 - Compression in Columns: $F_{a8} = 16.31 \cdot ksi$
All columns.
$F_{aIP} = 7.56 \cdot ksi$

Specification 3.4.9 - Compression in Column Elements: $F_{acw} = 9.63 \cdot ksi$
Flat elements supported on both edges.

Specification 3.4.10 - Compression in Column Elements: $F_{acc} = 20.03 \cdot ksi$
Curved elements supported on both edges.

Allowable Axial Stress:
$F_a = 7.56 \cdot ksi$ Use in Eq. 4.1.1-1
$F_{ao} = 9.63 \cdot ksi$ Use in Eq. 4.1.1-2
$F_{ex} = 7.56 \cdot ksi$ $F_{ey} = 53.72 \cdot ksi$

Allowable Bending Stress:

Specification 3.4.2 - Tension in Beams, extreme fibre, net section:
Flat elements in uniform tension (flanges). $F_{bT} := 19 \cdot ksi$

Specification 3.4.14 - Compression in Beams, gross section.:
Tubular shapes. $F_{bc1} = 21 \cdot ksi$

Specification 3.4.16 - Compression in Beams, gross section:
Flat elements supported on both edges. $F_{bc2} = 21 \cdot ksi$

Specification 3.4.16.1 - Compression in Beams, gross section:
Curved elements supported on both edges. $F_{bc3} = 23.76 \cdot ksi$

Specification 3.4.18 - Compression in Beams, elements:
Flat elements supported on both edges. $F_{bc4} = 26.73 \cdot ksi$

Allowable Bending Stress: $Fbx = 21 \cdot ksi$ $\quad Fby = 21 \cdot ksi$

Use in Eq. 4.1.1-1
& Eq. 4.1.1-2

Allowable Shear Stress:

Specification 3.4.20 - Shear in Elements, gross section:
Unstiffened flat elements supported on both edges. $F_V = 10.65 \cdot ksi$

Actual Stress:

Member ID = "M16" Load Case = "5b - D1 + 0.6W2 Second Order"

$Cmx := 0.85 \quad Cmy := 0.85 \quad Mx = -410.07 \cdot kip \cdot in \quad My = 0 \cdot kip \cdot in \quad C = -0.53 \cdot kip$

$$f_{bx} := \left| \frac{Mx}{S_x} \right| \qquad f_{by} := \frac{My}{S_y} \qquad f_{ac} := \left| \frac{C}{A_g} \right|$$

$f_{bx} = 10.1 \cdot ksi \quad f_{by} = 0.0 \cdot ksi \quad f_{ac} = 0.0 \cdot ksi$

Eq. 4.1.1-1 :

$$Eq1 := \frac{f_{ac}}{F_a} + \frac{Cmx \cdot f_{bx}}{\left(1 - \frac{f_{ac}}{F_{ex}}\right) \cdot Fbx} + \frac{Cmy \cdot f_{by}}{\left(1 - \frac{f_{ac}}{F_{ey}}\right) \cdot Fby}$$

$Eq1 = 0.42$

Eq1 is less than or equal to 1.0 = "OK"

Eq. 4.1.1-2 :

$$Eq2 := \frac{f_{ac}}{F_{ao}} + \frac{f_{bx}}{Fbx} + \frac{f_{by}}{Fby}$$

$Eq2 = 0.48$

Eq2 is less than or equal to 1.0 = "OK"

Member ID = "M07" Load Case = "6a - D1 + 0.75Lr + 0.75(0.6W1) Second Order"

$Mx = 757.14 \cdot kip \cdot in \quad My = 0 \cdot kip \cdot in \quad T = 5.7 \cdot kip$

$$f_{bx} := \left| \frac{Mx}{S_x} \right| \qquad f_{by} := \frac{My}{S_y} \qquad f_{at} := \frac{T}{A_g}$$

$f_{bx} = 18.6 \cdot ksi \quad f_{by} = 0 \cdot ksi \quad f_{at} = 0.5 \cdot ksi$

Eq. 4.1.2-1 :

$$Eq3 := \frac{f_{at}}{F_{aT}} + \frac{f_{bx}}{Fbx} + \frac{f_{by}}{Fby}$$

$Eq3 = 0.91$

Eq3 is less than or equal to 1.0 = "OK"

6b. Internal Column - HSS Design

Section Properties :

Shape Name = "HSS6x6x1/4"

$h = 6.000\cdot in$ $b = 6.000\cdot in$ $t = 0.233\cdot in$ Section dimensions

$A_g = 5.240\cdot in^2$ Cross-sectional area

$I_x = 28.6\cdot in^4$ $I_y = 28.6\cdot in^4$ Moment of inertia

$S_x = 9.54\cdot in^3$ $S_y = 9.54\cdot in^3$ Section Modulus

$r_x = 2.34\cdot in$ $r_y = 2.34\cdot in$ Radius of Gyration

$J = 45.6\cdot in^4$ Torsional constant

$K_x = 1$ $K_y = 1$ Factor for buckling

$L_x = 525\cdot in$ $L_y = 525\cdot in$ Length for buckling

$L_b := L_y$ Length restrained from twisting or moving laterally

Square and Rectangular HSS and Box-Shaped Members.

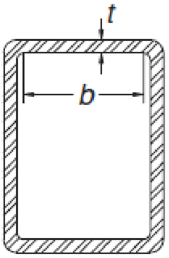
Table B4.1 Limiting Width-Thickness Ratios for Compression Elements

Case 12 Uniform compression in flanges of rectangular box and hollow structural sections of uniform thickness subject to bending or compression.

$b = 5.67\cdot in$ $t = 0.23\cdot in$ $\text{Ratio} := \frac{b}{t} = 24.34$

$\lambda_p := 1.12\cdot\sqrt{\frac{E}{F_y}} = 31.79$ $\lambda_r := 1.40\cdot\sqrt{\frac{E}{F_y}} = 39.74$

Section is = "compact"

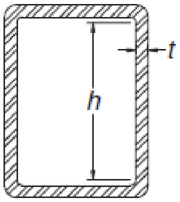


Case 13 Flexure in webs of rectangular HSS

$h = 5.67\cdot in$ $t = 0.23\cdot in$ $\text{Ratio} := \frac{h}{t} = 24.34$

$\lambda_p := 2.42\cdot\sqrt{\frac{E}{F_y}} = 68.69$ $\lambda_r := 5.70\cdot\sqrt{\frac{E}{F_y}} = 161.78$

Section is = "compact"



Chapter D - Design of Members for Tension

$\frac{P_n}{\Omega_t}$ design tensile strength for ASD design

where :

P_n nominal tensile strength as determined according to Sections D2-D6

$\Omega_{t.gross} = 1.67$ $\Omega_{t.net} = 2$ for ASD design

Tensile yielding in the gross section

$$P_{ny} = F_y \cdot A_g \qquad (D2\text{-}1)$$

$$P_{ny} := F_y \cdot A_g = 188.64 \cdot kip$$

Tensile rupture in the net section

$$P_{nr} = F_y \cdot A_e \qquad (D2\text{-}2)$$

$$P_{nr} := F_u \cdot A_e = 303.92 \cdot kip$$

Design tensile strength / Allowable tensile strength

$P_n = 112.96 \cdot kip$ for ASD design tensile strength

Chapter E - Design of Members for Compression

$\frac{P_n}{\Omega_c}$ design compressive strength

where : $\Omega_c = 1.67$

L laterally unbraced length of the member, in (mm)

r governing radius of gyration, in (mm)

K effective length factor determined in accordance with Section C2

Compressive strength for flexural buckling of members without slender elements

$$P_n = F_{cr} \cdot A_g$$

$$F_e := \frac{\pi^2 \cdot E}{\left(\max\left(\frac{K_x \cdot L_x}{r_x}, \frac{K_y \cdot L_y}{r_y}\right)\right)^2} = 5.69 \cdot ksi$$

$$F_{cr} := \text{if}\left[\max\left(\frac{K_x \cdot L_x}{r_x}, \frac{K_y \cdot L_y}{r_y}\right) \le 4.71 \cdot \sqrt{\frac{E}{F_y}}, \left(0.688^{\frac{F_y}{F_e}}\right) \cdot F_y, 0.877 \cdot F_e\right] = 4.99 \cdot ksi$$

$$P_n := F_{cr} \cdot A_g = 26.13 \cdot kip \qquad P_n := \frac{P_n}{\Omega_c} = 15.65 \cdot kip$$

Chapter F - Design of Members in Flexure

Section F7. Rectagular HSS members

Yielding - Bending in Strong Axis

$M_{nyx} := F_y \cdot Z_x = 403.2 \cdot kip \cdot in$ *(F7-1)*

$M_{px} := M_{nyx}$

Flange Local Buckling - Bending in Strong Axis

For compact section, the limit state of flange local buckling does not apply

For noncompact sections

$$M_{nx} := \min\left[M_{px} - \left(M_{px} - F_y \cdot S_x\right) \cdot \left(3.57 \cdot \frac{b}{t_d} \cdot \sqrt{\frac{F_y}{E}} - 4.0\right), M_{px}\right] = 254.2 \cdot kip \cdot in \qquad \textit{(F7-2)}$$

For sections with slender walls

$$b_e := 1.92 \cdot t_d \cdot \sqrt{\frac{E}{F_y}} \cdot \left(1 - \frac{0.38}{\frac{b}{t_d}} \cdot \sqrt{\frac{E}{F_y}}\right) = 4.74 \cdot in$$

$$S_{eff} := \mathrm{if}\left[b_e < b, \frac{b_e \cdot h^3 - \left(b_e - 2 \cdot t_d\right) \cdot \left(h - 2 \cdot t_d\right)^3}{6 \cdot h}, S_x\right]$$

$M_{nx} := F_y \cdot S_{eff} = 139.76 \cdot kip \cdot in$

Flange Section Status = "The flange section of the rectangular HSS is slender since b/t = 51.62"

$M_{nfbx} = 139.76 \cdot kip \cdot in$

Web Local Buckling - Bending in Strong Axis

For compact section, the limit state of web local buckling does not apply

For noncompact sections

$$M_{nx} := \min\left[M_{px} - \left(M_{px} - F_y \cdot S_x\right) \cdot \left(0.305 \cdot \frac{h}{t_d} \cdot \sqrt{\frac{F_y}{E}} - 0.738\right), M_{px}\right] = 403.2 \cdot kip \cdot in$$

Web Section Status = "The web section of the rectangular HSS is compact since h/t = 51.62"

Design Flexural Strength

$M_{nx} = 83.69 \cdot kip \cdot in$ for ASD design compressive strength

Yielding - Bending in Weak Axis

$M_{nyy} := F_y \cdot Z_y = 403.2 \cdot kip \cdot in$ *(F7-1)*

$M_{py} := M_{nyy}$

Flange Local Buckling - Bending in Weak Axis

For compact section, the limit state of flange local buckling does not apply

For noncompact sections

$$M_{ny} := \min\left[M_{py} - \left(M_{py} - F_y \cdot S_y\right) \cdot \left(3.57 \cdot \frac{b}{t_d} \cdot \sqrt{\frac{F_y}{E}} - 4.0\right), M_{py}\right] = 254.2 \cdot \text{kip} \cdot \text{in} \qquad \text{(F7-2)}$$

For sections with slender walls

$$b_e := 1.92 \cdot t_d \cdot \sqrt{\frac{E}{F_y}} \cdot \left(1 - \frac{0.38}{\frac{b}{t_d}} \cdot \sqrt{\frac{E}{F_y}}\right) = 4.74 \cdot \text{in}$$

$$S_{eff} := \text{if}\left[b_e < b, \frac{b_e \cdot h^3 - \left(b_e - 2 \cdot t_d\right) \cdot \left(h - 2 \cdot t_d\right)^3}{6 \cdot h}, S_y\right]$$

$$M_{ny} := F_y \cdot S_{eff} = 139.76 \cdot \text{kip} \cdot \text{in}$$

Flange Section Status = "The flange section of the rectangular HSS is slender since b/t = 51.62"

$$M_{nfby} = 139.76 \cdot \text{kip} \cdot \text{in}$$

Web Local Buckling - Bending in Strong Axis

For compact section, the limit state of web local buckling does not apply

For noncompact sections

$$M_{ny} := \min\left[M_{py} - \left(M_{py} - F_y \cdot S_y\right) \cdot \left(3.05 \cdot \frac{h}{t_d} \cdot \sqrt{\frac{F_y}{E}} - 0.738\right), M_{py}\right] = 115.78 \cdot \text{kip} \cdot \text{in}$$

Web Section Status = "The web section of the rectangular HSS is compact since h/t = 51.62"

Design Flexural Strength

$M_{ny} = 83.69 \cdot \text{kip} \cdot \text{in}$ for ASD design compressive strength

Actual Required Strength:

(worst case shown)

Member ID = "C01" $M_{rx} = 0 \cdot \text{kip} \cdot \text{in}$ $M_{ry} = 0 \cdot \text{kip} \cdot \text{in}$ $P_r = -13.83 \cdot \text{kip}$

Load Case = "3c - D1 + N2 Second Order"

For $\frac{P_r}{P_c} \geq 0.2$ $\quad \frac{P_r}{P_c} + \frac{8}{9} \cdot \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0$ *(H1-1a)*

For $\frac{P_r}{P_c} < 0.2$ $\quad \frac{P_r}{2 \cdot P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0$ *(H1-1b)*

$$IE := \text{if}\left[\frac{|P_r|}{P_c} \geq 0.2, \frac{|P_r|}{P_c} + \frac{8}{9} \cdot \left(\frac{|M_{rx}|}{M_{cx}} + \frac{|M_{ry}|}{M_{cy}}\right), \frac{|P_r|}{2 \cdot P_c} + \left(\frac{|M_{rx}|}{M_{cx}} + \frac{|M_{ry}|}{M_{cy}}\right)\right] = 0.88$$

IE is less than or equal to 1.0 = "OK"

7. Splice Design

The straight steel splice is connected to the main profiles by 8 bolts of M24.

Material : Steel AE355 — Profile : 250 x 150 x 6 mm

Reinforcing plates :
Plate : 90 x 10 x 420 mm

$Fy_{AE355} := 355\cdot\frac{N}{mm^2}$ $\qquad Fy_{AE355} = 51.5\cdot ksi$

$Fut_{AE355} := 490\cdot\frac{N}{mm^2}$ $\qquad Fut_{AE355} = 71.1\cdot ksi$

$E_{AE355} := 210000\cdot\frac{N}{mm^2}$ $\qquad E_{AE355} = 30458\cdot ksi$

Unreinforced Profile :

$A_{splice} := 4656\cdot mm^2$ $\qquad A_{splice} = 7.2\cdot in^2$

$I_{xsplice} := 40277872\cdot mm^4$ $\qquad I_{xsplice} = 96.8\cdot in^4$

$y_{x\_splice} := 125\cdot mm$ $\qquad y_{x\_splice} = 4.9\cdot in$

$S_{x\_splice} := 322223\cdot mm^3$ $\qquad S_{x\_splice} = 19.7\cdot in^3$

Reinforced Profile :

$A_{splice\_Re} := 5556\cdot mm^2$ $\qquad A_{splice\_Re} = 8.6\cdot in^2$

$I_{xsplice\_Re} := 70712872\cdot mm^4$ $\qquad I_{xsplice\_Re} = 169.9\cdot in^4$

$y_{x\_splice\_Re} := 135\cdot mm$ $\qquad y_{x\_splice\_Re} = 5.3\cdot in$

$S_{x\_splice\_Re} := 523799\cdot mm^3$ $\qquad S_{x\_splice\_Re} = 32\cdot in^3$

Allowable Stress on Splice :

$\sigma_{allowable} := (0.6)\cdot Fy_{AE355}$ $\qquad \sigma_{allowable} = 213\cdot\frac{N}{mm^2}$ $\qquad \sigma_{allowable} = 30.89\cdot ksi$

The moment in the connection splice increases gradually from the first row of bolts until the second row of bolts. Between the two middle rows of bolts, the whole moment is supported by the reinforced connecting splice.

Member ID = "M02" $\qquad Mx = -406.9\cdot kip\cdot in$ $\qquad V = 0.07\cdot kip$ $\qquad C = -0.59\cdot kip$

Load Case = "5c - D1 + 0.6W3 Second Order"

Stress at the unreinforced section of the connection splice :

$$\sigma := \left|\frac{C}{A_{splice}}\right| + \left|\frac{0.5(Mx)}{S_{x\_splice}}\right|$$

$\sigma = 10.4\cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Stress at the reinforced section of the connection splice :

$$\sigma := \left|\frac{C}{A_{splice\_Re}}\right| + \left|\frac{Mx}{S_{x\_splice\_Re}}\right|$$

$\sigma = 12.8\cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Member ID = "M01" $Mx = 511 \cdot kip \cdot in$ $V = 2.3 \cdot kip$ $T = 5.33 \cdot kip$

Load Case = "5c - D1 + 0.6W4 Second Order"

Stress at the unreinforced section of the connection splice : $\sigma := \frac{T}{A_{splice}} + \frac{0.5(|Mx|)}{S_{x\_splice}}$ $\sigma = 13.7 \cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Stress at the reinforced section of the connection splice : $\sigma := \frac{T}{A_{splice\_Re}} + \frac{|Mx|}{S_{x\_splice\_Re}}$ $\sigma = 16.6 \cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Bolts in Splice: M24

Grade :   **8.8**

Area : $A_{M24} = 452.39 \cdot mm^2$

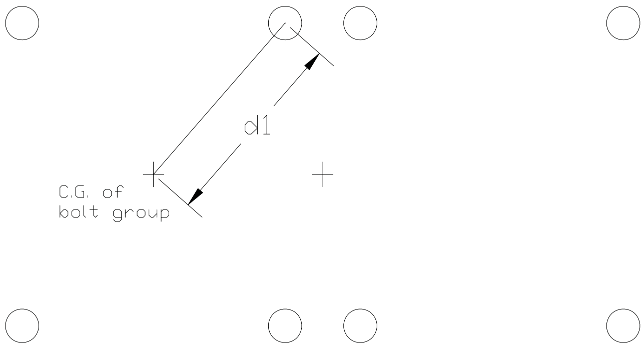
$A_{M24} = 0.7 \cdot in^2$

Yield Stress : $Fy_{M24} = 640 \cdot \frac{N}{mm^2}$

$Fy_{M24} = 92.8 \cdot ksi$

Tensile Strength : $Fut_{M24} = 800 \cdot \frac{N}{mm^2}$

$Fut_{M24} = 116 \cdot ksi$



$d1 = 168 \cdot mm$ $d1 = 6.6 \cdot in$

Allowable Shear Stress in bolt : $F_v := 0.4 \cdot Fut_{M24}$ $F_v = 320 \cdot \frac{N}{mm^2}$

$F_v = 46.4 \cdot ksi$

Member ID = "M01"

Load Case = "5c - D1 + 0.6W4 Second Order" $Mx = 511 \cdot kip \cdot in$ $V = 2.3 \cdot kip$ $A = 5.33 \cdot kip$

Considering only the 4 bolts in the middle to resist the full moment and forces, the resulting force on 1 bolt is :

$F_T := \frac{A}{4} = 1.33 \cdot kip$ $F_V := \frac{V}{4} = 0.58 \cdot kip$ $F_{B1} := \frac{Mx \cdot d1}{4 \cdot d1^2} = 19.35 \cdot kip$

$F_{res} := F_{B1} + \sqrt{F_T^2 + F_V^2} = 20.8 \cdot kip$

Shear Stress on Bolt taking Double Shear into account :

$f_{res} := \frac{F_{res}}{(2) \cdot A_{M24}} = 14.83 \cdot ksi$

f_{res} is less than or equal to F_v = "OK"

8. Leg Connnection Design

Steel Profile:

The splice is connected to the main profiles by 4 bolts of M16.

Material :   Steel AE235   Profile : 150 x 150 x 5 mm

$Fy_{AE235} := 235 \cdot \frac{N}{mm^2}$ $Fy_{AE235} = 34.1 \cdot ksi$

$Fut_{AE235} := 340 \cdot \frac{N}{mm^2}$ $Fut_{AE235} = 49.3 \cdot ksi$

$E_{AE235} := 210000 \cdot \frac{N}{mm^2}$ $E_{AE235} = 30458 \cdot ksi$

Properties of Profile :

$A_{splice} := 2900 \cdot mm^2$ $A_{splice} = 4.5 \cdot in^2$

$I_{xsplice} := 10174166 \cdot mm^4$ $I_{xsplice} = 24.4 \cdot in^4$

$y_{x\_splice} := 75 \cdot mm$ $y_{x\_splice} = 3 \cdot in$

$S_{x\_splice} := 135656 \cdot mm^3$ $S_{x\_splice} = 8.3 \cdot in^3$

Allowable Stress on Splice :

$\sigma_{allowable} := (0.6) \cdot Fy_{AE235}$ $\sigma_{allowable} = 141 \cdot \frac{N}{mm^2}$ $\sigma_{allowable} = 20.45 \cdot ksi$

Member ID = "M01" $Mx = -16.18 \cdot kip \cdot in$ $V = 2.24 \cdot kip$ $C = -3.3 \cdot kip$

Load Case = "5b - D1 + 0.6W2 Second Ord

$$\sigma := \left|\frac{C}{A_{splice}}\right| + \left|\frac{Mx}{S_{x\_splice}}\right|$$

$\sigma = 4.1 \cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Member ID = "M01" $Mx = 27.47 \cdot kip \cdot in$ $V = 4.33 \cdot kip$ $T = 6.67 \cdot kip$

Load Case = "6b - D1 + 0.75Lr + 0.75(0.6W

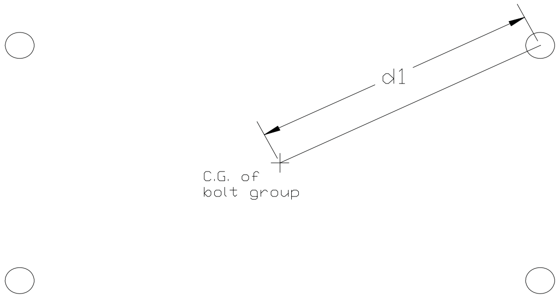
$$\sigma := \frac{T}{A_{splice}} + \frac{Mx}{S_{x\_splice}}$$

$\sigma = 4.8 \cdot ksi$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

Bolts in Splice: M16

Grade : **8.8**



Area : $A_{M16} := 157 \cdot mm^2$

$A_{M16} = 0.24 \cdot in^2$

Yield Stress : $Fy_{M16} := 640 \cdot \frac{N}{mm^2}$

$Fy_{M16} = 92.8 \cdot ksi$

Tensile Strength : $Fut_{M16} := 800 \cdot \frac{N}{mm^2}$

$d1 := \sqrt{(40 \cdot mm)^2 + (155 \cdot mm)^2}$ $d1 = 160 \cdot mm$ $d1 = 6.3 \cdot in$

$Fut_{M16} = 116 \cdot ksi$

Allowable Shear Stress in bolt : $F_v := (0.22) \cdot Fut_{M16}$ $F_v = 176 \cdot \frac{N}{mm^2}$ $F_v = 25.5 \cdot ksi$

Load Case = "3b - D1 + N1 Second Order"

Member ID = "M01" $Mx = 38.59 \cdot kip \cdot in$ $V = 5.71 \cdot kip$ $T = 3.11 \cdot kip$

Considering only the 4 bolts in the middle to resist the full moment and forces, the resulting force on 1 bolt is :

$$F_T := \frac{T}{4} = 0.78 \cdot kip \qquad F_V := \frac{V}{4} = 1.43 \cdot kip \qquad F_{B1} := \frac{Mx \cdot d1}{4 \cdot d1^2} = 1.53 \cdot kip$$

$$F_{res} := F_{B1} + \sqrt{F_T^{\,2} + F_V^{\,2}} = 3.16 \cdot kip$$

Shear Stress on Bolt taking Double Shear into account :

$$f_{res} := \frac{F_{res}}{(2) \cdot A_{M16}} = 6.48 \cdot ksi$$

f_{res} is less than or equal to F_v = "OK"

Bolt connecting Splice to baseplate : M36 Grade 8

Area : $A_{M36} := 817 \cdot mm^2$ $A_{M36} = 1.27 \cdot in^2$

Yield Stress : $Fy_{M36} := 640 \cdot \frac{N}{mm^2}$ $Fy_{M36} = 92.8 \cdot ksi$

Tensile Strength : $Fut_{M36} := 800 \cdot \frac{N}{mm^2}$ $Fut_{M36} = 116 \cdot ksi$

Allowable Shear Stress in bolt : $F_v := 0.4 \cdot Fut_{M36} = 46.41 \cdot ksi$

Worst Support Reaction Case for Bolt ;   D + S bal $H := 4.894 \cdot kip$ $V := 10.416 \cdot kip$

Shear Stress on Bolt taking Double Shear into account : $f_{res} := \frac{V}{(2) \cdot A_{M36}}$ $f_{res} = 4.1 \cdot ksi$ $<$ F_v **O.K.**

9. Gable End Upright Design

Gable Uprights :

This gable uprights are made from the ALU270-profile. Where appropriate, they are reinforced with the ALU260-profile. The uprights are connected to the gable end arch by means of a hinge. They are also connected to the upright baseplate by means of a hinge.

Material : 6061-T6 Allowable Bending Stress : $\sigma_{allowable} := 19 \cdot ksi$

Section Modulus (strong) : $S_{x_{e270}} = 12.34 \cdot in^3$

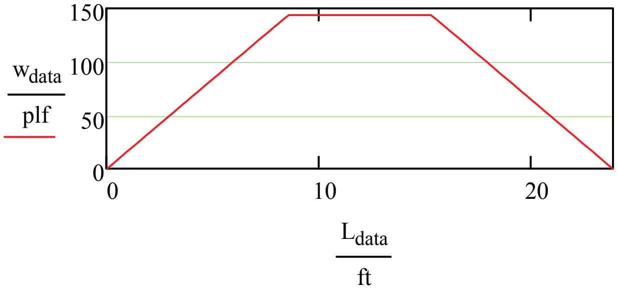
$S_{x_{e260}} = 11.98 \cdot in^3$

Upright #1 :

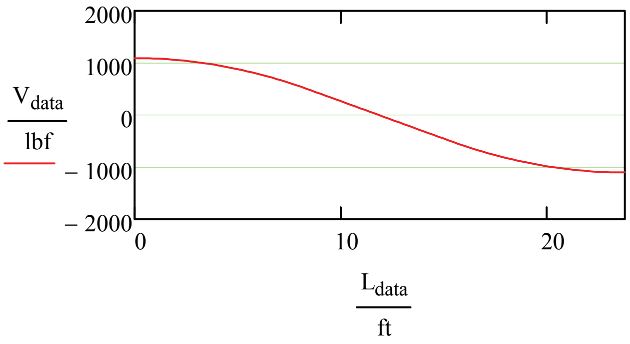
Gable Length : $L = 7.25\,m$ $L = 23.8 \cdot ft$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 404.36 \\ -327.67 \end{pmatrix} Pa$ $q = \begin{pmatrix} 8.45 \\ -6.84 \end{pmatrix} \cdot psf$

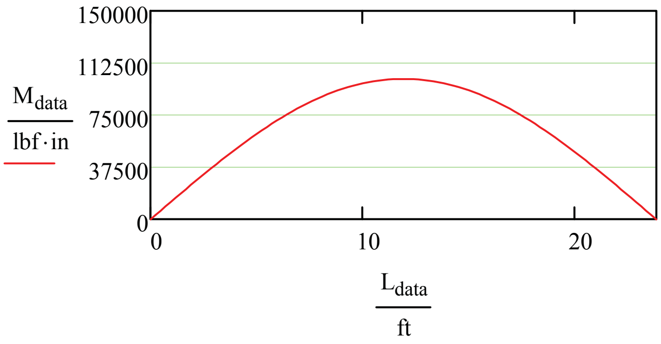
Load Diagram :



Shear Diagram :



Moment Diagram :



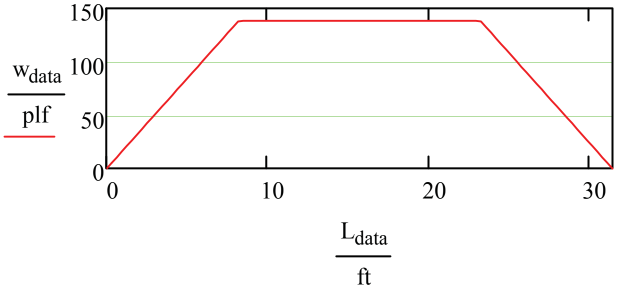
Bending Stress on Gable : $\sigma := \frac{max(M_{data})}{S_{x_{e270}}}$ $\sigma = 8.2 \cdot ksi$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

Upright #2 :

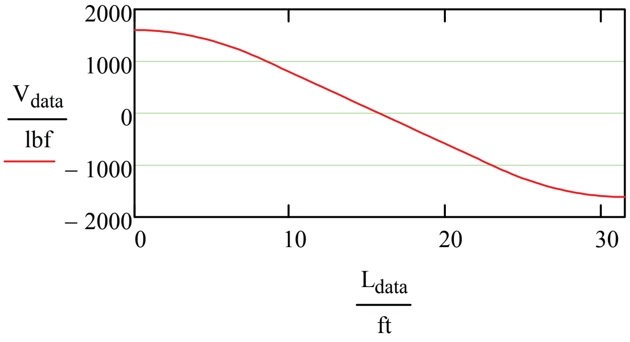
Gable Length : $L = 9.58\,\text{m}$ $L = 31.4\cdot\text{ft}$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 404.36 \\ -327.67 \end{pmatrix}\text{Pa}$ $q = \begin{pmatrix} 8.45 \\ -6.84 \end{pmatrix}\cdot\text{psf}$

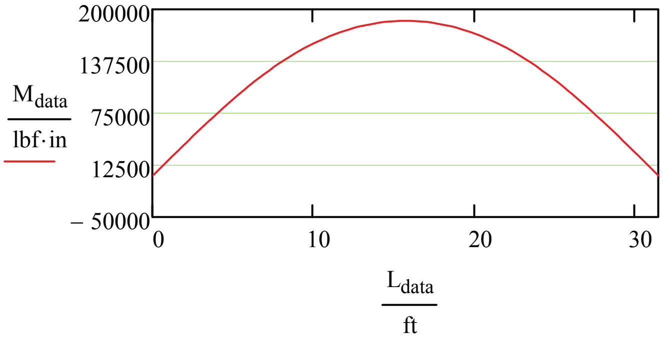
Load Diagram :



Shear Diagram :



Moment Diagram :



Bending Stress on Gable : $\sigma := \dfrac{\max(M_{data})}{S_{x_{e270}} + S_{x_{e260}}}$ $\sigma = 7.7\cdot\text{ksi}$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

$\sigma := \dfrac{M_{data_j}}{S_{x_{e270}}}$ $\sigma = 15.1\cdot\text{ksi}$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

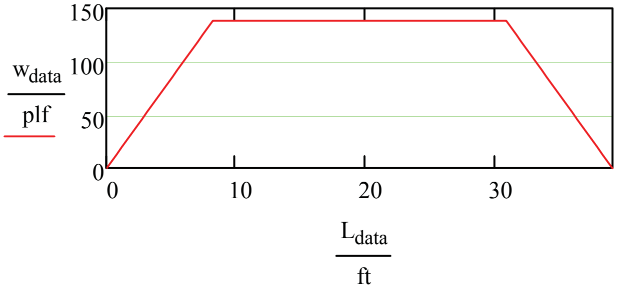
$L_{reinf_i} = 0\,\text{m}$

Upright #3 :

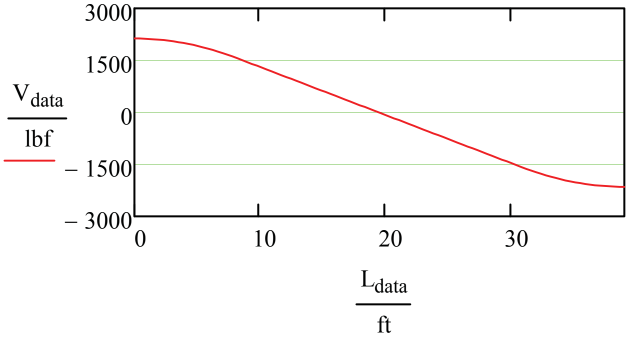
Gable Length : $L = 11.91\,m$ $L = 39.1 \cdot ft$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 404.36 \\ -327.67 \end{pmatrix} Pa$ $q = \begin{pmatrix} 8.45 \\ -6.84 \end{pmatrix} \cdot psf$

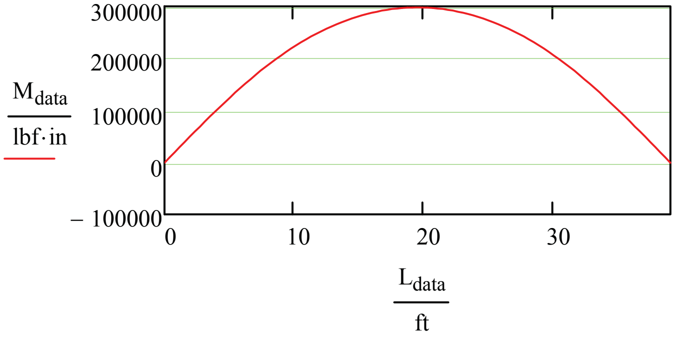
Load Diagram :



Shear Diagram :



Moment Diagram :



Bending Stress on Gable : $\sigma := \frac{\max(M_{data})}{S_{x_{e270}} + S_{x_{e260}}}$ $\sigma = 12.3 \cdot ksi$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

$\sigma := \frac{M_{data_j}}{S_{x_{e270}}}$ $\sigma = 18.3 \cdot ksi$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

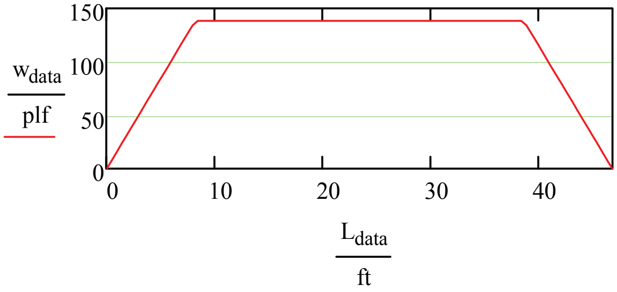
$L_{reinf_i} = 5.72\,m$

Upright #4 :

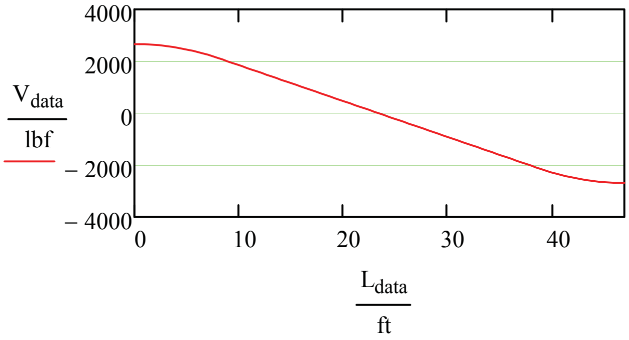
Gable Length : $L = 14.28\,\text{m}$ $L = 46.8\cdot\text{ft}$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 404.36 \\ -327.67 \end{pmatrix}\text{Pa}$ $q = \begin{pmatrix} 8.45 \\ -6.84 \end{pmatrix}\cdot\text{psf}$

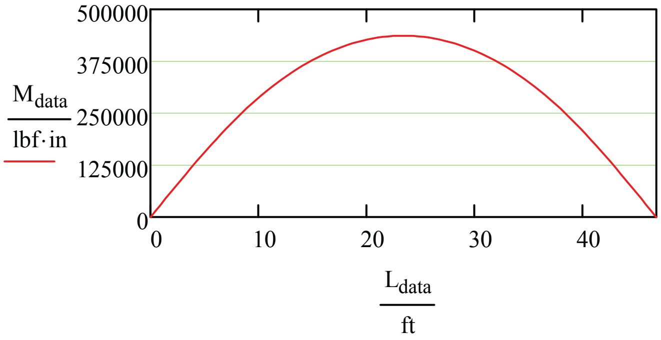
Load Diagram :



Shear Diagram :



Moment Diagram :



Bending Stress on Gable : $\sigma := \frac{\max(M_{data})}{S_{x_{e270}} + S_{x_{e260}}}$ $\sigma = 18\cdot\text{ksi}$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "OK"

$\sigma := \frac{M_{data_j}}{S_{x_{e270}}}$ $\sigma = 19.3\cdot\text{ksi}$ $|\sigma|$ is less than or equal to $\sigma_{allowable}$ = "Say OK"

$L_{reinf_i} = 9.42\,\text{m}$

10. Baseplate Design

Steel Profile:

Material : Steel S235

Plate no.2 : 200 x 15 x 265 mm
Plate no.4 : 90 x 10 x 100 mm

$Fy_{S235} := 235 \cdot \frac{N}{mm^2}$ $Fut_{S235} := 340 \cdot \frac{N}{mm^2}$ $E_{S235} := 210000 \cdot \frac{N}{mm^2}$

$Fy_{S235} = 34.1 \cdot ksi$ $Fut_{S235} = 49.3 \cdot ksi$ $E_{S235} = 30458 \cdot ksi$

Section : $A_{24} := (15mm \cdot 200mm) + (10mm \cdot 90mm)$ $A_{24} = 3900 \cdot mm^2$ $A_{24} = 6 \cdot in^2$

Center of Gravity: $y := \frac{[(15mm \cdot 200mm) \cdot 97.5mm] + [(10mm \cdot 90mm)45mm]}{A_{24}}$ $y = 85.4 \cdot mm$ $y = 3.4 \cdot in$

Moment of Inertia: $I := \frac{200mm \cdot (15mm)^3}{12} + \left[3000mm^2 \cdot (97.5mm - y)^2\right] + \frac{10mm \cdot (90mm)^3}{12} + \left[900mm^2 \cdot (45mm - y\right.$

$I = 2.57 \times 10^6 \cdot mm^4$ $I = 6.2 \cdot in^4$

Section Modulus: $S := \frac{I}{y}$ $S = 3 \times 10^4 \cdot mm^3$ $S = 1.8 \cdot in^3$

Allowable Stress on Profile :

$\sigma_{allowable} := (0.66) \cdot Fy_{S235}$ $\sigma_{allowable} = 155.1 \cdot \frac{N}{mm^2}$ $\sigma_{allowable} = 22.5 \cdot ksi$

Actual Stress on Profile :

Moment arm above Section : $d_B = 150 \cdot mm$

$LoadCase_0$ = "6a - 0.6 D1 + 0.75Lr + 0.6(0.75)W1" $H_0 = 6.18 \cdot kip$ $V_0 = 3.37 \cdot kip$

Stress of the Section : $\sigma := \left| \frac{V_0}{(2) \cdot A_{24}} - \frac{H_0 \cdot d_B}{S} \right|$ $\sigma = 19.6 \cdot ksi$ **<** $\sigma_{allowable} = 22.5 \cdot ksi$ **O.K.**

$LoadCase_1$ = "3b - D1 + N1" $H_1 = 6.18 \cdot kip$ $V_1 = 3.37 \cdot kip$

Stress of the Section : $\sigma := \left| \frac{V_1}{(2) \cdot A_{24}} - \frac{H_1 \cdot d_B}{S} \right|$ $\sigma = 19.6 \cdot ksi$ **≤** $\sigma_{allowable} = 22.5 \cdot ksi$ **O.K.**

Bending of Base Plate :

The reaction forces act on a distance "d" above the bottom side of plate No.1 : $d := 160 \cdot mm$

The Base Plate is shown in figure 25. It has the following dimensions.

Length : $L := 600 \cdot mm$

Width : $W := 400 \cdot mm$

Thickness : $T := 10 \cdot mm$

Surface area : $A := L \cdot W$ $A = 240000 \cdot mm^2$ $A = 372 \cdot in^2$

$LoadCase_0$ = "6a - 0.6 D1 + 0.75Lr + 0.6(0.75)W1" $H_0 = 6.18 \cdot kip$ $V_0 = 3.37 \cdot kip$

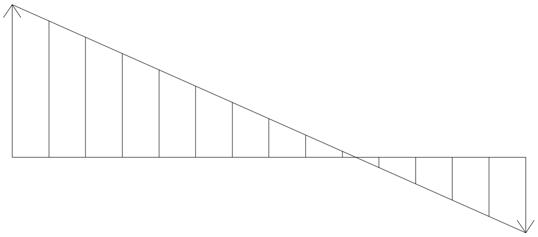
These forces result in the following pressure under the baseplate:

$$f_{max} := \frac{V_0}{A} + \frac{H_0 \cdot d \cdot (6)}{L \cdot W^2} \qquad f_{max} = 337.32 \cdot \frac{kN}{m^2}$$

$$f_{max} = 0.049 \cdot ksi$$

$$f_{min} := \frac{V_0}{A} - \frac{H_0 \cdot d \cdot (6)}{L \cdot W^2} \qquad f_{min} = -212.48 \cdot \frac{kN}{m^2}$$

$$f_{min} = -0.031 \cdot ksi$$



Pressure under the BasePlate

The pressure f_A equals : $f_A := f_{max} - \left(\left|f_{max}\right| + \left|f_{min}\right|\right) \cdot \frac{122.5 \cdot mm}{400 \cdot mm}$ $f_A = 168.9 \cdot \frac{kN}{m^2}$ $f_A = 0.02 \cdot ksi$

The moment resulting from the pressure under the plate equals :

$$M_A := \left(\frac{f_{max} + f_A}{2}\right) \cdot 122.5 \cdot mm \cdot \left(\frac{122.5 \cdot mm}{2} \cdot 600 \cdot mm\right) \qquad M_A = 1.14 \cdot kN \cdot m \qquad M_A = 10.1 \cdot kip \cdot in$$

The actual stress equals : $\sigma_A := \frac{M_A \cdot 6}{L \cdot T^2}$ $\sigma_A = 114 \cdot \frac{N}{mm^2}$ $\sigma_A = 16.5 \cdot ksi$

The actual stress is less than the allowable stress; BasePlate is **O.K.**

The mean pressure equals : $f_{mean} := \frac{f_{max} + f_{min}}{2}$ $f_{mean} = 62.4 \cdot \frac{kN}{m^2}$ $f_{mean} = 0.01 \cdot ksi$

The moment at section B-B equals :

$M_B := \left(f_{mean} \cdot 100mm\right) \cdot \frac{100 \cdot mm}{2} \cdot (400 \cdot mm)$ $M_B = 0.12 \cdot kN \cdot m$ $M_B = 1.1 \cdot kip \cdot in$

The actual stress equals : $\sigma_B := \frac{M_B \cdot 6}{W \cdot T^2}$ $\sigma_B = 18.7 \cdot \frac{N}{mm^2}$ $\sigma_B = 2.7 \cdot ksi$

The actual stress is less than the allowable stress; BasePlate is **O.K.**

$LoadCase_1 = \text{"3b - D1 + N1"}$ $H_1 = 6.18 \cdot kip$ $V_1 = 3.37 \cdot kip$

The vertical force is an uplift on the stiffened baseplate :
Assume middle stiffeners no.4 (10 x 40 mm) resists all the uplift.

Length of stiffener : $L := 166 \cdot mm$

Depth of stiffener and baseplate : $d := 50 \cdot mm$

Thickness of stiffener : $t := 10 \cdot mm$

Moment on stiffener : $M := \frac{V_1 \cdot L}{8}$ $M = 2.75 \cdot kip \cdot in$

Section Modulus : $S := \frac{t \cdot d^2}{6}$ $S = 0.25 \cdot in^3$

The actual stress equals : $\sigma := \frac{M}{(2)S}$ $\sigma = 37.3 \cdot \frac{N}{mm^2}$ $\sigma = 5.4 \cdot ksi$

The actual stress is less than the allowable stress; BasePlate is **O.K.**

Page Intentionally Left Blank

11. Purlin Design

Peak Purlins :

Web of seciton: $b_{w_{e133}} = 133 \cdot mm$ $t_{w_{e133}} = 5 \cdot mm$

Flange of section $b_{f_{e133}} = 70 \cdot mm$ $t_{f_{e133}} = 5 \cdot mm$

Cross-sectional area: $A_{g_{e133}} = 2.8 \cdot in^2$

Moment of Inertial: $I_{x_{e133}} = 10.13 \cdot in^4$ $I_{y_{e133}} = 2.93 \cdot in^4$

Section modulus: $S_{x_{e133}} = 3.87 \cdot in^3$ $S_{y_{e133}} = 2.13 \cdot in^3$

Radius of gyration: $r_{x_{e133}} = 1.9 \cdot in$ $r_{y_{e133}} = 1.02 \cdot in$

Slenderness ratio: $K_x = 1.0$ $K_y = 1$

$L = 16.17 \cdot ft$ (unbraced length of purlin)

The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Allowable Axial Stress :

Specification 3.4.1 - Tension, axial: $F_{3.4.1} = 32.3 \cdot ksi$
Any tension member.

Specification 3.4.7 - Compression in Columns: $F_{3.4.7x} = 8.12 \cdot ksi$
All columns. $F_{3.4.7y} = 2.63 \cdot ksi$

Specification 3.4.9 - Compression in Column Elements: $F_{3.4.9} = 27.4 \cdot ksi$
Flat elements supported on both edges.

Specification 3.4.10 - Compression in Column Elements: $F_{3.4.10} = 33.25 \cdot ksi$
Curved elements supported on both edges.

Allowable Axial Stress: $F_a = 2.63 \cdot ksi$ Use in Eq. 4.1.1-1

$F_{ao} = 27.4 \cdot ksi$ Use in Eq. 4.1.1-2

$F_{ex} = 8.12 \cdot ksi$ $F_{ey} = 2.63 \cdot ksi$

Allowable Bending Stress:

Specification 3.4.2 - Tension in Beams, extreme fibre, net section: $F_{3.4.2} = 32.3 \cdot ksi$
Flat elements in uniform tension (flanges).

Specification 3.4.14 - Compression in Beams, gross section.: $F_{3.4.14} = 26.73 \cdot ksi$
Tubular shapes.

Specification 3.4.16 - Compression in Beams, gross section: $F_{3.4.16} = 32.56 \cdot ksi$
Flat elements supported on both edges.

Specification 3.4.16.1 - Compression in Beams, gross section: $F_{3.4.16.1} = 38.9 \cdot ksi$
Curved elements supported on both edges.

Specification 3.4.19 - Compression in Beams, elements: $F_{3.4.19} = 43.22 \cdot ksi$
Flat elements supported on both edges with longitudinal stiffening.

Allowable Bending Stress: $F_{bx} = 26.73 \cdot ksi$
$F_{by} = 26.73 \cdot ksi$
Use in Eq. 4.1.1-1
& Eq. 4.1.1-2

Actual Stress:

Maximum Axial Compression Force due to Fabric and/or Wind loading: $P_c = 3288 \cdot lbf$

Maximum Bending Force due to Fabric tension: $M = 14.41 \cdot kip \cdot in$

$$f_{ac} := \frac{P_c}{A_{g_{e133}}} = 1.18 \cdot ksi \qquad f_{bx} := \frac{M}{S_{x_{e133}}} = 3.72 \cdot ksi \qquad f_{by} := 0ksi \qquad Cmx := 0.85 \qquad Cmy := 0.85$$

Eq. 4.1.1-1 :

$$Eq1 := \frac{f_{ac}}{F_a} + \frac{Cmx \cdot f_{bx}}{\left(1 - \frac{f_{ac}}{F_{ex}}\right) \cdot F_{bx}} + \frac{Cmy \cdot f_{by}}{\left(1 - \frac{f_{ac}}{F_{ey}}\right) \cdot F_{by}}$$

$Eq1 = 0.58$

$Eq1$ is less than or equal to 1.0 = "OK"

Eq. 4.1.1-2 :

$$Eq2 := \frac{f_{ac}}{F_{ao}} + \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}}$$

$Eq2 = 0.18$

$Eq2$ is less than or equal to 1.0 = "OK"

Intermediate Purlin:

Web of seciton: $b_{w_{e129}} = 129 \cdot mm$ $\quad t_{w_{e129}} = 5 \cdot mm$

Flange of section $b_{f_{e129}} = 89 \cdot mm$ $\quad t_{f_{e129}} = 5 \cdot mm$

Cross-sectional area: $A_{g_{e129}} = 1.46 \cdot in^2$

Moment of Inertial: $I_{x_{e129}} = 5.44 \cdot in^4$ $\quad I_{y_{e129}} = 3.09 \cdot in^4$

Radius of gyration: $r_{x_{e129}} = 1.93 \cdot in$ $\quad r_{y_{e129}} = 1.45 \cdot in$ $\quad 60mm = 2.36 \cdot in$

Slenderness ratio: $K_x = 1.0$ $\quad K_y = 1$ $\quad 3mm = 0.12 \cdot in$

$L = 16.11 \cdot ft$ (unbraced length of purlin)

The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Allowable Axial Stress :

Specification 3.4.1 - Tension, axial: $F_{3.4.1} = 32.3 \cdot ksi$
Any tension member.

Specification 3.4.7 - Compression in Columns: $F_{3.4.7x} = 8.37 \cdot ksi$
All columns. $F_{3.4.7y} = 5.24 \cdot ksi$

Specification 3.4.9 - Compression in Column Elements: $F_{3.4.9} = 27.73 \cdot ksi$
Flat elements supported on both edges.

Specification 3.4.10 - Compression in Column Elements: $F_{3.4.10} = 33.25 \cdot ksi$
Curved elements supported on both edges.

Allowable Axial Stress: $F_a = 5.24 \cdot ksi$ Use in Eq. 4.1.1-1
$F_{ao} = 27.73 \cdot ksi$ Use in Eq. 4.1.1-2
$F_{ex} = 8.37 \cdot ksi$ $\quad F_{ey} = 5.24 \cdot ksi$

Actual Stress:

Maximum Axial Compression Force due to Fabric and/or Wind loading: $P_c = 6451 \cdot lbf$

$$f_{ac} := \frac{P_c}{A_{g_{e129}}} = 4.42 \cdot ksi \quad f_{bx} := 0ksi \quad f_{by} := 0ksi \quad Cmx := 0.85 \quad Cmy := 0.85$$

Eq. 4.1.1-1 :

$$Eq1 := \frac{f_{ac}}{F_a} + \frac{Cmx \cdot f_{bx}}{\left(1 - \frac{f_{ac}}{F_{ex}}\right) \cdot Fbx} + \frac{Cmy \cdot f_{by}}{\left(1 - \frac{f_{ac}}{F_{ey}}\right) \cdot Fby}$$

$Eq1 = 0.84$

Eq1 is less than or equal to 1.0 = "OK"

Eq. 4.1.1-2 :

$$Eq2 := \frac{f_{ac}}{F_{ao}} + \frac{f_{bx}}{Fbx} + \frac{f_{by}}{Fby}$$

$Eq2 = 0.16$

Eq2 is less than or equal to 1.0 = "OK"

This page intentionally left blank

12. Miscellaneous

Cables

The bracing cables are constructed of ϕ 5/8" 6x19 Galvanized Improved Plow IWRC wire rope.
The cables are connected to the arch frames by means of an eyebolt and shackle.
The length of the cable is adjusted by means of a 7/8 x 12" Jaw & Jaw turnbuckle (Built-in Safety factor of 5.0).
Cable components are connected together with 3/4" S-210 Shackles (Built-in Safety factor of 6.0).

Nominal Strength of Cable : $\text{CableCapacity} := 17.9\cdot\text{ton}$

Working Load of Turnbuckle : $\text{TBuckleCap} := 7200\cdot\text{lb}$

Working Load of Shackle : $\text{ShackleCap} := 4.75\cdot\text{ton}$

Recommended Safety Factor is : $\text{SF} := 3$

The max force in the ***Bracing Cable*** is : $T_{max} = 6.31\cdot\text{kip}$

$$\text{BracingCable} := \text{if}\left[\frac{0.9(\text{CableCapacity})}{\text{SF}\cdot\left(\frac{\text{ton}}{2000\text{lbf}}\right)} > T_{max}, \text{"is OK"}, \text{"is not OK"}\right]$$

$\text{BracingCable} = \text{"is OK"}$

$$\text{Turnbuckle} := \text{if}\left[\frac{5\cdot\text{TBuckleCap}}{\text{SF}\cdot\left(\frac{\text{ton}}{2000\text{lbf}}\right)} > T_{max}, \text{"is OK"}, \text{"is not OK"}\right]$$

$\text{Turnbuckle} = \text{"is OK"}$

$$\text{Shackle} := \text{if}\left[\frac{6\cdot\text{ShackleCap}}{\text{SF}\cdot\left(\frac{\text{ton}}{2000\text{lbf}}\right)} > T_{max}, \text{"is OK"}, \text{"is not OK"}\right]$$

$\text{Shackle} = \text{"is OK"}$

Anchors

The structure's base plates will be anchored to the grade with stakes made for that purpose. Due to the variability of ground and site conditions, a pull-test is recommended to determine the soil's capacity and quantity of stakes to support the required loads.

The worst case loading occurs for $\text{Load Case} = \text{"7c - 0.6D1 + 0.6W3 Second Order"}$

$\text{Uplift} = 6660\cdot\text{lbf}$

$\text{Shear Load} = 7201.36\cdot\text{lbf}$

$\text{Safety Factor} = 1.25$

Required load for pull test : $\text{Pull Load} := \text{Safety Factor}\cdot\sqrt{\text{Uplift}^2 + \text{Shear Load}^2} = 12261\cdot\text{lbf}$

Angle from horizontal for pull test : $\alpha := \text{atan}\left(\frac{\text{Uplift}}{\text{Shear Load}}\right) = 43\cdot\text{deg}$

Page Intentionally Left Blank

Mahaffey Fabric Structures
4161 Delp Street
Memphis, TN 38118

APPENDIX A

FIGURES AND SKETCHES

Page Intentionally Left Blank

REV.	DATE	DESCRIPTION	NAME
0	6MAR2015	ORIGINAL RELEASE	SH

GENERAL:

1) IF ANY CONFLICTS OR INCONSISTENCIES EXIST BETWEEN THE SPECIFICATIONS AND THE DRAWINGS (INCLUDING THE GENERAL NOTES), THE DRAWINGS AND THE GENERAL NOTES SHALL TAKE PRECEDENCE.
2) ALL DIMENSIONS ON STRUCTURAL DRAWINGS SHALL BE CHECKED AND VERIFIED AGAINST ARCHITECTURAL DRAWINGS. ALL DIMENSIONS RELATING TO EXISTING SITE, BUILDING, INSTALLATION OR CONSTRUCTION SHALL BE FIELD VERIFIED, ALL DISCREPANCIES SHALL BE SUBMITTED TO THE ARCHITECT. DO NOT PROCEED WITH FABRICATION AND ERECTION OF MATERIAL AFFECTED UNTIL DISCREPANCIES ARE RESOLVED.
3) ALL OMISSIONS OR DISCREPANCIES IN THE WORKING DRAWING AND OR SPECIFICATIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT AND/OR STRUCTURAL ENGINEER BEFORE PROCEEDING WITH ANY WORK INVOLVED.
4) DRAWINGS INDICATE GENERAL AND TYPICAL DETAILS OF CONSTRUCTIONS. WHERE CONDITIONS ARE NOT SPECIFICALLY INDICATED BUT ARE OF SIMILAR CHARACTER TO DETAILS SHOWN, SIMILAR DETAILS OF CONSTRUCTION SHALL BE USED SUBJECT TO REVIEW AND APPROVAL BY PROJECT ENGINEER OF RECORD.
5) MAHAFFEY FABRIC STRUCTURES MAINTAINS A LIMITED VARIETY OF STRUCTURAL MEMBERS AND COMPONENTS NECESSARY TO CONSTRUCT EACH TEMPORARY FABRIC STRUCTURE. INVENTORY MOBILIZED TO EACH PROJECT SITE IS CROSS-REFERENCED WITH PARTS AND MATERIALS LISTINGS SPECIFIC TO EACH BUILDING SIZE, ENGINEERING PROTOCOL, AND INTENDED USE ON SITE. THE DEFINED CONTROLS ARE UTILIZED IN AN EFFORT TO ELIMINATE THE POTENTIAL FOR CONSTRUCTION RELATED DEVIATIONS FROM PLANS AND SPECIFICATIONS. THEREFORE, THE MEMBERS AND COMPONENTS NEED NOT BE FULLY DETAILED ON THE PLANS.
6) DRAWINGS AND SPECIFICATIONS REPRESENT FINISHED STRUCTURE. CONTRACTOR SHALL BE RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION INCLUDING, BUT NOT LIMITED TO, SHORING AND TEMPORARY BRACING.
7) THE CONTRACTOR SHALL UNDERTAKE ALL NECESSARY MEASURES TO ENSURE SAFETY OF ALL PERSONS AND STRUCTURES AT THE SITE. OBSERVATION VISITS BY ARCHITECT OR STRUCTURAL ENGINEER SHALL NOT RELIEVE THE CONTRACTOR OF SUCH RESPONSIBILITY.

CODES AND REGULATIONS:

1) BUILDING CODE:
    INTERNATIONAL BUILDING CODE 2012

STRUCTURAL:

1) CODES AND SPECIFICATIONS:
    (A) AISC MANUAL OF STEEL DESIGN, 2005, 13TH EDITION
    (B) WELD IN ACCORDANCE WITH THE "STRUCTURAL WELDING CODE – STEEL" AWS D1.1
    (C) ASCE 7–10 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, 2010
    (D) ALUMINUM DESIGN MANUAL, SPECIFICATIONS & GUIDELINES FOR ALUMINUM STRUCTURES. (THE ALUMINUM ASSOCIATION, 2005)

2) MATERIALS OF CONSTRUCTION:
    (A) STRUCTURAL WIDE FLANGE SHAPES: ASTM A992, GRADE 50
    (B) ANGLES: ASTM A572, GRADE 50, Fy = 50ksi
    (C) CHANNELS AND PLATES: ASTM AE355, OR EQUIV.
    (D) TUBES: ASTM A500, GRADE B, Fy = 50ksi
    (E) PIPE COLUMNS: ASTM A53, GRADE B, TYPE E OR TYPE S U.N.O.
    (F) ALUMINUM EXTRUSIONS: 6061–T6
    (G) FASTENERS: ASTM GRADE 5 ZINC PLATED or EQUAL

3) STRUCTURAL STEEL SHALL BE HOT DIPPED GALVANIZED PER ASTM A123 OR A123M. MINIMUM NOMINAL 1 MIL COATING.

CONNECTIONS:

1) ATTACHMENT FOR LIGHTING AND ELECTRICAL EQUIPMENT TO ALUMINUM MEMBERS SHALL BE BY CLAMPS THAT SPECIFICALLY DESIGNED FOR USE WITH THE EXTRUSION BEING ATTACHED TO, UNLESS OTHERWISE SHOWN OR APPROVED BY THE ENGINEER.

FABRIC:

1) THE EXTERIOR FABRIC SHALL BE MINIMUM FINISH WEIGHT OF 22 oz/sq yd
2) THE FABRIC SHALL CONFORM TO INTERNATIONAL FIRE STANDARDS IN FORCE FOR ESTABLISHMENTS THAT RECEIVE THE GENERAL PUBLIC.
3) FABRIC SHALL BE FLAME RETARDANT TO THE STANDARDS OF NFP 92.503 & NFPA 701

DESIGN CRITERIA:

1) ROOF LIVE LOAD (concentrated at peak): 500 Lb

2) COLLATERAL DEAD LOAD:

– INCLUDES LOADS FOR A GENERAL LIGHTING SYSTEM COMPRISED OF METAL HALIDE HIGH BAY WAREHOUSE STYLE LIGHT FIXTURES THAT ARE EVENLY DISTRIBUTED THROUGHOUT THE STRUCTURE. NO OTHER LOADS HAVE BEEN CONSIDERED.
– THE STRUCTURE MAY OR MAY NOT BE CAPABLE OF SUPPORTING ADDITIONAL COLLATERAL LOADS. THE OWNER OF THE STRUCTURE SHALL NOT HAND, OR OTHERWISE AFFIX ADDITIONAL LOADS TO THIS STRUCTURE WITHOUT A REVIEW BY AN ENGINEER QUALIFIED TO MAKE SAID REVIEW. ADDITIONALLY, PRIOR TO ADDING LOAD TO THIS STRUCTURE, THE OWNER SHALL GET A HAND WRITTEN CONFIRMATION BY THE QUALIFIED ENGINEER AS TO THE MAGNITUDE AND LOCATION OF THE LOAD, OR LOADS BEING APPLIED.

3) SNOW LOAD:

5 psf

4) WIND LOAD:

(A) BASIC WIND VELOCITY:	120 mph
(B) EXPOSURE CATEGORY:	C
(C) BUILDING CATEGORY:	I
(D) TOPOGRAPHIC FACTOR (Kzt):	1.0
(E) DIRECTIONALITY FACTOR (Kd):	0.85
(F) VELOCITY PRESSURE (MEAN ROOF):	14.56 psf
(G) PRESSURE COEFFICIENT, SUCTION (GCpi):	−0.18
(H) PRESSURE COEFFICIENT, PRESSURE (GCpi):	+0.18

5) DIFFERENTIAL SETTLEMENT:

– THE STRUCTURE CAN ACCOMMODATE A DIFFERENTIAL SETTLEMENT OF UP TO 6" WITHOUT FIELD VERIFICATION.

FOR CONSTRUCTION

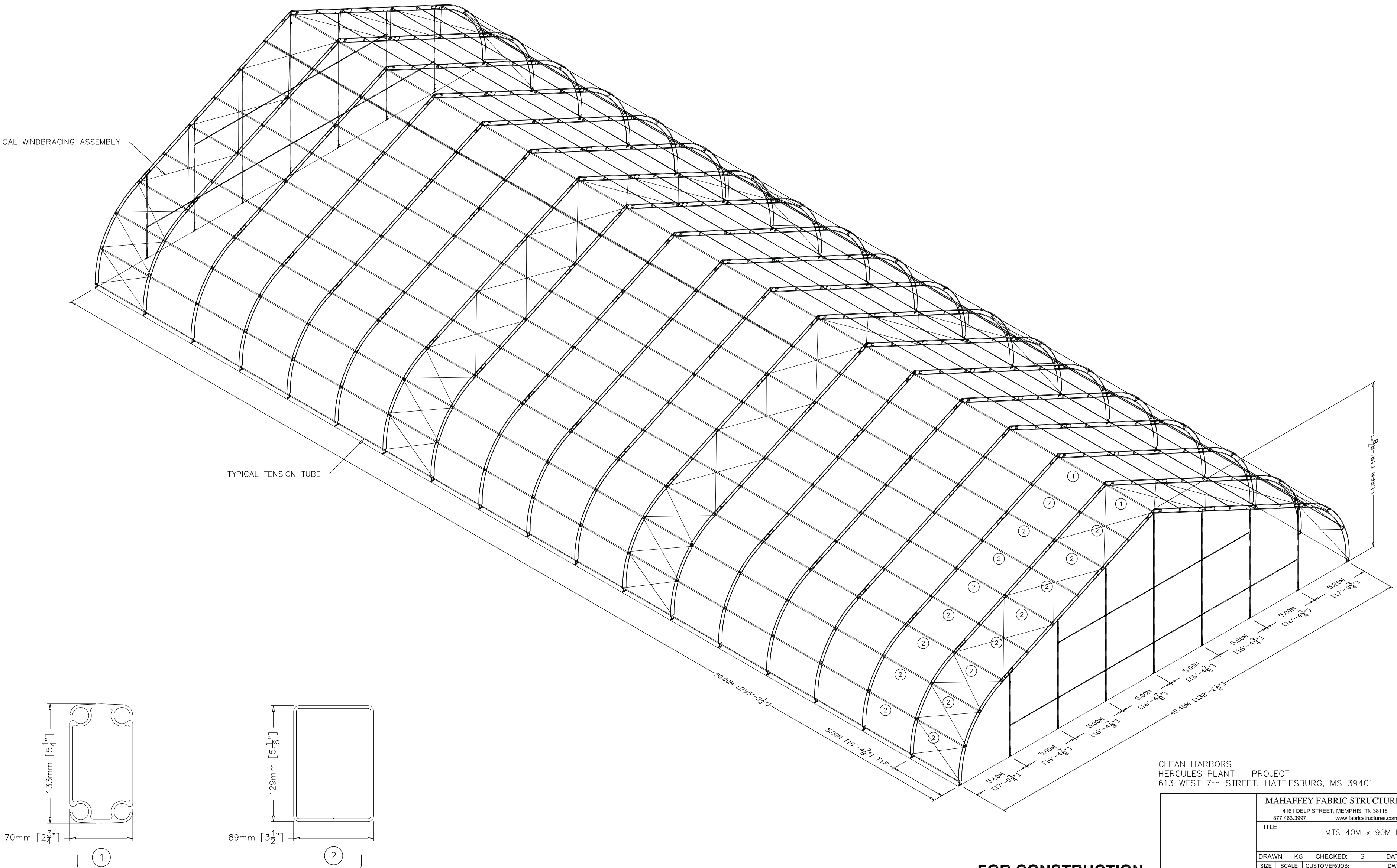
CLEAN HARBORS
HERCULES PLANT – PROJECT
613 WEST 7th STREET, HATTIESBURG, MS 39401

MAHAFFEY FABRIC STRUCTURES
4161 DELP STREET, MEMPHIS, TN 38118
877.463.3997 www.fabricstructures.com
MAHAFFEY

TITLE: MTS 40M x 90M GENERAL NOTES
DRAWN: KG
CHECKED: SH
DATE: 6MAR2015
REV.: 0
SIZE: D
SCALE: N.T.S.
CUSTOMER/JOB:
DWG. NO.: D350–000
-
SHEET: 1 OF 1

REV.	DATE	DESCRIPTION	NAME
0	6MAR2015	ORIGINAL RELEASE	SH

TYPICAL WINDBRACING CABLE ASSEMBLY:
- ø5/8" 6X19 CLASS STEEL CABLE. EIP IWRC
- 7/8"X12" GALVANIZED JAW & JAW TURNBUCKLE
- 3/4" GALVANIZED SHACKLE



PURLINS SHOWN ARE ALUMINUM EXTRUSION 6061 T6

FOR CONSTRUCTION

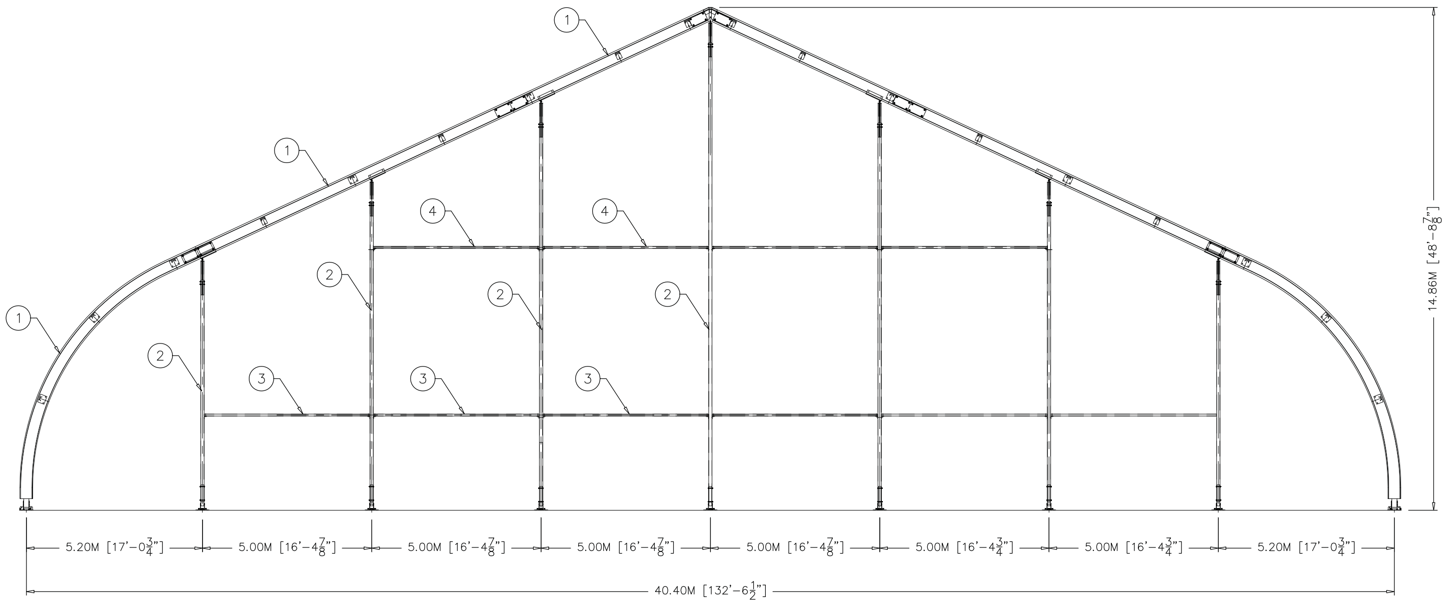
CLEAN HARBORS
HERCULES PLANT – PROJECT
613 WEST 7th STREET, HATTIESBURG, MS 39401

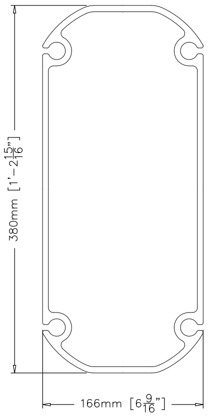
MAHAFFEY FABRIC STRUCTURES
4161 DELP STREET, MEMPHIS, TN 38118
877.463.3997 www.fabricstructures.com

TITLE: MTS 40M x 90M ISO VIEW

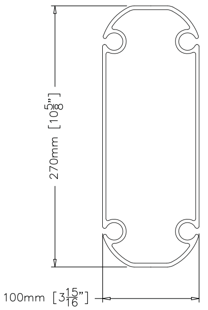
DRAWN: KG
CHECKED: SH
DATE: 6MAR2015
REV.: 0
SIZE: D
SCALE: N.T.S.
CUSTOMER/JOB:
DWG. NO.: D350-101
-
SHEET: 1 OF 1

REV.	DATE	DESCRIPTION	NAME
0	6MAR2015	ORIGINAL RELEASE	SH

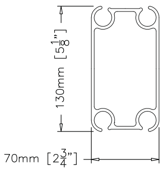




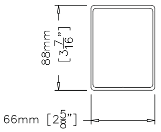
①



②



③



④

ALL EXTRUSION ALUMINUM 6061-T6

FOR CONSTRUCTION

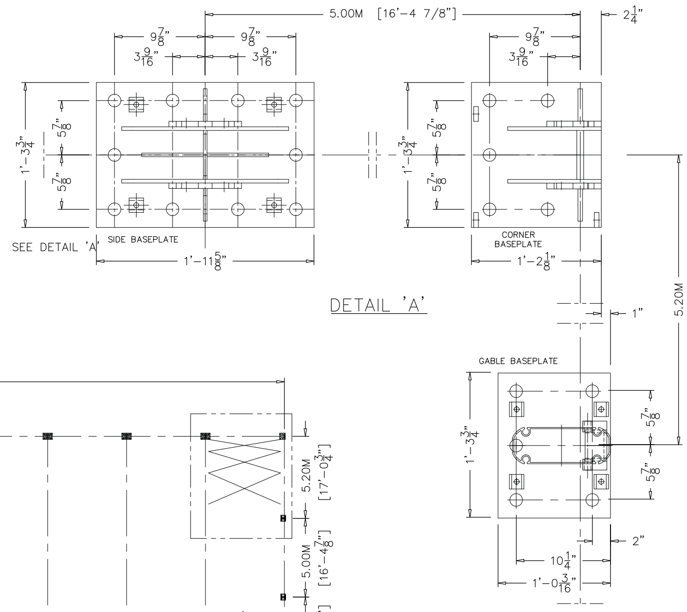
CLEAN HARBORS
HERCULES PLANT – PROJECT
613 WEST 7th STREET, HATTIESBURG, MS 39401

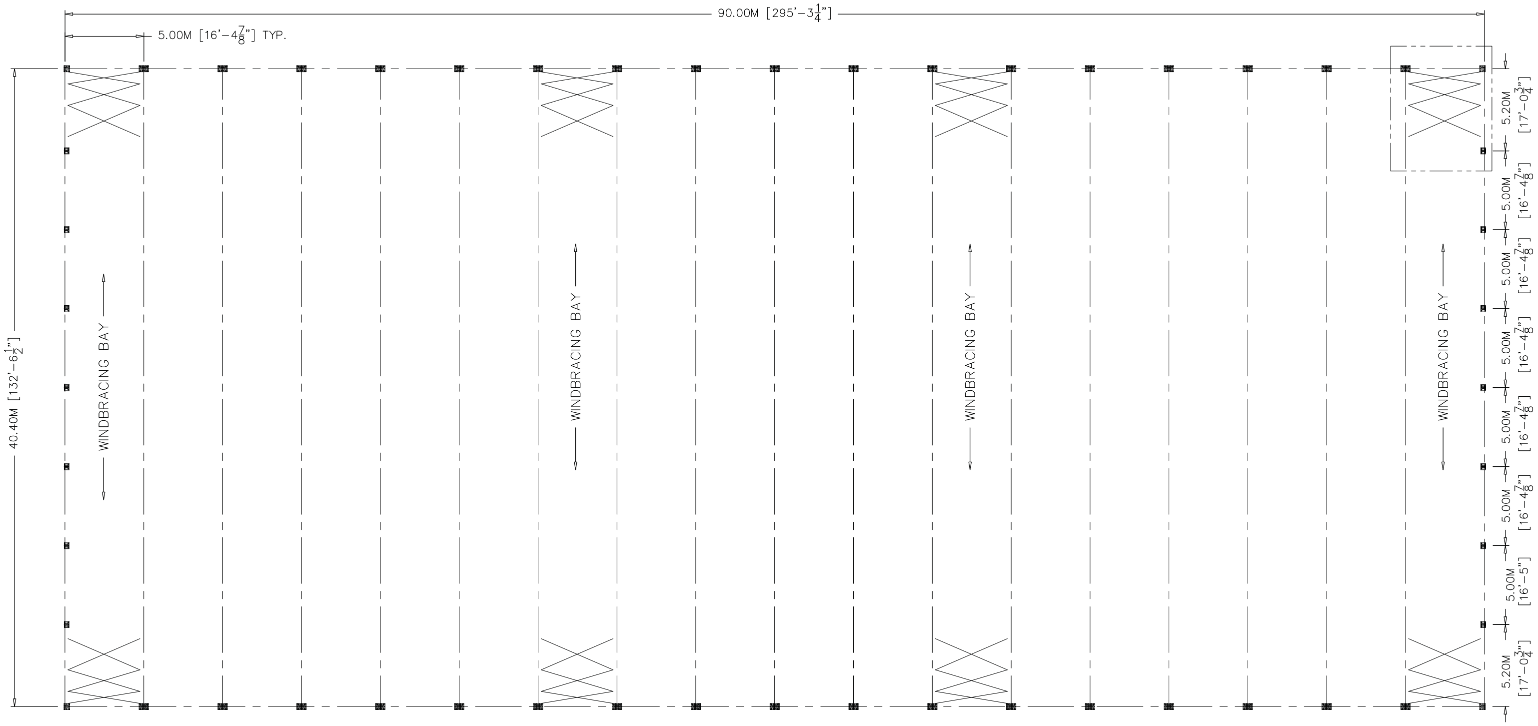
MAHAFFEY FABRIC STRUCTURES
4161 DELP STREET, MEMPHIS, TN 38118
877.463.3997 www.fabricstructures.com

TITLE: MTS 40M GABLE VIEW
w/PROFILES

DRAWN: SH
CHECKED: SF
DATE: 6MAR2015
REV.: 0
SIZE: D
SCALE: N.T.S.
CUSTOMER/JOB:
DWG. NO.: D350-102
-
SHEET: 1 OF 1

REV.	DATE	DESCRIPTION	NAME
0	6MAR2015	ORIGINAL RELEASE	SH





CLEAN HARBORS
HERCULES PLANT – PROJECT
613 WEST 7th STREET, HATTIESBURG, MS 39401

FOR CONSTRUCTION

MAHAFFEY FABRIC STRUCTURES
4161 DELP STREET, MEMPHIS, TN 38118
877.463.3997 www.fabricstructures.com
MAHAFFEY

TITLE: MTS 40M x 90M BASEPLATE LAYOUT

DRAWN: SH	CHECKED: SF	DATE: 6MAR2015	REV.: 0
SIZE D	SCALE N.T.S.	CUSTOMER/JOB:	DWG. NO.: 0350-103
-			SHEET: 1 OF 1

APPENDIX B

COMPUTER MODEL INPUT

This page intentionally left blank

Project: MTS 40M

Table of Contents

Model Summary

Structure Type: Plane Frame
27 Nodes, and 77 Degrees of Freedom
26 Member Elements
The model is linear.
The model will have 77 unique mode shapes.
The size of the model is:
1606 in, in the X direction
588.4 in, in the Y direction

Nodes

Node	X	Y	Fix DX	Fix DY	Fix RZ
	in	in			
01	-803.150	0.000	Yes	Yes	No
02	-803.150	28.114	No	No	No
03	-801.953	66.914	No	No	No
04	-795.703	105.414	No	No	No
05	-783.234	145.214	No	No	No
06	-767.456	178.514	No	No	No
07	-745.890	211.614	No	No	No
08	-719.599	241.714	No	No	No
09	-688.791	268.214	No	No	No
10	-647.837	293.514	No	No	No
11	-614.711	309.120	No	No	No
12	-579.211	325.674	No	No	No
13	-233.268	479.921	No	No	No
14	0.000	588.425	No	No	No
15	233.268	479.921	No	No	No
16	579.210	325.674	No	No	No
17	614.710	309.120	No	No	No
18	647.837	293.514	No	No	No
19	688.790	268.214	No	No	No
20	719.599	241.714	No	No	No
21	745.890	211.614	No	No	No
22	767.456	178.514	No	No	No
23	783.234	145.214	No	No	No
24	795.703	105.414	No	No	No
25	801.953	66.914	No	No	No
26	803.150	28.114	No	No	No
27	803.150	0.000	Yes	Yes	No

Material Properties

Material	Strength	Elasticity	Poisson	Density	Therm. Coeff.
	psi	psi		lb/in^3	in/in/deg-F
6061-T6-E	35000.000	10100000.000	0.330000	0.098	1.310e-005

Nodal Supports

Node	Fix DX	Fix DY	Fix RZ
01	Yes	Yes	No
27	Yes	Yes	No

Service Load Cases

Load Case	Self Weight
D1 - Dead load	Standard
Lr - Live Load Roof	None
W1 - Wind (Lateral +)	None
W2 - Wind (Lateral -)	None
W3 - Wind (Longitudinal +)	None
W4 - Wind (Longitudinal -)	None

Load Cases

Load Case
(1)D1 - Dead load
(2)Lr - Live Load Roof
(5)W1 - Wind (Lateral +)
(6)W2 - Wind (Lateral -)
(7)W3 - Wind (Longitudinal +)
(8)W4 - Wind (Longitudinal -)
(9)3a - D1 + Lr
(10)3b - D1 + N1
(11)3c - D1 + N2
(12)5a - D1 + 0.6W1
(13)5b - D1 + 0.6W2
(14)5c - D1 + 0.6W3
(15)5c - D1 + 0.6W4
(16)6a - D1 + 0.75Lr + 0.75(0.6W1)
(17)6b - D1 + 0.75Lr + 0.75(0.6W2)
(18)6c - D1 + 0.75Lr + 0.75(0.6W3)
(19)6d - D1 + 0.75Lr + 0.75(0.6W4)
(20)6e - D1 + 0.75N1 + 0.75(0.6W1)
(21)6f - D1 + 0.75N1 + 0.75(0.6W2)
(22)6g - D1 + 0.75N1 + 0.75(0.6W3)
(23)6h - D1 + 0.75N1 + 0.75(0.6W4)
(24)6i - D1 + 0.75N2 + 0.75(0.6W1)
(25)6j - D1 + 0.75N2 + 0.75(0.6W2)
(26)6k - D1 + 0.75N2 + 0.75(0.6W3)
(27)6l - D1 + 0.75N2 + 0.75(0.6W4)
(28)7a - 0.6D1 + 0.6W1
(29)7b - 0.6D1 + 0.6W2
(30)7c - 0.6D1 + 0.6W3
(31)7d - 0.6D1 + 0.6W4

APPENDIX C

COMPUTER MODEL OUTPUT

This page intentionally left blank

Table of Contents

Load Cases

Load Case
(1)D1 - Dead load
(2)Lr - Live Load Roof
(5)W1 - Wind (Lateral +)
(6)W2 - Wind (Lateral -)
(7)W3 - Wind (Longitudinal +)
(8)W4 - Wind (Longitudinal -)
(9)3a - D1 + Lr
(10)3b - D1 + N1
(11)3c - D1 + N2
(12)5a - D1 + 0.6W1
(13)5b - D1 + 0.6W2
(14)5c - D1 + 0.6W3
(15)5c - D1 + 0.6W4
(16)6a - D1 + 0.75Lr + 0.75(0.6W1)
(17)6b - D1 + 0.75Lr + 0.75(0.6W2)
(18)6c - D1 + 0.75Lr + 0.75(0.6W3)
(19)6d - D1 + 0.75Lr + 0.75(0.6W4)
(20)6e - D1 + 0.75N1 + 0.75(0.6W1)
(21)6f - D1 + 0.75N1 + 0.75(0.6W2)
(22)6g - D1 + 0.75N1 + 0.75(0.6W3)
(23)6h - D1 + 0.75N1 + 0.75(0.6W4)
(24)6i - D1 + 0.75N2 + 0.75(0.6W1)
(25)6j - D1 + 0.75N2 + 0.75(0.6W2)
(26)6k - D1 + 0.75N2 + 0.75(0.6W3)
(27)6l - D1 + 0.75N2 + 0.75(0.6W4)
(28)7a - 0.6D1 + 0.6W1
(29)7b - 0.6D1 + 0.6W2
(30)7c - 0.6D1 + 0.6W3
(31)7d - 0.6D1 + 0.6W4

Member Extreme Results

Member	Fx (lc)	Vy (lc)	Mz (lc)
	lb	lb	lb-in
M01	-3312 (9)	-2239 (9)	-64706 (9)
M01	15788 (7)	**10618 (5)**	294065 (5)
M02	-3318 (9)	-2141 (9)	-150066 (9)
M02	15963 (7)	10034 (5)	675089 (5)
M03	-3483 (9)	-1717 (9)	-218959 (9)
M03	16599 (7)	8369 (5)	992975 (5)
M04	-3608 (9)	-1244 (9)	-272267 (9)
M04	17047 (7)	6427 (5)	1251238 (5)
M05	**-3658 (9)**	-853 (19)	-301687 (9)
M05	17226 (7)	4373 (5)	1404734 (5)
M06	-3657 (9)	-1746 (7)	-314982 (9)
M06	17147 (7)	2341 (5)	1488427 (5)
M07	-3596 (9)	-3616 (7)	-314982 (9)
M07	16806 (7)	808 (6)	**1489745 (5)**
M08	-3479 (9)	-5446 (7)	-309755 (9)
M08	16216 (7)	612 (9)	1486325 (5)
M09	-3294 (9)	-7383 (7)	-301798 (19)
M09	15289 (7)	1072 (9)	1394755 (5)

M10	-3107 (9)	-7865 (7)	-375030 (8)
M10	14521 (7)	1341 (9)	1198596 (5)
M11	-3040 (9)	-7011 (7)	-545796 (8)
M11	14495 (7)	1221 (9)	1020124 (5)
M12	-2963 (9)	-6279 (7)	**-1244821 (7)**
M12	14394 (7)	3384 (7)	844615 (5)
M13	-2497 (9)	-823 (6)	-1014687 (7)
M13	14339 (7)	10014 (7)	746616 (7)
M14	-2497 (9)	-6458 (5)	-744352 (5)
M14	16897 (7)	569 (1)	746614 (7)
M15	-2963 (9)	-2262 (5)	-907148 (5)
M15	16908 (7)	4742 (7)	826984 (7)
M16	-3040 (9)	-1221 (9)	-508292 (6)
M16	16986 (7)	5009 (7)	1012349 (7)
M17	-3107 (9)	-1341 (9)	-433288 (6)
M17	17006 (7)	5460 (7)	1202794 (7)
M18	-3294 (9)	-1072 (9)	-401491 (13)
M18	17513 (7)	4514 (5)	1387899 (7)
M19	-3479 (9)	-612 (9)	-389808 (17)
M19	17952 (7)	3490 (5)	1455478 (7)
M20	-3596 (9)	-990 (8)	-377073 (17)
M20	**18045 (7)**	2537 (5)	1455478 (7)
M21	-3657 (9)	-2639 (7)	-352683 (17)
M21	17851 (7)	1554 (5)	1440442 (7)
M22	-3658 (9)	-4503 (7)	-316780 (17)
M22	17403 (7)	1249 (13)	1346422 (7)
M23	-3608 (9)	-6389 (7)	-272675 (17)
M23	16679 (7)	1492 (17)	1189401 (7)
M24	-3483 (9)	-8154 (7)	-218957 (9)
M24	15679 (7)	1788 (17)	934349 (7)
M25	-3318 (9)	**-9610 (7)**	-150064 (9)
M25	14555 (7)	2141 (9)	626318 (7)
M26	-3312 (9)	-9545 (7)	-64706 (9)
M26	14268 (7)	2239 (9)	263155 (7)

Nodal Reactions

Node	Result Case Name	FX	FY	MZ
		lb	lb	lb-in
01	3a - D1 + Lr	2236	3312	-NA-
01	3a - D1 + Lr Second Order	2239	**3312**	-NA-
01	3b - D1 + N1	1970	3062	-NA-
01	3b - D1 + N1 Second Order	1972	3062	-NA-
01	3c - D1 + N2	1970	3062	-NA-
01	3c - D1 + N2 Second Order	1972	3062	-NA-
01	5a - D1 + 0.6W1	-4401	-2053	-NA-
01	5a - D1 + 0.6W1 Second Order	-4385	-2025	-NA-
01	5b - D1 + 0.6W2	-2995	1400	-NA-
01	5b - D1 + 0.6W2 Second Order	-2993	1386	-NA-
01	5c - D1 + 0.6W3	-1470	-6302	-NA-
01	5c - D1 + 0.6W3 Second Order	-1435	-6356	-NA-
01	5c - D1 + 0.6W4	-66	-2851	-NA-
01	5c - D1 + 0.6W4 Second Order	-59	-2874	-NA-
01	6a - D1 + 0.75Lr + 0.75(0.6W1)	-5794	-3144	-NA-
01	6a - D1 + 0.75Lr + 0.75(0.6W1) Second Order	-5765	-3092	-NA-
01	6b - D1 + 0.75Lr + 0.75(0.6W2)	-1554	2003	-NA-
01	6b - D1 + 0.75Lr + 0.75(0.6W2) Second Order	-1555	1985	-NA-
01	6c - D1 + 0.75Lr + 0.75(0.6W3)	-410	-3774	-NA-
01	6c - D1 + 0.75Lr + 0.75(0.6W3) Second Order	-398	-3799	-NA-
01	6d - D1 + 0.75Lr + 0.75(0.6W4)	643	-1185	-NA-
01	6d - D1 + 0.75Lr + 0.75(0.6W4) Second Order	642	-1191	-NA-
01	6e - D1 + 0.75N1 + 0.75(0.6W1)	-2809	-774	-NA-

01	6e - D1 + 0.75N1 + 0.75(0.6W1) Second Order	-2803	-765	-NA-
01	6f - D1 + 0.75N1 + 0.75(0.6W2)	-1754	1816	-NA-
01	6f - D1 + 0.75N1 + 0.75(0.6W2) Second Order	-1754	1799	-NA-
01	6g - D1 + 0.75N1 + 0.75(0.6W3)	-610	-3961	-NA-
01	6g - D1 + 0.75N1 + 0.75(0.6W3) Second Order	-596	-3987	-NA-
01	6h - D1 + 0.75N1 + 0.75(0.6W4)	443	-1373	-NA-
01	6h - D1 + 0.75N1 + 0.75(0.6W4) Second Order	443	-1379	-NA-
01	6i - D1 + 0.75N2 + 0.75(0.6W1)	-2809	-774	-NA-
01	6i - D1 + 0.75N2 + 0.75(0.6W1) Second Order	-2803	-765	-NA-
01	6j - D1 + 0.75N2 + 0.75(0.6W2)	-1754	1816	-NA-
01	6j - D1 + 0.75N2 + 0.75(0.6W2) Second Order	-1754	1799	-NA-
01	6k - D1 + 0.75N2 + 0.75(0.6W3)	-610	-3961	-NA-
01	6k - D1 + 0.75N2 + 0.75(0.6W3) Second Order	-596	-3987	-NA-
01	6l - D1 + 0.75N2 + 0.75(0.6W4)	443	-1373	-NA-
01	6l - D1 + 0.75N2 + 0.75(0.6W4) Second Order	443	-1379	-NA-
01	7a - 0.6D1 + 0.6W1	-5189	-3277	-NA-
01	7a - 0.6D1 + 0.6W1 Second Order	-5165	-3235	-NA-
01	7b - 0.6D1 + 0.6W2	-3783	176	-NA-
01	7b - 0.6D1 + 0.6W2 Second Order	-3778	180	-NA-
01	7c - 0.6D1 + 0.6W3	-2258	-7526	-NA-
01	7c - 0.6D1 + 0.6W3 Second Order	-2210	-7590	-NA-
01	7d - 0.6D1 + 0.6W4	-854	-4075	-NA-
01	7d - 0.6D1 + 0.6W4 Second Order	-839	-4112	-NA-
01	D1 - Dead load	1970	3062	**-NA-**
01	D1 - Dead load Second Order	1972	3062	-NA-
01	Lr - Live Load Roof	267	250	-NA-
01	Lr - Live Load Roof Second Order	267	250	-NA-
01	W1 - Wind (Lateral +)	**-10618**	-8525	-NA-
01	W1 - Wind (Lateral +) Second Order	-10516	-8374	-NA-
01	W2 - Wind (Lateral -)	-8274	-2770	-NA-
01	W2 - Wind (Lateral -) Second Order	-8245	-2697	-NA-
01	W3 - Wind (Longitudinal +)	-5733	-15607	-NA-
01	W3 - Wind (Longitudinal +) Second Order	-5552	**-15788**	-NA-
01	W4 - Wind (Longitudinal -)	-3393	-9856	-NA-
01	W4 - Wind (Longitudinal -) Second Order	-3318	-9987	-NA-
27	3a - D1 + Lr	-2236	3312	-NA-
27	3a - D1 + Lr Second Order	-2239	3312	-NA-
27	3b - D1 + N1	-1969	3062	-NA-
27	3b - D1 + N1 Second Order	-1972	3062	-NA-
27	3c - D1 + N2	-1969	3062	-NA-
27	3c - D1 + N2 Second Order	-1972	3062	-NA-
27	5a - D1 + 0.6W1	-585	-3324	-NA-
27	5a - D1 + 0.6W1 Second Order	-601	-3352	-NA-
27	5b - D1 + 0.6W2	-1991	129	-NA-
27	5b - D1 + 0.6W2 Second Order	-1993	143	-NA-
27	5c - D1 + 0.6W3	3536	-5499	-NA-
27	5c - D1 + 0.6W3 Second Order	3500	-5445	-NA-
27	5c - D1 + 0.6W4	2132	-2048	-NA-
27	5c - D1 + 0.6W4 Second Order	2125	-2025	-NA-
27	6a - D1 + 0.75Lr + 0.75(0.6W1)	-439	-4733	-NA-
27	6a - D1 + 0.75Lr + 0.75(0.6W1) Second Order	-467	-4784	-NA-
27	6b - D1 + 0.75Lr + 0.75(0.6W2)	-2186	1050	-NA-
27	6b - D1 + 0.75Lr + 0.75(0.6W2) Second Order	-2185	1068	-NA-
27	6c - D1 + 0.75Lr + 0.75(0.6W3)	1959	-3171	-NA-
27	6c - D1 + 0.75Lr + 0.75(0.6W3) Second Order	1947	-3146	-NA-
27	6d - D1 + 0.75Lr + 0.75(0.6W4)	906	-583	-NA-
27	6d - D1 + 0.75Lr + 0.75(0.6W4) Second Order	907	-578	-NA-
27	6e - D1 + 0.75N1 + 0.75(0.6W1)	-931	-1727	-NA-
27	6e - D1 + 0.75N1 + 0.75(0.6W1) Second Order	-936	-1736	-NA-
27	6f - D1 + 0.75N1 + 0.75(0.6W2)	-1986	862	-NA-
27	6f - D1 + 0.75N1 + 0.75(0.6W2) Second Order	-1985	879	-NA-

27	6g - D1 + 0.75N1 + 0.75(0.6W3)	2159	-3359	-NA-
27	6g - D1 + 0.75N1 + 0.75(0.6W3) Second Order	2145	-3333	-NA-
27	6h - D1 + 0.75N1 + 0.75(0.6W4)	1106	-770	-NA-
27	6h - D1 + 0.75N1 + 0.75(0.6W4) Second Order	1106	-764	-NA-
27	6i - D1 + 0.75N2 + 0.75(0.6W1)	-931	-1727	-NA-
27	6i - D1 + 0.75N2 + 0.75(0.6W1) Second Order	-936	-1736	-NA-
27	6j - D1 + 0.75N2 + 0.75(0.6W2)	-1986	862	-NA-
27	6j - D1 + 0.75N2 + 0.75(0.6W2) Second Order	-1985	879	-NA-
27	6k - D1 + 0.75N2 + 0.75(0.6W3)	2159	-3359	-NA-
27	6k - D1 + 0.75N2 + 0.75(0.6W3) Second Order	2145	-3333	-NA-
27	6l - D1 + 0.75N2 + 0.75(0.6W4)	1106	-770	-NA-
27	6l - D1 + 0.75N2 + 0.75(0.6W4) Second Order	1106	-764	-NA-
27	7a - 0.6D1 + 0.6W1	203	-4548	-NA-
27	7a - 0.6D1 + 0.6W1 Second Order	179	-4591	-NA-
27	7b - 0.6D1 + 0.6W2	-1203	-1096	-NA-
27	7b - 0.6D1 + 0.6W2 Second Order	-1208	-1100	-NA-
27	7c - 0.6D1 + 0.6W3	4324	-6724	-NA-
27	7c - 0.6D1 + 0.6W3 Second Order	4276	-6660	-NA-
27	7d - 0.6D1 + 0.6W4	2919	-3273	-NA-
27	7d - 0.6D1 + 0.6W4 Second Order	2905	-3236	-NA-
27	D1 - Dead load	-1969	3062	-NA-
27	D1 - Dead load Second Order	-1972	3062	-NA-
27	Lr - Live Load Roof	-267	250	-NA-
27	Lr - Live Load Roof Second Order	-267	250	-NA-
27	W1 - Wind (Lateral +)	2308	-10643	-NA-
27	W1 - Wind (Lateral +) Second Order	2206	-10794	-NA-
27	W2 - Wind (Lateral -)	-36	-4889	-NA-
27	W2 - Wind (Lateral -) Second Order	-65	-4962	-NA-
27	W3 - Wind (Longitudinal +)	**9176**	-14268	-NA-
27	W3 - Wind (Longitudinal +) Second Order	8994	-14087	-NA-
27	W4 - Wind (Longitudinal -)	6835	-8516	-NA-
27	W4 - Wind (Longitudinal -) Second Order	6760	-8384	-NA-

Nodal Extreme Displacements

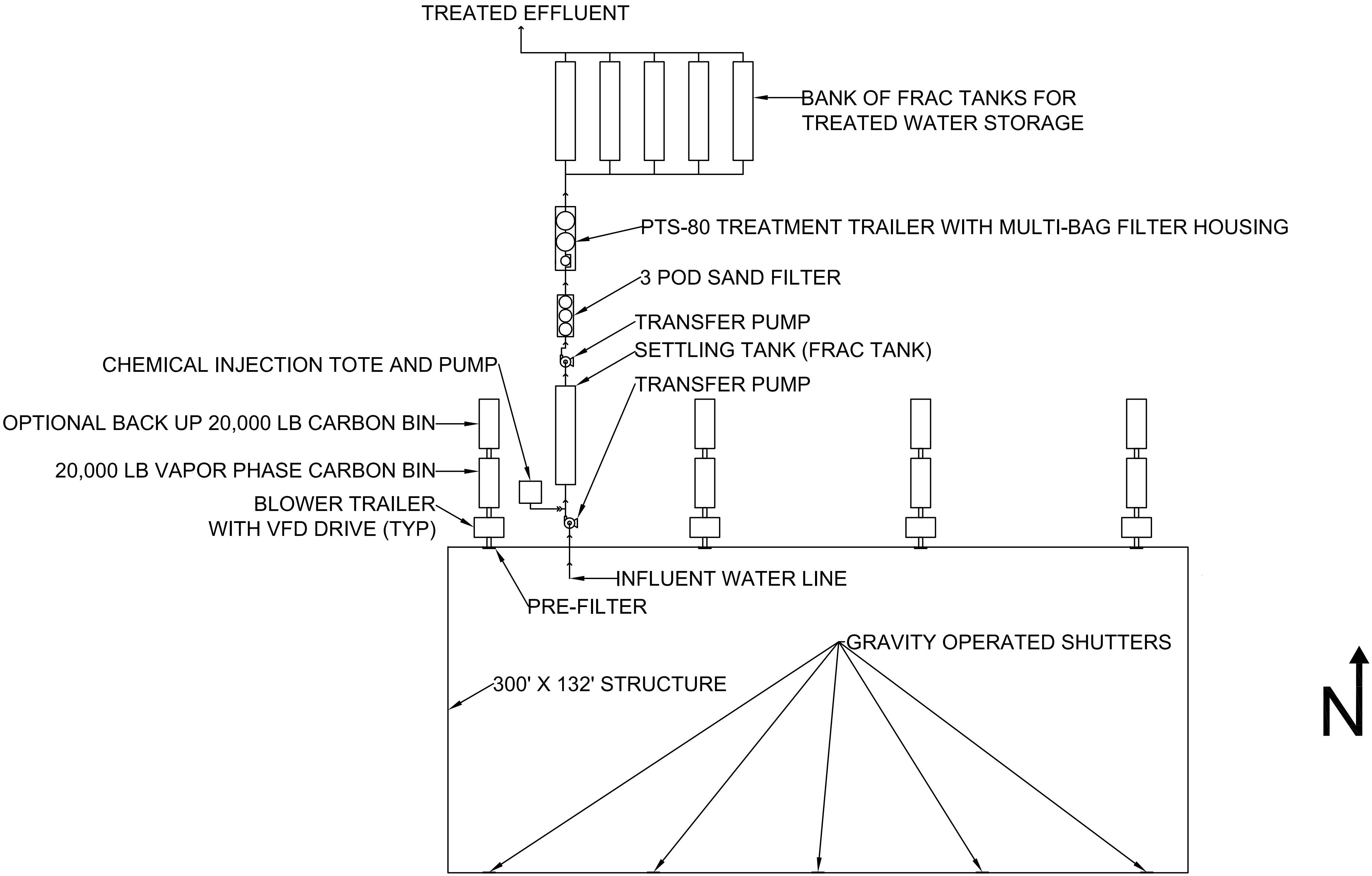
Node	DX	DY
	in	in
11	**29.529 (5)**	15.519 (7)
12	-22.720 (8)	**-12.042 (6)**
13	24.867 (6)	**27.957 (7)**
17	**-28.833 (7)**	-11.372 (8)

Appendix I

Ventilation, Air Treatment Design and
Water Treatment Design

SYSTEM LAYOUT

WATER & AIR SYSTEM



NOT TO SCALE

FILE NAME:
HERCULES - VENT STRUCTURE LAYOUT

DATE 02-11-2015
DRAWN BY T. BENTLEY

CLEAN HARBORS ENVIRONMENTAL SERVICES
3300 US 131 NORTH
KALKASKA, MI 49646
PH: 231-258-8014
FAX 231-258-6993

CONCEPT LAYOUT
HERCULES - IB SPRUNG
STRUCTURE VENTILATION

SHEET
1 OF 1

FRAC STORAGE TANK

500-Barrel Steel Temporary Liquid Storage Tanks

Easy to clean, smooth-wall interior

500-barrel (21,000 gallon) steel temporary liquid storage tanks feature the most recent advances to enhance safety and usability. From the innovative safety stairway and grip strut steps to high-visibility paint on rails and stair steps, every part of an Adler tank is designed to safeguard workers and enhance efficiency.

Adler tanks are ruggedly constructed and may be specified with bare steel or epoxy-coated interiors. Conveniently located manways, multiple valved ports and available heating coils make Adler tanks versatile and efficient on the job site. They are also designed for easy cleaning, making them more cost-effective for you.

Mechanical Features

- Integral safety stairway
  - Easy-to-inspect top manway
  - No guardrails to set up and take down
  - No moving parts or pins to break
  - Eliminates potential for guardrails violating height restrictions
- Easy-to-clean design reduces costs
  - V-shaped bottom for complete cleanout
  - Smooth wall interior
  - No corrugations
  - No internal rods
- 4 easily accessible, side-hinged manways
- Multiple 4-inch valved fill/drain ports in front and rear
- 3-inch fill line
- Vapor ready
- Lifting eyes
- Level gauges
- Fixed rear axle to fit in tight areas
- Nose rail cut-out for easy access when installing hose and fittings on the front/bottom of tank

Safety Features

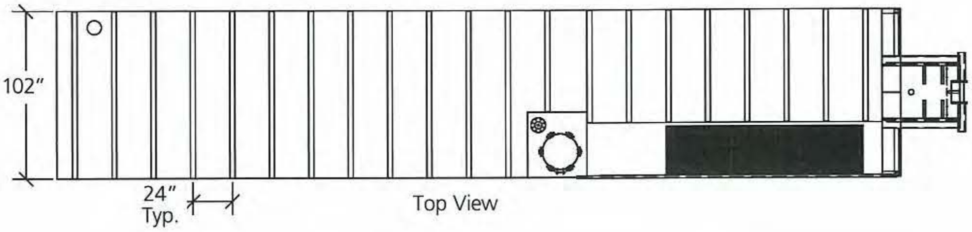
- Safety stairway eliminates need for workers to get on top of the tank
- Grip strut steps to prevent slipping
- Rails and stair steps painted "safety yellow" for high visibility
- Safe Operation reminder decals applied
- Attached strapping charts
- Stringent and thorough maintenance program

Options

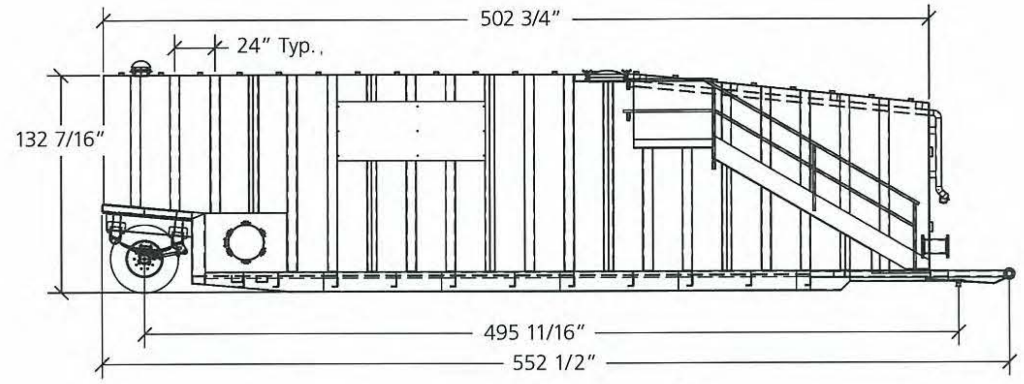
- Epoxy coated interior
- Bare steel interior
- Dual wall
- Heating coils

Strategic Storage Solutions 800-421-7471 www.adlertankrentals.com

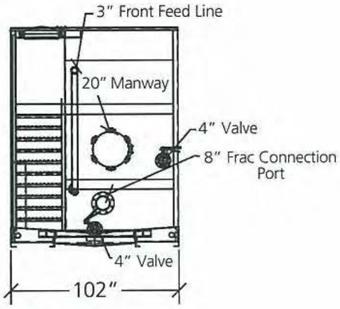
STORAGE TANKS | MOBILE LIQUID STORAGE | EMERGENCY LIQUID STORAGE | HAZARDOUS WASTE ENVIRONMENTAL TANKS | FRAC TANKS | ISO TANKS | INDUSTRIAL WASTE TANKS | INDUSTRIAL TANKS SOLUTIONS STORAGE TANKS | WASTE STORAGE TANKS | HAZARDOUS SOLUTION STORAGE TANKS OSHA TANKS | NESHAP TANKS | EMERGENCY RESPONSE TANKS | STORAGE TANKS | MOBILE LIQUID



Top View



Side View



Front View

PRODUCT DATA SHEET

November, 2007

FRAC TANK

GENERAL INFORMATION

This tank is sloped downward from working surface at rear of tank to the front. The rear axle is fixed to the tank (permanent).

WEIGHTS AND MEASURES

» Capacity:	500 BBL. (21,000 gal.)
» Height:	Front: 9'-0", Rear: 12'-5" Handrail up: 16'-1"
» Width :	8'-0"
» Length:	36'-4" (tank only) 42'-3" (manifolded tank overall)
» Weight:	18,000 lbs. (est.)

STRUCTURAL DESIGN

» Floor:	Carbon steel
» Sides/Ends:	Carbon steel
» Top Deck:	Carbon steel
» Internal Cross Bracing:	Round stock, 3/4" – 7/8" depending on manufacturer

FEATURES

» Manifold:	Some are equipped, some are not
» Valves:	Rear: one (1) - 4″ butterfly valve Front Fill: one (1) - 4″ butterfly valve Front Manifold: four (4) - butterfly valves
» Relief Valve:	Standard style: None Safety Vapor style: Buna-N seal, 16 oz. Pressure setting, 0.4 oz. Vacuum setting

FEATURES – cont.

» Top Access:	One (1) access door
» Front Access:	One (1) access door
» Side Access:	One (1) access door (passenger side)
» Guardrails:	At rear platform only
» Exterior Ladder:	One (1) at rear of tank
» Internal Ladder:	One (1) located at top access door
» Front Drain:	One (1) 4" connection
» Rear Flush:	One (1) 4" capped nipple
» Level Gauge:	None
» Rear Wheels:	Fixed axle
» Overflow:	One (1) 3" overflow pipe at rear of tank
» Vent:	Original design tanks have flip open hatch

SURFACE DETAILS

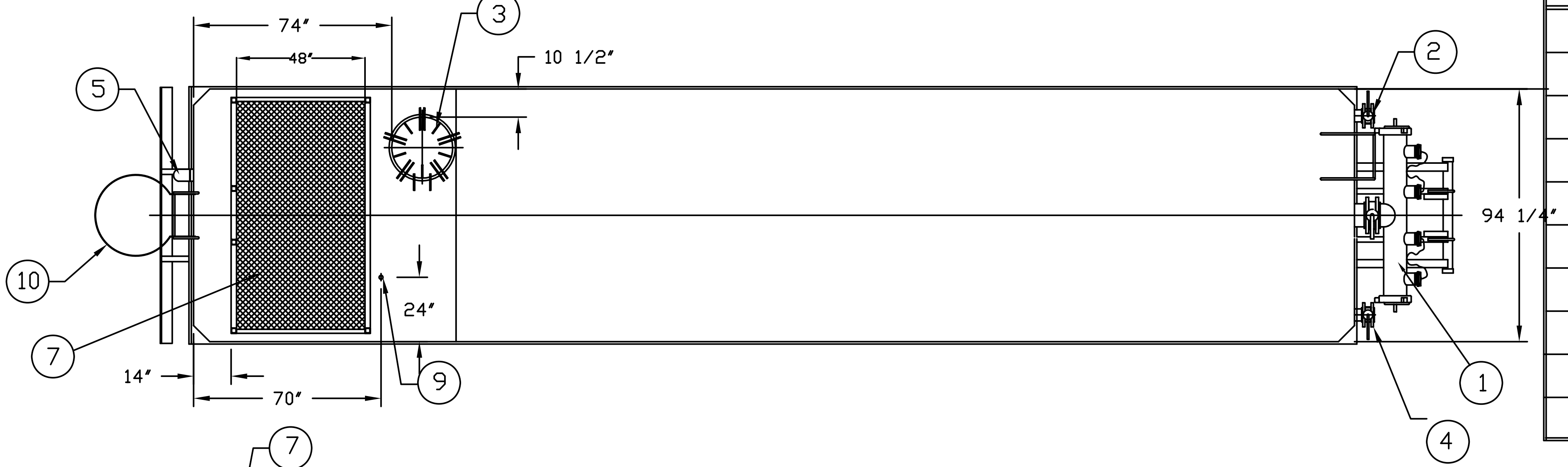
» Exterior Coating:	High gloss polyurethane
» Interior Coating:	Both lined & unlined available. Consult your local Baker representative.

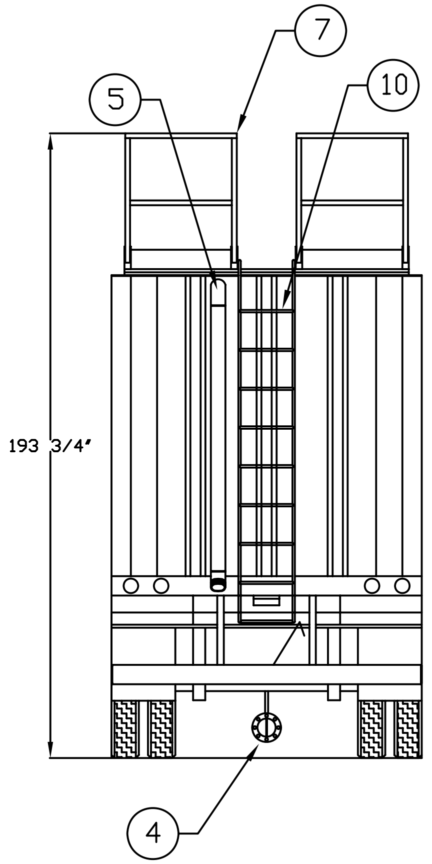
TESTS/CERTIFICATIONS

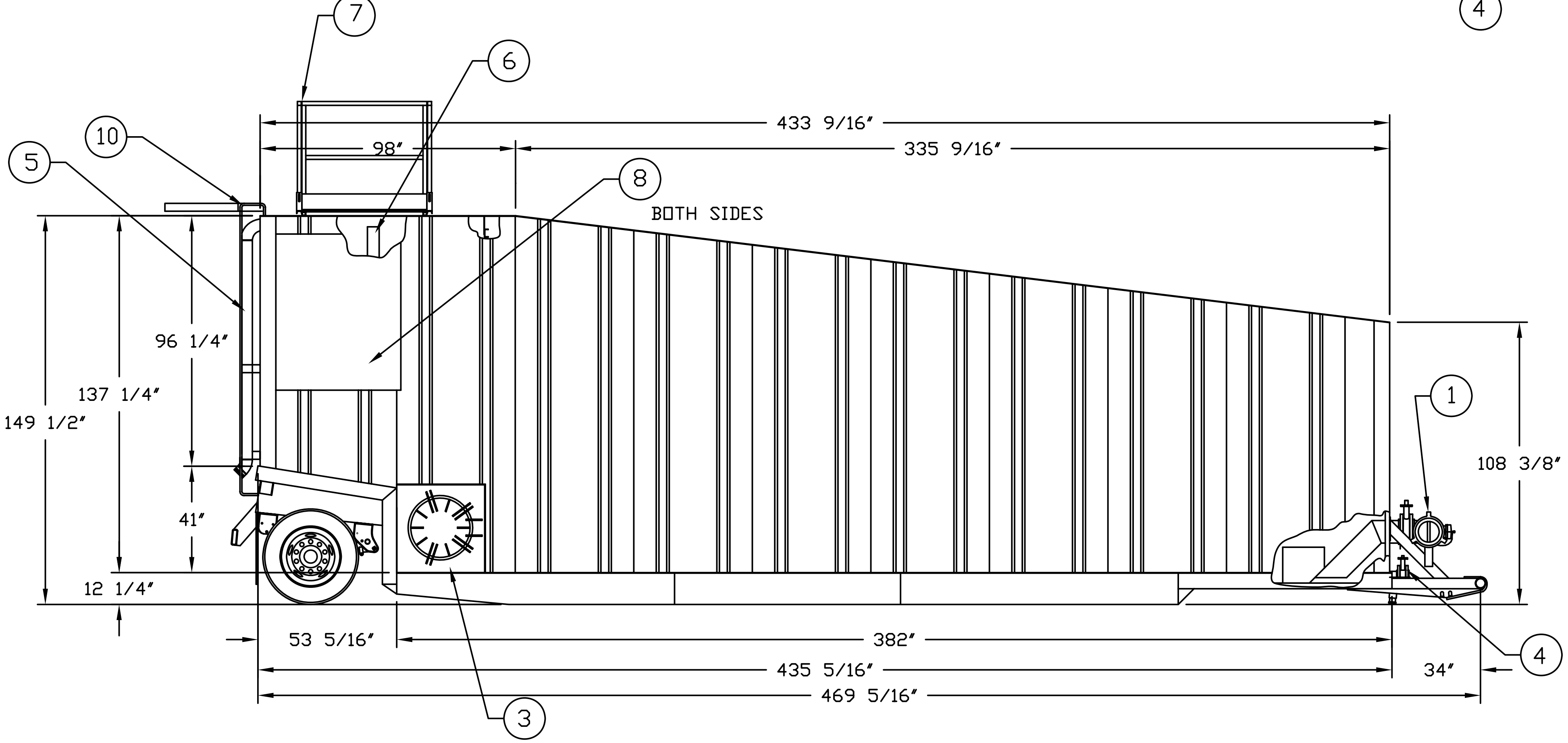
» Test Performed:	Scheduled QMS inspections

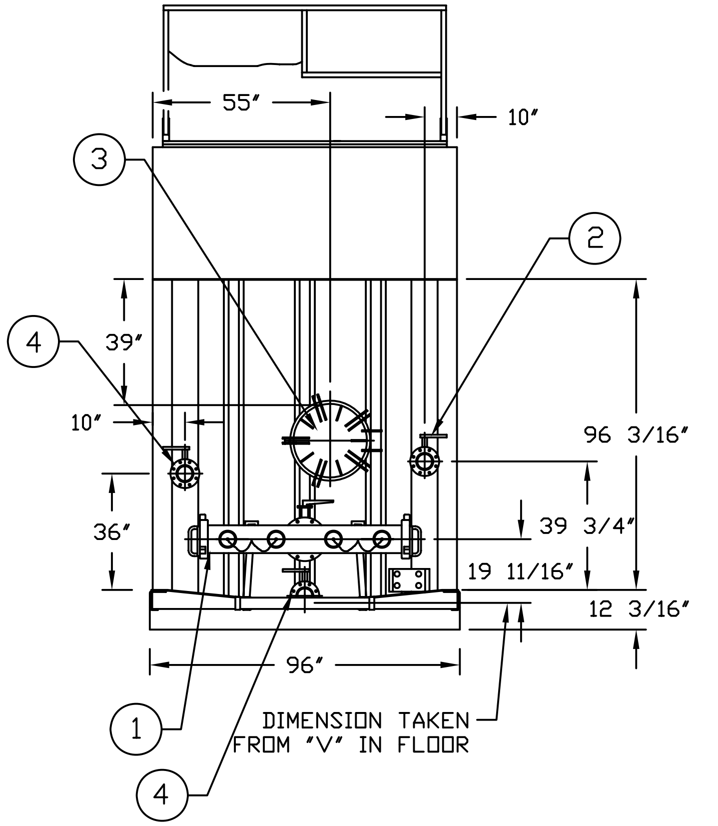
BAKERCORP™

ITEM	QTY	DESCRIPTION
1	1	8" header w/two knock–on half unions & 4–4" nipples
2	1	4" gel line
3	3	22" diameter manway
4	4	4" connection with butterfly valve
5	1	3" fill pipe
6	1	4" overflow pipe
7	1	Rear platform with ramp and handrails
8	2	60"x48" Baker Tanks sign plate
9	1	1 1/4" pipe vent
10	1	Rear ladder









SPECIFICATIONS:

1) Tank Capacity: 21,000 gallons (500 BBL)
2) Tank Weight: 18,000 lbs. (empty)

NOTES:

1. This drawing is a baseline representation for this model of tank. Variations between this drawing and the actual equipment in the field can and do exist, primarily with appurtenance locations, sizes and quantities. Consult your local BakerCorp representative if specific needs exist.
2. THIS TANK IS _NOT DESIGNED FOR TRANSPORTING LIQUIDS_. It should be moved only when empty.

The information contained herein is proprietary to Baker Tanks and shall not be reproduced or disclosed in whole or in part, or used for any design or manufacture except when user obtains direct written authorization from Baker Tanks.

BAKERCORP
3020 OLD RANCH PARKWAY
SEAL BEACH, CA 90740-2751

G			
F			
E			
D			
C			
B			
A			
REV.	DESCRIPTION	DATE	BY

SCALE: Do Not Scale
SIZE: B
ORIGINAL DWG. DATE: 16JUL02
DRAWN BY: P.J.B.
APPROVED BY:
CAT/CLASS: --
TITLE: VE ENTERPRISES FRAC TANK
SHEET: 1 of 1
DRAWING NO.: S-2-M0004-1-
REV.: 0

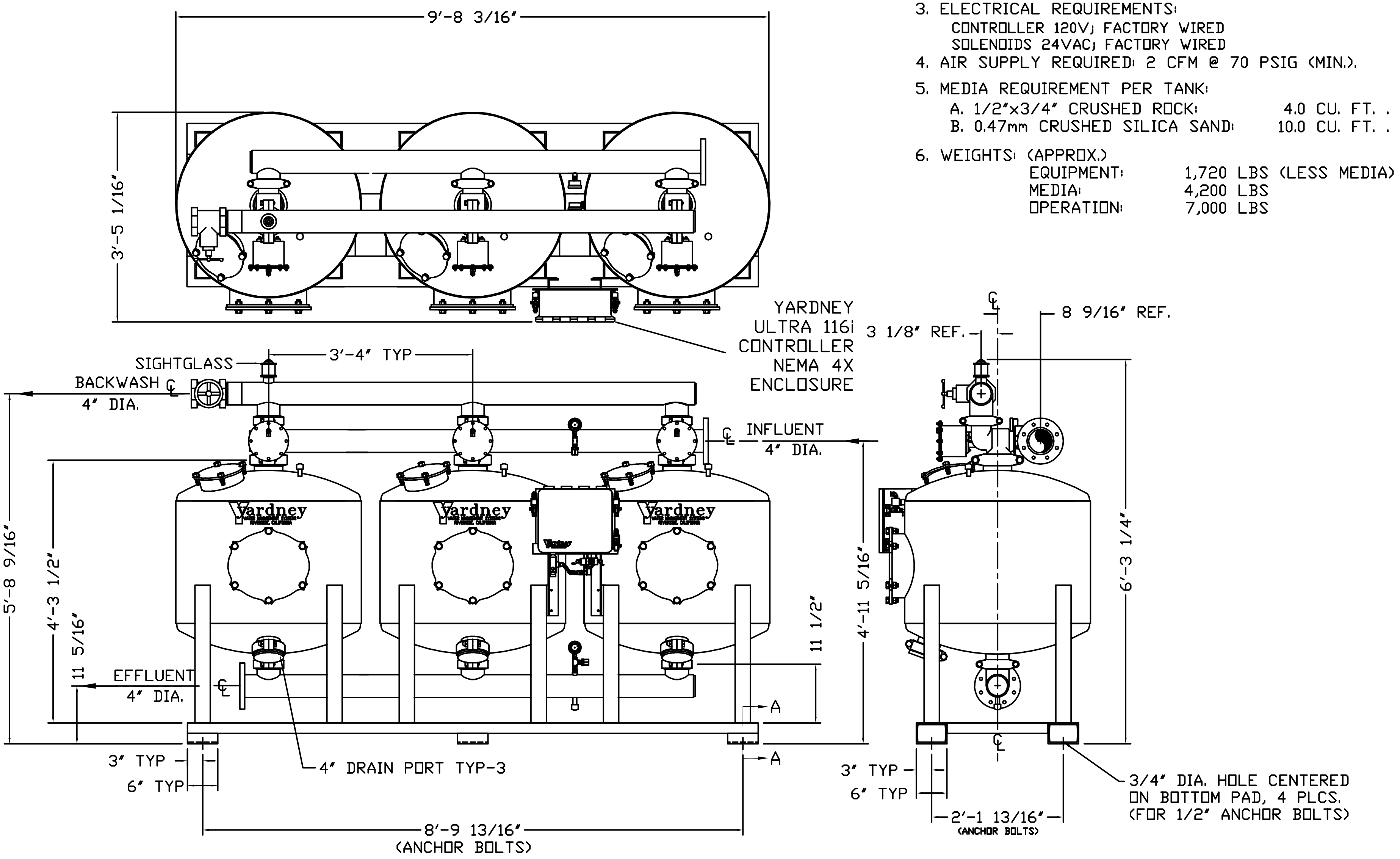
3 POD SAND FILTER

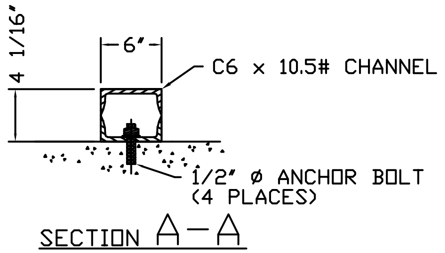
IL 3624-3A

NOTES:

1. FLOW RATE DESIGN: 320 GPM. @ 40 PSI.
2. MAXIMUM WORKING PRESSURE: 80 PSI.
3. ELECTRICAL REQUIREMENTS:
   CONTROLLER 120V; FACTORY WIRED
   SOLENOIDS 24VAC; FACTORY WIRED
4. AIR SUPPLY REQUIRED: 2 CFM @ 70 PSIG (MIN.).
5. MEDIA REQUIREMENT PER TANK:
   A. 1/2"x3/4" CRUSHED ROCK: 4.0 CU. FT. .
   B. 0.47mm CRUSHED SILICA SAND: 10.0 CU. FT. .
6. WEIGHTS: (APPROX.)

EQUIPMENT:	1,720 LBS (LESS MEDIA)
MEDIA:	4,200 LBS
OPERATION:	7,000 LBS





SECTION A-A

THIS DRAWING, INCLUDING THE INFORMATION IT CONTAINS, IS CONFIDENTIAL, PROPRIETARY, AND IS THE PROPERTY OF YARDNEY WATER MANAGEMENT, INC. IT IS SUBMITTED ONLY IN CONNECTION WITH THE TRANSACTION TO WHICH IT PERTAINS AND MUST NOT BE USED IN ANY OTHER MANNER DETRIMENTAL TO THE INTERESTS OF YARDNEY WATER MANAGEMENT. THE DRAWING IS NOT TO BE COPIED AND MUST BE RETURNED UPON REQUEST. COPYRIGHT YARDNEY WATER MANAGEMENT SYSTEMS, 1994.

NO.	REVISION	BY	DATE
B	ADDED 4" DRAIN PORT	DTC	11-09
A	STANDARDIZED NOTES	DTC	9-05

Yardney
WATER MANAGEMENT SYSTEMS
RIVERSIDE, CALIFORNIA

CUSTOMER:

USED ON:

DRAWN BY: DTC

DATE: 12-1-04

IL 3624-3A

DRAWING NO: 9500362403

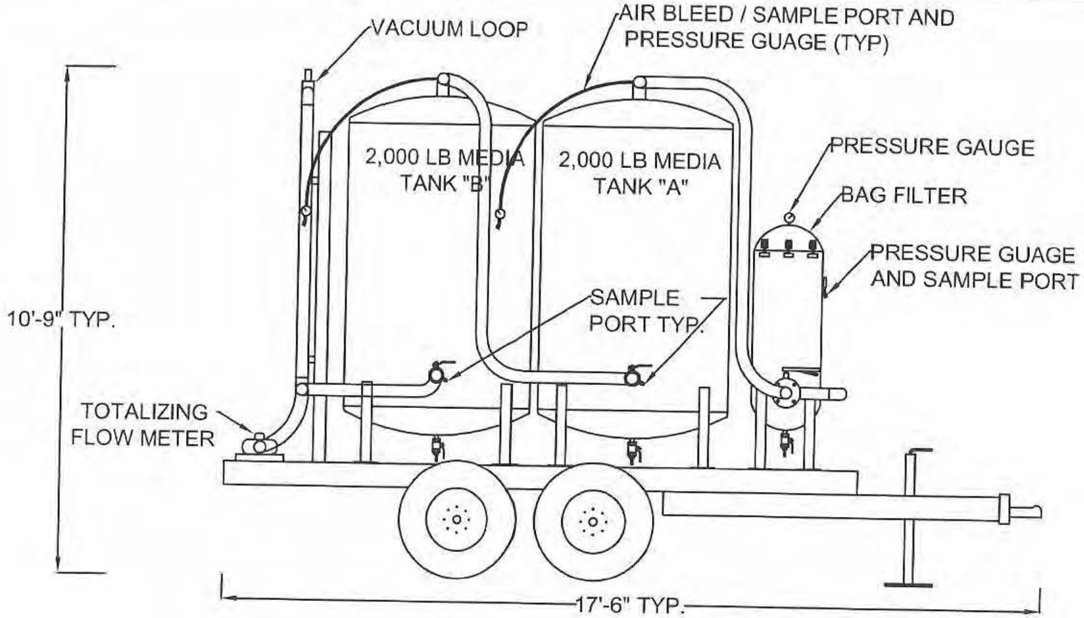
REV: B

LOCATION: SYSTEMS\IL

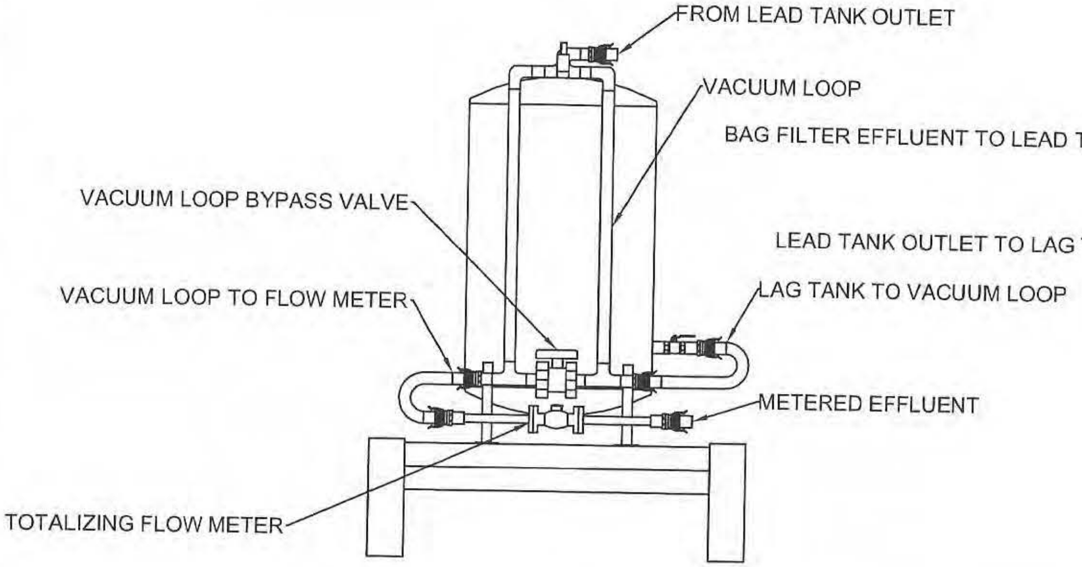
SHEET 1 OF 1

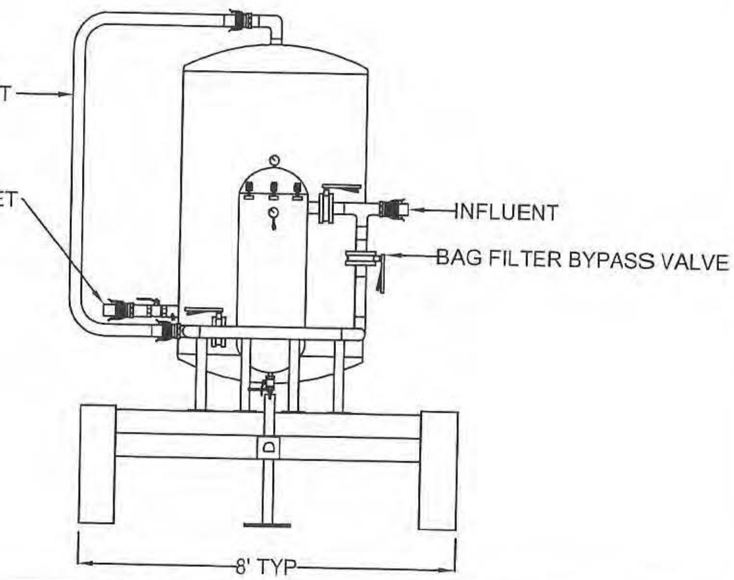
PTS -80

PORTABLE TREATMENT TRAILER



NOTES:
MAX FLOW RATE: 70 GPM
MAX PRESSURE: 75 PSI
HOSES ARE 3" SUCTION RATED WITH FEMALE CAMLOCKS
FILTER BAGS ARE AVAILABLE IN THE RANGE OF 1 TO 100 MICRON





NOT TO SCALE

NO.	DATE	REVISON DESCRIPTION

DATE 03-03-2015
DRAWN BY T. BENTLEY

FILE NAME:
PTS-80

CleanHarbors®

CLEAN HARBORS ENVIRONMENTAL SERVICES

PTS-80 TREATMENT TRAILER
PORTABLE TREATMENT SYSTEM

SHEET
1 OF 1

VAPOR BIN

STANDARD SPECIFICATIONS

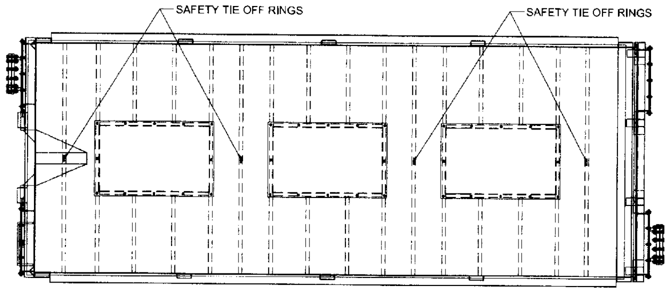
CONTAINER SIZE AND CAPACITY
SIZE: 20' l x 100" w x 94" h
CAPACITY: 42.5 CU YD.
MINUS FALSE FLOOR: 33.5 CU YD

STANDARD COMPONENTS

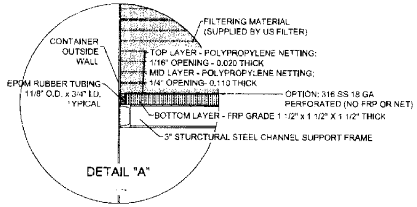
1. 7 GA FLOOR w/ FALSE FLOOR
2. 10 GA SIDES, BULKHEAD, & TAILGATE
3. 3"x4.1# STRUCTURAL CHANNEL FLOOR CROSS MEMBERS
4. 4"x3"x1/8" STRUCTURAL TUBING TOP CAP
5. 8 5/8" OD x 8" FRONT & REAR ROLLERS
6. STANDARD DOGHOUSE FRONT HOOK @ NOSE ROLLERS
7. RADIUS BOTTOM
8. TOP HINGE TAILGATE
9. 3/4" HOSE TAILGATE SEAL
10. CONTINUOUS WELDED CONSTRUCTION
11. AIR TESTED (3 psi MAX)
12. PRIMED INTERIOR & PRIMED & PAINTED EXTERIOR

ADDITIONAL COMPONENTS

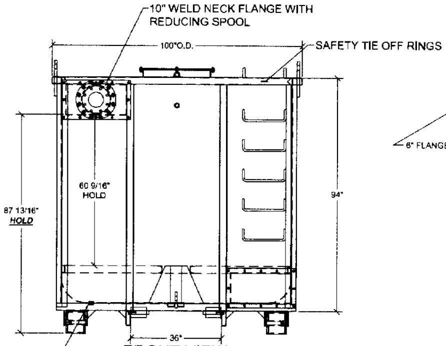
1. FALSE FLOOR 3" 4.1 STRUCTURAL CHANNEL ONLY
2. (2) 10" 150 lbs. WELD FLANGES w/ 6" REDUCING SPOOLS
3. (2) 1" COUPLINGS (1) IN THE FRONT & (1) REAR w/ PLUGS IN FRONT AND REAR WALL
4. (3) 48"x24" OPENINGS with BOLT-ON LIDS
5. ROOF DECKING IS TREAD PLATE
6. (4) 1" COUPLINGS w/ PLUGS IN FLOOR AND ALL FOUR CORNERS
7. (4) LIFTING LUGS (ONE IN EACH CORNER)
8. (4) SAFETY LINE TIE OFF RINGS



PLAN VIEW

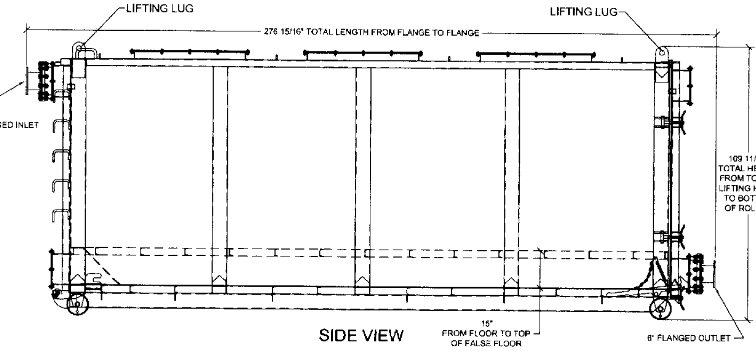


DETAIL "A"

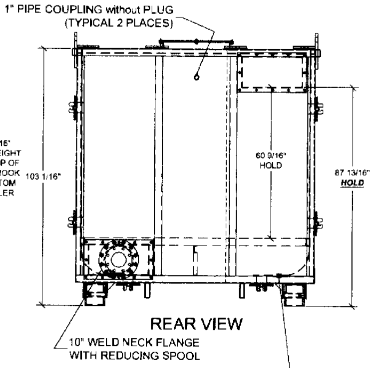


FRONT VIEW

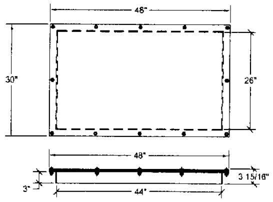
1" COUPLER LOCATED IN THE FLOOR IN ALL FOUR CORNERS



SIDE VIEW

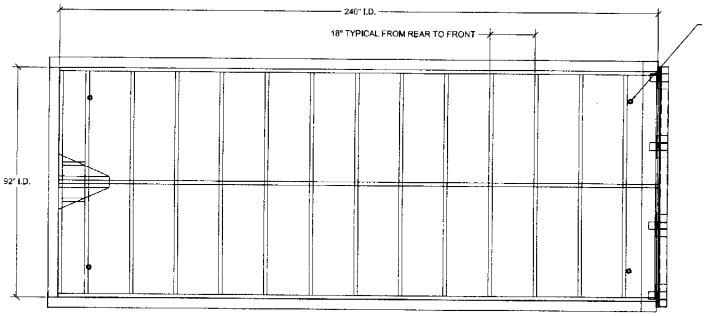


REAR VIEW

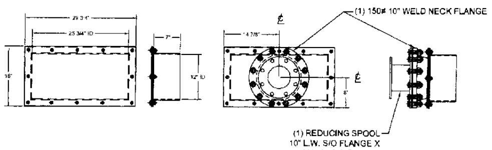


(3) ROOF OPENINGS with COVERS

w/ (12) 1/2"-13 x 1 1/2" Bolts with Locknuts



VIEW OF FALSE FLOOR SUPPORT



One of Each Required

(2) FRONT with COVERS & (2) REAR with COVERS PORTS

(12) 1/2" - 13 x 1 1/2" Bolts Required for Each Port and
(12) 3/4" - 10 x 4" Bolts for 10" Round Flange

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
A	LEFT STANDARD 10" OUTLETS BUT ADDED A 6" RED. SPOOL	11-10-04	AJA			

DESIGNER AJA DATE 11-5-04
CHECKER DATE
ENGINEER DATE
MANAGER DATE
FILE:
SCALE: 1/2" = 1'

TITLE RB 20 WITH 6" INLET/OUTLET
GENERAL ASSEMBLY

CLIENT [redacted]

[redacted]

PROJECT 23299NJ
DRAWING
SHEET 1 OF 1
REV 1

STD: 2-C200-24X36D1
NTL REF:

BLOWERS

Product Information Packet

EM7090T

100HP,1780RPM,3PH,60HZ,405T,XPFC,F1

Part Detail

Revision:	H	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	A40072M	**Elec. Spec:**	A40WG0494	**CD Diagram:**	416820-002
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**		**Layout:**	611742-001-SH1
Frame:	X405T	**Mounting:**	F1	**Poles:**	04	**Created Date:**	10-19-2010
Base:		**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	11-15-2013
Leads:	3#2,6#4					**Replaced By:**	
Literature:		**Elec. Diagram:**					

Nameplate 000613006PC	
CLASS I GROUP	C D X
CLASS II GROUP	F G X
OPERATING TEMP CODE	T4

Nameplate NP2293L

CAT.NO.	EM7090T	**SPEC NO.**	P40G4845	**FRAME**	X405T		
HP	100//75	**PHASE**	3	**DESIGN**	B	**TYPE**	P
RPM	1780//1485	**HZ**	60//50	**AMB**	40	**SF**	1.00
VOLTS	230/460//190/380	**DUTY**	CONT	**INSUL.CLASS**	F		
AMPS	224/112//206/103	**ENCL**	TEFC	**CODE**	G		
DRIVE END BEARING	80BC03JPP30A	**NEMA-NOM-EFFICIENCY**	95.4				
OPP D.E. BEARING	80BC03JPP30A						
SER.NO.		OVER TEMP PROT 2					
	SUIT FOR 208V @ 248 AMPS			**MOTOR WEIGHT**			

Parts List

Part Number	Description	Quantity
SA209314	SA P40G4845	1.000 EA
RA196576	RA P40G4845	1.000 EA
000613006PC	N/P U/L (REL QTY 500)	1.000 EA
NP2293L	BALDOR RELIANCE INDUST. MTR,SS,CSA-C US,	1.000 EA
000692000FX	UL LISTED LOGO LABEL 2.53 X 0.75 X .018	1.000 EA
000692000JF	CAUTION LABEL TO PREVENT IGNITION	1.000 EA
000692000VD	LABEL WARNING	1.000 EA
421948032	LABEL, MYLAR	1.000 EA
603284001Y	SLGR - 400	1.000 EA
609158001E	SLGR - 400	1.000 EA
004824015A	GREASE POLYREX EM	0.884 LB
032018010CK	HHCS 3/8-16X1-1/4 PLTD.	4.000 EA
032018032CK	HHCS 3/8-16X4 PLATED	3.000 EA
032130020EB	HSHCS 5/8-11X2-1/2PLTD.	4.000 EA
034000014AB	WSH ID.406 OD.812 TH.065	4.000 EA
34017-14AB	LCKW 3/8 STD. PLATED	3.000 EA
034017018AB	LCKW 5/8"	4.000 EA
34017-14AB	LCKW 3/8 STD. PLATED	4.000 EA
034180012DA	KEY 1X4X1/4X1-1/2 L	1.000 EA
034530064AB	P/NIP 1/8X8" GALV.	1.000 EA
034690001AB	SQHDPLG, COND	1.000 EA
034690002AB	"unbulked" PPLG 1/4" PLTD.	1.000 EA
078548001R	FAN KB 234/150 (84) 400	1.000 EA
032018004AM	HHCS 1/4-20X1/2PLTD GREN	1.000 EA

Parts List (continued)

Part Number	Description	Quantity
032018014DK	HHCS 1/2-13X1-3/4 PLTD	4.000 EA
415072001B	CLAMP	1.000 EA
083198036A	FANCV BLKT 400	1.000 EA
089416052B	BRKT 400 089416052WCB	1.000 EA
410700000DA	WAVY SPRING WASHER (400)	1.000 EA
415045002B	SLGR	1.000 EA
415096002A	CPLG 1/8 HEX TYPE	1.000 EA
032018032CK	HHCS 3/8-16X4 PLATED	3.000 EA
032130020EB	HSHCS 5/8-11X2-1/2PLTD.	4.000 EA
34017-14AB	LCKW 3/8 STD. PLATED	3.000 EA
034017018AB	LCKW 5/8"	4.000 EA
034690001AB	SQHDPLG, COND	1.000 EA
034690002AB	"unbulked" PPLG 1/4" PLTD.	1.000 EA
089416052A	BRKT 400 089416052WCB	1.000 EA
415045002B	SLGR	1.000 EA
034017016AB	LCKW 1/2" PLATED	4.000 EA
034036012AB	LCKW EXTERNAL TOOTH 1/4"	1.000 EA
063916001S	+P/NIP 3X3 DIMPL-400	1.000 EA
064069000A	C/BC320/360 X 064069000B KB	1.000 EA
073646000E	C/B 320 WA073646000 KB	1.000 EA
406099000A	PLUG - FAN COVER 320-440	1.000 EA
415000103D	T/LUG #4AWG-1/0AWG W/HOLE FOR .250 BOLT	1.000 EA
MG1025G05	MEDIUM CHARCOAL METALLIC GREY	0.250 GA
033775004EA	DRSCR #6-1/4 304 S.S.	8.000 EA

Parts List (continued)

Part Number	Description	Quantity
034180044JA	KEY 3/4X3/4X5-1/2 L	1.000 EA
PK5004A02	WOOD BASE 40X32 STACK 2X4 RUNNER	1.000 EA

REL. S.O.	FRAME	HP	TYPE	PHASE/ HERTZ	RPM	VOLTS
	405T	100	P	3/60	1780	230/460

AMPS	DUTY	AMB °C/ INSUL.	S.F.	NEMA DESIGN	CODE LETTER	ENCL.
224/112	CONT	40/F	1.00	B	G	XPFC

E/S	ROTOR	TEST S.O.	TEST DATE	STATOR RES.@25 °C OHMS (BETWEEN LINES)
596181	418142037AE	---	---	.0141/.0564

PERFORMANCE

LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY
NO LOAD	0	34.2	1800	4.25	0
1/4	25.0	43.3	1796	57.9	93.5
2/4	50.0	62.9	1792	77.9	95.5
3/4	74.9	86.4	1787	84.9	95.7
4/4	100	112	1782	87.5	95.4
5/4	125	140	1777	88.1	94.8

SPEED TORQUE

	RPM	TORQUE % FULL LOAD	TORQUE LB.-FT.	AMPERES
LOCKED ROTOR	0	169	498	708
PULL UP	270	148	437	665
BREAKDOWN	1712	242	714	409
FULL LOAD	1782	100	295	112

AMPERES SHOWN FOR 460. VOLT CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE

REMARKS: TYPICAL DATA
NEMA PREMIUM - 95.4 PCT NOMINAL EFFICIENCY

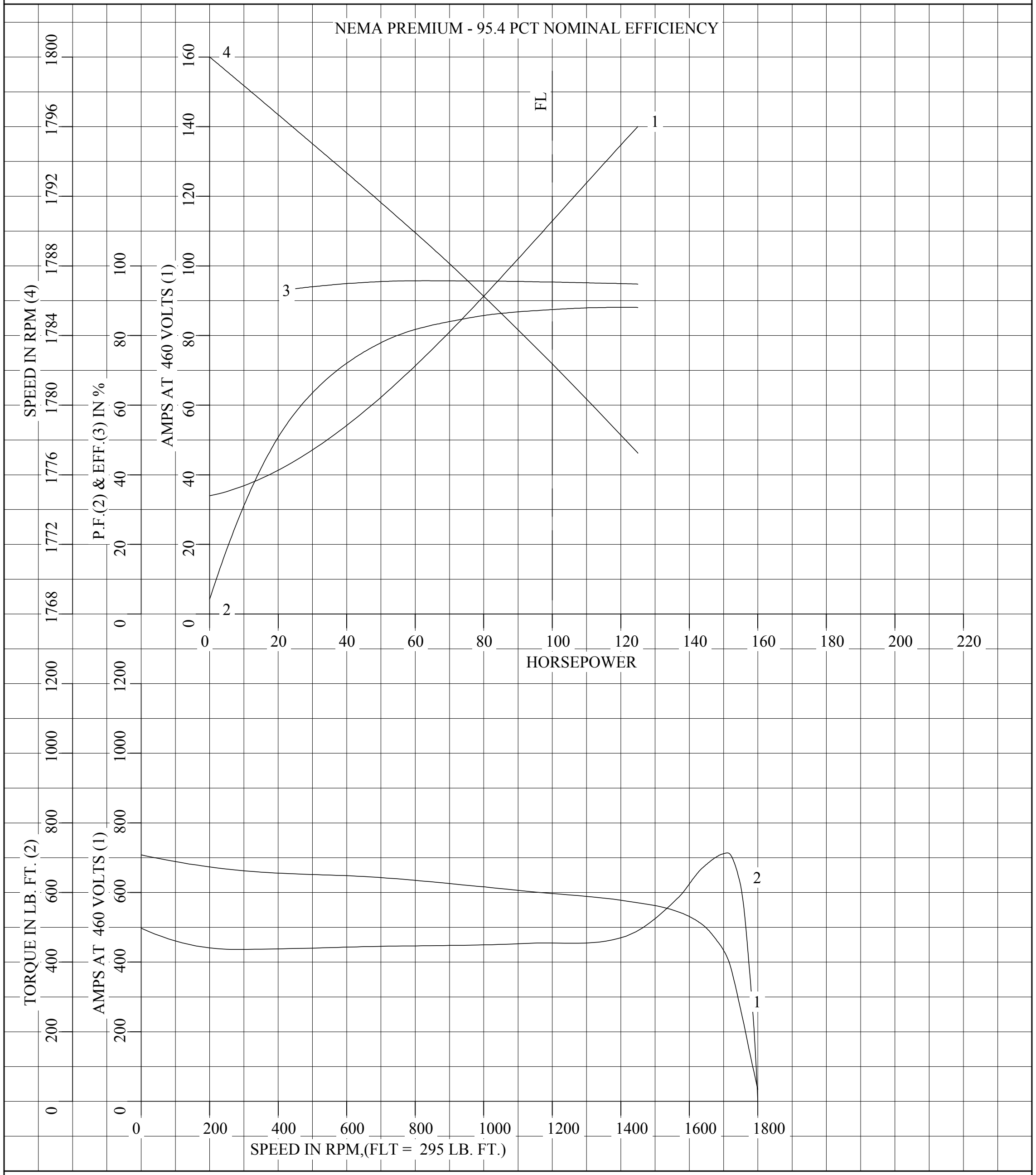
DR. BY W. L. SMITH
CK. BY J.J.HARRISON
APP. BY W. L. SMITH
DATE 09/01/10

A-C MOTOR PERFORMANCE DATA

A40WG0494-R001
ISSUE DATE 01/07/11

Printed on 1/7/11 11:40 @ psecs-motoren

REL S.O.	RPM 1780	S.F. 1.00	ROTOR 418142037AE
FRAME 405T	VOLTS 230/460	NEMA DESIGN B	TEST S.O. TYPICAL DATA
HP 100	AMPS 224/112	CODE LETTER G	TEST DATE ---
TYPE P	DUTY CONT	ENCLOSURE XPFC	STATOR RES.@ 25 °C .0141/.0564
PHASE/HERTZ 3/60	AMB °C/INSUL 40/F	E/S 596181	OHMS (BETWEEN LINES)



AMPERES SHOWN FOR 460 VOLT CONNECTION, IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

BALDOR

DR. BY W. L. SMITH
CK. BY J.J.HARRISON
APP. BY W. L. SMITH
DATE 09/01/10

A-C MOTOR PERFORMANCE CURVES

A40WG0494-R001

ISSUE DATE 01/07/11

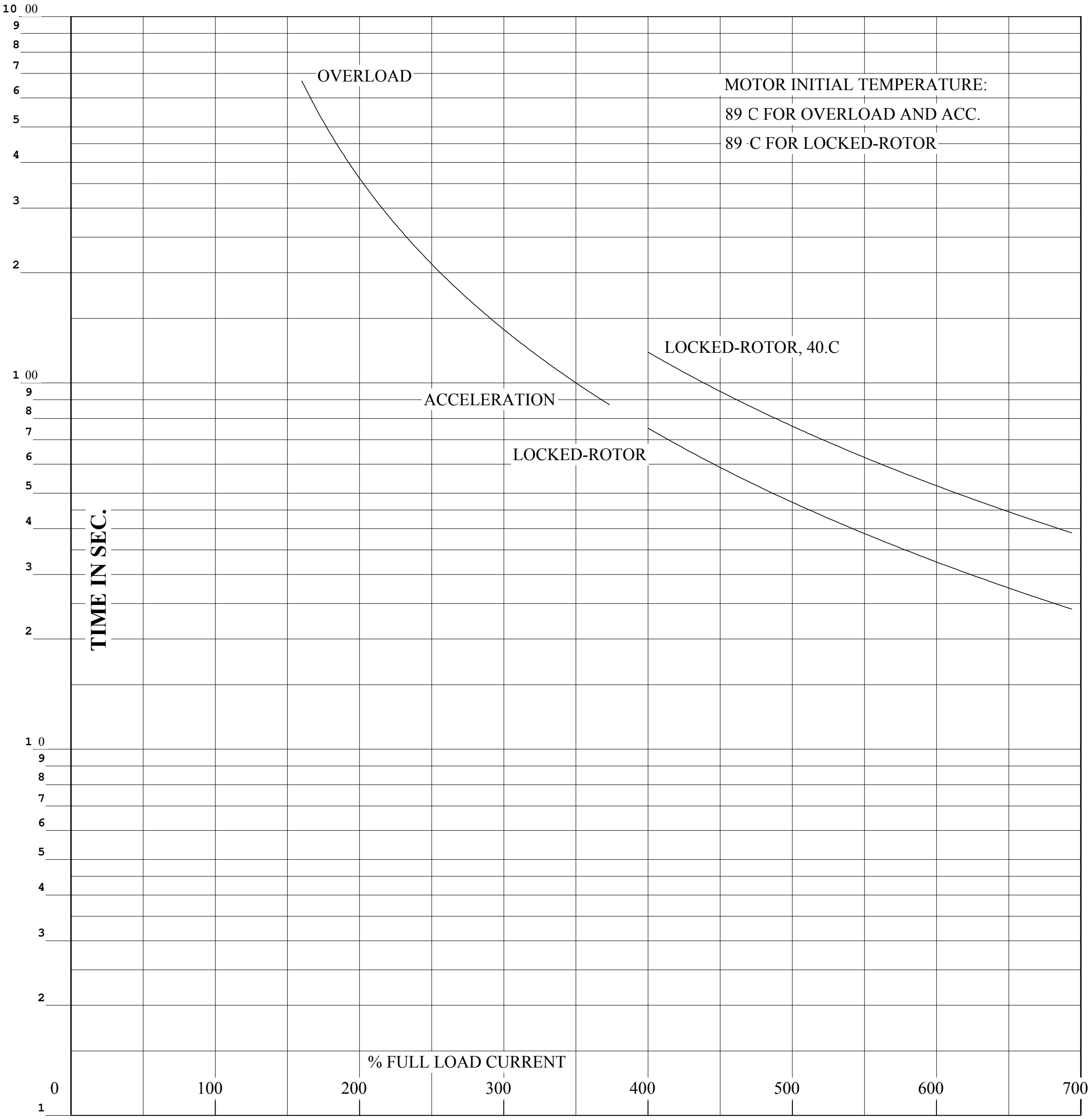
Printed on 1/7/11 11:40 @ psecs-motoreng

REL. S.O.
FRAME 405T
HP 100
TYPE P
PHASE/HERTZ 3/60

RPM 1780
VOLTS 230/460
AMPS 224/112
DUTY CONT
AMB °C/INSUL 40/F

S.F. 1.00
NEMA DESIGN B
CODE LETTER G
ENCLOSURE XPFC
E/S 596181

ROTOR 418142037AE
TEST S.O. TYPICAL DATA
TEST DATE ---
STATOR RES.@ 25 °C .0141/.0564
OHMS (BETWEEN LINES)



THERMAL LIMIT CURVE

REMARKS: NEMA PREMIUM - 95.4 PCT NOMINAL EFFICIENCY

AMPERES SHOWN FOR 460 VOLT CONNECTION, IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

BALDOR

DR. BY W. L. SMITH
CK. BY J.J.HARRISON
APP. BY W. L. SMITH
DATE 09/01/10

A-C MOTOR
PERFORMANCE
CURVES

A40WG0494-R001
ISSUE DATE 01/07/11

Printed on 1/7/11 11:40 @ psecs-motoren

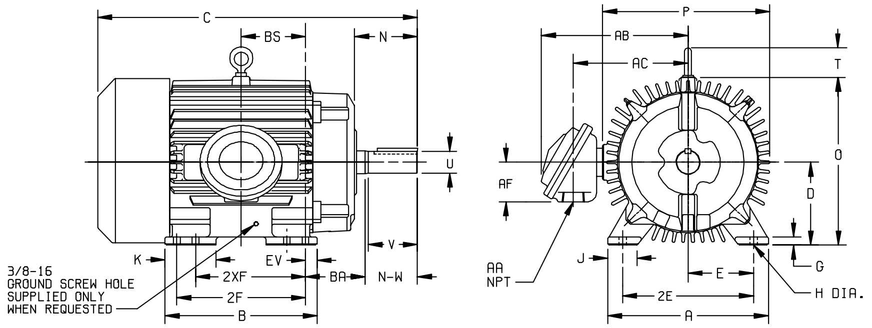
DUTY MASTER ALTERNATING CURRENT MOTORS

SQUIRREL–CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED
UNDERWRITERS LISTED MOTOR
MOUNTING: FOOT

COOLING: FAN COOLED

FRAMES 250T THRU 440T



DIMENSIONS ARE IN INCHES; SEE SHEET 2 FOR DIMENSIONS IN MILLIMETERS

FRAME	A	D(2)	E	G	H	J	K	O	P	T	XP TERMINAL BOX				BA	EV
											AA	AB	AC	AF		
254T–256T	12.50	6.25	5.00	.75	.56	2.50	––	13.25	13.25	2.44	1–1/4	12.38	9.69	3.38	4.25	1.00
284T–286TS	13.75	7.00	5.50	.75	.56	2.50	––	14.75	14.88	2.44	1–1/2	13.25	10.56	3.38	4.75	1.00
324T–326TS	15.50	8.00	6.25	.88	.69	2.75	4.50	16.69	17.00	2.44	2	17.06	12.50	4.25	5.25	1.38
364T–365TS	17.00	9.00	7.00	.88	.69	2.75	4.00	18.50	19.50	2.94	3	18.81	14.25	4.25	5.88	1.38
404T–405TS	19.00	10.00	8.00	1.12	.81	3.25	4.62	21.31	22.50	2.94	3	20.50	15.88	4.25	6.62	1.13
444T–445TS	21.00	11.00	9.00	1.12	.81	3.25	5.25	23.38	25.25	3.25	3	26.25	20.38	6.00	7.50	1.25
(1)																

FRAME SIZE	C	BS	B	2F	(4) 2XF	N	SHAFT AND KEY					WEIGHT LBS. (5)
							N–W(6)	U(3)	V	SQ.	LGTH.	
254T	24.56	5.00	12.00	–––	8.25	4.06	4.00	1.625	3.75	.375	2.88	335
256T	24.56	5.00	12.00	10.00	–––	4.06	4.00	1.625	3.75	.375	2.88	345
284T	27.44	5.50	13.00	–––	9.50	4.69	4.62	1.875	4.38	.500	3.25	495
284TS	26.06	5.50	13.00	–––	9.50	3.31	3.25	1.625	3.00	.375	1.88	495
286T	27.44	5.50	13.00	11.00	–––	4.69	4.62	1.875	4.38	.500	3.25	510
286TS	26.06	5.50	13.00	11.00	–––	3.31	3.25	1.625	3.00	.375	1.88	510
324T	30.44	6.00	14.75	–––	10.50	5.62	5.25	2.125	5.00	.500	3.88	610
324TS	28.94	6.00	14.75	–––	10.50	4.12	3.75	1.875	3.50	.500	2.00	610
326T	30.44	6.00	14.75	12.00	–––	5.62	5.25	2.125	5.00	.500	3.88	650
326TS	28.94	6.00	14.75	12.00	–––	4.12	3.75	1.875	3.50	.500	2.00	650
364T	33.44	6.12	15.00	–––	11.25	6.00	5.88	2.375	5.62	.625	4.25	910
364TS	31.31	6.12	15.00	–––	11.25	3.88	3.75	1.875	3.50	.500	2.00	904
365T	33.44	6.12	15.00	12.25	–––	6.00	5.88	2.375	5.62	.625	4.25	950
365TS	31.31	6.12	15.00	12.25	–––	3.88	3.75	1.875	3.50	.500	2.00	944
404T	38.31	6.88	16.00	–––	12.25	7.50	7.25	2.875	7.00	.750	5.62	1300
404TS	35.31	6.88	16.00	–––	12.25	4.50	4.25	2.125	4.00	.500	2.75	1291
405T	38.31	6.88	16.00	13.75	–––	7.50	7.25	2.875	7.00	.750	5.62	1335
405TS	35.31	6.88	16.00	13.75	–––	4.50	4.25	2.125	4.00	.500	2.75	1326
444T	44.62	8.25	19.00	–––	14.50	8.94	8.50	3.375	8.25	.875	6.88	1770
444TS	40.88	8.25	19.00	–––	14.50	5.19	4.75	2.375	4.50	.625	3.00	1754
445T	44.62	8.25	19.00	16.50	–––	8.94	8.50	3.375	8.25	.875	6.88	1960
445TS	40.88	8.25	19.00	16.50	–––	5.19	4.75	2.375	4.50	.625	3.00	1944
(1)												

(1) SPECIAL DIMENSIONS APPLYING TO THIS ORDER ON THIS LINE.

(2) "D" VARIES
- 250T – 320T +.00, –.03.
- 360T – 440T +.00, –.06.

(3) "U" VARIES
- UP TO 1.625 DIA. +.0000, –.0005
- 1.625 AND LARGER +.000, –.001.

(4) ALL FRAMES HAVE EIGHT MOUNTING HOLES FOR DUAL MOUNTING.

(5) MOTOR WEIGHTS MAY VARY BY 15% DEPENDING UPON RATING.

(6) "N–W" VARIES +.00, –.25.

CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F–2,W–1, W–4,W–5,W–7, OR C–1 MOUNTING IS SPECIFIED.

IF MOUNTING CLEARANCE DETAILS ARE REQUIRED, CONSULT FACTORY.

MAXIMUM PERMISSIBLE SHAFT RUNOUT WHEN MEASURED AT END OF STD. SHAFT EXTENSION IS .002 T.I.R. UP TO AND INCLUDING 1.625 DIA. AND .003 T.I.R. 1.625 DIA. TO 5 INCH DIA.

FRAME–__________ TYPE–__________ CERTIFIED FOR–__________
ORDER–__________ ITEM–__________ HP–__________ RPM–__________ PH–__________ HZ __________VOLTS__________
SALES ORDER–__________ APPROVED BY–__________ DATE __________

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

REV. DESC: ASSIGNED TO BUSLOAD
REV. LTR: A
VERSION: 01
TDR: 000000467918
FILE: \RAG\00006\851
REVISED: 13:58:48 06/17/2008
BY: RAGRXH
MTL: –

Baldor • Dodge • Reliance

DIM SHT FCXP FT 250–440T
SH 1 of 1

611742-001-SH2

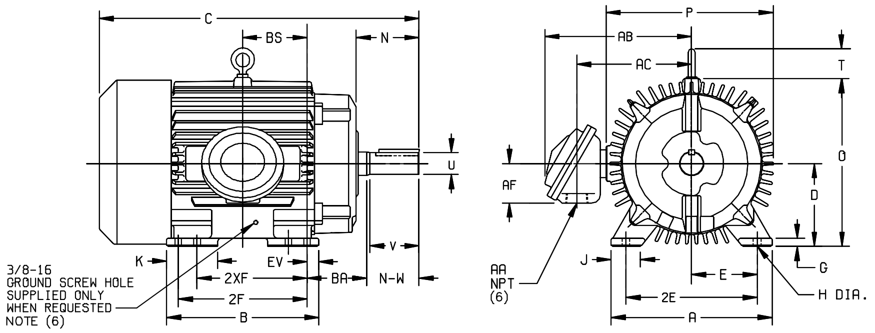
DUTY MASTER ALTERNATING CURRENT MOTORS

SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED
UNDERWRITERS LISTED MOTOR
MOUNTING: FOOT

COOLING: FAN COOLED

FRAMES 250T THRU 440T



DIMENSIONS ARE IN MILLIMETERS; SEE SHEET 1 FOR DIMENSIONS IN INCHES

FRAME	A	D(2)	E	G	H	J	K	O	P	T	XP TERMINAL BOX AA(6)	AB	AC	AF	BA	EV
254T–256T	317.5	158.7	127.0	19.0	14.2	63.5	---	336.5	336.5	62.0	1–1/4	314.5	246.1	85.9	108.0	25.4
284T–286TS	349.2	177.8	139.7	19.0	14.2	63.5	---	374.6	377.9	62.0	1–1/2	336.5	268.2	85.9	120.7	25.4
324T–326TS	393.7	203.2	158.7	22.4	17.5	69.9	114.3	423.9	431.8	62.0	2	433.3	317.5	108.0	133.4	35.1
364T–365TS	431.8	228.6	177.8	22.4	17.5	69.9	101.6	469.9	495.3	74.7	3	477.8	361.9	108.0	149.4	35.1
404T–405TS	482.6	254.0	203.2	28.4	20.6	82.5	117.3	541.3	571.5	74.7	3	520.7	403.4	108.0	168.1	28.7
444T–445TS	533.4	279.4	228.6	28.4	20.6	82.5	133.3	593.9	641.3	82.5	3	666.7	517.7	152.4	190.5	31.7
(1)																

FRAME SIZE	C	BS	B	2F	(4) 2XF	N	SHAFT AND KEY N–W(7)	U(3)	V	SQ.	LGTH.	WEIGHT KGS. (5)
254T	623.8	127.0	304.8	---	209.6	103.1	101.6	41.28	95.3	9.53	73.2	152
256T	623.8	127.0	304.8	254.0	---	103.1	101.6	41.28	95.3	9.53	73.2	156
284T	697.0	139.7	330.2	---	241.3	119.1	117.3	47.63	111.3	12.70	82.6	225
284TS	661.9	139.7	330.2	---	241.3	84.1	82.6	41.28	76.2	9.53	47.8	225
286T	697.0	139.7	330.2	279.4	---	119.1	117.3	47.63	111.3	12.70	82.6	231
286TS	661.9	139.7	330.2	279.4	---	84.1	82.6	41.28	76.2	9.53	47.8	231
324T	773.2	152.4	374.7	---	266.7	142.7	133.4	53.98	127.0	12.70	98.6	277
324TS	735.1	152.4	374.7	---	266.7	104.6	95.3	47.63	88.9	12.70	50.8	277
326T	773.2	152.4	374.7	304.8	---	142.7	133.4	53.98	127.0	12.70	98.6	295
326TS	735.1	152.4	374.7	304.8	---	104.6	95.3	47.63	88.9	12.70	50.8	295
364T	849.4	155.4	381.0	---	285.7	152.4	149.4	60.33	142.7	15.88	108.0	412
364TS	795.3	155.4	381.0	---	285.7	98.6	95.3	47.63	88.9	12.70	50.8	410
365T	849.4	155.4	381.0	311.1	---	152.4	149.4	60.33	142.7	15.88	108.0	430
365TS	795.3	155.4	381.0	311.1	---	98.6	95.3	47.63	88.9	12.70	50.8	428
404T	973.1	174.8	406.4	---	311.1	190.5	184.1	73.02	177.8	19.05	142.7	589
404TS	896.9	174.8	406.4	---	311.1	114.3	108.0	53.97	101.6	12.70	69.9	585
405T	973.1	174.8	406.4	349.2	---	190.5	184.1	73.02	177.8	19.05	142.7	605
405TS	896.9	174.8	406.4	349.2	---	114.3	108.0	53.97	101.6	12.70	69.9	601
444T	1133.3	209.6	482.6	---	368.3	227.1	215.9	85.72	209.6	22.22	174.8	802
444TS	1038.4	209.6	482.6	---	368.3	131.8	120.7	60.33	114.3	15.88	76.2	795
445T	1133.3	209.6	482.6	419.1	---	227.1	215.9	85.72	209.6	22.22	174.8	889
445TS	1038.4	209.6	482.6	419.1	---	131.8	120.7	60.33	114.3	15.88	76.2	881
(1)												

(1) SPECIAL DIMENSIONS APPLYING TO THIS ORDER ON THIS LINE.

(2) "D" VARIES
- 250T – 440T +.0, –.8
- 360T – 440T +.0, –1.5

(3) "U" VARIES
- UP TO 41.27 DIA. +.000, –.013
- 41.27 AND LARGER +.00, –.03

(4) ALL FRAMES HAVE EIGHT MOUNTING HOLES FOR DUAL MOUNTING.

(5) MOTOR WEIGHTS MAY VARY BY 15% DEPENDING UPON RATING.

(6) DIMENSIONS ARE IN INCHES.

(7) "N–W" VARIES +.0, –6.4

CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F–2,W–1, W–4,W–5,W–7, OR C–1 MOUNTING IS SPECIFIED.

IF MOUNTING CLEARANCE DETAILS ARE REQUIRED, CONSULT FACTORY.

MAXIMUM PERMISSIBLE SHAFT RUNOUT WHEN MEASURED AT END OF STD. SHAFT EXTENSION IS .05 T.I.R. UP TO AND INCLUDING 41.27 DIA. AND .08 T.I.R. 41.27 DIA. TO 127 MILL. DIA.

FRAME–__________ TYPE–__________ CERTIFIED FOR–__________
ORDER–__________ ITEM–__________ HP–__________ RPM–__________ PH–__________ HZ __________VOLTS__________
SALES ORDER–__________ APPROVED BY–__________DATE __________

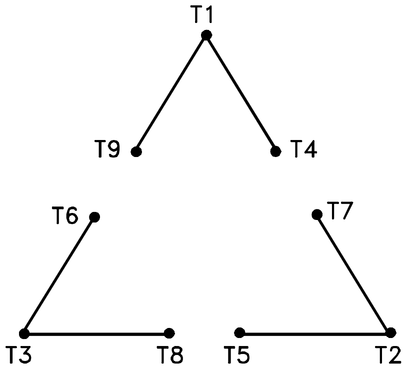
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

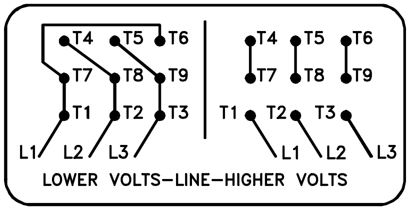
REV. DESC: ASSIGNED TO BUSLOAD			**Baldor • Dodge • Reliance**
REV. LTR: A	VERSION: 01	TDR: 000000467918	
FILE: \RAG\00006\852	REVISED: 14:00:05 06/17/2008	BY: RAGRXH	DIM SHT FCXP FT 250–440T
MTL: –			SH 1 of 1

611742–001–SH2

416820–002

A–C MOTOR
CONNECTION DIAGRAM
STANDARD 9 LEAD DELTA–CONNECTED





(N.P. 1575–B)

416820–002

REV. DESC: LOADED TO BUS, C/R 335225			BALDOR
REV. LTR: –	VERSION: 00	TDR: 000000538207	
FILE: \MGA\00000\661		REVISED: 10:47:51 04/30/2010	CONN DIAG – STANDARD 9 LEAD, DELTA–CONNECTED
MTL: –		BY: RAGRA	SH 1 of 1

Marketing maintained PDF of MN408:

http://www.baldor.com/support/Literature/Load.ashx/MN408?ManNumber=MN408

Marketing maintained PDF of MN416:

http://www.baldor.com/support/Literature/Load.ashx/MN416?ManNumber=MN416

cincinnati fan
OEM and Industrial Air Handling Specialist

FAN SELECTION
And
SPECIFICATIONS

Your Cincinnati Fan Representative:
Lisa Rich
Air Systems

Phone
Fax

Tuesday, January 20, 2015

Job Name: Clean Harbors
Reference: 25,000 CFM @ 15" Quote: 284391

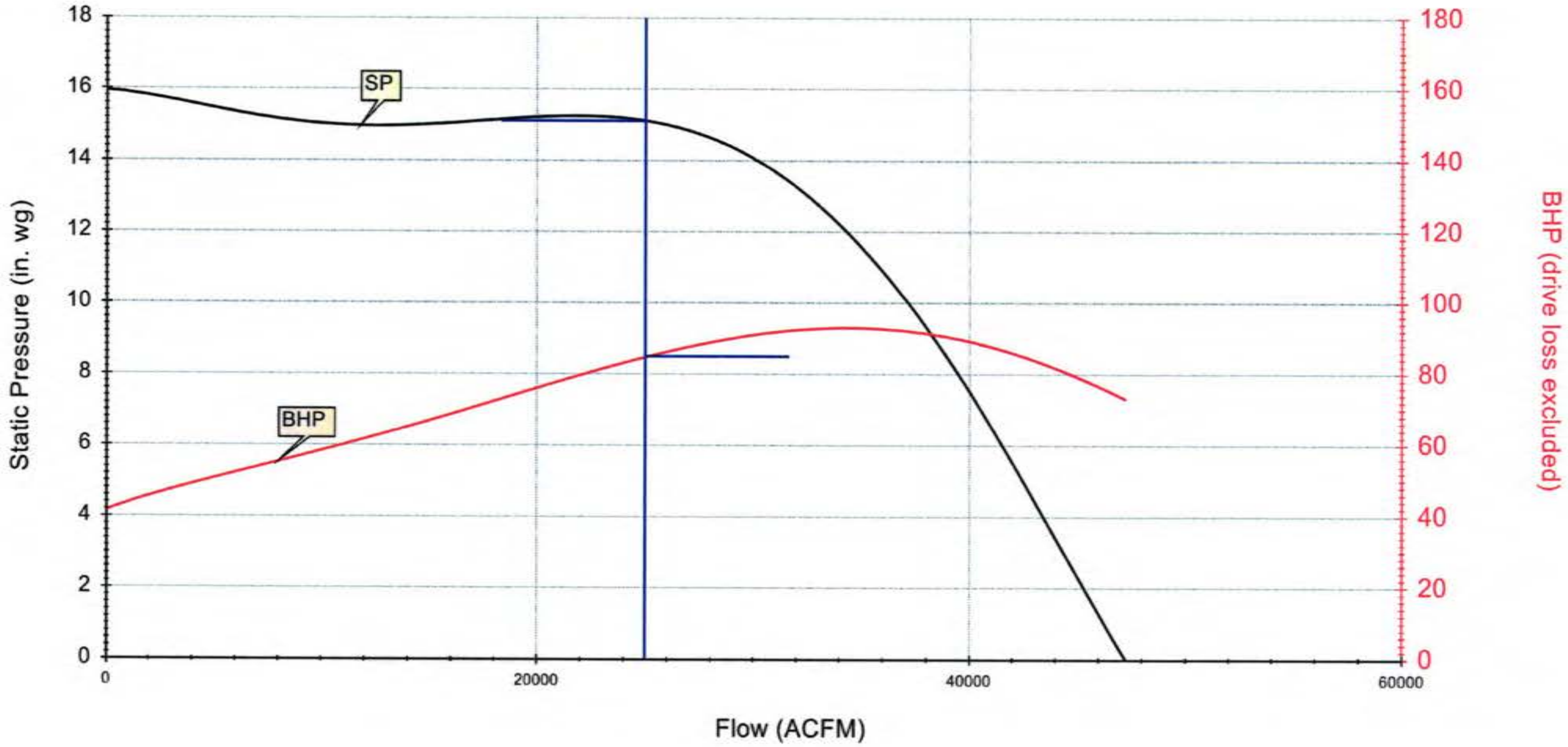
Operating Requirements

Volume, ACFM	25,000
Static Pressure, in. wg	15.0
Density, lb./ft.³	0.075
Operating Temperature, °F	70
AMCA Arrangement No.	4
Motor Frequency, Hz	60
Start-Up Temperature, °F	70

Fan Selection and Specifications

Model	HDBI-360
Fan RPM	1,780
Suggested Motor RPM	1,780
Actual Flow, ACFM	25,091
Actual SP, in. wg	15.1098
Percentage of Peak SP	99.2%
Wheel Description	HD Backward Inclined
Wheel Width, %	100%
Wheel Diameter, in.	36.00
Number of Blades	9
WR², lb. - ft.²	
Tip Speed, ft./min.	16,776
Inlet Diameter, in.	40.00
Inlet Area, ft.²	8.62
Outlet Dimensions	40.25 X 27.25 in. rect.
Outlet Area, ft.²	7.62
Outlet Velocity, ft./min.	3,294
Fan BHP	84.9
Suggested Motor HP	100.0
Static Efficiency, %	70.2%
Cold Start BHP	84.9
Construction Class	Class IV
Maximum Wheel RPM	1,950
Maximum Shaft RPM	N/A

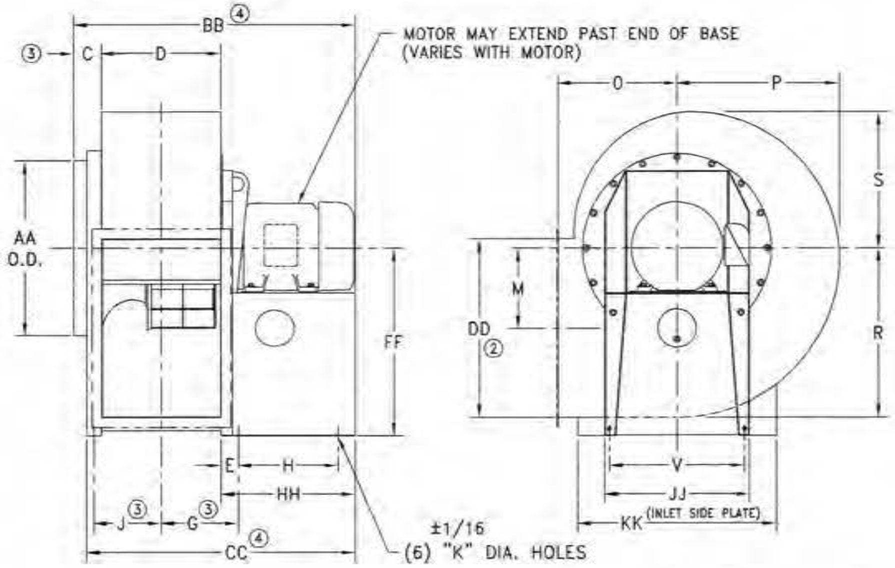
Cincinnati Fan HDBI-360 HD Backward Inclined Wheel (Full Width) @ 1,780 RPM
Rating Point: 25,000 ACFM @ 15.0 in. wg SP, 0.075 lb./ft.³ Density, 84.9 BHP



A HD4

	SIZE	MOTOR FRAME	E	③ G	H	④ BB	④ CC	HH	WEIGHT ⊕		
									SM.	LG.	EX. LG.
	-120	143T-184T	3	7 11/16	5 1/2	24 15/16	22 15/16	11 1/2	130		
	-130	143T-215T		8 3/16	7 5/8	28 1/16	26 1/16	13 5/8	160		
	-150	SM. 143T-215T		8 11/16	7 5/8	29 1/16	27 1/16	13 5/8	190	210	
		LG. 254T-256T			16	37 7/16	35 7/16	22			
	-160	SM. 143T-184T		9 1/4	7 5/8	30 3/16	28 3/16	13 5/8	220	240	
		LG. 213T-256T			17	39 9/16	37 9/16	23			
	-180	SM. 143T-215T		9 15/16	8 3/8	32 5/16	30 5/16	14 3/8	280	315	320
		LG. 254T-286T			18 1/2	42 7/16	40 7/16	24 1/2			
		EX. LG. 324T-326T			21	44 15/16	42 15/16	27			
	-200	SM. 182T-256T		10 5/8	11 1/2	36 13/16	34 13/16	17 1/2	350	385	390
		LG. 284T-286T			18 1/2	43 13/16	41 13/16	24 1/2			
		EX. LG. 324T-326T			21	46 5/16	44 5/16	27			
	-220	SM. 182T-256T		11 7/16	11 1/2	38 7/16	36 7/16	17 1/2	390	450	
		LG. 284T-326T			21	47 15/16	45 15/16	27			
	-240	SM. 213T-256T		12 5/16	11 1/2	42 1/8	38 1/8	17 1/2	490	560	
		LG. 284T-326T			21	51 5/8	47 5/8	27			
	-270	SM. 213T-256T		13 1/4	11 1/2	44	40	17 1/2	610	690	
		LG. 284T-326T			21	53 1/2	49 1/2	27			
	-300	SM. 213T-256T		14 3/8	11 1/2	46 5/16	42 5/16	17 1/2	740	850	
		LG. 284T-326T			21	55 13/16	51 13/16	27			
	-330	SM. 284T-326T	3 1/2	15 15/16	20	55 1/8	54 15/16	27	1100	1160	1190
		LG. 364T-405T			25	60 1/8	59 15/16	32			
		EX. LG. 444T			29	64 1/8	63 15/16	36			
	-360	SM 284T-326T		17 1/8	20	57 1/2	57 5/16	27	1215	1365	1410
		LG. 364T-405T			25	62 1/2	62 5/16	32			
		EX. LG. 444T			29	66 1/2	66 5/16	36			

⊕ WEIGHT DOES NOT INCLUDE MOTOR OR OPTIONS.



CLOCKWISE BOTTOM HORIZONTAL
DISCHARGE SHOWN ABOVE

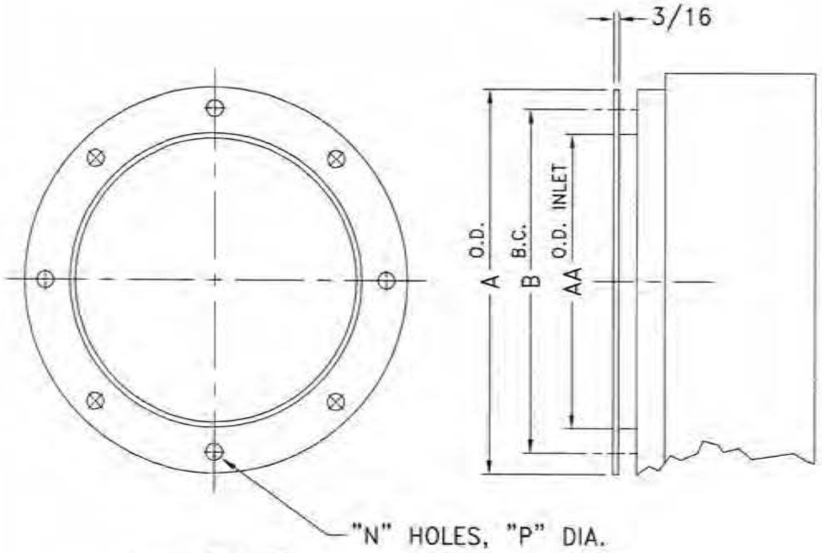
	SIZE	③ C	D	③ J	K	M	O	P	R	S	V	AA	DD	FF	JJ	KK
	-120	4 1/16	9 3/8	5 3/4	9/16	6 3/16	9 15/16	12 3/8	13	10 3/8	14	13 1/4	13 3/4	15 1/2	16	
	-130	4 1/16	10 3/8	6 1/4	9/16	6 13/16	10 13/16	13 3/4	14 7/16	11 9/16	15 3/4	14 5/8	15 1/4	16 5/8	17 3/4	
	-150	4 1/16	11 3/8	6 3/4	9/16	7 9/16	11 3/4	15 3/16	15 15/16	12 3/4	17 1/4	16 1/8	16 13/16	18 1/8	19 1/4	
	-160	4 1/16	12 1/2	7 5/16	9/16	8 5/16	12 11/16	16 11/16	17 1/2	14	19 1/8	18	18 7/16	19 3/4	21 1/8	
	-180	4 1/16	13 7/8	8	9/16	9 1/4	13 13/16	18 7/16	19 7/16	15 1/2	21 1/2	20	20 3/8	22 3/4	23 1/2	
	-200	4 1/16	15 1/4	8 11/16	9/16	10 1/16	14 15/16	20 1/4	21 1/4	17	23 1/2	22	22 3/8	23 1/2	25 1/2	
	-220	4 1/16	16 7/8	9 1/2	9/16	11 3/16	16 3/8	22 1/2	23 5/8	18 7/8	26 1/8	24 5/8	24 7/8	26 1/4	28 1/8	
	-240	6 1/16	18 9/16	10 3/8	9/16	12 5/16	18 13/16	24 3/4	26	20 3/4	28 1/4	27	27 3/8	28 1/2	30 3/4	
	-270	6 1/16	20 7/16	11 5/16	9/16	13 9/16	20 5/8	27 1/4	28 5/8	22 7/8	31	30	30 1/16	31 1/4	33 3/4	
	-300	6 1/16	22 3/4	12 7/16	9/16	15 1/8	22 5/8	30 3/8	31 7/8	25 1/2	34 1/4	33 1/2	33 9/16	34 1/2	37 1/4	
	-330	3 1/4	24 7/8	14 1/2	3/4	16 9/16	24 11/16	33 3/8	35	28	28	36 3/4	36 7/8	38 3/4	30	41 3/4
	-360	3 1/4	27 1/4	15 11/16	3/4	18 1/8	27 3/16	36 1/2	38 1/4	30 1/2	31	40	40 1/4	42	33	45

NOTES:

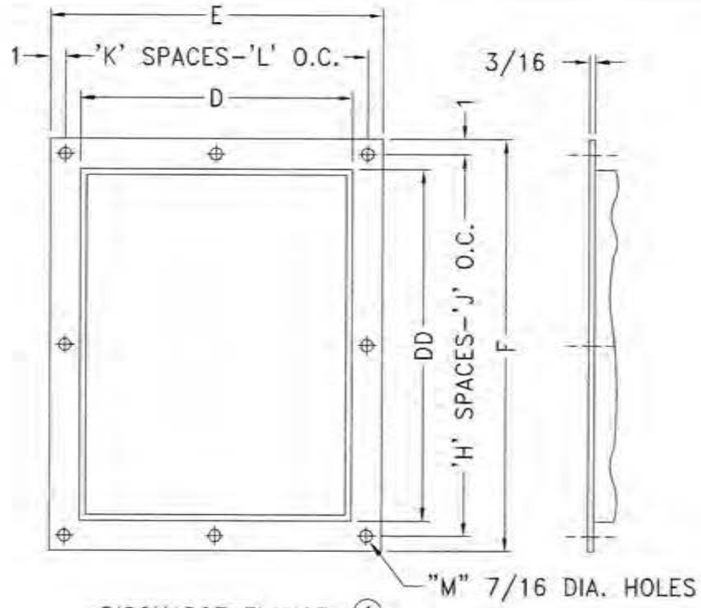
1. MODELS HDBI/HDAF-120 THRU -300 ROTATABLE IN 45° INCREMENTS. HDBI/HDAF-330 & 360-FAN HOUSING IS FIXED.
2. DISCHARGE FLANGE IS STANDARD ON MODELS 270 THRU 360.
3. ADD 1/8" FOR AMCA "C" CONSTRUCTION FANS AND/OR DOWNBLAST DISCHARGE POSITION.
4. ADD 1/4" FOR AMCA "C" CONSTRUCTION FANS AND/OR DOWNBLAST DISCHARGE POSITION.
5. HDBI/HDAF-330 & 360-DOWNBLAST DISCHARGE ORIENTATION NOT AVAILABLE.

cincinnati fan 7697 SNIDER ROAD MASON, OHIO 45040	TOLERANCES: ANGLES: ± 1° FRACTIONS ±1/8	ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED	SUPERSEDES:	CERTIFIED DRAWING	TITLE HDBI/HDAF ARR. 4	A	DRAWING NO. HD4	REV. 1

A 27205



INLET FLANGE



DISCHARGE FLANGE ①

	INLET					DISCHARGE								
SIZE	A O.D.	B B.C.	N	AA DIA.	P	D	E	F	H	J	K	L	M	DD
120	16	14-3/8	8	13-1/4	7/16	9-3/8	13-3/8	17-11/16	2	7-27/32	2	5-11/16	8	13-3/4
130	17-3/4	15-15/16	8	14-5/8	7/16	10-3/8	14-3/8	19-3/16	2	8-19/32	2	6-3/16	8	15-1/4
150	19-1/4	17-1/2	8	16-1/8	7/16	11-3/8	15-3/8	20-3/4	3	6-1/4	2	6-11/16	10	16-13/16
160	21-1/8	19-3/8	8	18	7/16	12-1/2	16-1/2	22-7/16	3	6-13/16	2	7-1/4	10	18-7/16
180	23-1/2	21-1/2	12	20	7/16	13-7/8	17-7/8	24-1/2	3	7-1/2	2	7-15/16	10	20-3/8
200	25-1/2	23-1/2	12	22	7/16	15-1/4	19-1/4	26-3/8	3	8-1/8	3	5-3/4	12	22-3/8
220	28-1/8	26-1/8	12	24-5/8	7/16	16-7/8	20-15/16	28-7/8	4	6-23/32	3	6-5/16	14	24-7/8
240	30-3/4	28-3/4	16	27	7/16	18-9/16	22-5/8	31-3/8	4	7-11/32	3	6-7/8	14	27-3/8
270	33-3/4	31-5/8	16	30	7/16	20-7/16	24-1/2	34-1/8	4	8-1/32	3	7-1/2	14	30-1/16
300	37-1/4	35-1/4	16	33-1/2	7/16	22-3/4	26-3/4	37-5/8	5	7-1/8	3	8-1/4	16	33-9/16
330	40-3/8	38-3/4	16	36-3/4	1/2	24-7/8	28-7/8	40-7/8	7	5-9/16	5	5-3/8	24	36-3/4
360	43-5/8	42	16	40	1/2	27-1/4	31-1/4	44-1/4	7	6-1/32	5	5-27/32	24	40-1/4

NOTE:

① NOT AVAILABLE ON ANY MODEL FOR DOWNBLAST, BOTTOM ANGULAR DOWN OR TOP ANGULAR DOWN DISCHARGE POSITIONS. DISCHARGE FLANGE IS STANDARD ON SIZES -270 THRU -360.

cincinnati fan
7697 SNIDER ROAD MASON, OHIO 45040

TOLERANCES:
ANGLES: ± 1°
FRACTIONS ±1/8
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

SUPERSEDES:

CERTIFIED DRAWING

TITLE
HDBI/HDAF INLET AND DISCHARGE FLANGES

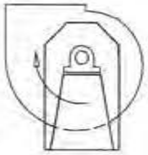
A

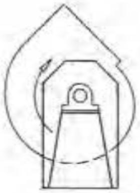
DRAWING NO.
27205

REV.
12

A ROTATION–DISCHARGE

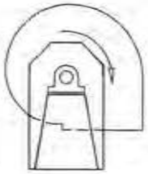
CLOCKWISE ROTATION

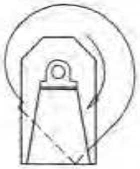

CLOCKWISE
UP BLAST

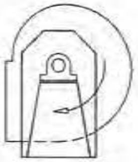

CLOCKWISE
TOP ANGULAR UP

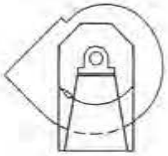

CLOCKWISE
TOP HORIZONTAL


CLOCKWISE
TOP ANGULAR DOWN

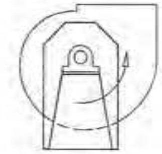

CLOCKWISE
DOWN BLAST

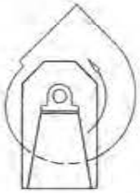

CLOCKWISE
BOTTOM ANGULAR DOWN

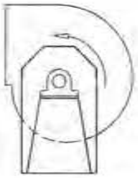

CLOCKWISE
BOTTOM HORIZONTAL


CLOCKWISE
BOTTOM ANGULAR UP

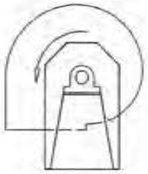
COUNTERCLOCKWISE ROTATION

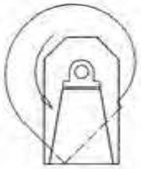

COUNTERCLOCKWISE
UP BLAST

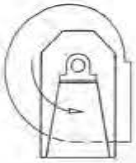

COUNTERCLOCKWISE
TOP ANGULAR UP

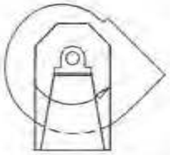

COUNTERCLOCKWISE
TOP HORIZONTAL


COUNTERCLOCKWISE
TOP ANGULAR DOWN


COUNTERCLOCKWISE
DOWN BLAST


COUNTERCLOCKWISE
BOTTOM ANGULAR DOWN


COUNTERCLOCKWISE
BOTTOM HORIZONTAL


COUNTERCLOCKWISE
BOTTOM ANGULAR UP

NOTES:

1. DIRECTION OF ROTATION IS DETERMINED FROM DRIVE SIDE OF FAN.
2. SAME AS AMCA STANDARD 99-2406-83.

cincinnati fan
7697 SNIDER ROAD MASON, OHIO 45040

TOLERANCES:
ANGLES: ± 1°
FRACTIONS ±1/8

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

SUPERSEDES:

CERTIFIED DRAWING

TITLE DESIGNATION FOR ROTATION AND DISCHARGE OF CENTRIFUGAL FANS

A

DRAWING NO. ROTATION–DISCHARGE

REV.

Temporary Structure Ventilation & Odor Mitigation

Odor, gas, contaminant vapor concentrations and working conditions will be managed at the IB, ET-10, and ET-18 to ensure worker safety and control of nuisance odors.

Air pressure inside the IB temporary structure must be maintained at a pressure lower than the ambient atmosphere. This will promote capture and treatment of odors, gases, and vapors (OGVs) released during sludge solidification and loading. This will also remove internal combustion engine exhaust gases.

The OGVs within the temporary building (TB) will fluctuate in composition and concentration due to the varying contaminants and characteristics of the sludge and water. Clean Harbors anticipates these differences will trigger a change in the treatment parameters. CHES evaluated this situation and developed several control and mitigation methods.

Odor, Gas, and Vapor Evolution

Odors, gases, and contaminant vapors will be released to the TB atmosphere during two scenarios. Each scenario will require different control measures.

1. Undisturbed Work Site – These conditions are present at the site currently and will persist until water and sludge treatment, mixing, and removal begin.
2. Disturbed Work Site– These conditions will be created during water and sludge handling, treatment, and removal tasks. OGV composition and release rates will transition as site activities change.

Typical tasks are ranked based on the anticipated rate of OGV release during their execution, from highest to lowest.

1. Sludge Solidification – Dry Cement Kiln Dust or similar material (reagent) will be applied to the exposed surface of sludge after the overlying water has been removed. The reagent will then be mixed with the sludge. OGVs will be released at different rates during these two phases. The reagent will be applied and mixed with the sludge at a rate that balances sludge stabilization with odor, gas, and vapor generation. (The order is highest to lowest odor, gas, and sludge release.)
    a. A chemical reaction will occur when the sludge and reagent are mixed. The reaction is exothermic. The maximum temperature observed will depend on the reagent dose and the reaction speed as well as stirring that may allow heat to escape. The combination of physical stirring and elevated temperatures will increase the release of OGVs.
    b. Heat will be generated as the amended sludge cures or solidifies. This heat will enhance the release of OGVs but only from or near the sludge mass surface since the permeability of the amended sludge will decrease, slowing release from deeper within the mass.

2. Sludge Handling – Sludge will be handled during four periods.

    a. Transfer from ET-10 to the IB
    b. Movement prior to the addition of solidification reagents
    c. Movement during and immediately after solidification
    d. Loading of solidified sludge for transport and off-site disposal

3. Water Removal – Except during sludge sampling, water above the surface of the sludge appears to suppress the release of OGVs from the sludge mass surface based on the very low air-borne concentrations observed by CHES at the IB. During sampling the submerged sludge was disturbed and one or more voids created by the sampler allowed horizontal movement followed by rapid, vertical movement of OGVs. Increased air concentrations were readily apparent.

4. Sheet-pile Driving – OGVs may be released during this task. However, the total area/mass of sludge disturbed at any time and the presence of overlying water will minimize the release.

Odor, Gas, and Vapor Management

A focus on health and safety, as well as the working conditions of onsite personnel are important. Standard PPE for site work will be Level D. The following two project requirements apply to the TB and OGV management.

1. The pressure inside the TB must be lower than outside during work. (This condition is assumed to be met for the remainder of this discussion.)
2. Odor levels and concentrations of selected gases and contaminant vapors must be monitored.

If the monitoring shows unacceptable OGV levels or conditions, one or more of the following may be required.

1. Workers upgrade to an acceptable PPE Level.
2. OGV concentration control and reduction. General tasks are listed below in the anticipated order of execution.
    a. Increase in TB ventilation and concurrent OGV capture. One or more ventilation fans will be started or their speed increased. The captured air will be passed through a media bed containing vapor phase, and granular activated carbon, which will adsorb many organic odors, gases, and vapors. (See below)
    b. Direct OGV mitigation, before and during sludge treatment. (See below)
    c. Work rate reduction or stoppage – The former will slow OGV generation; the latter will stop OGV release entirely. Time will be required for concentrations to return to acceptable levels.

Odor, Gas, and Vapor Capture

Estimation of the amount of vapor phase activated carbon needed to capture OGVs was based on:

1. Provided site data. The data did not quantify OGV production or release rates, concentration or mass of odor compounds, or gases in the sludge.

2. Field test observations and results. The evaluated field test reagent doses needed to solidify sludge samples and the permanganate dose needed to destroy dissolved volatile organic compounds and gases.

Table 2 of Item D of the provided information contained relevant data. Twenty-three sludge samples were collected from points in the IB, usually at two depths. There was no raw sludge analysis from ET-10. The following VOC compounds were reported.

Compounds	Detections	Average per Detection
Benzene	8	36.11 ppm
Carbon tetrachloride	1	14 ppm
Chloroform	1	2.1 ppm
Methyl ethyl ketone	3	220.28 ppm
Methylene chloride	5	460.32 ppm
Cyanide (total)	10	3.3 ppm
1,1 – Biphenyl	21	448.1 ppm
Dibenzofuran	2	4.205 ppm
Naphthalene	3	15.0 ppm
Toluene	23	10,634,826 ppb
All VOCs		**11,838 ppm**

- Concentration based on dry weight

The concentration of hazardous air pollutants (HAPs) in the IB sludge samples is 1.18% (weight/dry weight sludge). Toluene was approximately 90% of the VOCs reported. If a total of 3,957 tons of wet sludge or 725 tons of dry sludge is present at the IB and minimal VOCs are present at ET-10, the total mass of VOCs in the sludge would be 8.6 tons (7.7 tons of toluene).

Depending on the rate and effect of various activities at the site, e.g., water removal, sludge handling, sludge solidification, loading, etc., the VOCs will partition into one or more phases.

1. Dissolved in the water
2. Volatized into the air
3. Incorporated into the solidified sludge

It is difficult to determine the amount of HAPs that would volatilize into the air, nonetheless, a series of calculations can be made.

Both dissolved and vapor phase toluene will be controlled via adsorption onto activated carbon. Toluene will capture at levels from 25-50% on both liquid and vapor phase carbon depending on its concentration in the media and contact time. If the entire 7.7 tons were absorbed onto carbon at the loading rates below the carbon consumed are also below.

- 25% loading would require 30.8 tons (61,600 pounds) of carbon.
- 50% loading would require 15.4 tons (30,800 pounds) of carbon.

This assumes that all the toluene transfers from the sludge to the water or air and is captured by the carbon. This scenario does not consider the destruction of toluene by potassium permanganate (oxidant) mixed into the water for odor treatment (see below).

Odor, Gas, and Vapor Mitigation

OGV mitigation is critical to project progress and success and maintaining a safe work environment. Destruction of OGV compounds before they transfer to the atmosphere, where they are more mobile, would be preferable in most cases. Summarized below are several possible situations and the OGV prevention or mitigation techniques that may be applied.

Pre-treatment –Water in the IB or other structures may be treated with an oxidant before de-watering, handling, or treatment. This treatment will minimize future releases as well as reduce dissolved OGV concentrations in the water and surficial sludges.

Permanganate ions will degrade or destroy chlorinated solvents, toluene, gases such as hydrogen sulfide and cyanide, and other organic molecules, particularly those with double and triple bonds. It typically requires one, two, or three permanganate ions to react with each contaminant molecule. Typical dose masses are 5 to 10 times the estimated mass of susceptible organics present. This stoichiometric imbalance is needed because permanganate ions will also react with naturally occurring, inorganic substances.

The reagent used will be either potassium permanganate or sodium permanganate. (The choice will depend on solution preparation and handling, required oxidant strength and volume, and health & safety.)

Treatment – Water being treated or waiting for treatment may release unacceptable levels of OGVs from the surface. Several methods may be used to control or eliminate OGVs.

1. An oxidant containing permanganate ions will oxidize dissolved organics and gases in water, either in place in the IB or a tank, or as it is pumped and processed.
2. A permanganate solution can be sprayed onto the non-hazardous sludge mass surface before and as the sludge is solidified to control odors. The oxidant solution will destroy/transform dissolved organics and inorganics and raise the oxidation-reduction potential (ORP) of the media to a positive value. The creation of oxidizing positive ORP conditions may trigger destruction of reduced nuisance OGVs through natural reactions. The oxidant may also react with OGVs and organic contaminants adsorbed to organic sludges.
3. Previously submerged material adhered to the walls of the ET-10, or other structures will be exposed as the water or sludge is removed. This material may release associated vapors or gases. In addition, aerobic bacteria may biodegrade organic matter on the structure walls and release biogenic gases, which may be a nuisance. CHES will be prepared to wash the sides of a structure with limited amounts of previously treated site water, or to spray a dilute sodium or potassium permanganate solution on the walls to destroy susceptible organics

Control - Additional methods, such as deployment of reinforced plastic sheeting or foam to physically restrict mixing of OGVs with the overlying air, may be deployed.

Calculation of Total Mass of Hazardous Air Pollutants in the IB, Hercules, Hattiesburg, MS

Given:

4431 cubic yards
18.33 % solids
1.06 SW
See concentrations below (presented in ppm, dry weight basis)

Problem:

Calculate the total mass of hazardous air pollutants (HAPs) in the IB sludge

Solution:

Step 1: Determine the the dry weight of sludge in the IB.

4,431 cubic yards sludge (27 cf/cy)
119,637 cubic feet of sludge
7,913,270 lbs of sludge (wet, 62.4 lbs per cf of water, multiply by 1.06 specific weight of sludg 3957 tons wet sludge
6,462,767 lbs of water in sludge (multiply by % water = (100-18.33)/100))
1,450,502 lbs of dry sludge (difference between wet sludge weight and water weight) 725 tons dry sludge
657,948 kgs dry sludge (2.2046 lbs/kg)

Step 2: Calculate tons of individual HAP compounds in sludge based on average of detected concentrations.

Compound	**Benzene**	**Toluene**	**Carbon Tetrachloride**	**Chloroform**	**Methyl Ethyl Keytone**	**Methylene Chloride**	**Cyanide (Total)**	**1,1 Biphenyl**	**Dibenzofuran**	**Naphthalene**
Miligrams of Compound	23,759	6,997,163,947	9,211,270	1,381,691	144,932,755	302,866,560	2,171,228	294,823,304	2,766,671	9,869,218
Kilograms of Compound	23.76	6,997	9.21	1.38	144.93	302.87	2.17	294.82	2.77	9.87
Weight of Compound (lbs)	52.38	15,426	20.31	3.05	319.52	667.71	4.79	649.97	6.10	21.76
Weight of Compound (tons	0.026	7.71	0.01	0.002	0.16	0.33	0.0024	0.32	0.0030	0.011

Step 3: Calculate total tons of HAPs

Total HAPs = 8.6 tons

Conclusion:

No HAP exceeds 10 tons per year (Toluene at 7.71 < 10)
Total of all HAPs does not exceed 25 tons per year (8.6<25)

2010 Total Concentration Data (Hits only, ppm)

Benzene hits	Toluene hits	Carbon tetrachloride	Chloroform	MEK hits	Methylene chloride hits	Total Cyanide	1,1-Biphenyl	Dibenzofuran	Naphthalene
55	160000	14	2.1	180	530	1.7	1100	7.9	8
17	820			480	740	1.3	230	0.51	35
12	9400			0.84	420	6.4	470	4.205	2
55	290			220.28	610	1.2	33		15.0
2.5	640				1.6	6.8	55		
37	6800				460.32	1.6	1000		
110	190					4.1	51		
0.39	2000					1	340		
36.11	13000					5.4	1600		
	150					3.5	360		
	1100					3.3	180		
	9800						940		
	1.1						160		
	980						800		
	14000						290		
	33						140		
	1800						620		
	5900						18		
	70						230		
	2800						760		
	14000						33		
	17						448.10		
	810								
	10635								

Total Average Concentration 11,838 (based on hits only)

Appendix J

Truck Routes

Hercules, Inc.
613 West 7th Street, Hattiesburg, MS 39401

All trucks routes will be verified with our approved waste haulers prior to utilizing their services.

Pine Belt Regional Solid Waste

5274 Highway 29 S
Ovett, MS 39464-3973

From: 613 W 7th St, Hattiesburg, MS 39401-2813 US
To: 5274 Highway 29 S, Ovett, MS 39464-3973 US

DRIVING DIRECTIONS

Start: 613 W 7th St, Hattiesburg, MS 39401-2813 US

---

1. Start out going east on W 7th St toward North Street
2. Turn left onto Main Street
3. Turn right on Glendale (North) travel north for approximately 1.4 miles
4. Turn right on Evelyn Gandy Parkway (MS-42 East)
5. Continue approximately 12.3 miles to Runnelstown
6. Bear left onto MS-29
7. Continue approximately 2.2 miles
8. Turn left into Pine Belt Regional Landfill (5274 HIGHWAY 29 S)

End: 5274 Highway 29 S, Ovett, MS 39464-3973 US

Waste Management

98 Stegall St
Emelle, AL 35459

Start: 613 W 7th St, Hattiesburg, MS 39401-2813 US

---

1. Head **southwest** on **N 38th Ave** toward **W 4th St**	
2. Turn right onto **Hardy St**	0.7 mi
3. Merge onto **I-59 N** via the ramp to **Laurel** **Entering Alabama**	0.2 mi
4. Take exit **8** toward **AL-17 N**	114 mi
5. Turn left onto **AL-17 N**	0.2 mi
6. Turn left onto **Stegall St** **Destination will be on the right**	14.6 mi

---

End: 98 Stegall St, Emelle, AL

Clean Harbors

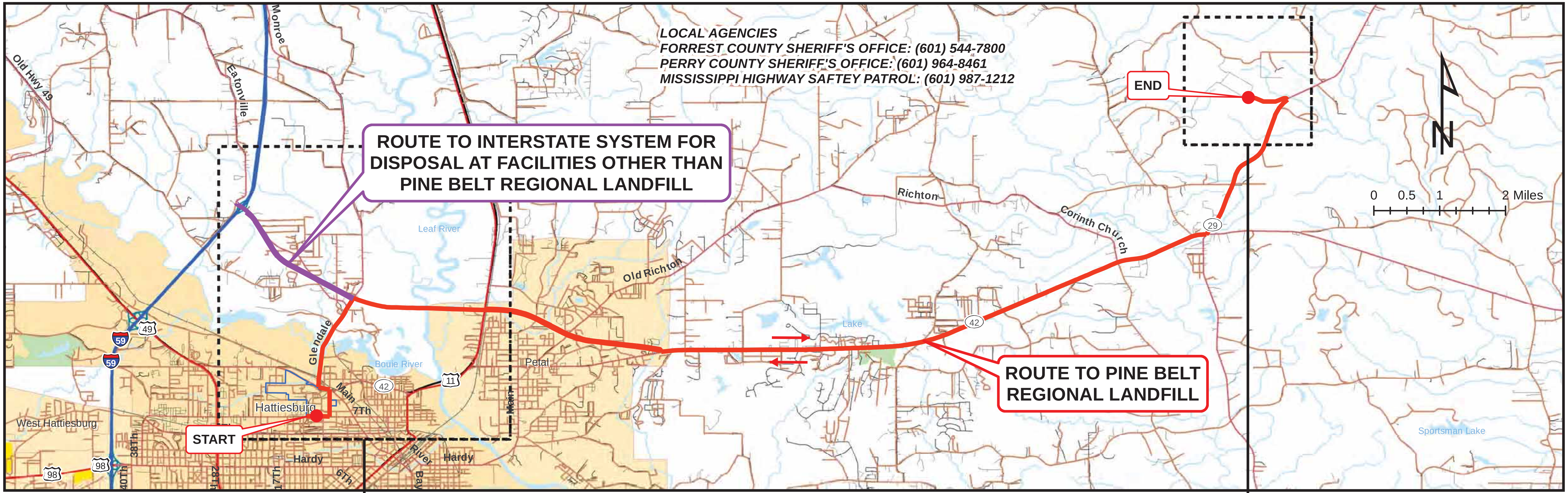
2027 Independence Pkwy
La Porte, TX 77571

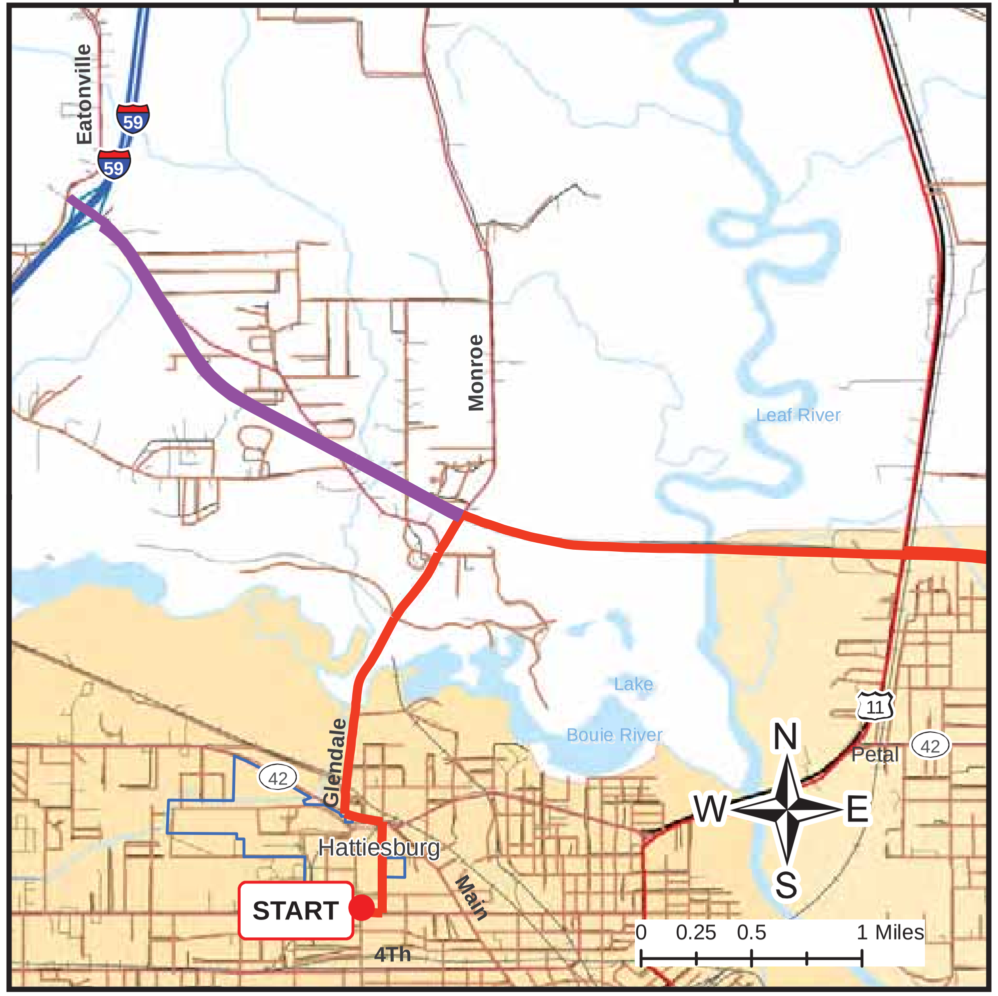
Start: 613 W 7th St, Hattiesburg, MS 39401-2813 US

---

1. Head **southwest** on **N 38th Ave** toward **W 4th St**	
2. Turn right onto **Hardy St**	0.7 mi
3. Turn left to merge onto **I-59 S** **Entering Louisiana**	0.5 mi
4. Take exit **1A** for **I-12 W** toward **Hammond**	76.5 mi
5. **Exit 1A** turns slightly right and becomes **I-12 W**	0.5 mi
6. Merge onto **I-10 W**	85.2 mi
7. Keep left at the fork to stay on **I-10 W**, follow signs for **Interstate 10 W/Lafayette** **Entering Texas**	3.7 mi
8. Keep left at the fork to stay on **I-10 W**	186 mi
9. Take exit **798** toward **Texas 146/San Jacinto Monument Battleship Texas**	51.4 mi
10. Merge onto **E Freeway Service Rd/I-10 Frontage**	0.2 mi
11. Turn left onto **TX-146 S**	0.7 mi
12. Take the **TX-225 W** exit toward **Pasadena/Houston**	13.5 mi
13. Continue onto **TX-225 W**	0.5 mi
14. Take the exit toward **Battleground Rd/East Blvd**	3.1 mi
15. Merge onto **Pasadena Freeway Frontage Rd**	0.2 mi
16. Slight right toward **Independence Pkwy** (signs for **Battleship/Monument**)	0.2 mi
17. Turn right onto **Independence Pkwy**	0.2 mi
18. Turn left onto **Tidal Rd**	1.9 mi

End: 2027 Independence Pkwy, La Porte, TX





HERCULES INCORPORATED HATTIESBURG FACILITY

TRUCK ROUTE

ARCADIS

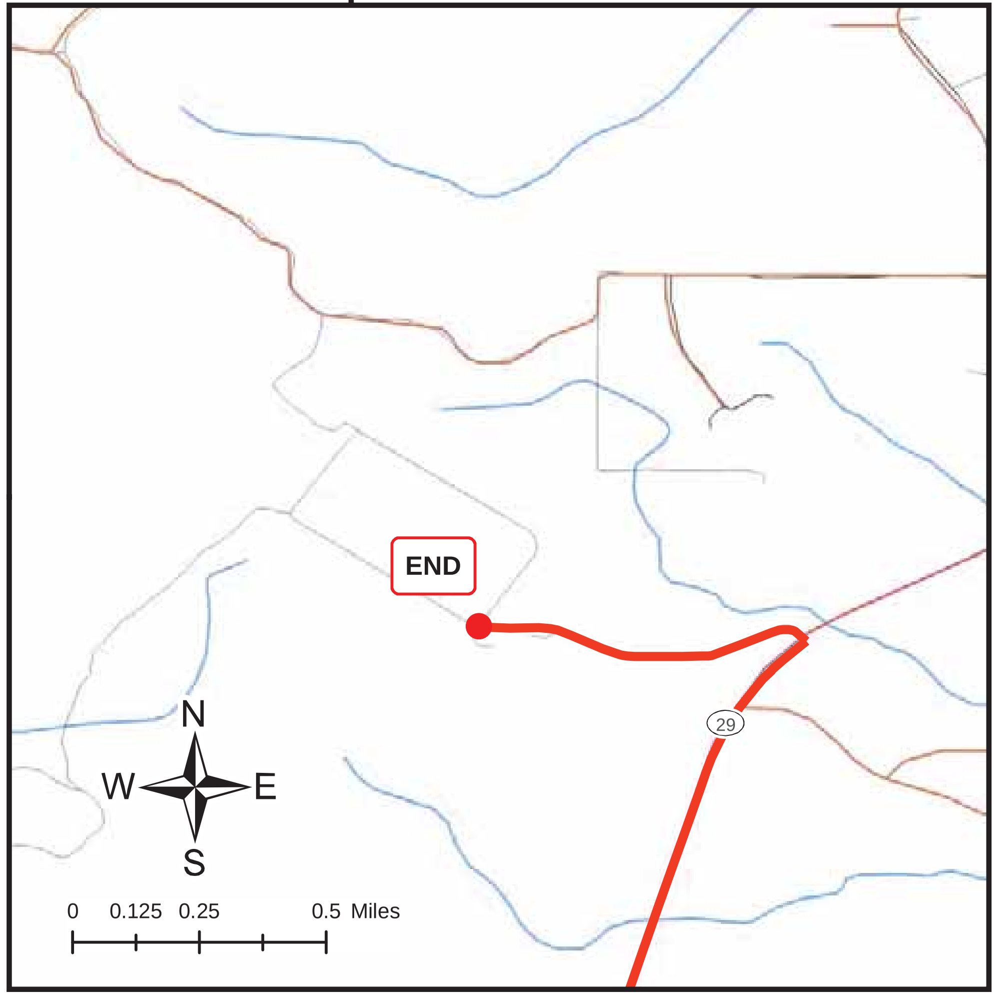
DRIVING DIRECTIONS

FIGURE 1

START: Hercules Facility, 613 W. 7th St., Hattiesburg, MS

DRIVE: 16.12 Miles - About 24 minutes
1. Head East on W. 7th St. to Providence St.
2. Turn left (North) on Providence St.
3. Turn left on North Main (West) to Glendale
4. Turn right on Glendale (North) travel north for approx. 1.4 miles
5. Turn right on to Evelyn Gandy Parkway (MS 42 East)
6. Continue approximately 12.3 miles to Runnelstown
7. Bear left onto MS 29 (Northeast)
8. Contine approximately 2.2 miles
9. Turn left into Pine Belt Regional Landfill

END: Pine Belt Regional Landfill
5274 Highway 29 Ovett, Mississippi 39464



Appendix K

ET-10 and ET-18 Sludge Analytical Data

ET-10 Data

Analytical Data

Client: Hercules Inc.

Job Number: 680-38282-1

Client Sample ID: **HER-SS3-070108**

Lab Sample ID:	680-38282-3		Date Sampled:	07/01/2008 1700
Client Matrix:	Solid		Date Received:	07/03/2008 0852

8260B Volatile Organic Compounds by GC/MS-TCLP

Method:	8260B	Analysis Batch: 680-111100	Instrument ID:	GC/MS Volatiles - A
Preparation:	5030B		Lab File ID:	a0864.d
Dilution:	20	Leachate Batch: 680-110884	Initial Weight/Volume:	5 mL
Date Analyzed:	07/09/2008 1626		Final Weight/Volume:	5 mL
Date Prepared:	07/09/2008 1626			
Date Leached:	07/07/2008 1515			

Analyte	DryWt Corrected: N Result (mg/L)	Qualifier	RL
Benzene	<0.020		0.020
Carbon tetrachloride	<0.020		0.020
Chlorobenzene	<0.020		0.020
Chloroform	<0.020		0.020
1,2-Dichloroethane	<0.020		0.020
1,1-Dichloroethene	<0.020		0.020
2-Butanone (MEK)	<0.20		0.20
Tetrachloroethene	<0.020		0.020
Trichloroethene	<0.020		0.020
Vinyl chloride	<0.020		0.020

Surrogate	%Rec	Acceptance Limits
4-Bromofluorobenzene	93	75 - 120
Dibromofluoromethane	89	75 - 121
Toluene-d8 (Surr)	108	75 - 120

2.0 FIELD ACTIVITIES

Field activities were initiated on July 23, 2009. Unless otherwise stated, field activities were conducted in accordance with applicable protocols of the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EPA Region IV, November, 2001), (EISOPQAM) and the site-specific Health and Safety Plan (Eco-Systems, May 2004).

2.1 SAMPLING

Sampling was conducted following all appropriate safety precautions as described in the above referenced Health and Safety Plan. Sample locations are shown in **Figure 2**. Samples were placed on ice after collection and shipped via FedEx to a contract laboratory. Standard chain-of-custody procedures were observed. Sample results are discussed in Section 3 of this report.

2.1.1 Tank ET-18 Bottom Sludge Sample

One sludge sample was collected from a discharge valve and hose fitted to the lower portion of the tank. The hose was purged for approximately one minute by allowing sludge to flow through to a lift station; then sample containers provided by the contract laboratory were filled. Samples were collected for the following laboratory test procedures: Toxic Characteristic Leaching Procedure (TCLP) volatile and semi-volatile organic compounds (VOC/SVOC) analysis; pesticides and herbicides; arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver (RCRA metals); flash point, pH, cyanide and sulfide content (hazardous waste characterization). The sample was designated ET-18.

3.1 ET-18 BOTTOM SLUDGE SAMPLE RESULTS

The bottom sludge sample from tank ET-18 was analyzed for TCLP VOC and SVOC analysis; pesticides and herbicides; arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver (RCRA metals); flash point, pH, cyanide and sulfide content (hazardous waste characterization). There were no identified problems in analysis reported by the laboratory. A summary of the analytical results include:

- TCLP Volatile/semi-volatile Organic Compounds: no detections.
- TCLP Organochlorine Pesticides and Herbicides: no detections.
- TCLP/RCRA Metals: no detections.
- Total Cyanide: non-detect.
- Sulfide: 1500 milligrams per kilogram (mg/kg).
- pH: 6.50
- Ignitibility: non-ignitable.

Client Sample ID: **ET-18 Bottom Sludge**

Lab Sample ID:	680-49267-1	Date Sampled: 07/23/2009 1048
Client Matrix:	Solid	Date Received: 07/24/2009 0928

8260B Volatile Organic Compounds (GC/MS)-TCLP

Method:	8260B	Analysis Batch: 680-144185	Instrument ID:	MSO2
Preparation:	5030B		Lab File ID:	o0518.d
Dilution:	20	Leachate Batch: 680-143798	Initial Weight/Volume:	5 mL
Date Analyzed:	07/30/2009 1212		Final Weight/Volume:	5 mL
Date Prepared:	07/30/2009 1212			
Date Leached:	07/27/2009 1315			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
Benzene		<0.020		0.020
Carbon tetrachloride		<0.020		0.020
Chlorobenzene		<0.020		0.020
Chloroform		<0.020		0.020
1,2-Dichloroethane		<0.020		0.020
1,1-Dichloroethene		<0.020		0.020
2-Butanone (MEK)		<0.20		0.20
Tetrachloroethene		<0.020		0.020
Trichloroethene		<0.020		0.020
Vinyl chloride		<0.020		0.020

Surrogate	%Rec	Qualifier	Acceptance Limits
4-Bromofluorobenzene	103		75 - 120
Dibromofluoromethane	98		75 - 121
Toluene-d8 (Surr)	111		75 - 120

Client Sample ID: **ET-18 Bottom Sludge**

Lab Sample ID:	680-49267-1	Date Sampled: 07/23/2009 1048
Client Matrix:	Solid	Date Received: 07/24/2009 0928

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-TCLP

Method:	8270C	Analysis Batch: 680-144180	Instrument ID:	MST
Preparation:	3520C	Prep Batch: 680-143903	Lab File ID:	t2514.d
Dilution:	1.0	Leachate Batch: 680-143799	Initial Weight/Volume:	200 mL
Date Analyzed:	07/30/2009 1657		Final Weight/Volume:	1 mL
Date Prepared:	07/28/2009 1312		Injection Volume:	1.0 uL
Date Leached:	07/27/2009 1400			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
1,4-Dichlorobenzene		<0.050		0.050
2,4-Dinitrotoluene		<0.050		0.050
Hexachloroethane		<0.050	*	0.050
Hexachlorobenzene		<0.050		0.050
Hexachlorobutadiene		<0.050		0.050
Methyl Phenols,Total		<0.10		0.10
Nitrobenzene		<0.050		0.050
Pentachlorophenol		<0.25		0.25
Pyridine		<0.25		0.25
2,4,5-Trichlorophenol		<0.050		0.050
2,4,6-Trichlorophenol		<0.050		0.050

Surrogate	%Rec	Qualifier	Acceptance Limits
2,4,6-Tribromophenol	104		50 - 150
2-Fluorobiphenyl	87		50 - 150
2-Fluorophenol	78		50 - 150
Nitrobenzene-d5	90		50 - 150
Phenol-d5	76		50 - 150
Terphenyl-d14	73		50 - 150

Client: Ashland Inc.   Job Number: 680-49267-1

Client Sample ID:	**ET-18 Bottom Sludge**		
Lab Sample ID:	680-49267-1	Date Sampled:	07/23/2009 1048
Client Matrix:	Solid	Date Received:	07/24/2009 0928

8081A_8082 Organochlorine Pesticides & PCBs (GC)-TCLP

Method:	8081A_8082	Analysis Batch: 680-144123	Instrument ID:	SGM
Preparation:	3520C	Prep Batch: 680-143847	Initial Weight/Volume:	20 mL
Dilution:	1.0	Leachate Batch: 680-143799	Final Weight/Volume:	10 mL
Date Analyzed:	07/29/2009 1750		Injection Volume:	1.0 uL
Date Prepared:	07/28/2009 1212		Result Type:	PRIMARY
Date Leached:	07/27/2009 1400			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
Chlordane (technical)		<0.025		0.025
Endrin		<0.0050		0.0050
gamma-BHC (Lindane)		<0.0025		0.0025
Methoxychlor		<0.025		0.025
Heptachlor		<0.0025		0.0025
Heptachlor epoxide		<0.0025		0.0025
Toxaphene		<0.25		0.25

Surrogate	%Rec	Qualifier	Acceptance Limits
Tetrachloro-m-xylene	72		50 - 150
DCB Decachlorobiphenyl	103		50 - 150

Client Sample ID: **ET-18 Bottom Sludge**

Lab Sample ID: 680-49267-1
Client Matrix: Solid

Date Sampled: 07/23/2009 1048
Date Received: 07/24/2009 0928

8151A Herbicides (GC)-TCLP

Method:	8151A	Analysis Batch: 680-144253		Instrument ID:	SGS
Preparation:	8151A	Prep Batch: 680-144007		Initial Weight/Volume:	10 mL
Dilution:	1.0	Leachate Batch: 680-143799		Final Weight/Volume:	10 mL
Date Analyzed:	07/30/2009 1856			Injection Volume:	1.0 uL
Date Prepared:	07/29/2009 1042			Result Type:	PRIMARY
Date Leached:	07/27/2009 1400				

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
2,4-D		<0.050		0.050
Silvex (2,4,5-TP)		<0.050		0.050

Surrogate	%Rec	Qualifier	Acceptance Limits
DCAA	108		50 - 150

Client Sample ID: **ET-18 Bottom Sludge**

Lab Sample ID:	680-49267-1	Date Sampled:	07/23/2009 1048
Client Matrix:	Solid	Date Received:	07/24/2009 0928

6010B Metals (ICP)-TCLP

Method:	6010B	Analysis Batch:	680-144156	Instrument ID:	ICPD
Preparation:	3010A	Prep Batch:	680-144011	Lab File ID:	N/A
Dilution:	1.0	Leachate Batch:	680-143799	Initial Weight/Volume:	5 mL
Date Analyzed:	07/29/2009 1837			Final Weight/Volume:	50 mL
Date Prepared:	07/29/2009 1046				
Date Leached:	07/27/2009 1400				

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
Arsenic		<0.20		0.20
Barium		<1.0		1.0
Cadmium		<0.10		0.10
Chromium		<0.20		0.20
Lead		<0.20		0.20
Selenium		<0.50		0.50
Silver		<0.10		0.10

7470A Mercury (CVAA)-TCLP

Method:	7470A	Analysis Batch:	680-144249	Instrument ID:	LEEMAN1
Preparation:	7470A	Prep Batch:	680-143857	Lab File ID:	N/A
Dilution:	1.0	Leachate Batch:	680-143799	Initial Weight/Volume:	0.50 mL
Date Analyzed:	07/30/2009 1906			Final Weight/Volume:	50 mL
Date Prepared:	07/28/2009 1008				
Date Leached:	07/27/2009 1400				

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	RL
Mercury		<0.020		0.020

General Chemistry

Client Sample ID: **ET-18 Bottom Sludge**

Lab Sample ID: 680-49267-1 Date Sampled: 07/23/2009 1048
Client Matrix: Solid % Moisture: 93.2 Date Received: 07/24/2009 0928

Analyte	Result	Qual	Units	RL	Dil	Method
Cyanide, Total	<74		mg/Kg	74	1.0	9012A
	Analysis Batch: 680-143969	Date Analyzed: 07/29/2009 0759				DryWt Corrected: Y
	Prep Batch: 680-143737	Date Prepared: 07/27/2009 0900				

Analyte	Result	Qual	Units	Dil	Method
pH	6.50		SU	1.0	9045C
	Analysis Batch: 680-143811	Date Analyzed: 07/27/2009 1330			DryWt Corrected: N
Ignitability	NB		mm/sec	1.0	1030
	Analysis Batch: 680-143859	Date Analyzed: 07/27/2009 1309			DryWt Corrected: N

Analyte	Result	Qual	Units	RL	Dil	Method
Sulfide	1500		mg/Kg	370	1.0	9034
	Analysis Batch: 680-143913	Date Analyzed: 07/28/2009 1341				DryWt Corrected: Y
	Prep Batch: 680-143860	Date Prepared: 07/28/2009 1010				
Percent Moisture	93		%	0.010	1.0	Moisture
	Analysis Batch: 680-143768	Date Analyzed: 07/27/2009 1103				DryWt Corrected: N

DATA REPORTING QUALIFIERS

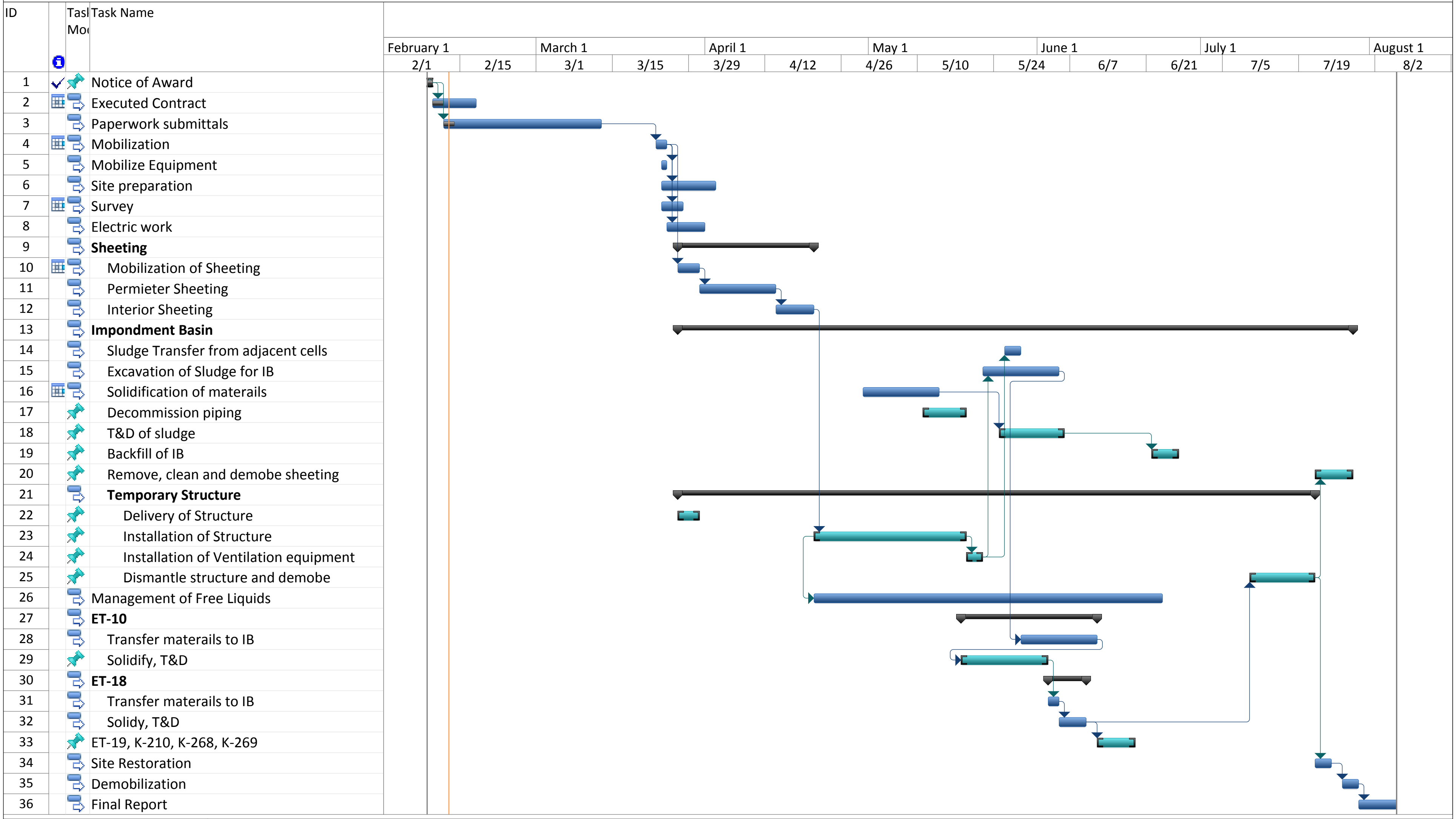
Client: Ashland Inc. Job Number: 680-49267-1

Lab Section	Qualifier	Description
GC/MS Semi VOA		
	*	LCS or LCSD exceeds the control limits
GC Semi VOA		
	p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
General Chemistry		
	H	Sample was prepped or analyzed beyond the specified holding time

Appendix L

Contractor Schedule

Hercules Hattiesburg, MS
IB Sludge Removal Tiimeline



ID	Tasl Mo	Task Name
1		Notice of Award
2		Executed Contract
3		Paperwork submittals
4		Mobilization
5		Mobilize Equipment
6		Site preparation
7		Survey
8		Electric work
9		**Sheeting**
10		Mobilization of Sheeting
11		Permieter Sheeting
12		Interior Sheeting
13		**Impondment Basin**
14		Sludge Transfer from adjacent cells
15		Excavation of Sludge for IB
16		Solidification of materails
17		Decommission piping
18		T&D of sludge
19		Backfill of IB
20		Remove, clean and demobe sheeting
21		**Temporary Structure**
22		Delivery of Structure
23		Installation of Structure
24		Installation of Ventilation equipment
25		Dismantle structure and demobe
26		Management of Free Liquids
27		**ET-10**
28		Transfer materails to IB
29		Solidify, T&D
30		**ET-18**
31		Transfer materails to IB
32		Solidy, T&D
33		ET-19, K-210, K-268, K-269
34		Site Restoration
35		Demobilization
36		Final Report

Project: IB schedule r1
Date: Fri 2/13/15

Task	▬	External Tasks	▬	Manual Task	▬	Finish-only	]
Split	┈	External Milestone	◆	Duration-only	▬	Deadline	⇩
Milestone	◆	Inactive Task	▭	Manual Summary Rollup	▬	Progress	▬
Summary	▬	Inactive Milestone	◇	Manual Summary	▬		
Project Summary	▬	Inactive Summary	▭	Start-only	[		