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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

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NMED
Hazardous Waste Bureau

Mr. John Kieling
Bureau Chief
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Dear Mr. Kieling:

Subject: Submittal of Reply to Disapproval of Work Plan and Associated Design Documents for Los Alamos County Airport Landfill Cover Replacement, Los Alamos National Laboratory, EPA ID # NM0890010515 HWB-LANL-15-018

Enclosed are two hard copies with electronic files of the work plan and associated design documents for the Los Alamos County Airport Landfill Cover Replacement. In addition, the revised work plan is accompanied by a response to New Mexico Environment Department's (NMED) comments and cross-references NMED's numbered comments. An electronic redline-strikeout version of the work plan is provided that shows where all revisions to the Work Plan were made.

If you have any questions, please call Ramoncita N. Massey at (505) 665-7771 or at Ramoncita.Massey@em.doe.gov.

Sincerely,

Christine Gelles
Acting Manager
Environmental Management
Los Alamos Field Office

Enclosure

37214

cc w/enclosure:
Siona Briley
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Jerzy Kulis
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Dave Cobrain
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Michael Dale
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Neelam Dhawan
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

R. Massey, EM-LA
T. Haagenstad, ADEP-PDO, LANS, MS-M992
Records Center, EM-LA
Official Contract File, EM-LA

EPO-32RM-810-635369

Response to NOD for
Design of Los Alamos County Airport Landfill Cover Replacement
Department of Energy, EPA ID#NM0890010515, HWB-LANL-15-018,
Dated July 17, 2015

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the NOD received. The US Department of Energy (DOE) response follows each respective NMED comment.

No.	NMED Comment/DOE Response	Referenced Document in Response
1.	*NMED General Comment No. 1:* The Construction Implementation Plan and Technical Specifications do not appear to contain specific procedures that address application of the daily cover. Please revise the Construction Implementation Plan and Technical Specifications to indicate that a minimum of 6 inches of clean dry material or an alternative landfill cover will be placed over all exposed waste surfaces at the end of every working day as required in subsection N of 20.9.5.9 NMAC.	
	DOE Response to NMED General Comment No. 1: Technical Specifications Section 02266, 3.02 H include the following statement: "Placed and compacted waste shall be covered with a minimum of 6-inches of clean dry material at the conclusion of each day unless otherwise directed by the FPD." The Construction Implementation Plan included a statement in section 5.7 - Relocated Waste: "Placed and compacted waste shall have a minimum 6-inch thick lift of clean dry material placed over it at the conclusion of each day unless directed otherwise by the FPD."	Documents revised: Technical Specifications 02266, 3.02 H Construction implementation Plan, Section 5.7
2	*NMED General Comment No. 2:* Several sections of the Work Plan are very general in nature and do not include sufficient detail to ensure that the reader can understand the overall design without having to frequently refer to another document. For example, Section 9.0 Construction Schedule does not include any schedule for the proposed actions and the reader is referred to the Construction	

	Implementation Plan. Revise the Work Plan to include, at a minimum, a summary level of detail of the actions covered by the Work Plan.	
	DOE Response to NMED General Comment No. 2: The Work Plan was written to summarize all work planned for the completion of the entire project including its justification. The Work Plan was intended to summarize all aspects while referring to supporting documents for details. Each of these supporting documents was intended to be a stand-alone document. The DOE felt it was prudent to summarize the material submitted in the Work Plan and eliminate duplication of information contained in supporting information submitted to NMED for review. For example, the construction schedule was summarized in Section 9 of the Work Plan. The end of the summary contained : *The planned start date of the construction is August 2015 and estimated to be complete by the end of October 2015. Details of the individual work elements, start and end dates for each, and schedule details are included in the Construction Implementation Plan* The Construction Implementation Plan contained a detail of the schedule in Section 3, figures 1 and 2 with description of each task.	No document revision
3	*NMED General Comment No. 3:* NMED noted that the Work Plan and Design Report relied heavily on references primarily authored by the designer (Dr. Stephen F. Dwyer) and a guidance document for closing small tribal landfills and open dumps (EPA-909-R-11-007), the latter of which does not appear relevant to the Los Alamos County Airport Landfill Cover Replacement. The Interstate Technology and Regulatory Council (ITRC) guidance has a broad range of authors that includes Dr. Dwyer. No changes are necessary at this time; however, in the future, the documents referenced must include independent authors to ensure that design documents do not appear to be self-substantiating and are more defensible.	
	DOE Response to NMED General Comment No. 3: There were 53 references cited in the Work Plan, of which 5 were papers published by Dr. Dwyer. Dr. Dwyer developed many of the engineering concepts utilized in the design. Dr. Dwyer was hired because the DOE recognizes him as an expert on cover systems for environments such as that in Los Alamos, NM. Dr. Dwyer is a nationally recognized expert in the field of ET Covers and Alternative cover systems. Dr. Dwyer co-authored the ITRC Guidance mentioned with multiple people who all	No document revision

	performed research in the field of alternative landfill closures. However, Dr. Dwyer is unique in that he has taken the research findings and transferred them to practical designs. Dwyer Engineering has been involved in over 200 site closures across the United states. The EPA cover design guidance (EPA-909-R-11-007) is a relevant document because it includes the design concepts utilized in this Los Alamos Cover Design and developed by Dr. Dwyer.	
4	*NMED General Comment No. 4:* It is unclear from the Work Plan and Design Report how the Permittees will assess and repair potential future differential settlement of the hangar pad or the evapotranspiration (ET) cap. The unit has already experienced two-feet of differential settlement, resulting in cracks to the existing MATCON cap and pending of surface water on the site. Please include a discussion of the future potential settlement of the landfill after placement of the ET Cover in the Design Report.	
	DOE Response to NMED General Comment No. 4: Discussion of the strengths of an ET Cover regarding its ability to accommodate settlement was added in the Design Report in Section 3. Furthermore, the Post Closure Care and Monitoring Plan includes inspections and monitoring of the cover system including settlement, water balance of the cover, methane gas, and ponding	Documents revised: Design Report, Section 3. Post-Closure Care and Monitoring Plan, Section 3.1.1 and 3.1.2.
5	*NMED General Comment No. 5:* The Work Plan, Design Report, Specifications, CQA Plan, Borrow Report, and Drawings do not uniquely and consistently refer to the three layers which comprise the ET Cover, the existing subgrade surface, and the existing waste which is being moved within the landfill from the location of the proposed new- hanger. This could have an impact on the construction process and may result in a poorly constructed ET Cover. For example, Drawing 3002, refers to a compacted soil clay mixture, but none of the other documents refer to some of the cover layers as a "clay." The Design Report refers to the ET Cover layers as "desert pavement," "cover soil," and "blended soil," but these terms are not used in any of the other design documents. Given that the soils used to construct the ET Cover are each critical design elements, revise the Work Plan, Design Report, Specifications, CQA Plan, Borrow Report, and Drawings to identify each ET Cover component by material property type. Ensure, where appropriate *(i.e.,* all materials except for waste to be placed on top of the landfill), that the specifications include material gradations and material properties.	

	DOE Response to NMED General Comment No. 5: Drawing 3002 shows that the cover is to be built in three layers. The design report, technical specifications, CQAP, and Construction Implementation plan all consistently refer to the cover being constructed in three layers: a bottom compacted soil layer of 12-inches thick, middle compacted soil layer of 18-inches, and upper rock/soil admixture of minimum 6-inches thick. This is consistent throughout all of these documents. However, because of the complexity encountered regarding soil, the descriptions of the various layers have a minimum set of criteria they must adhere to as described in the Technical Specifications Section 02200 – Earthwork and the CQAP for each respective layer. That is, the bottom layer must have a minimum fines content that is significantly higher than the middle or upper layer. The higher fines content is required to produce a lower saturated hydraulic conductivity to meet the design described in the Design Report. The bottom layer soil can come from a blending of the same soil material to be used for the upper layer mixed with an identified high fines content clay or a better borrow source that meets the fines content without blending a clay soil in. The tested and approved borrow sources are described in the Borrow Report.	No document revision
6	*NMED General Comment No. 6:* Various documents reference different compaction criteria. The Drawing 2001 indicates compacted soil is to be placed in no more than 6-inch lifts compacted to 95% maximum density, which is not what is indicated in Specification 02200 which specifies both a 95% as well as a 90% maximum compaction, and placement of 18-inches of material in two equal (i.e., 9-inch) lifts. The CQA Plan only specifies a 90% compaction criterion with tolerances which allow for less than 90% compaction. It is also unclear how the DOE intends to demonstrate that a 95% compaction has been achieved. Revise the document to include consistent and achievable compaction criteria.	
	DOE Response to NMED General Comment No. 6: Drawing 2001 states that all relocated waste material is to be compacted to a minimum of 95% of the maximum dry density (MDD) per ASTM D698 in compacted lifts not to exceed 6-inches thick. Furthermore, it states that all backfill placed where waste is removed is to follow the same compaction requirements. This is specified to ensure maximum density and minimal chance for differential settlement. It also allows for a solid subgrade for placement of the cover and / or concrete hangar. Technical Specification 02200 (Earthwork) states that the prepared subgrade is to be compacted to a minimum of 95% of MDD per ASTM D698. This is to ensure the subgrade for the cover provides for a solid	No document revision

	foundation and reduces the potential for settlement. The same specification further states that the cover soil is to be placed in specific lift thicknesses and compacted to 90% of MDD plus or minus 5 pounds per cubic foot. The cover density specification ensures that the cover will be uniformly compacted to mitigate preferential flow. It also specifies to compact it at a density that mimics the natural soil's in situ density or the density that soil resides at in an undisturbed setting since this is where that density will migrate toward long term. Further, it provides a density that maximizes the hydraulic characteristics of the soil while not being too dense that it inhibits the establishment of vegetation. The Construction Quality Assurance Plan has a specific plan for ensuring all of the densities, thicknesses, and initial moisture contents are installed as specified. Section 7 and Table 1 in the CQAP provides specifics for placement for all subgrade material and what to do if it is out of compliance. Section 8, tables 2, 3, 4and 5 describe what cover soil is acceptable, compaction and moisture controls, testing requirements, as well as what to do if the material is out of compliance for cover soil.	
7	*NMED General Comment No. 7:* Include a discussion of the remedial strategy. Specifically, please explain how the ET Cap will: protect human health and the environment; attain protective levels specified by NMED (i.e., reduces gas emissions, meets RSLs); control releases (i.e., to groundwater or air); comply with all waste handling standards during waste excavation and relocation ; is reliable and effective over the short- and long- term, and is implementable. In addition, the Permittees must demonstrate that the proposed ET Cover satisfies the original closure criteria listed in the 2004 Work Plan (North Wind 2004).	
	DOE Response to NMED General Comment No. 7: Section 1.1 was added to discuss the original closure criteria contained in Northwind (2004) and how this design addresses it. The Post-Closure Care and Monitoring Plan was modified to include quarterly site inspections to ensure that the cover systems is performing as expected or identify issues that arise and address them. This includes a quarterly physical surveillance by a qualified engineer, continual water balance monitoring of the cover system, and methane monitoring. A section of reporting procedures on any issue found is also included in the Post-closure Care and Monitoring Plan in section 4.	Documents revised: Work Plan, Section 1.1 Post-Closure Care and Monitoring Plan, Section 3 and 4.
8	*NMED Specific Comment No. 8:* The responsibility for installation of the 40 *mil* polyethylene vertical barrier (liner); the schedule for the installation of the liner; and	Work Plan:5.1 Los Alamos County Requirements (p.26)

	additional supporting design information for this liner is unclear from the text in this section and in the Construction and Implementation Plan. Documentation of the method for safe installation of this liner, and descriptions of how it will be designed to meet the stated objectives and how it will successfully remain intact over the 30-year design life by resisting friction, shear, and tensile forces were not provided in the Design Report or the specifications. DOE must clarify where the supporting design information is for this feature that demonstrates that it will serve its intended purpose. Please provide descriptions for how landfill gas will be successfully vented to the surface once captured by the vertical barrier, and how landfill gas will be prevented from migrating around the vertical barrier to the hangar expansion area. As discussed during June 10, 2015 and June 16, 2016 teleconference DOE must propose to install a methane monitoring well west of the liner to ensure methane migration is prevented by the vertical liner. Revise the text of the Work Plan accordingly.	
	DOE Response to NMED Specific Comment No. 8: Waste is to be removed from directly beneath the footprint of the proposed hangar pad area shown on Drawing 2000 and relocated within the footprint of the landfill as shown on Drawing 2001. A vertical 40 mil polyethylene liner will be installed separating the footprint beneath the hangar asphalt apron from the landfill and mechanically attached to the outside of the concrete culvert as shown on Drawing 3002, Detail 7. The liner will begin at the base of the excavation and be installed as the backfilling of the landfill and area beneath the hangar pad is backfilled. Care will be taken to compact backfilled soil using compaction equipment submitted by the contractor and approved by the engineer such as a hand operated jumping jack compactor. Continual quality assurance inspection will ensure the liner is constructed without defects. This will include ensuring any damage incurred to the liner during its placement or compaction of soil shall be properly repaired before continuing. The membrane is a smooth polyethylene liner and thus friction given any movement between soils should be minimal. The liner has more than enough flexibility to offset the minimal movement or settlement expected in the area, especially given the significant emphasis to minimize settlement in the area including relocation of waste and heavy compaction during backfilling operations. The liner material is designed to last in excess of thirty years as they are marketed to be placed as liners in RCRA landfills. Because the liner will not be exposed to sunlight, the degradation of the liner should be minimal over the 30 year post-closure monitoring period. Methane monitoring has been added to the project. The Post-Closure	Documents revised: Construction Quality Assurance Plan, Section 6.2; Construction Implementation Plan, Section 5.9 Work Plan, Section 13 – Post-Closure Care and Monitoring Plan

	Care and Monitoring Plan, Section 3.1.2 was added stating that three locations will have methane monitoring installed. This equipment will be installed within three months of the completion of the cover system. Methane monitoring will be located west of the vertical liner to ensure there is no significant lateral methane migration west of the vertical liner; two locations within the footprint of landfill will also be monitored near PS-2 and PS-5 respectively. These two locations were the areas receiving the highest methane readings over the past couple of years. The methane monitoring shall be performed on a quarterly basis. If measured gas concentrations do not exceed 25% of the lower explosive limit (LEL) at any monitoring location for two years, the locations will be monitored twice the third year. If measured concentrations do not exceed 25% of the LEL the third year, monitoring will be discontinued. By mutual agreement between the NMED and DOE, if a descending trend is identified whereby the gas levels are decreasing - monitoring may also be discontinued prior to the time periods mentioned above. If combustible gas levels exceed 25% of the LEL in any enclosed structure, or 100% of the LEL at the north edge of the cap, the owner or operator shall: • Immediately take all necessary steps to ensure protection of public health, welfare and the environment and notify the NMED; • Within 7 days of detection, record the methane gas levels detected and a description of the steps taken to protect public health, welfare and the environment and report them to NMED. For the first year as a minimum, methane monitoring will be performed at three locations. This monitoring will be performed on a quarterly basis. The results of this methane monitoring shall be submitted to NMED for review. This monitoring shall continue until DOE and NMED concur that it is no longer warranted.	Post-Closure Care and Monitoring Plan, Section 3.1.2

9	*NMED Specific Comment No. 9:* a. Revise the Work Plan to include the borrow soil site history identifying all potential contaminants and a sampling and analysis plan to verify that those contaminants do not pose a risk to human health or the environment. If there is no evidence that potential contaminants could be present in the borrow material, provide NMED with relevant references and documents justifying that determination. If an analysis of the borrow soil has already been performed, provide NMED with the results in a tabular format that compares analytical results with residential soil screening levels (RSLs). b. The Work Plan does not appear to discuss the availability of the materials tested. Information from the Borrow Report must be utilized for the Specifications in the Design Report and include a description of the methods for soil testing that will be used to construct the various ET Cover layers and how these materials meet the daily cover requirements for the relocated wastes. Please revise the ET Cover design documents to combine all of this information in a manner that will demonstrate that adequate soil volumes of appropriate gradation are available for all the various soil needs of the project.	Work Plan:5.2 Borrow Soil Investigation (p.26)
	DOE Response to NMED Specific Comment No. 9: a. DOE will submit Contaminant sampling and analysis performed on the soils to NMED for review. Identified clean soils from Los Alamos borrow sites have been sampled and submitted for laboratory analysis. These results are not available to date. This information will be submitted as supporting information to the Work Plan. b. The available soil and soil testing results have been updated in the Cover Soil Borrow Investigation, Table 2. The Technical Specifications – Section 02200 (Earthwork), Section 3.08 states that the bottom soil layer is to be a blend consisting of 50% of a sandy loam soil possessing a minimum fines (material passing the #200 sieve) content of 25% mixed with a higher fines content soil having a minimum fines content of 60%. A substitute approved soil must have a minimum of 45% fines. The fines content principally controls the hydraulic properties of the soil. The middle and top soil requires a soil with a minimum of 25% fines. A myriad of profiles with varying soil properties was modeled to evaluate the ability of a cover profile to minimize flux. The Design Report presents the most conservative modeled profile that yields a cover profile of 3-ft thick that yields no annual downward flux. The sensitive parameter is the hydraulic properties of the soil. Specifically, the hydraulic properties of the	Documents revised: Analysis test results to be submitted as they become available. Work Plan, Section 5.2 Cover Soil Borrow Investigation, Table 2 Technical Specifications, Earthwork 02200, Section 3.08; Design Report, Section 4.

	bottom foot of soil. The lower saturated hydraulic conductivity of the bottom foot of soil with the higher fines content slows the movement of moisture downward through the profile to the point where evapotranspiration can effectively remove it before any appreciable flux is generated. For this reason, the bottom foot of soil requires higher fines content. The soils and respective testing parameters are summarized in the Cover Soil Borrow Investigation, Table 2. The available volumes of soils are also contained in this table. These soils can be utilized for the various layers of the cover profiles depending on the fines content of the soil with the exception of the Espanola Transit Silt processed material that was disallowed based on modeling results. For example, The Los Alamos Borrow site in TA54 (RANT) can be used by itself in the upper 6-inches of soil to be mixed with the rock because it has a fines content of 32.4% which is greater than the specified minimum amount for this layer of 25%. It can also be blended with a higher fines content soil (for example Espanola Transit clay with a fines content of 64.5% which is greater than the minimum specified of 60%) at 50% by volume. Another example is that the Espanola Transit clay, Los Alamos Sigma Mesa TW-052, TW-053, TW-054 can all be used without mixing as the bottom foot of soil or for any soil above the bottom foot because they each have minimum fines content significantly greater than 45%. It is OK to use a higher fines content soil in the upper soil layers – that would yield a better cover. The analytical data for the potential Los Alamos soil stockpiles (TA-54 RANT and Sigma Mesa) has been added as an attachment to the work plan along with a summary table.	
10	*NMED Specific Comment No. 10:* Revise the statement: "Observed differential settlement is most significant toward the east and decreases toward the east" to read "Observed differential settlement is most significant toward the east and decreases toward the west."	Work Plan:5.5 Geoprobe and VOC Investigation (p.30)
	DOE Response to NMED Specific Comment No. 10: Agreed - changed	Documents revised: Work Plan: Section 5.5
11	*NMED Specific Comment No. 11:* Revise Table 2 to include the following: • Provide the entire soil boring ID (e.g.• SB-0 l instead of 1) to be consistent with the IDs used throughout the document. • Identify the units of measurement used for soil and waste depth measurements. • Include the units of measurement.	Work Plan:5.5 Geoprobe and VOC Investigation, Table 2 (p.33-34)

	• The term ”na" in the last two columns is not defined in the table; it is unclear if no waste was observed or if the soil boring did not extend into the waste. Revise the table to define "na".	
	DOE Response to NMED Specific Comment No. 11: Agreed – changes made	Documents revised: Work Plan: 5.5 Geoprobe and VOC Investigation, Table 2
12	*NMED Specific Comment No. 12:* The proposed cover design does not include features designed to address burrowing animals. NMED considers the top five feet of soil cover to be subject to burrowing animals. The proposed cover will not be more than three feet thick and does not include a rock layer or other design feature to prevent animals from burrowing into wastes and bringing contaminants to the surface or generating preferential pathways for surface water infiltration. Revise the Post-Closure Care Monitoring Plan (PCCMP) section to describe management procedures to discourage animals from burrowing at the site, and the timely repair of observed burrows greater than 3 inches in diameter.	Work Plan: Cover System Design (p.37)
	DOE Response to NMED Specific Comment No. 12: The Post-Closure Care and Monitoring Plan has been revised by adding Section 3.1.3 summarizing biointrusion monitoring to be included in periodic inspections. Repair of holes larger than 3-inches in diameter has been included.	Documents revised: Post-Closure Care and Monitoring Plan, Section 3.1.3
13	*NMED Specific Comment No. 13:* In the Construction Implementation Plan, the Permittees describe the removal of the MATCON cap (proposed for July. 2015) during what is typically the monsoon season for northern New Mexico. Please describe what precautions or emergency measures will be implemented by the contractor to prevent flooding and manage run-on/run-off of the landfill during monsoon events.	Work Plan: 9.0 Construction Schedule (p. 40)
	DOE Response to NMED Specific Comment No. 13: The actual removal of the MATCON now is planned for removal in August or September. The contactor is to maintain positive drainage during construction activities wherever possible to minimize ponding and maintain controlled runoff of the site. Temporary erosion control measures such as silt fencing and wattles are to be used. The contractor’s SWPPP addresses some of these issues. Furthermore, the Technical Specifications, Section 02200 (Earthwork) require that all soil directly under the cover or within the cover profile (subgrade and cover soil) be	No changes

	installed to meet specific moisture requirements that disallow excessive moisture. Should soils become too wet due to weather conditions, they are to be reworked until they meet the applicable specifications for moisture status prior to placement of the subsequent lift of soil.	
14	*NMED Specific Comment No. 14:* a. The Permittees state that the ET Cover will not concentrate gases via a specific collection system, but will allow it to vertically migrate up through the soil profile distributed over the entire cover surface. The Work Plan further indicates that the methane is expected to undergo oxidization as it moves through the new cover profile prior to release to the atmosphere. This design approach is not supported by landfill gas calculations, and should excessive landfill gas be emitted, it could negatively affect the ability of the vegetation to germinate and achieve the desired amount of vegetation to support the ET Cover design. DOE shall propose to monitor migration and decomposition of landfill gas through the soil profile to demonstrate such decomposition through moisture, landfill gas and vegetation monitoring. DOE must also propose that if it is determined that excessive landfill gas production is negatively affecting vegetation growth on the ET cover, the DOE will propose to NMED corrective action measures to reduce the concentration beneath the ET cover. b. DOE states that "Dave Ploeger, Los Alamos County Airport Manager, stated that procedures in place at the airport for snow removal do not allow for piling of snow on the cover. There are designated locations in place where the snow is pushed to away from the cover area." In a meeting on June 10, 2015, DOE indicated that there is a signed assurance from the Los Alamos County Airport Manager indicating that controls are in place to prevent the stacking of snow on the ET cover. Provide a copy of that assurance in the revised Work Plan.	Work Plan:11.0 Reply to NMED Concerns (p.42)
	DOE Response to NMED Specific Comment No. 14: a. Agreed. Methane monitoring has been included in the Post-Closure Care and Monitoring Plan, Section 3.1.2. The monitoring of vegetation and its potential distress from oxygen displacement due to excessive methane production is included in the inspection check list. For the first year as a minimum, methane monitoring will be performed at three locations. This monitoring will be performed on a quarterly basis. The results of this methane monitoring shall be submitted to NMED for review. This monitoring shall	Documents revised: Post-Closure Care and Monitoring Plan, Section 3.1.2

	continue until DOE and NMED concur that it is no longer warranted. b. Agreed – a signed letter from the Los Alamos County Airport manager will be provided to NMED stating that snow removal does allow for piling snow on the landfill.	
15	*NMED Specific Comment No. 15:* DOE quotes a section of text that mentions "the existing monitoring wells." Please provide information on the location and depth of these monitoring wells in the revised Work Plan.	Work Plan:12.0 Groundwater Monitoring Data (p.46)
	DOE Response to NMED Specific Comment No. 15: The quoted text is from work performed by Northwind under the direction of Los Alamos National Laboratory prior to 2004. This work was part of the original remedy and negotiations for final remedy with NMED. The location of one well west of the Landfill was found by NMED and DOE during a search for wells at location coordinates: X = 1633798.079 Y = 1776121.294. The depth information for this well could not be located by DOE. This well was referenced for informational purposes only and has no impact on the construction of this ET Cover.	No changes.
16	*NMED Specific Comment No. 16:* a. The Work Plan only discusses a schedule for landfill cover inspections for the first five years. DOE must revise the Work Plan to address the inspection schedule after the initial five years, which would be dependent on data collected during the first five years. b. In addition to the scheduled inspections of the landfill cover, DOE must revise the text to require that landfill cover inspections be performed after each major precipitation event that exceeds 50% of the design rainfall event until vegetation is established.	Work Plan: 13.0 Post-Closure Care and Monitoring Plan (p.47)
	DOE Response to NMED Specific Comment No. 16: a. The Work Plan and Post-Closure Care and Monitoring Plan have been revised to include: *The quarterly monitoring will continue beyond the initial 5-year post-closure monitoring period unless DOE can provide adequate information to NMED that allows for a reduction in the number of inspections or elimination of inspections. The information will include all monitoring and inspections performed to date at the time of such a request.* b. The Work Plan and Post-Closure Care and Monitoring Plan have	Documents revised: Work Plan, Section 13 – Post-Closure Care and Monitoring Plan; Post-Closure Care and Monitoring Plan, Section 1.

	been revised to include: *In addition to the quarterly inspections, if the site experiences a precipitation event that exceeds 1-inch in any given hour (the 100-year, 1-hour design storm event is 2.17in/hr.); the site shall also be inspected.*	
17	*NMED Specific Comment No. 17:* a. In the second paragraph, the Permittees state that the installed density of cover soil will be between 85% and 92% of maximum dry density. This is inconsistent with the Permittees statement in the Technical Specifications, Section 02200, Part 3.07.0, which states, "90% of maximum dry density plus or minus 5 pcf [pounds per cubic foot]". Revise the text to resolve this discrepancy. b. The third paragraph states that the upper 6-inches of the cover profile will be mixed with rock at a volumetric ratio of 25% rock to 75% soil (with a rock size of 050 or 0.5-inches), effectively altering its hydraulic properties. It then presents the equation used to alter the saturated hydraulic conductivity based on the addition of rock. Please provide an explanation of why an equation was used to alter the material properties in lieu of actual testing of the 25% rock to 75% soil mixture. c. The last sentence in the last paragraph on page 21 incorrectly references "Section 3.1.5"; the reference should be revised to read "Section 4.1.5". d. The DOE states that prior to performing the UNSAT H computer simulation, they adjusted the calculated saturated hydraulic conductivities (Ksat) for the top 3 feet of landfill cover (O–3 ft below ground surface (bgs)) in order to account for dynamic processes that increase Ksat· The Ksat for rock/soil admixture (O–0.5 ft bgs) and for cover soil between 0.5 and 1 ft bgs were increased by an order of magnitude, and Ksat for cover soil between 1 and 2 ft bgs was increased by half an order of magnitude. This appears to be inconsistent with the soil input parameters for the UNSAT H simulation in Table 2, which shows unadjusted Ksat values. The DOE must revise Table 2 and verify the Ksat values used in the UNSAT H simulation. If the incorrect Ksat values were used, repeat the UNSAT H simulation with correct values and, if necessary, adjust cover design based on the output of the simulation.	ET Cover Design Report: 4.1.7 Soil Properties (p. 21)
	DOE Response to NMED Specific Comment No. 17: a. Design Report amended to read 90% plus or minus 5 pcf of MDD b. ASTM D4718 and Peck and Watson (1979) provide for an	Documents revised: Design Report, Section 4.1.7

	adjustment to measured hydraulic values for soil. The soil was measured in the laboratory for its hydraulic property (refer to the Cover Soil Borrow Investigation Appendix) for laboratory determined parameters. The laboratory equipment and procedures require that the soil tested be effectively screened of rock based on the applicable ASTM standards. For example, the pressure plates utilized to measure soil suction cannot accommodate rock because of their size. The measured values are then corrected for rock content. Based on standards presented in ASTM D4718 and Peck and Watson (1979). These standards allow for rock corrections up to 40%. This is industry standard practice. c. Design Report amended to read 4.1.5 d. The Design Report, Table 2 Soil Input Parameters were corrected. Modeling was rerun with adjusted output values shown in table 3. The result predicting no flux through 3-ft of cover did not change.	Design Report, Table 2
18	*NMED Specific Comment No. 18:* The DOE states that Table 3 provides "the remaining water storage capacity in the modeled soil profile." However, the numerical values in the last column of Table 3 are greater for the wettest year on record than for the average year, suggesting that these values represent used storage. Revise the table and/or text to clarify if the values represent the remaining water storage capacity or the total used storage in the modeled soil profile.	ET Cover Design Report: 4.1.8 Model Output (p. 23)
	DOE Response to NMED Specific Comment No. 18: Design report, table 3 computer simulation results were corrected to correlate with soil input values shown in table 2. The storage output value shown represents the remaining water capacity storage of the modeled soil profile. This is described in the first paragraph in Section 4.1.8.	Documents revised: Design Report, Section 4.1.8, Table 2
19	*NMED Specific Comment No. 19:* The caption at the top of Figure 10 states, "Espanola Transit Blended-50% Overburden 50% Clay." It is unclear whether Figure 10 represents computer simulation results for a soil profile where the blended soil constitutes the bottom layer of the profile, or if it represents a soil profile consisting exclusively of the blended soil. Please provide additional information on the soil profile represented by Figure 10, both in the text and in the figure caption clarifying the composition of the soil profile. If Figure 10 does not represent the complete soil profile (as shown in Figure 5), provide computer simulation results for the complete soil profile.	ET Cover Design Report: 4.1.8 Model Output, Figure 10 (p.24)

	DOE Response to NMED Specific Comment No. 19: The Design Report, Section 4.1.8 was modified to include full description of the cover profile represented in Figure 10. The caption within Figure 10 was modified to provide a better description of the cover profile represented.	Documents revised: ET Cover Design Report: Section 4.1.8 Model Output, Figure 10
20	*NMED Specific Comment No. 20:* Correct units for total average shear stress from "pcf" to "psf" (pounds per square foot).	ET Cover Design Report: 5.1.4 Incipient Particle Size (p.28)
	DOE Response to NMED Specific Comment No. 20: Units for total average shear stress were corrected to “psf”.	Documents revised: ET Cover Design Report: Section 5.1.4 Equation 10
21	*NMED Specific Comment No. 21:* The Permittees state that all soil cover systems naturally regulate methane through both physical barrier and methane oxidation processes; however, documentation of this is not provided within the Design Report. Section 5.3 of USEPA's Technical Guidance for RCRA/CERCLA Final Covers, EPA 540-R-04-007, dated April 2004 states that gas emission rates for municipal solid waste landfills can be difficult to predict and vary over time. EPA recommends the use of a first order decomposition rate equation to estimate annual emissions over a user-specified time period. EPA has developed an automated estimation tool for calculating landfill gas emissions which is referred to as the Landfill Gas Emissions Model (LandGEM). Revise the supporting design documentation for managing the landfill gas to either include calculations of landfill gas emissions or other supporting documentation that the proposed landfill gas management approach is adequate.	Work Plan: Cover System Design 7.0 (p.35)
	DOE Response to NMED Specific Comment No. 21: LandGEM is a simplistic software package that may not readily apply to the Los Alamos Airport landfill. The landfill was not producing significant methane prior to closure with an asphalt cap. Installation and subsequent degradation of the asphaltic cover surface amplified the methane production due to the significant water percolation (without allowance for removal) into the waste and accelerated biodegradation. This will be significantly improved when the asphalt cover is removed and an ET Cover is installed effectively limiting future migration of fluids into the waste. However, in the short term, it is anticipated that methane will continue to be generated until the waste biodegradation advances further and/or the moisture within the waste decreases with time.	Documents revised: Work Plan, Section 13.0 Post-Closure Care and Monitoring Plan; Post-Closure Care and Monitoring Plan, Section 3.1.2.

	DOE agrees to monitor the methane production and has modified the Work Plan and Post-Closure Care and Monitoring Plan to reflect this. Methane monitoring shall be performed at three locations. The monitoring equipment shall be installed within three months after the completion of the cover construction. The monitoring shall include the installation of the three passive vent locations.	
22	*NMED Specific Comment No. 22:* a. The Attachment to the Design Report lists storm intensity criteria in a table on the first page of the attachment, but it does not include criteria from the County of Los Alamos, Public Works Design and Construction Standards, Revised September 2008. This document specifies use of a Tc (time of concentration) for existing conditions which is not less than 10 minutes and not more than 60 minutes. The Design Report must be revised to include the Los Alamos County design criteria, and select the most conservative storm intensity criteria. b. There appears to be a discrepancy between rainfall intensity and the time of concentration values used in the runoff prediction in Section 5.1.2 and those being used in Hydrology Calculation in Attachment 1. Please explain or correct the discrepancy, and if necessary, redesign the drainage channels.	ET Cover Design Report: Attachment 1 (p.40)
	DOE Response to NMED Specific Comment No. 22: a. Department of Energy guidance was utilized since this is a DOE project. Calculations using both guidance were performed in answering this concern and both came to the same conclusion about size of rock, admixture design, channel sizing, and riprap sizing. Thus the final results do not change in the design. However, in response to this concern and to comply with Los Alamos County standards, the Los Alamos County Design and Construction Standards were utilized, specifically the use of 10 minutes for the minimum time of concentration. All calculations in the Design Report were updated utilizing this criterion. The use of a smaller time of concentration as was part of the original calculations is more conservative. That is, using the larger 10 minute time of concentration leads to the calculation of a smaller flow rate. Also note in the calculations, that NOAA Atlas 14 precipitation values have been increased from the previous version in place when the original calculations were performed. Consequently, the larger intensity values were incorporated into the calculations to represent the latest values included in NOAA Atlas 14 for the Los Alamos, NM area. b. Calculations were revised. Both sets of calculations used the	Documents revised: Design Report, Section 5.1 and Attachment

	rainfall intensity of 2.17 in/hr based on NOAA Atlas 14, Volume 1, version 5 with a time of concentration of 10 minutes per the Los Alamos County Design and Construction Standards (2008). The revised calculations and results did not change the design based on the previous calculations.	
23	*NMED Specific Comment No. 23:* a. The proposed PCCMP does not include landfill gas monitoring. As discussed during a meeting on June 10, 2015, the DOE shall propose to install three landfill gas monitoring wells: one well on the west side of the vertical liner separating the waste from the backfill; a well near the current monitoring location PS-02; and another well near the current monitoring location PS-05. The DOE must submit for NMED approval the exact locations and construction details for the monitoring wells at least 15 calendar days prior to the scheduled installation. The new monitoring wells must be sampled quarterly for the first year, using a methodology approved by NMED for the existing landfill monitoring wells. The monitoring frequency for subsequent years will be determined by NMED based on the collected monitoring data. Please revise the Work Plan to include the above-referenced landfill gas monitoring requirements. b. The proposed PCCMP does not include plans to monitor the performance of the ET cover, and its ability to minimize water infiltration into the waste. Soil moisture probes can be used to measure vertical gradients in soil moisture within the ET cover, and can indicate whether the cover system is approaching its storage capacity. The DOE shall install two or more nests or strings of soil moisture probes capable of measuring vertical distribution of soil moisture, in the center of the ET Cover and near the edge. The DOE must also submit a plan for NMED approval that includes the exact locations and construction details for the soil moisture monitoring equipment at least 15 calendar days prior to the scheduled installation. For the first year DOE must measure soil moisture quarterly and between 5 to 10 calendar days after each major precipitation event that exceeds 50% of the design rainfall. The monitoring frequency for subsequent years will be determined by NMED based on the collected monitoring data. Revise the Work Plan to include the above-referenced soil moisture monitoring of the ET Cover.	Post-Closure Care and Monitoring Plan: General Comment
	DOE Response to NMED Specific Comment No. 23: a. The Work Plan. Section 13.0 – Post-Closure Care and Monitoring Plan was modified to include methane monitoring. Three	Documents revised: Work Plan. Section 13– Post-Closure Care and Monitoring

	locations including one on the west side and two within the landfill near PS-2 and PS-5. More specifics and details are included in the Post-Closure Care and Monitoring Plan, Section 3.1.2. Locations and details are included in this revised section. b. The Work Plan. Section 13.0 – Post-Closure Care and Monitoring Plan was modified to include water balance monitoring of the cover system. More specifics and details are included in the Post-Closure Care and Monitoring Plan, Section 3.1.1. Locations, equipment and details are included in this revised section. Two locations within the landfill are to be monitored on a continual basis. The data will be collected with field located data loggers and downloaded with each field inspection to be included in each report.	Plan. Post-Closure Care and Monitoring Plan, Section 3.1.1 and 3.1.2.
24	*NMED Specific Comment No. 24:* a. In the Section titled, "Permanent Erosion & Sedimentation Control Measures'," the checklist focuses exclusively on geotextile fabric. However, in many instances, the fabric is going to be completely covered by rocks. Please review the checklist in the 'Permanent Erosion & Sedimentation Control Measures' and in all other sections of Attachment 1 to ensure that the checklist items reflect the actual construction of the structures being inspected. Revise the Work Plan where appropriate. b. Inspection tolerances which would trigger corrective action could not be located in the PCCM Plan. For example, inspections should ensure that settlement of the cover surface in excess of 6 inches, erosion of the cover soil in excess of 6 inches below the cover surface, areas of ponding water, animal intrusion burrows in excess of 3 inches in diameter, or contiguous areas lacking vegetation in excess of 200 square feet would trigger corrective actions that are taken in a timely manner to prevent excessive deterioration of the cover system. Please revise the PCCM Plan to specify inspection tolerance criteria for damage which would trigger corrective action.	Post-Closure Care and Monitoring Plan: Attachment 1
	DOE Response to NMED Specific Comment No. 24: a. The checklist for Permanent and Temporary Erosion & Sedimentation Control has been corrected. The intent of the checklist at this point was to provide a generic table of what will be inspected. The checklist will be adjusted during the first and subsequent inspections to reflect actual conditions. b. Discussion about potential corrective actions and reporting requirements was added to the Post-Closure Care and Monitoring Plan in Sections 1, 3, and 4. Triggers such as size of burrow was added. Other specific criteria was left open ended other than methane. This was done because specific values may not be	Documents revised: Post-closure Care and Monitoring Plan, Attachment, Sections 1, 3, and 4.

	applicable or adequate. For example, a vegetative distress area smaller than the 200 square feet may warrant corrective action based on the specific situation. Similarly, localized differential settlement less than 6-inches may warrant further review. It is understood that differential settlement and vegetation distress are important items to monitor and will be. NMED will have opportunities to comment on all inspection reports.	
25	*NMED Specific Comment No. 25:* Specification 01400, Quality Control does not include preparation of Construction Completion documentation. Revise this section or another appropriate section of the design documentation to indicate that preparation and submittal of Construction Completion documentation is required.	Technical Specifications 01400
	DOE Response to NMED Specific Comment No. 25: The Construction Quality Assurance Plan, Sections 1.3 and 3.9 describe a Construction Completion Report to be prepared by the Design Engineer. It is to be completed and submitted to NMED within 90 days after Final Inspection of the finished project. The Technical Specifications, Section 01400 – Quality Control was modified to include the inclusion of a Construction Completion Report.	Documents revised: Technical Specifications Section 01400

Lab Sample	Client Samp	Matrix	Sample Typ	Collection D	Percent Mo	Analysis Me	Dilution Fac	Analysis Da	CAS	Analyte	Result	Unit	Flag	High Limit	High Limit T	Low Limit	Low Limit T	Percent Rec	Lower Reco	Upper Reco
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	71-55-6	1,1,1-Trichl	ND	ug/Kg		6.3	RL	0.54	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	79-34-5	1,1,2,2-Tetr	ND	ug/Kg		6.3	RL	0.51	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	76-13-1	1,1,2-Trichl	ND	ug/Kg		6.3	RL	2.1	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	79-00-5	1,1,2-Trichl	ND	ug/Kg		6.3	RL	0.72	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-34-3	1,1-Dichlon	ND	ug/Kg		6.3	RL	0.49	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-35-4	1,1-Dichlon	ND	ug/Kg		6.3	RL	2	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	120-82-1	1,2,4-Trichl	ND	ug/Kg		6.3	RL	0.54	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	96-12-8	1,2-Dibrom	ND	ug/Kg		13	RL	1.8	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	106-93-4	1,2-Dibrom	ND	ug/Kg		6.3	RL	0.89	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	95-50-1	1,2-Dichlon	ND	ug/Kg		6.3	RL	0.35	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	107-06-2	1,2-Dichlon	ND	ug/Kg		6.3	RL	1.1	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	17060-07-0	1,2-Dichlon	64	ug/Kg						101	72	127
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	78-87-5	1,2-Dichlon	ND	ug/Kg		6.3	RL	0.48	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	541-73-1	1,3-Dichlon	ND	ug/Kg		6.3	RL	0.35	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	106-46-7	1,4-Dichlon	ND	ug/Kg		6.3	RL	0.76	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	78-93-3	2-Butanone	16	ug/Kg	J	25	RL	2.4	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	591-78-6	2-Hexanone	ND	ug/Kg		25	RL	2.2	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	460-00-4	4-Bromoflu	67	ug/Kg						107	63	150
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	108-10-1	4-Methyl-2-	ND	ug/Kg		25	RL	0.92	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	67-64-1	Acetone	120	ug/Kg		25	RL	8.2	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	71-43-2	Benzene	ND	ug/Kg		6.3	RL	0.32	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-27-4	Bromodichl	ND	ug/Kg		6.3	RL	0.32	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-25-2	Bromoform	ND	ug/Kg		6.3	RL	0.47	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	74-83-9	Bromometh	ND	ug/Kg		13	RL	1.4	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-15-0	Carbon disu	3.2	ug/Kg	J	6.3	RL	0.87	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	56-23-5	Carbon tetr	ND	ug/Kg		6.3	RL	0.65	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	108-90-7	Chlorobenz	ND	ug/Kg		6.3	RL	0.48	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-00-3	Chloroetha	ND	ug/Kg		13	RL	0.66	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	67-66-3	Chloroform	ND	ug/Kg		6.3	RL	0.48	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	74-87-3	Chlorometh	ND	ug/Kg		13	RL	0.82	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	156-59-2	cis-1,2-Dich	ND	ug/Kg		6.3	RL	0.76	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	10061-01-5	cis-1,3-Dich	ND	ug/Kg		6.3	RL	0.76	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	110-82-7	Cyclohexan	ND	ug/Kg		13	RL	0.46	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	124-48-1	Dibromoch	ND	ug/Kg		6.3	RL	0.52	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	1868-53-7	Dibromoflu	62	ug/Kg						97	70	126
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-71-8	Dichlorodif	ND	ug/Kg		13	RL	1.7	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	100-41-4	Ethylbenze	ND	ug/Kg		6.3	RL	0.38	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	98-82-8	Isopropylbe	ND	ug/Kg		6.3	RL	0.33	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	79-20-9	Methyl ace	ND	ug/Kg		32	RL	1.7	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	1634-04-4	Methyl tert	ND	ug/Kg		6.3	RL	0.61	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	108-87-2	Methylcycl	ND	ug/Kg		13	RL	0.33	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	75-09-2	Methylene	ND	ug/Kg		6.3	RL	2	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	179601-23-	m-Xylene &	ND	ug/Kg		6.3	RL	0.72	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	95-47-6	o-Xylene	ND	ug/Kg		6.3	RL	0.43	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	100-42-5	Styrene	ND	ug/Kg		6.3	RL	0.44	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	127-18-4	Tetrachlor	ND	ug/Kg		6.3	RL	0.41	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	108-88-3	Toluene	ND	ug/Kg		6.3	RL	0.89	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	2037-26-5	Toluene-d8	62	ug/Kg						98	80	120
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	156-60-5	trans-1,2-D	ND	ug/Kg		6.3	RL	1.2	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	10061-02-6	trans-1,3-D	ND	ug/Kg		6.3	RL	0.44	MDL			
160-9039-1	SB-11 8.5-9	Solid		########	20.1	8260C	1	########	79-01-6	Trichloroet	ND	ug/Kg		6.3	RL	0.49	MDL			
[illegible]																				

LCSD 320-57212/5	Air	LCSD	TO-15	1	########	127-18-4	Tetrachloro	18.3	ppb v/v		0.4	RL	0.051	MDL	92	56	138	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	15.012	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	108-88-3	Toluene	18.4	ppb v/v		0.4	RL	0.051	MDL	92	71	132	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	14.038	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	2037-26-5	Toluene-d8	4.19	ppb v/v						105	70	130			LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Surrogate	PRIMARY	13.923	4	4
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	156-60-5	trans-1,2-D	17.3	ppb v/v		0.4	RL	0.1	MDL	86	70	130	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	8.527	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	10061-02-6	trans-1,3-D	16.5	ppb v/v		0.4	RL	0.088	MDL	82	56	136	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	14.172	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	79-01-6	Trichloroet	17.5	ppb v/v		0.4	RL	0.11	MDL	88	64	127	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	12.268	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	75-69-4	Trichloroflu	20	ppb v/v		0.4	RL	0.2	MDL	100	68	128	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	6.343	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	108-05-4	Vinyl acetat	18.7	ppb v/v		0.8	RL	0.15	MDL	93	77	134	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	9.08	20	
LCSD 320-57212/5	Air	LCSD	TO-15	1	########	75-01-4	Vinyl chlori	20.3	ppb v/v		0.4	RL	0.12	MDL	101	69	129	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Spike	PRIMARY	4.876	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	71-55-6	1,1,1-Trichl	18.8	ppb v/v		0.3	RL	0.065	MDL	94	65	124	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	12.585	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	79-34-5	1,1,2,2-Tetr	21.4	ppb v/v		0.4	RL	0.069	MDL	107	75	135	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	23.103	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	76-13-1	1,1,2-Trichl	17.6	ppb v/v		0.4	RL	0.16	MDL	88	50	132	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	7.329	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	79-00-5	1,1,2-Trichl	20.5	ppb v/v		0.4	RL	0.067	MDL	102	71	131	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	18.206	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-34-3	1,1-Dichloro	18.4	ppb v/v		0.3	RL	0.072	MDL	92	65	125	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	10.042	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-35-4	1,1-Dichloro	16.7	ppb v/v		0.8	RL	0.13	MDL	83	53	128	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	7.554	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	120-82-1	1,2,4-Trichl	22.1	ppb v/v		2	RL	0.43	MDL	111	59	150	5	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	29.923	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	95-63-6	1,2,4-Trime	21.9	ppb v/v		0.8	RL	0.16	MDL	109	61	145	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	24.898	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	106-93-4	1,2-Dibrom	21.2	ppb v/v		0.8	RL	0.075	MDL	106	68	131	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	19.8	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	76-14-2	1,2-Dichloro	21.2	ppb v/v		0.4	RL	0.16	MDL	106	64	124	3	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	4.177	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	95-50-1	1,2-Dichloro	22.2	ppb v/v		0.4	RL	0.13	MDL	111	73	143	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	26.589	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	107-06-2	1,2-Dichloro	17.8	ppb v/v		0.8	RL	0.088	MDL	89	71	131	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	13.291	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	17060-07-0	1,2-Dichloro	3.46	ppb v/v						87	70	130			LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	13.096	4	4
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	78-87-5	1,2-Dichloro	18.4	ppb v/v		0.4	RL	0.24	MDL	92	74	128	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	15.079	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	108-67-8	1,3,5-Trime	21.6	ppb v/v		0.4	RL	0.13	MDL	108	65	136	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	24.095	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	541-73-1	1,3-Dichloro	21.9	ppb v/v		0.4	RL	0.11	MDL	110	77	136	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	25.659	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	106-46-7	1,4-Dichloro	22.7	ppb v/v		0.4	RL	0.15	MDL	114	73	143	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	25.859	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	78-93-3	2-Butanone	18.8	ppb v/v		0.8	RL	0.2	MDL	94	71	131	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	10.894	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	591-78-6	2-Hexanone	18.8	ppb v/v		0.4	RL	0.087	MDL	94	70	128	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	18.328	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	460-00-4	4-Bromoflu	3.84	ppb v/v						96	70	130			LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	23.335	4	4
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	622-96-8	4-Ethyltolu	19.8	ppb v/v		0.4	RL	0.19	MDL	99	62	136	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	23.998	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	108-10-1	4-Methyl-2	16.5	ppb v/v		0.4	RL	0.14	MDL	82	73	133	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	16.381	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	67-64-1	Acetone	17.1	ppb v/v		5	RL	0.18	MDL	86	71	131	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	7.177	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	71-43-2	Benzene	19.2	ppb v/v		0.4	RL	0.079	MDL	96	68	128	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	13.418	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	100-44-7	Benzyl chlo	19.5	ppb v/v		0.8	RL	0.16	MDL	98	58	120	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	26.03	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-27-4	Bromodichl	18.3	ppb v/v		0.3	RL	0.066	MDL	92	65	130	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	15.536	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-25-2	Bromoform	24	ppb v/v		0.4	RL	0.07	MDL	120	64	144	3	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	22.702	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	74-83-9	Bromometh	17.5	ppb v/v		0.8	RL	0.34	MDL	87	70	131	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	5.467	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-15-0	Carbon dis	18.1	ppb v/v		0.8	RL	0.078	MDL	91	63	123	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	8.509	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	56-23-5	Carbon tetr	22.1	ppb v/v		0.8	RL	0.064	MDL	111	67	127	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	13.157	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	108-90-7	Chlorobenz	21.3	ppb v/v		0.3	RL	0.064	MDL	106	70	132	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	20.822	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-00-3	Chloroetha	17.2	ppb v/v		0.8	RL	0.31	MDL	86	70	131	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	5.662	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	67-66-3	Chloroform	18.6	ppb v/v		0.3	RL	0.095	MDL	93	69	129	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	11.66	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	74-87-3	Chlorometh	18.6	ppb v/v		0.8	RL	0.2	MDL	93	67	127	7	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	4.36	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	156-59-2	cis-1,2-Dich	20.2	ppb v/v		0.4	RL	0.089	MDL	101	68	128	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	11.307	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	10061-01-5	cis-1,3-Dich	20.9	ppb v/v		0.4	RL	0.1	MDL	105	78	132	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	16.746	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	124-48-1	Dibromoch	20.8	ppb v/v		0.4	RL	0.079	MDL	104	68	128	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	19.338	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-71-8	Dichlorodif	18.8	ppb v/v		0.4	RL	0.15	MDL	94	69	129	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	3.928	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	100-41-4	Ethylbenze	17.4	ppb v/v	B	0.4	RL	0.063	MDL	87	76	136	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	21.005	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	87-68-3	Hexachloro	19.6	ppb v/v		2	RL	0.43	MDL	98	42	150	3	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	30.288	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	179601-23-	m,p-Xylene	33.9	ppb v/v	B	0.8	RL	0.1	MDL	85	75	138	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	21.193	40	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-09-2	Methylene	16.3	ppb v/v		0.4	RL	0.072	MDL	82	65	125	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	8.466	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	95-47-6	o-Xylene	17.4	ppb v/v		0.4	RL	0.054	MDL	87	77	132	2	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	22.106	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	100-42-5	Styrene	22.4	ppb v/v		0.4	RL	0.059	MDL	112	76	144	3	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	22.136	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	127-18-4	Tetrachloro	21.3	ppb v/v		0.4	RL	0.051	MDL	107	56	138	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	19.113	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	108-88-3	Toluene	18.3	ppb v/v		0.4	RL	0.051	MDL	91	71	132	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	17.561	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	2037-26-5	Toluene-d8	3.91	ppb v/v						98	70	130			LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	17.385	4	4
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	156-60-5	trans-1,2-D	18.5	ppb v/v		0.4	RL	0.1	MDL	93	70	130	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	9.209	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	10061-02-6	trans-1,3-D	17.9	ppb v/v		0.4	RL	0.088	MDL	90	56	136	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	17.853	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	79-01-6	Trichloroet	20.5	ppb v/v		0.4	RL	0.11	MDL	102	64	127	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	14.781	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-69-4	Trichloroflu	18.2	ppb v/v		0.4	RL	0.2	MDL	91	68	128	8	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	6.288	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	108-05-4	Vinyl acetat	21.1	ppb v/v		0.8	RL	0.15	MDL	105	77	134	0	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	10.079	20	
LCSD 320-57324/5	Air	LCSD	TO-15	1	########	75-01-4	Vinyl chlori	18.1	ppb v/v		0.4	RL	0.12	MDL	90	69	129	1	25	LASO Airport Landfill	160-9039-1	Lab Control Sample Duplicate	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Spike	PRIMARY	4.609	20	
MB 320-57212/9	Air	MB	TO-15	1	########	71-55-6	1,1,1-Trichl	ND	ppb v/v		0.3	RL	0.065	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	79-34-5	1,1,2,2-Tetr	ND	ppb v/v		0.4	RL	0.069	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	76-13-1	1,1,2-Trichl	ND	ppb v/v		0.4	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	79-00-5	1,1,2-Trichl	ND	ppb v/v		0.4	RL	0.067	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-34-3	1,1-Dichloro	ND	ppb v/v		0.3	RL	0.072	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-35-4	1,1-Dichloro	ND	ppb v/v		0.8	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	120-82-1	1,2,4-Trichl	ND	ppb v/v		2	RL	0.43	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	95-63-6	1,2,4-Trime	ND	ppb v/v		0.8	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	106-93-4	1,2-Dibrom	ND	ppb v/v		0.8	RL	0.075	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	76-14-2	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	95-50-1	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	107-06-2	1,2-Dichloro	ND	ppb v/v		0.8	RL	0.088	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	17060-07-0	1,2-Dichloro	3.65	ppb v/v						91	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Surrogate	PRIMARY	11.167	4	4
MB 320-57212/9	Air	MB	TO-15	1	########	78-87-5	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.24	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	108-67-8	1,3,5-Trime	ND	ppb v/v		0.4	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	541-73-1	1,3-Dichloro	ND	ppb v/v		0.4	RL	0.11	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	106-46-7	1,4-Dichloro	ND	ppb v/v		0.4	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	78-93-3	2-Butanone	ND	ppb v/v		0.8	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	591-78-6	2-Hexanone	ND	ppb v/v		0.4	RL	0.087	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	460-00-4	4-Bromoflu	4.18	ppb v/v						105	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Surrogate	PRIMARY	17.816	4	4
MB 320-57212/9	Air	MB	TO-15	1	########	622-96-8	4-Ethyltolu	ND	ppb v/v		0.4	RL	0.19	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	108-10-1	4-Methyl-2	ND	ppb v/v		0.4	RL	0.14	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	67-64-1	Acetone	ND	ppb v/v		5	RL	0.18	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	71-43-2	Benzene	ND	ppb v/v		0.4	RL	0.079	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	100-44-7	Benzyl chlo	ND	ppb v/v		0.8	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-27-4	Bromodichl	ND	ppb v/v		0.3	RL	0.066	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-25-2	Bromoform	ND	ppb v/v		0.4	RL	0.07	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	74-83-9	Bromometh	ND	ppb v/v		0.8	RL	0.34	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-15-0	Carbon dis	ND	ppb v/v		0.8	RL	0.078	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	56-23-5	Carbon tetr	ND	ppb v/v		0.8	RL	0.064	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	108-90-7	Chlorobenz	ND	ppb v/v		0.3	RL	0.064	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-00-3	Chloroetha	ND	ppb v/v		0.8	RL	0.31	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	67-66-3	Chloroform	ND	ppb v/v		0.3	RL	0.095	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	74-87-3	Chlorometh	ND	ppb v/v		0.8	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	156-59-2	cis-1,2-Dich	ND	ppb v/v		0.4	RL	0.089	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	10061-01-5	cis-1,3-Dich	ND	ppb v/v		0.4	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	124-48-1	Dibromoch	ND	ppb v/v		0.4	RL	0.079	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-71-8	Dichlorodif	ND	ppb v/v		0.4	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	100-41-4	Ethylbenze	ND	ppb v/v		0.4	RL	0.063	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	87-68-3	Hexachloro	ND	ppb v/v		2	RL	0.43	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	179601-23-	m,p-Xylene	ND	ppb v/v		0.8	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-09-2	Methylene	ND	ppb v/v		0.4	RL	0.072	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	95-47-6	o-Xylene	ND	ppb v/v		0.4	RL	0.054	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	100-42-5	Styrene	ND	ppb v/v		0.4	RL	0.059	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	127-18-4	Tetrachloro	ND	ppb v/v		0.4	RL	0.051	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	108-88-3	Toluene	ND	ppb v/v		0.4	RL	0.051	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	2037-26-5	Toluene-d8	4.27	ppb v/v						107	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Surrogate	PRIMARY	13.923	4	4
MB 320-57212/9	Air	MB	TO-15	1	########	156-60-5	trans-1,2-D	ND	ppb v/v		0.4	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	10061-02-6	trans-1,3-D	ND	ppb v/v		0.4	RL	0.088	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	79-01-6	Trichloroet	ND	ppb v/v		0.4	RL	0.11	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-69-4	Trichloroflu	ND	ppb v/v		0.4	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	108-05-4	Vinyl acetat	ND	ppb v/v		0.8	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57212/9	Air	MB	TO-15	1	########	75-01-4	Vinyl chlori	ND	ppb v/v		0.4	RL	0.12	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57212	TestAmeric ATMS2	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	71-55-6	1,1,1-Trichl	ND	ppb v/v		0.3	RL	0.065	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	79-34-5	1,1,2,2-Tetr	ND	ppb v/v		0.4	RL	0.069	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	76-13-1	1,1,2-Trichl	ND	ppb v/v		0.4	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	79-00-5	1,1,2-Trichl	ND	ppb v/v		0.4	RL	0.067	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-34-3	1,1-Dichloro	ND	ppb v/v		0.3	RL	0.072	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-35-4	1,1-Dichloro	ND	ppb v/v		0.8	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	120-82-1	1,2,4-Trichl	ND	ppb v/v		2	RL	0.43	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	95-63-6	1,2,4-Trime	ND	ppb v/v		0.8	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	24.892		
MB 320-57324/12	Air	MB	TO-15	1	########	106-93-4	1,2-Dibrom	ND	ppb v/v		0.8	RL	0.075	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	76-14-2	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	95-50-1	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	26.583		
MB 320-57324/12	Air	MB	TO-15	1	########	107-06-2	1,2-Dichloro	ND	ppb v/v		0.8	RL	0.088	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	17060-07-0	1,2-Dichloro	3.06	ppb v/v						76	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	13.084	4	4
MB 320-57324/12	Air	MB	TO-15	1	########	78-87-5	1,2-Dichloro	ND	ppb v/v		0.4	RL	0.24	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	108-67-8	1,3,5-Trime	ND	ppb v/v		0.4	RL	0.13	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	24.089		
MB 320-57324/12	Air	MB	TO-15	1	########	541-73-1	1,3-Dichloro	ND	ppb v/v		0.4	RL	0.11	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	25.652		
MB 320-57324/12	Air	MB	TO-15	1	########	106-46-7	1,4-Dichloro	ND	ppb v/v		0.4	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	25.871		
MB 320-57324/12	Air	MB	TO-15	1	########	78-93-3	2-Butanone	ND	ppb v/v		0.8	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	591-78-6	2-Hexanone	ND	ppb v/v		0.4	RL	0.087	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	460-00-4	4-Bromoflu	3.62	ppb v/v						90	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	23.322	4	4
MB 320-57324/12	Air	MB	TO-15	1	########	622-96-8	4-Ethyltolu	ND	ppb v/v		0.4	RL	0.19	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	108-10-1	4-Methyl-2	ND	ppb v/v		0.4	RL	0.14	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	67-64-1	Acetone	ND	ppb v/v		5	RL	0.18	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	71-43-2	Benzene	ND	ppb v/v		0.4	RL	0.079	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	100-44-7	Benzyl chlo	ND	ppb v/v		0.8	RL	0.16	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-27-4	Bromodichl	ND	ppb v/v		0.3	RL	0.066	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-25-2	Bromoform	ND	ppb v/v		0.4	RL	0.07	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	74-83-9	Bromometh	ND	ppb v/v		0.8	RL	0.34	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-15-0	Carbon dis	ND	ppb v/v		0.8	RL	0.078	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	56-23-5	Carbon tetr	ND	ppb v/v		0.8	RL	0.064	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	108-90-7	Chlorobenz	ND	ppb v/v		0.3	RL	0.064	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-00-3	Chloroetha	ND	ppb v/v		0.8	RL	0.31	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	67-66-3	Chloroform	ND	ppb v/v		0.3	RL	0.095	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	74-87-3	Chlorometh	ND	ppb v/v		0.8	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	156-59-2	cis-1,2-Dich	ND	ppb v/v		0.4	RL	0.089	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	10061-01-5	cis-1,3-Dich	ND	ppb v/v		0.4	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	124-48-1	Dibromoch	ND	ppb v/v		0.4	RL	0.079	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-71-8	Dichlorodif	ND	ppb v/v		0.4	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	100-41-4	Ethylbenze	0.0697	ppb v/v	J	0.4	RL	0.063	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	20.992		
MB 320-57324/12	Air	MB	TO-15	1	########	87-68-3	Hexachloro	ND	ppb v/v		2	RL	0.43	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	179601-23-	m,p-Xylene	0.115	ppb v/v	J	0.8	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	21.193		
MB 320-57324/12	Air	MB	TO-15	1	########	75-09-2	Methylene	ND	ppb v/v		0.4	RL	0.072	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	95-47-6	o-Xylene	ND	ppb v/v		0.4	RL	0.054	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	22.099		
MB 320-57324/12	Air	MB	TO-15	1	########	100-42-5	Styrene	ND	ppb v/v		0.4	RL	0.059	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	127-18-4	Tetrachloro	ND	ppb v/v		0.4	RL	0.051	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	108-88-3	Toluene	ND	ppb v/v		0.4	RL	0.051	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY	17.549		
MB 320-57324/12	Air	MB	TO-15	1	########	2037-26-5	Toluene-d8	3.86	ppb v/v						97	70	130			LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Surrogate	PRIMARY	17.373	4	4
MB 320-57324/12	Air	MB	TO-15	1	########	156-60-5	trans-1,2-D	ND	ppb v/v		0.4	RL	0.1	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	10061-02-6	trans-1,3-D	ND	ppb v/v		0.4	RL	0.088	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	79-01-6	Trichloroet	ND	ppb v/v		0.4	RL	0.11	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-69-4	Trichloroflu	ND	ppb v/v		0.4	RL	0.2	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	108-05-4	Vinyl acetat	ND	ppb v/v		0.8	RL	0.15	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			
MB 320-57324/12	Air	MB	TO-15	1	########	75-01-4	Vinyl chlori	ND	ppb v/v		0.4	RL	0.12	MDL						LASO Airport Landfill	160-9039-1	Method Blank	Total/NA	250	mL	250	mL	320-57324	TestAmeric ATMS7	WET	Target	PRIMARY			

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-9039-1
Client Project/Site: LASO Airport Landfill

For:
CTI and Associates Inc.
51331 W Pontiac Trail
Wixom, Michigan 48393

Attn: Brent Kelley

Authorized for release by:
11/10/2014 3:49:15 PM

Chenise Lambert-Sykes, Project Management Assistant II
(314)298-8566
chenise.lambert-sykes@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Case Narrative 3
Chain of Custody 5
Field Data Sheets 8
Receipt Checklists 14
Definitions/Glossary 16
Method Summary 17
Sample Summary 18
Detection Summary 19
Client Sample Results 23
QC Sample Results 40
QC Association Summary 53
Surrogate Summary 55

Job ID: 160-9039-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: CTI and Associates Inc.

Project: LASO Airport Landfill

Report Number: 160-9039-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 10/24/2014 and 10/25/2014; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 2.2 C.

VOLATILE ORGANIC COMPOUNDS BY GC/MS

Samples SB-11 8.5-9.0 FT (160-9039-1), SB-12 7-7.5 FT (160-9039-2), SB20 2.5-3FT (160-9039-3), SB19 6.5-7FT (160-9039-4), SB50 2-2.5FT (160-9039-5) and SB51 3-3.5FT (160-9039-6) were analyzed for Volatile Organic Compounds by GC/MS in accordance with EPA SW-846 Method 8260C. The samples were prepared on 10/25/2014 and analyzed on 10/29/2014.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with batch 152963. An LCS/LCSD was performed to demonstrate accuracy and precision.
(MB 160-152012/1-A), SB-11 8.5-9.0 FT (160-9039-1), SB-12 7-7.5 FT (160-9039-2), SB19 6.5-7FT (160-9039-4), SB20 2.5-3FT (160-9039-3), SB50 2-2.5FT (160-9039-5), SB51 3-3.5FT (160-9039-6)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Job ID: 160-9039-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

PERCENT SOLIDS

Samples SB-11 8.5-9.0 FT (160-9039-1), SB-12 7-7.5 FT (160-9039-2), SB20 2.5-3FT (160-9039-3), SB19 6.5-7FT (160-9039-4), SB50 2-2.5FT (160-9039-5) and SB51 3-3.5FT (160-9039-6) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 10/28/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

FIXED GASES

Samples SB-11 (160-9039-7), SB-12 (160-9039-8), SB 20 (160-9039-9), SB 19 (160-9039-10), SB 50 (160-9039-11) and SB 51 (160-9039-12) were analyzed for Fixed Gases in accordance with ASTM Method D1946. The samples were analyzed on 10/30/2014.

Nitrogen was detected in method blank MB 320-56731/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

Samples SB-11 (160-9039-7)[2.25X], SB-11 (160-9039-7)[4.5X], SB-12 (160-9039-8)[2.37X], SB 20 (160-9039-9)[2.3X], SB 19 (160-9039-10)[2.32X], SB 50 (160-9039-11)[2.32X] and SB 51 (160-9039-12)[2.35X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

SULFUR EMISSIONS FROM STATIONARY SOURCES

Samples SB-11 (160-9039-7), SB-12 (160-9039-8), SB 20 (160-9039-9), SB 19 (160-9039-10), SB 50 (160-9039-11) and SB 51 (160-9039-12) were analyzed for Sulfur Emissions from Stationary Sources in accordance with EPA_15_16. The samples were analyzed on 10/24/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

VOLATILE ORGANIC COMPOUNDS

Samples SB-11 (160-9039-7), SB-12 (160-9039-8), SB 20 (160-9039-9), SB 19 (160-9039-10), SB 50 (160-9039-11) and SB 51 (160-9039-12) were analyzed for volatile organic compounds in accordance with EPA Method TO-15. The samples were analyzed on 11/06/2014 and 11/07/2014.

Ethylbenzene and m,p-Xylene were detected in method blank MB 320-57324/12 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

Samples SB-12 (160-9039-8)[1.18X], SB-12 (160-9039-8)[2.37X], SB 20 (160-9039-9)[1.98X], SB 19 (160-9039-10)[386X], SB 19 (160-9039-10)[763X], SB 50 (160-9039-11)[11.6X] and SB 51 (160-9039-12)[1.68X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

The following sample was diluted due to the abundance of non-target analytes: SB 50 (160-9039-11). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: J. Jordan	Lab PM: Lambert-Sykes, Chenise Y	Carrier Tracking No(s): Fed Ex 8996 6538 1080	COC No: 160-1929-955.1
Client Contact: Brent Kelley	Phone: 505-379-1269	E-Mail: chenise.lambert-sykes@testamericainc.com		Page: Page 1 of 1
Company: CTI and Associates Inc.				Job #:
Address: 51331 W Pontiac Trail	Due Date Requested:			
City: Wixom	TAT Requested (days):			
State, Zip: MI, 48393				
Phone:	PO #: Purchase Order not required			
Email: bkelley@cticompanies.com	WO #:			
Project Name: LASO Airport Landfill	Project #: 16003715			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8260	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SB-11 8.5-9.0 ft	10/23/14	0840	G	S			X		
SB-12 7-7.5 ft	10/23/14	1000	G	S			X		
~~8~~ SB20 2.5-3 ft	10/23/14	1100	G	S			X		
SB19 6.5-7 ft	10/23/14	1215	G	S			X		
SB 50 2-2.5 ft	10/23/14	1330	G	S			X		
SB 51 3-3.5 ft	10/23/14	1415	G	S			X		

160-9039 Chain of Custody

Possible Hazard Identification
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☑ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment: Fed Ex

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
J. Jordan	10/24/14 1300	TPMC	B	10/25/14 0850	T4
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Brent Kelley	Samples Collected By: J. Jordan	COC No:
Company Name: CTI + Assoc Inc	Phone: 248-486-5100		____ of ____ COCs
Address: 51331 W. Pontiac Trail	Email: bkelley@ctiscompanies.com		
City/State/Zip Wixom MI 48393			For Lab Use Only:
Phone: 248 486 5100	Site Contact: Evangelos Gletsos		Walk-in Client:
FAX:	TA Contact:		Lab Sampling:
Project Name:	Anaylsis Turnaround Time		
Site/Location:	Standard (Specific):		Job / SDG No.:
P O #	Rush (Specifiy):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
SB-11 Suma	10/23/14	0900	0900	NA	NA	NA	~~[illegible]~~ 1064	X														
SB-11 Tedlar bag		0900	0910	↓	↓	↓															X	CH_4, CO_2, H_2S N_2
SB-12 Suma		1000	1000	NA	NA	NA	C8508	X														
SB-12 Tedlar bag ~~[illegible]~~		1000	1010	↓	↓	↓															X	
SB20 Suma		1100	1102	NA	NA	NA	C8387	X														
SB20 tedlar bag		1100	1115	↓	↓	↓															X	
SB19 Suma		1230	1230	↓	↓	↓	C8417	X														
SB 19 tedlar bag		1230	1239	↓	↓	↓															X	
SB 50 Suma		1330	1330	↓	↓	↓	7950	X														
SB 50 Tedlar bag		1330	1345	↓	↓	↓															X	

Temperature (Fahrenheit)			
Start	Interior	Ambient	50
Stop			70

Temperature (Fahrenheit)			
Start	Interior	Ambient	50
Stop			70

Page 1 of 2

Fed Ex 8996 6538 1070

Special Instructions/QC Requirements & Comments:

Samples Shipped by: J. Jordan / E. Gletsos	Date / Time: 10/23/14 1600	Samples Received by: [signature] 10/24/14	900
Samples Relinquished by: [signature]	Date / Time:	Received by:	
Relinquished by:	Date / Time:	Received by:	
Lab Use Only: Shipper Name:	Opened by:	Condition:	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	Project Manager: Brent Kelley	Samples Collected By:	COC No:
Company Name: CTI & Associates Inc	Phone: 248 486 5100		_____ of _____ COCs
Address: 51331 W. Pontiac Trail	Email: bkelley@CTicompanies.com		
City/State/Zip Wixom, MI 48393			For Lab Use Only:
Phone: 248 486 5100	Site Contact: Evangelos Glotsos		Walk-in Client:
FAX:	TA Contact:		Lab Sampling:
Project Name: Los Alamos Airport Landfill	Anaylsis Turnaround Time		
Site/Location: Los Alamos, NM	Standard (Specific):		Job / SDG No.:
P O #	Rush (Specifiy):		(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes: JLS 10/23/14
SB S1 Sumo	10/23/14	1415	1415	NA	NA	NA	08327	X														~~CH4, CO2, H2S, N2~~
SB S1 Tedlar bag	↓	1415	1420	NA	NA	NA	NA														X	CH4, CO2, H2S, N2

	Temperature (Fahrenheit)			
	Start	Interior	Ambient	
	Stop			

See Pg 1

Page 2 of 2

	Temperature (Fahrenheit)			
	Start	Interior	Ambient	
	Stop			

Fed Ex 8996 6539 1070

Special Instructions/QC Requirements & Comments:

Samples Shipped by: See Pg 1	Date / Time:	Samples Received by:	
Samples Relinquished by: See Pg 1	Date / Time:	Received by:	
Relinquished by:	Date / Time:	Received by:	

Lab Use Only: Shipper Name: Opened by: Condition:

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 7

Client/Project:		VFR ID:		
Canister Serial #:	34000402	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.23	10/28/14	AO
FINAL PRESSURE (PSIA)	25.26	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.25			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.25		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							10/30/2014	atgc1			
Canister DF =	2.25	X	Load DF =	2	X	Bag DF =	1	=	FINAL DF 4.498664292		
			LVf (mLs)	50		BVf (mLs)					
			LVi (mLs)	25		Bvi (mLs)					
							Date	Instr.	File #		
							11/5/2014	atms2			
Canister DF =	2.25	X	Load DF =	0.4464286	X	Bag DF =	1	=	FINAL DF 1.004166137		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	560		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.25	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 8

Client/Project:		VFR ID:		
Canister Serial #:	34000140	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.73	10/28/14	AO
FINAL PRESSURE (PSIA)	25.42	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.37			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.37		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							11/5/2014	atms2			
Canister DF =	2.37	X	Load DF =	0.5	X	Bag DF =	1	=	FINAL DF 1.184529357		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	500		Bvi (mLs)					
							Date	Instr.	File #		
							11/6/2014	atms7			
Canister DF =	2.37	X	Load DF =	1	X	Bag DF =	1	=	FINAL DF 2.369058714		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	250		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.37	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 9

Client/Project:		VFR ID:		
Canister Serial #:	34001302	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	11.01	10/28/14	AO
FINAL PRESSURE (PSIA)	25.35	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.30			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.30		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								11/5/2014	atms2		
Canister DF =	2.30	X	Load DF =	0.4347826	X	Bag DF =	1	=		FINAL DF	1.001066224
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	575		Bvi (mLs)					
								Date	Instr.	File #	
								11/6/2014	atms7		
Canister DF =	2.30	X	Load DF =	0.862069	X	Bag DF =	1	=		FINAL DF	1.984872686
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	290		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.30	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 10

Client/Project:		VFR ID:		
Canister Serial #:	34001275	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.93	10/28/14	AO
FINAL PRESSURE (PSIA)	25.35	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.32			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.32		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

Canister DF		Load DF		Bag DF		Date	Instr.	File #	FINAL DF
2.32	X	3.3333333 (LVf 250, LVi 75)	X	50 (BVf 1000, Bvi 20)	=	11/5/2014	atms2		386.5507777
2.32	X	6.5789474 (LVf 250, LVi 38)	X	50 (BVf 1000, Bvi 20)	=	11/6/2014	atms7		762.9291665
2.32	X	#DIV/0! (LVf, LVi)	X	1 (BVf, Bvi)	=				#DIV/0!

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 11

Client/Project:		VFR ID:		
Canister Serial #:	34000183	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.89	10/28/14	AO
FINAL PRESSURE (PSIA)	25.29	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.32			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.32		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

							Date	Instr.	File #		
							11/5/2014	atms2			
Canister DF =	2.32	X	Load DF =	5	X	Bag DF =	1	=	FINAL DF 11.61157025		
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	50		Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.32	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
							Date	Instr.	File #		
Canister DF =	2.32	X	Load DF =	#DIV/0!	X	Bag DF =	1	=	FINAL DF #DIV/0!		
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

Sacramento

JOB # 160-9039
Sample # 12

Client/Project:		VFR ID:		
Canister Serial #:	34000154	Duration:		☐ Hrs ☐ Min
Cleaning Job:		Flow:		mL/min
Client ID:		Initials:		
Site Location:				

FIELD				
READING	TIME	PRESS.	DATE	INITIALS
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY			
READING	PRESS.	DATE	INITIALS
INITIAL VACUUM CHECK (INCHES Hg)	29.8		JMT
☐ Helium Pre-dilution - Final Pressure (INCHES Hg)			
INITIAL PRESSURE (PSIA)	10.74	10/28/14	AO
FINAL PRESSURE (PSIA)	25.27	10/28/14	AO
Pressurization Gas: ☐ N2 ☐ He	SCREENED ☐	SCRN DIL. VS 250mLs:	
Initial Canister Dilution Factor = 2.35			

CANISTER REPRESSURIZATION

Date	Pi (PSIA)	Pf (PSIA)	Initial DF	Initials	NEW DF
			2.35		#DIV/0!
			#DIV/0!		#DIV/0!
			#DIV/0!		#DIV/0!

Analytical Dilution Factors

								Date	Instr.	File #	
								11/5/2014	atms2		
Canister DF =	2.35	X	Load DF =	0.7142857	X	Bag DF =	1	=		FINAL DF	1.680633147
			LVf (mLs)	250		BVf (mLs)					
			LVi (mLs)	350		Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.35	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					
								Date	Instr.	File #	
Canister DF =	2.35	X	Load DF =	#DIV/0!	X	Bag DF =	1	=		FINAL DF	#DIV/0!
			LVf (mLs)			BVf (mLs)					
			LVi (mLs)			Bvi (mLs)					

Login Sample Receipt Checklist

Client: CTI and Associates Inc.

Job Number: 160-9039-1

Login Number: 9039

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: CTI and Associates Inc.

Job Number: 160-9039-1

Login Number: 9039
List Number: 2
Creator: Nelson, Kym D

List Source: TestAmerica Sacramento
List Creation: 10/27/14 02:39 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	False	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Air - GC/MS VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

Air - GC VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL SL
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC
D1946	Fixed Gases in Air (GC)	ASTM	TAL SAC
EPA 15_16	Sulfur Emissions from Stationary Sources (GC/FPD)	EPA	TAL SAC
Moisture	Percent Moisture	EPA	TAL SL

Protocol References:

ASTM = ASTM International

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-9039-1	SB-11 8.5-9.0 FT	Solid	10/23/14 08:40	10/25/14 08:50
160-9039-2	SB-12 7-7.5 FT	Solid	10/23/14 10:00	10/25/14 08:50
160-9039-3	SB20 2.5-3FT	Solid	10/23/14 11:00	10/25/14 08:50
160-9039-4	SB19 6.5-7FT	Solid	10/23/14 12:15	10/25/14 08:50
160-9039-5	SB50 2-2.5FT	Solid	10/23/14 13:30	10/25/14 08:50
160-9039-6	SB51 3-3.5FT	Solid	10/23/14 14:15	10/25/14 08:50
160-9039-7	SB-11	Air	10/23/14 09:10	10/24/14 09:30
160-9039-8	SB-12	Air	10/23/14 10:10	10/25/14 08:50
160-9039-9	SB 20	Air	10/23/14 11:15	10/25/14 08:50
160-9039-10	SB 19	Air	10/23/14 12:39	10/25/14 08:50
160-9039-11	SB 50	Air	10/23/14 13:45	10/25/14 08:50
160-9039-12	SB 51	Air	10/23/14 14:20	10/25/14 08:50

Detection Summary

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB-11 8.5-9.0 FT — Lab Sample ID: 160-9039-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	16	J	25	2.4	ug/Kg	1	☼	8260C	Total/NA
Acetone	120		25	8.2	ug/Kg	1	☼	8260C	Total/NA
Carbon disulfide	3.2	J	6.3	0.87	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB-12 7-7.5 FT — Lab Sample ID: 160-9039-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	62		28	9.1	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB20 2.5-3FT — Lab Sample ID: 160-9039-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	24		24	2.3	ug/Kg	1	☼	8260C	Total/NA
Acetone	130		24	7.7	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB19 6.5-7FT — Lab Sample ID: 160-9039-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	51		24	7.7	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB50 2-2.5FT — Lab Sample ID: 160-9039-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	8.0	J	18	5.9	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB51 3-3.5FT — Lab Sample ID: 160-9039-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	52		29	9.3	ug/Kg	1	☼	8260C	Total/NA

Client Sample ID: SB-11 — Lab Sample ID: 160-9039-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	24		5.0	0.18	ppb v/v	1		TO-15	Total/NA
Benzene	0.96		0.40	0.079	ppb v/v	1		TO-15	Total/NA
2-Butanone (MEK)	4.0		0.80	0.20	ppb v/v	1		TO-15	Total/NA
Carbon disulfide	2.7		0.80	0.078	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.095	J	0.80	0.064	ppb v/v	1		TO-15	Total/NA
Chlorobenzene	0.27	J	0.30	0.064	ppb v/v	1		TO-15	Total/NA
Chloromethane	0.61	J	0.80	0.20	ppb v/v	1		TO-15	Total/NA
1,4-Dichlorobenzene	8.0		0.40	0.15	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	12		0.40	0.15	ppb v/v	1		TO-15	Total/NA
cis-1,2-Dichloroethene	2.1		0.40	0.089	ppb v/v	1		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.37	J	0.40	0.16	ppb v/v	1		TO-15	Total/NA
Ethylbenzene	8.3		0.40	0.063	ppb v/v	1		TO-15	Total/NA
4-Ethyltoluene	0.68		0.40	0.19	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.12	J	0.40	0.072	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	0.061	J	0.40	0.051	ppb v/v	1		TO-15	Total/NA
Toluene	1.0		0.40	0.051	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.41		0.40	0.20	ppb v/v	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB-11 (Continued) — Lab Sample ID: 160-9039-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2,4-Trimethylbenzene	4.8		0.80	0.16	ppb v/v	1		TO-15	Total/NA
1,3,5-Trimethylbenzene	2.2		0.40	0.13	ppb v/v	1		TO-15	Total/NA
Vinyl chloride	0.50		0.40	0.12	ppb v/v	1		TO-15	Total/NA
m,p-Xylene	9.4		0.80	0.10	ppb v/v	1		TO-15	Total/NA
o-Xylene	1.6		0.40	0.054	ppb v/v	1		TO-15	Total/NA
Carbon Dioxide (TCD)	0.18	J	1.1	0.024	% v/v	2.25		D1946	Total/NA
Methane (FID)	0.14		0.00045	0.000090	% v/v	4.5		D1946	Total/NA
Nitrogen	82	B	2.3	0.055	% v/v	2.25		D1946	Total/NA

Client Sample ID: SB-12 — Lab Sample ID: 160-9039-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	47		5.9	0.21	ppb v/v	1.18		TO-15	Total/NA
Benzene	9.8		0.47	0.093	ppb v/v	1.18		TO-15	Total/NA
2-Butanone (MEK)	11		0.94	0.23	ppb v/v	1.18		TO-15	Total/NA
Carbon disulfide	39		0.94	0.092	ppb v/v	1.18		TO-15	Total/NA
Carbon tetrachloride	0.098	J	0.94	0.076	ppb v/v	1.18		TO-15	Total/NA
Chloroform	3.4		0.35	0.11	ppb v/v	1.18		TO-15	Total/NA
Chloromethane	0.61	J	0.94	0.23	ppb v/v	1.18		TO-15	Total/NA
1,4-Dichlorobenzene	5.9		0.47	0.18	ppb v/v	1.18		TO-15	Total/NA
Dichlorodifluoromethane	2.6		0.47	0.17	ppb v/v	1.18		TO-15	Total/NA
1,1-Dichloroethane	0.17	J	0.35	0.085	ppb v/v	1.18		TO-15	Total/NA
cis-1,2-Dichloroethene	68		0.47	0.11	ppb v/v	1.18		TO-15	Total/NA
trans-1,2-Dichloroethene	1.1		0.47	0.12	ppb v/v	1.18		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	15		0.47	0.18	ppb v/v	1.18		TO-15	Total/NA
4-Ethyltoluene	12		0.47	0.22	ppb v/v	1.18		TO-15	Total/NA
Methylene Chloride	0.34	J	0.47	0.085	ppb v/v	1.18		TO-15	Total/NA
Styrene	4.2		0.47	0.070	ppb v/v	1.18		TO-15	Total/NA
Tetrachloroethene	0.42	J	0.47	0.060	ppb v/v	1.18		TO-15	Total/NA
Toluene	7.1		0.47	0.060	ppb v/v	1.18		TO-15	Total/NA
Trichloroethene	0.65		0.47	0.12	ppb v/v	1.18		TO-15	Total/NA
Trichlorofluoromethane	0.33	J	0.47	0.23	ppb v/v	1.18		TO-15	Total/NA
1,2,4-Trimethylbenzene	49		0.94	0.19	ppb v/v	1.18		TO-15	Total/NA
1,3,5-Trimethylbenzene	26		0.47	0.15	ppb v/v	1.18		TO-15	Total/NA
Vinyl chloride	17		0.47	0.14	ppb v/v	1.18		TO-15	Total/NA
m,p-Xylene	58		0.94	0.12	ppb v/v	1.18		TO-15	Total/NA
o-Xylene	10		0.47	0.064	ppb v/v	1.18		TO-15	Total/NA
Ethylbenzene - DL	40	B	0.95	0.15	ppb v/v	2.37		TO-15	Total/NA
Carbon Dioxide (TCD)	1.3		1.2	0.025	% v/v	2.37		D1946	Total/NA
Methane (TCD)	1.9		1.2	0.32	% v/v	2.37		D1946	Total/NA
Nitrogen	80		2.4	0.058	% v/v	2.37		D1946	Total/NA

Client Sample ID: SB 20 — Lab Sample ID: 160-9039-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzene	5.7		0.40	0.079	ppb v/v	1		TO-15	Total/NA
2-Butanone (MEK)	15		0.80	0.20	ppb v/v	1		TO-15	Total/NA
Carbon disulfide	8.1		0.80	0.078	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.10	J	0.80	0.064	ppb v/v	1		TO-15	Total/NA
Chloromethane	0.65	J	0.80	0.20	ppb v/v	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB 20 (Continued) — Lab Sample ID: 160-9039-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,2-Dichlorobenzene	0.67		0.40	0.13	ppb v/v	1		TO-15	Total/NA
1,3-Dichlorobenzene	0.26	J	0.40	0.11	ppb v/v	1		TO-15	Total/NA
1,4-Dichlorobenzene	4.2		0.40	0.15	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	3.8		0.40	0.15	ppb v/v	1		TO-15	Total/NA
cis-1,2-Dichloroethene	4.4		0.40	0.089	ppb v/v	1		TO-15	Total/NA
trans-1,2-Dichloroethene	0.24	J	0.40	0.10	ppb v/v	1		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.92		0.40	0.16	ppb v/v	1		TO-15	Total/NA
Ethylbenzene	4.9		0.40	0.063	ppb v/v	1		TO-15	Total/NA
4-Ethyltoluene	0.85		0.40	0.19	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.11	J	0.40	0.072	ppb v/v	1		TO-15	Total/NA
Styrene	3.1		0.40	0.059	ppb v/v	1		TO-15	Total/NA
Tetrachloroethene	0.099	J	0.40	0.051	ppb v/v	1		TO-15	Total/NA
Toluene	4.6		0.40	0.051	ppb v/v	1		TO-15	Total/NA
Trichloroethene	5.1		0.40	0.11	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.22	J	0.40	0.20	ppb v/v	1		TO-15	Total/NA
1,2,4-Trimethylbenzene	4.3		0.80	0.16	ppb v/v	1		TO-15	Total/NA
1,3,5-Trimethylbenzene	1.9		0.40	0.13	ppb v/v	1		TO-15	Total/NA
Vinyl chloride	1.8		0.40	0.12	ppb v/v	1		TO-15	Total/NA
m,p-Xylene	6.8		0.80	0.10	ppb v/v	1		TO-15	Total/NA
o-Xylene	2.5		0.40	0.054	ppb v/v	1		TO-15	Total/NA
Acetone - DL	44		9.9	0.35	ppb v/v	1.98		TO-15	Total/NA
Carbon Dioxide (TCD)	1.4		1.2	0.025	% v/v	2.3		D1946	Total/NA
Methane (TCD)	2.0		1.2	0.31	% v/v	2.3		D1946	Total/NA
Nitrogen	79		2.3	0.056	% v/v	2.3		D1946	Total/NA

Client Sample ID: SB 19 — Lab Sample ID: 160-9039-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	1900		1900	69	ppb v/v	386		TO-15	Total/NA
Benzene	120	J	150	30	ppb v/v	386		TO-15	Total/NA
2-Butanone (MEK)	2800		310	77	ppb v/v	386		TO-15	Total/NA
Carbon disulfide	40	J	310	30	ppb v/v	386		TO-15	Total/NA
1,4-Dichlorobenzene	2800		150	58	ppb v/v	386		TO-15	Total/NA
cis-1,2-Dichloroethene	800		150	34	ppb v/v	386		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	210		150	60	ppb v/v	386		TO-15	Total/NA
Ethylbenzene	4700		150	24	ppb v/v	386		TO-15	Total/NA
4-Ethyltoluene	850		150	72	ppb v/v	386		TO-15	Total/NA
Methylene Chloride	160		150	28	ppb v/v	386		TO-15	Total/NA
4-Methyl-2-pentanone (MIBK)	1500		150	52	ppb v/v	386		TO-15	Total/NA
Styrene	380		150	23	ppb v/v	386		TO-15	Total/NA
Tetrachloroethene	390		150	20	ppb v/v	386		TO-15	Total/NA
Toluene	9100		150	20	ppb v/v	386		TO-15	Total/NA
1,1,1-Trichloroethane	70	J	120	25	ppb v/v	386		TO-15	Total/NA
Trichloroethene	150		150	41	ppb v/v	386		TO-15	Total/NA
1,2,4-Trimethylbenzene	2400		310	63	ppb v/v	386		TO-15	Total/NA
1,3,5-Trimethylbenzene	1000		150	48	ppb v/v	386		TO-15	Total/NA
Vinyl chloride	210		150	46	ppb v/v	386		TO-15	Total/NA
m,p-Xylene	11000		310	39	ppb v/v	386		TO-15	Total/NA
o-Xylene	3700		150	21	ppb v/v	386		TO-15	Total/NA
Dichlorodifluoromethane - DL	25000		310	110	ppb v/v	763		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB 19 (Continued) — Lab Sample ID: 160-9039-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Carbon Dioxide (TCD)	38		1.2	0.025	% v/v	2.32		D1946	Total/NA
Methane (TCD)	50		1.2	0.31	% v/v	2.32		D1946	Total/NA
Nitrogen	15		2.3	0.057	% v/v	2.32		D1946	Total/NA
Hydrogen sulfide	1.5		0.40	0.20	ppm v/v	1		EPA 15_16	Total/NA

Client Sample ID: SB 50 — Lab Sample ID: 160-9039-11

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	62		58	2.1	ppb v/v	11.6		TO-15	Total/NA
Benzene	7.6		4.6	0.92	ppb v/v	11.6		TO-15	Total/NA
2-Butanone (MEK)	13		9.3	2.3	ppb v/v	11.6		TO-15	Total/NA
Carbon disulfide	14		9.3	0.90	ppb v/v	11.6		TO-15	Total/NA
Dichlorodifluoromethane	56		4.6	1.7	ppb v/v	11.6		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	12		4.6	1.8	ppb v/v	11.6		TO-15	Total/NA
Ethylbenzene	2.4	J	4.6	0.73	ppb v/v	11.6		TO-15	Total/NA
Styrene	5.2		4.6	0.68	ppb v/v	11.6		TO-15	Total/NA
Toluene	7.4		4.6	0.59	ppb v/v	11.6		TO-15	Total/NA
Vinyl chloride	5.7		4.6	1.4	ppb v/v	11.6		TO-15	Total/NA
m,p-Xylene	2.5	J	9.3	1.2	ppb v/v	11.6		TO-15	Total/NA
o-Xylene	1.4	J	4.6	0.63	ppb v/v	11.6		TO-15	Total/NA
Carbon Dioxide (TCD)	4.1		1.2	0.025	% v/v	2.32		D1946	Total/NA
Methane (TCD)	5.5		1.2	0.31	% v/v	2.32		D1946	Total/NA
Nitrogen	75		2.3	0.057	% v/v	2.32		D1946	Total/NA

Client Sample ID: SB 51 — Lab Sample ID: 160-9039-12

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	55		8.4	0.30	ppb v/v	1.68		TO-15	Total/NA
Benzene	7.4		0.67	0.13	ppb v/v	1.68		TO-15	Total/NA
2-Butanone (MEK)	12		1.3	0.33	ppb v/v	1.68		TO-15	Total/NA
Carbon disulfide	6.3		1.3	0.13	ppb v/v	1.68		TO-15	Total/NA
Chloromethane	0.61	J	1.3	0.33	ppb v/v	1.68		TO-15	Total/NA
1,3-Dichlorobenzene	0.19	J	0.67	0.18	ppb v/v	1.68		TO-15	Total/NA
1,4-Dichlorobenzene	1.3		0.67	0.25	ppb v/v	1.68		TO-15	Total/NA
Dichlorodifluoromethane	2.3		0.67	0.24	ppb v/v	1.68		TO-15	Total/NA
cis-1,2-Dichloroethene	3.2		0.67	0.15	ppb v/v	1.68		TO-15	Total/NA
trans-1,2-Dichloroethene	0.25	J	0.67	0.17	ppb v/v	1.68		TO-15	Total/NA
1,2-Dichloro-1,1,2,2-tetrafluoroethane	16		0.67	0.26	ppb v/v	1.68		TO-15	Total/NA
Ethylbenzene	2.2		0.67	0.11	ppb v/v	1.68		TO-15	Total/NA
4-Ethyltoluene	0.38	J	0.67	0.31	ppb v/v	1.68		TO-15	Total/NA
Styrene	5.0		0.67	0.099	ppb v/v	1.68		TO-15	Total/NA
Tetrachloroethene	0.13	J	0.67	0.086	ppb v/v	1.68		TO-15	Total/NA
Toluene	6.1		0.67	0.086	ppb v/v	1.68		TO-15	Total/NA
1,2,4-Trimethylbenzene	0.91	J	1.3	0.27	ppb v/v	1.68		TO-15	Total/NA
1,3,5-Trimethylbenzene	0.30	J	0.67	0.21	ppb v/v	1.68		TO-15	Total/NA
Vinyl chloride	4.1		0.67	0.20	ppb v/v	1.68		TO-15	Total/NA
m,p-Xylene	2.5		1.3	0.17	ppb v/v	1.68		TO-15	Total/NA
Carbon Dioxide (TCD)	2.8		1.2	0.025	% v/v	2.35		D1946	Total/NA
Methane (TCD)	3.9		1.2	0.32	% v/v	2.35		D1946	Total/NA
Nitrogen	78		2.4	0.057	% v/v	2.35		D1946	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB-11 8.5-9.0 FT

Lab Sample ID: 160-9039-1

Date Collected: 10/23/14 08:40
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 79.9

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		6.3	0.54	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,1,2,2-Tetrachloroethane	ND		6.3	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		6.3	2.1	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,1,2-Trichloroethane	ND		6.3	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,1-Dichloroethane	ND		6.3	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,1-Dichloroethene	ND		6.3	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2,4-Trichlorobenzene	ND		6.3	0.54	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2-Dibromo-3-Chloropropane	ND		13	1.8	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2-Dichlorobenzene	ND		6.3	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2-Dichloroethane	ND		6.3	1.1	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2-Dichloropropane	ND		6.3	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,3-Dichlorobenzene	ND		6.3	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,4-Dichlorobenzene	ND		6.3	0.76	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
2-Butanone (MEK)	**16**	**J**	25	2.4	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
2-Hexanone	ND		25	2.2	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
4-Methyl-2-pentanone (MIBK)	ND		25	0.92	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Acetone	**120**		25	8.2	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Benzene	ND		6.3	0.32	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Bromoform	ND		6.3	0.47	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Bromomethane	ND		13	1.4	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Carbon disulfide	**3.2**	**J**	6.3	0.87	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Carbon tetrachloride	ND		6.3	0.65	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Chlorobenzene	ND		6.3	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Dibromochloromethane	ND		6.3	0.52	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Chloroethane	ND		13	0.66	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Chloroform	ND		6.3	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Chloromethane	ND		13	0.82	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
cis-1,2-Dichloroethene	ND		6.3	0.76	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
cis-1,3-Dichloropropene	ND		6.3	0.76	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Cyclohexane	ND		13	0.46	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Bromodichloromethane	ND		6.3	0.32	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Dichlorodifluoromethane	ND		13	1.7	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Ethylbenzene	ND		6.3	0.38	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
1,2-Dibromoethane (EDB)	ND		6.3	0.89	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Isopropylbenzene	ND		6.3	0.33	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Methyl acetate	ND		32	1.7	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Methyl tert-butyl ether	ND		6.3	0.61	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Methylcyclohexane	ND		13	0.33	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Methylene Chloride	ND		6.3	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
m-Xylene & p-Xylene	ND		6.3	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
o-Xylene	ND		6.3	0.43	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Styrene	ND		6.3	0.44	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Tetrachloroethene	ND		6.3	0.41	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Toluene	ND		6.3	0.89	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
trans-1,2-Dichloroethene	ND		6.3	1.2	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
trans-1,3-Dichloropropene	ND		6.3	0.44	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Trichloroethene	ND		6.3	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Trichlorofluoromethane	ND		6.3	0.63	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1
Vinyl chloride	ND		6.3	0.54	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1

Client Sample ID: SB-11 8.5-9.0 FT

Lab Sample ID: 160-9039-1
Date Collected: 10/23/14 08:40
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 79.9

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Xylenes, Total	ND		13	1.1	ug/Kg	☼	10/25/14 10:50	10/29/14 05:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*98*		*80 - 120*	*10/25/14 10:50*	*10/29/14 05:24*	*1*
Dibromofluoromethane (Surr)	*97*		*70 - 126*	*10/25/14 10:50*	*10/29/14 05:24*	*1*
4-Bromofluorobenzene (Surr)	*107*		*63 - 150*	*10/25/14 10:50*	*10/29/14 05:24*	*1*
1,2-Dichloroethane-d4 (Surr)	*101*		*72 - 127*	*10/25/14 10:50*	*10/29/14 05:24*	*1*

Client Sample ID: SB-12 7-7.5 FT

Lab Sample ID: 160-9039-2
Date Collected: 10/23/14 10:00
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 81.8

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		7.0	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,1,2,2-Tetrachloroethane	ND		7.0	0.56	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		7.0	2.4	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,1,2-Trichloroethane	ND		7.0	0.80	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,1-Dichloroethane	ND		7.0	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,1-Dichloroethene	ND		7.0	2.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2,4-Trichlorobenzene	ND		7.0	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2-Dibromo-3-Chloropropane	ND		14	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2-Dichlorobenzene	ND		7.0	0.39	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2-Dichloroethane	ND		7.0	1.2	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2-Dichloropropane	ND		7.0	0.53	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,3-Dichlorobenzene	ND		7.0	0.39	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,4-Dichlorobenzene	ND		7.0	0.84	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
2-Butanone (MEK)	ND		28	2.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
2-Hexanone	ND		28	2.5	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
4-Methyl-2-pentanone (MIBK)	ND		28	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Acetone	**62**		28	9.1	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Benzene	ND		7.0	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Bromoform	ND		7.0	0.52	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Bromomethane	ND		14	1.5	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Carbon disulfide	ND		7.0	0.97	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Carbon tetrachloride	ND		7.0	0.71	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Chlorobenzene	ND		7.0	0.53	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Dibromochloromethane	ND		7.0	0.57	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Chloroethane	ND		14	0.73	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Chloroform	ND		7.0	0.53	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Chloromethane	ND		14	0.91	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
cis-1,2-Dichloroethene	ND		7.0	0.84	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
cis-1,3-Dichloropropene	ND		7.0	0.84	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Cyclohexane	ND		14	0.50	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Bromodichloromethane	ND		7.0	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Dichlorodifluoromethane	ND		14	1.8	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Ethylbenzene	ND		7.0	0.42	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
1,2-Dibromoethane (EDB)	ND		7.0	0.98	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Isopropylbenzene	ND		7.0	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Methyl acetate	ND		35	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1

Client Sample ID: SB-12 7-7.5 FT

Lab Sample ID: 160-9039-2
Date Collected: 10/23/14 10:00
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 81.8

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl tert-butyl ether	ND		7.0	0.67	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Methylcyclohexane	ND		14	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Methylene Chloride	ND		7.0	2.2	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
m-Xylene & p-Xylene	ND		7.0	0.80	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
o-Xylene	ND		7.0	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Styrene	ND		7.0	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Tetrachloroethene	ND		7.0	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Toluene	ND		7.0	0.98	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
trans-1,2-Dichloroethene	ND		7.0	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
trans-1,3-Dichloropropene	ND		7.0	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Trichloroethene	ND		7.0	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Trichlorofluoromethane	ND		7.0	0.70	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Vinyl chloride	ND		7.0	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1
Xylenes, Total	ND		14	1.2	ug/Kg	☼	10/25/14 10:50	10/29/14 04:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*97*		*80 - 120*	*10/25/14 10:50*	*10/29/14 04:59*	*1*
Dibromofluoromethane (Surr)	*98*		*70 - 126*	*10/25/14 10:50*	*10/29/14 04:59*	*1*
4-Bromofluorobenzene (Surr)	*105*		*63 - 150*	*10/25/14 10:50*	*10/29/14 04:59*	*1*
1,2-Dichloroethane-d4 (Surr)	*101*		*72 - 127*	*10/25/14 10:50*	*10/29/14 04:59*	*1*

Client Sample ID: SB20 2.5-3FT

Lab Sample ID: 160-9039-3
Date Collected: 10/23/14 11:00
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 84.4

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		5.9	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,1,2,2-Tetrachloroethane	ND		5.9	0.47	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		5.9	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,1,2-Trichloroethane	ND		5.9	0.67	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,1-Dichloroethane	ND		5.9	0.46	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,1-Dichloroethene	ND		5.9	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2,4-Trichlorobenzene	ND		5.9	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2-Dibromo-3-Chloropropane	ND		12	1.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2-Dichlorobenzene	ND		5.9	0.33	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2-Dichloroethane	ND		5.9	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2-Dichloropropane	ND		5.9	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,3-Dichlorobenzene	ND		5.9	0.33	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,4-Dichlorobenzene	ND		5.9	0.71	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
2-Butanone (MEK)	**24**		24	2.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
2-Hexanone	ND		24	2.1	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
4-Methyl-2-pentanone (MIBK)	ND		24	0.86	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Acetone	**130**		24	7.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Benzene	ND		5.9	0.30	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Bromoform	ND		5.9	0.44	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Bromomethane	ND		12	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Carbon disulfide	ND		5.9	0.82	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Carbon tetrachloride	ND		5.9	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Chlorobenzene	ND		5.9	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1

Client Sample ID: SB20 2.5-3FT

Lab Sample ID: 160-9039-3
Date Collected: 10/23/14 11:00
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 84.4

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dibromochloromethane	ND		5.9	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Chloroethane	ND		12	0.61	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Chloroform	ND		5.9	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Chloromethane	ND		12	0.77	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
cis-1,2-Dichloroethene	ND		5.9	0.71	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
cis-1,3-Dichloropropene	ND		5.9	0.71	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Cyclohexane	ND		12	0.43	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Bromodichloromethane	ND		5.9	0.30	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Dichlorodifluoromethane	ND		12	1.5	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Ethylbenzene	ND		5.9	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
1,2-Dibromoethane (EDB)	ND		5.9	0.83	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Isopropylbenzene	ND		5.9	0.31	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Methyl acetate	ND		30	1.6	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Methyl tert-butyl ether	ND		5.9	0.57	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Methylcyclohexane	ND		12	0.31	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Methylene Chloride	ND		5.9	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
m-Xylene & p-Xylene	ND		5.9	0.67	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
o-Xylene	ND		5.9	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Styrene	ND		5.9	0.41	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Tetrachloroethene	ND		5.9	0.38	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Toluene	ND		5.9	0.83	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
trans-1,2-Dichloroethene	ND		5.9	1.1	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
trans-1,3-Dichloropropene	ND		5.9	0.41	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Trichloroethene	ND		5.9	0.46	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Trichlorofluoromethane	ND		5.9	0.59	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Vinyl chloride	ND		5.9	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1
Xylenes, Total	ND		12	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*97*		*80 - 120*	*10/25/14 10:50*	*10/29/14 04:34*	*1*
Dibromofluoromethane (Surr)	*104*		*70 - 126*	*10/25/14 10:50*	*10/29/14 04:34*	*1*
4-Bromofluorobenzene (Surr)	*103*		*63 - 150*	*10/25/14 10:50*	*10/29/14 04:34*	*1*
1,2-Dichloroethane-d4 (Surr)	*107*		*72 - 127*	*10/25/14 10:50*	*10/29/14 04:34*	*1*

Client Sample ID: SB19 6.5-7FT

Lab Sample ID: 160-9039-4
Date Collected: 10/23/14 12:15
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 83.8

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		6.0	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,1,2,2-Tetrachloroethane	ND		6.0	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		6.0	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,1,2-Trichloroethane	ND		6.0	0.68	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,1-Dichloroethane	ND		6.0	0.47	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,1-Dichloroethene	ND		6.0	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,2,4-Trichlorobenzene	ND		6.0	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,2-Dibromo-3-Chloropropane	ND		12	1.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,2-Dichlorobenzene	ND		6.0	0.34	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,2-Dichloroethane	ND		6.0	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1

Client Sample ID: SB19 6.5-7FT

Date Collected: 10/23/14 12:15
Date Received: 10/25/14 08:50

Lab Sample ID: 160-9039-4

Matrix: Solid
Percent Solids: 83.8

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloropropane	ND		6.0	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,3-Dichlorobenzene	ND		6.0	0.34	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,4-Dichlorobenzene	ND		6.0	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
2-Butanone (MEK)	ND		24	2.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
2-Hexanone	ND		24	2.1	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
4-Methyl-2-pentanone (MIBK)	ND		24	0.87	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Acetone	**51**		24	7.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Benzene	ND		6.0	0.30	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Bromoform	ND		6.0	0.44	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Bromomethane	ND		12	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Carbon disulfide	ND		6.0	0.83	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Carbon tetrachloride	ND		6.0	0.61	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Chlorobenzene	ND		6.0	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Dibromochloromethane	ND		6.0	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Chloroethane	ND		12	0.62	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Chloroform	ND		6.0	0.45	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Chloromethane	ND		12	0.78	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
cis-1,2-Dichloroethene	ND		6.0	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
cis-1,3-Dichloropropene	ND		6.0	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Cyclohexane	ND		12	0.43	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Bromodichloromethane	ND		6.0	0.30	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Dichlorodifluoromethane	ND		12	1.6	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Ethylbenzene	ND		6.0	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
1,2-Dibromoethane (EDB)	ND		6.0	0.84	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Isopropylbenzene	ND		6.0	0.31	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Methyl acetate	ND		30	1.7	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Methyl tert-butyl ether	ND		6.0	0.57	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Methylcyclohexane	ND		12	0.31	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Methylene Chloride	ND		6.0	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
m-Xylene & p-Xylene	ND		6.0	0.68	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
o-Xylene	ND		6.0	0.41	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Styrene	ND		6.0	0.42	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Tetrachloroethene	ND		6.0	0.38	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Toluene	ND		6.0	0.84	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
trans-1,2-Dichloroethene	ND		6.0	1.1	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
trans-1,3-Dichloropropene	ND		6.0	0.42	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Trichloroethene	ND		6.0	0.47	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Trichlorofluoromethane	ND		6.0	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Vinyl chloride	ND		6.0	0.51	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1
Xylenes, Total	ND		12	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 04:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*80 - 120*	*10/25/14 10:50*	*10/29/14 04:08*	*1*
Dibromofluoromethane (Surr)	*99*		*70 - 126*	*10/25/14 10:50*	*10/29/14 04:08*	*1*
4-Bromofluorobenzene (Surr)	*100*		*63 - 150*	*10/25/14 10:50*	*10/29/14 04:08*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*72 - 127*	*10/25/14 10:50*	*10/29/14 04:08*	*1*

Client Sample Results

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB50 2-2.5FT

Date Collected: 10/23/14 13:30
Date Received: 10/25/14 08:50

Lab Sample ID: 160-9039-5

Matrix: Solid
Percent Solids: 86.4

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		4.6	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,1,2,2-Tetrachloroethane	ND		4.6	0.37	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		4.6	1.5	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,1,2-Trichloroethane	ND		4.6	0.52	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,1-Dichloroethane	ND		4.6	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,1-Dichloroethene	ND		4.6	1.5	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2,4-Trichlorobenzene	ND		4.6	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2-Dibromo-3-Chloropropane	ND		9.2	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2-Dichlorobenzene	ND		4.6	0.26	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2-Dichloroethane	ND		4.6	0.80	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2-Dichloropropane	ND		4.6	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,3-Dichlorobenzene	ND		4.6	0.26	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,4-Dichlorobenzene	ND		4.6	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
2-Butanone (MEK)	ND		18	1.8	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
2-Hexanone	ND		18	1.6	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
4-Methyl-2-pentanone (MIBK)	ND		18	0.67	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Acetone	**8.0**	**J**	18	5.9	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Benzene	ND		4.6	0.23	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Bromoform	ND		4.6	0.34	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Bromomethane	ND		9.2	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Carbon disulfide	ND		4.6	0.63	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Carbon tetrachloride	ND		4.6	0.47	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Chlorobenzene	ND		4.6	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Dibromochloromethane	ND		4.6	0.38	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Chloroethane	ND		9.2	0.48	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Chloroform	ND		4.6	0.35	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Chloromethane	ND		9.2	0.60	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
cis-1,2-Dichloroethene	ND		4.6	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
cis-1,3-Dichloropropene	ND		4.6	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Cyclohexane	ND		9.2	0.33	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Bromodichloromethane	ND		4.6	0.23	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Dichlorodifluoromethane	ND		9.2	1.2	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Ethylbenzene	ND		4.6	0.28	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
1,2-Dibromoethane (EDB)	ND		4.6	0.64	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Isopropylbenzene	ND		4.6	0.24	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Methyl acetate	ND		23	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Methyl tert-butyl ether	ND		4.6	0.44	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Methylcyclohexane	ND		9.2	0.24	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Methylene Chloride	ND		4.6	1.5	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
m-Xylene & p-Xylene	ND		4.6	0.52	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
o-Xylene	ND		4.6	0.31	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Styrene	ND		4.6	0.32	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Tetrachloroethene	ND		4.6	0.29	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Toluene	ND		4.6	0.64	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
trans-1,2-Dichloroethene	ND		4.6	0.86	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
trans-1,3-Dichloropropene	ND		4.6	0.32	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Trichloroethene	ND		4.6	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Trichlorofluoromethane	ND		4.6	0.46	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1
Vinyl chloride	ND		4.6	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1

Client Sample ID: SB50 2-2.5FT

Lab Sample ID: 160-9039-5
Date Collected: 10/23/14 13:30
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 86.4

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Xylenes, Total	ND		9.2	0.78	ug/Kg	☼	10/25/14 10:50	10/29/14 03:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*95*		*80 - 120*	*10/25/14 10:50*	*10/29/14 03:44*	*1*
Dibromofluoromethane (Surr)	*100*		*70 - 126*	*10/25/14 10:50*	*10/29/14 03:44*	*1*
4-Bromofluorobenzene (Surr)	*103*		*63 - 150*	*10/25/14 10:50*	*10/29/14 03:44*	*1*
1,2-Dichloroethane-d4 (Surr)	*103*		*72 - 127*	*10/25/14 10:50*	*10/29/14 03:44*	*1*

Client Sample ID: SB51 3-3.5FT

Lab Sample ID: 160-9039-6
Date Collected: 10/23/14 14:15
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 87.0

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		7.2	0.62	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,1,2,2-Tetrachloroethane	ND		7.2	0.58	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		7.2	2.4	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,1,2-Trichloroethane	ND		7.2	0.82	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,1-Dichloroethane	ND		7.2	0.56	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,1-Dichloroethene	ND		7.2	2.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2,4-Trichlorobenzene	ND		7.2	0.62	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2-Dibromo-3-Chloropropane	ND		14	2.1	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2-Dichlorobenzene	ND		7.2	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2-Dichloroethane	ND		7.2	1.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2-Dichloropropane	ND		7.2	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,3-Dichlorobenzene	ND		7.2	0.40	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,4-Dichlorobenzene	ND		7.2	0.86	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
2-Butanone (MEK)	ND		29	2.8	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
2-Hexanone	ND		29	2.5	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
4-Methyl-2-pentanone (MIBK)	ND		29	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Acetone	**52**		29	9.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Benzene	ND		7.2	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Bromoform	ND		7.2	0.53	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Bromomethane	ND		14	1.6	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Carbon disulfide	ND		7.2	0.99	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Carbon tetrachloride	ND		7.2	0.73	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Chlorobenzene	ND		7.2	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Dibromochloromethane	ND		7.2	0.59	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Chloroethane	ND		14	0.75	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Chloroform	ND		7.2	0.55	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Chloromethane	ND		14	0.93	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
cis-1,2-Dichloroethene	ND		7.2	0.86	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
cis-1,3-Dichloropropene	ND		7.2	0.86	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Cyclohexane	ND		14	0.52	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Bromodichloromethane	ND		7.2	0.36	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Dichlorodifluoromethane	ND		14	1.9	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Ethylbenzene	ND		7.2	0.43	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
1,2-Dibromoethane (EDB)	ND		7.2	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Isopropylbenzene	ND		7.2	0.37	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Methyl acetate	ND		36	2.0	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1

Client Sample ID: SB51 3-3.5FT

Lab Sample ID: 160-9039-6

Date Collected: 10/23/14 14:15
Matrix: Solid
Date Received: 10/25/14 08:50
Percent Solids: 87.0

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl tert-butyl ether	ND		7.2	0.69	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Methylcyclohexane	ND		14	0.37	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Methylene Chloride	ND		7.2	2.3	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
m-Xylene & p-Xylene	ND		7.2	0.82	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
o-Xylene	ND		7.2	0.49	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Styrene	ND		7.2	0.50	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Tetrachloroethene	ND		7.2	0.46	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Toluene	ND		7.2	1.0	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
trans-1,2-Dichloroethene	ND		7.2	1.4	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
trans-1,3-Dichloropropene	ND		7.2	0.50	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Trichloroethene	ND		7.2	0.56	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Trichlorofluoromethane	ND		7.2	0.72	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Vinyl chloride	ND		7.2	0.62	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1
Xylenes, Total	ND		14	1.2	ug/Kg	☼	10/25/14 10:50	10/29/14 03:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*80 - 120*	*10/25/14 10:50*	*10/29/14 03:19*	*1*
Dibromofluoromethane (Surr)	*99*		*70 - 126*	*10/25/14 10:50*	*10/29/14 03:19*	*1*
4-Bromofluorobenzene (Surr)	*104*		*63 - 150*	*10/25/14 10:50*	*10/29/14 03:19*	*1*
1,2-Dichloroethane-d4 (Surr)	*101*		*72 - 127*	*10/25/14 10:50*	*10/29/14 03:19*	*1*

Client Sample ID: SB-11

Lab Sample ID: 160-9039-7

Date Collected: 10/23/14 09:10
Matrix: Air
Date Received: 10/24/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**24**		5.0	0.18	ppb v/v			11/06/14 02:31	1
Benzene	**0.96**		0.40	0.079	ppb v/v			11/06/14 02:31	1
Benzyl chloride	ND		0.80	0.16	ppb v/v			11/06/14 02:31	1
Bromodichloromethane	ND		0.30	0.066	ppb v/v			11/06/14 02:31	1
Bromoform	ND		0.40	0.070	ppb v/v			11/06/14 02:31	1
Bromomethane	ND		0.80	0.34	ppb v/v			11/06/14 02:31	1
2-Butanone (MEK)	**4.0**		0.80	0.20	ppb v/v			11/06/14 02:31	1
Carbon disulfide	**2.7**		0.80	0.078	ppb v/v			11/06/14 02:31	1
Carbon tetrachloride	**0.095**	**J**	0.80	0.064	ppb v/v			11/06/14 02:31	1
Chlorobenzene	**0.27**	**J**	0.30	0.064	ppb v/v			11/06/14 02:31	1
Dibromochloromethane	ND		0.40	0.079	ppb v/v			11/06/14 02:31	1
Chloroethane	ND		0.80	0.31	ppb v/v			11/06/14 02:31	1
Chloroform	ND		0.30	0.095	ppb v/v			11/06/14 02:31	1
Chloromethane	**0.61**	**J**	0.80	0.20	ppb v/v			11/06/14 02:31	1
1,2-Dibromoethane (EDB)	ND		0.80	0.075	ppb v/v			11/06/14 02:31	1
1,2-Dichlorobenzene	ND		0.40	0.13	ppb v/v			11/06/14 02:31	1
1,3-Dichlorobenzene	ND		0.40	0.11	ppb v/v			11/06/14 02:31	1
1,4-Dichlorobenzene	**8.0**		0.40	0.15	ppb v/v			11/06/14 02:31	1
Dichlorodifluoromethane	**12**		0.40	0.15	ppb v/v			11/06/14 02:31	1
1,1-Dichloroethane	ND		0.30	0.072	ppb v/v			11/06/14 02:31	1
1,2-Dichloroethane	ND		0.80	0.088	ppb v/v			11/06/14 02:31	1
1,1-Dichloroethene	ND		0.80	0.13	ppb v/v			11/06/14 02:31	1

Client Sample Results

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB-11

Lab Sample ID: 160-9039-7

Date Collected: 10/23/14 09:10
Matrix: Air
Date Received: 10/24/14 09:30
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**2.1**		0.40	0.089	ppb v/v			11/06/14 02:31	1
trans-1,2-Dichloroethene	ND		0.40	0.10	ppb v/v			11/06/14 02:31	1
1,2-Dichloropropane	ND		0.40	0.24	ppb v/v			11/06/14 02:31	1
cis-1,3-Dichloropropene	ND		0.40	0.10	ppb v/v			11/06/14 02:31	1
trans-1,3-Dichloropropene	ND		0.40	0.088	ppb v/v			11/06/14 02:31	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	**0.37**	**J**	0.40	0.16	ppb v/v			11/06/14 02:31	1
Ethylbenzene	**8.3**		0.40	0.063	ppb v/v			11/06/14 02:31	1
4-Ethyltoluene	**0.68**		0.40	0.19	ppb v/v			11/06/14 02:31	1
Hexachlorobutadiene	ND		2.0	0.43	ppb v/v			11/06/14 02:31	1
2-Hexanone	ND		0.40	0.087	ppb v/v			11/06/14 02:31	1
Methylene Chloride	**0.12**	**J**	0.40	0.072	ppb v/v			11/06/14 02:31	1
4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14	ppb v/v			11/06/14 02:31	1
Styrene	ND		0.40	0.059	ppb v/v			11/06/14 02:31	1
1,1,2,2-Tetrachloroethane	ND		0.40	0.069	ppb v/v			11/06/14 02:31	1
Tetrachloroethene	**0.061**	**J**	0.40	0.051	ppb v/v			11/06/14 02:31	1
Toluene	**1.0**		0.40	0.051	ppb v/v			11/06/14 02:31	1
1,2,4-Trichlorobenzene	ND		2.0	0.43	ppb v/v			11/06/14 02:31	1
1,1,1-Trichloroethane	ND		0.30	0.065	ppb v/v			11/06/14 02:31	1
1,1,2-Trichloroethane	ND		0.40	0.067	ppb v/v			11/06/14 02:31	1
Trichloroethene	ND		0.40	0.11	ppb v/v			11/06/14 02:31	1
Trichlorofluoromethane	**0.41**		0.40	0.20	ppb v/v			11/06/14 02:31	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16	ppb v/v			11/06/14 02:31	1
1,2,4-Trimethylbenzene	**4.8**		0.80	0.16	ppb v/v			11/06/14 02:31	1
1,3,5-Trimethylbenzene	**2.2**		0.40	0.13	ppb v/v			11/06/14 02:31	1
Vinyl acetate	ND		0.80	0.15	ppb v/v			11/06/14 02:31	1
Vinyl chloride	**0.50**		0.40	0.12	ppb v/v			11/06/14 02:31	1
m,p-Xylene	**9.4**		0.80	0.10	ppb v/v			11/06/14 02:31	1
o-Xylene	**1.6**		0.40	0.054	ppb v/v			11/06/14 02:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*108*		*70 - 130*		*11/06/14 02:31*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*11/06/14 02:31*	*1*
Toluene-d8 (Surr)	*104*		*70 - 130*		*11/06/14 02:31*	*1*

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	**0.18**	**J**	1.1	0.024	% v/v			10/30/14 11:20	2.25
Methane (FID)	**0.14**		0.00045	0.000090	% v/v			10/30/14 15:28	4.5
Nitrogen	**82**	**B**	2.3	0.055	% v/v			10/30/14 11:20	2.25

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 11:15	1

Client Sample Results

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB-12

Lab Sample ID: 160-9039-8

Date Collected: 10/23/14 10:10
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**47**		5.9	0.21	ppb v/v			11/06/14 03:17	1.18
Benzene	**9.8**		0.47	0.093	ppb v/v			11/06/14 03:17	1.18
Benzyl chloride	ND		0.94	0.19	ppb v/v			11/06/14 03:17	1.18
Bromodichloromethane	ND		0.35	0.078	ppb v/v			11/06/14 03:17	1.18
Bromoform	ND		0.47	0.083	ppb v/v			11/06/14 03:17	1.18
Bromomethane	ND		0.94	0.40	ppb v/v			11/06/14 03:17	1.18
2-Butanone (MEK)	**11**		0.94	0.23	ppb v/v			11/06/14 03:17	1.18
Carbon disulfide	**39**		0.94	0.092	ppb v/v			11/06/14 03:17	1.18
Carbon tetrachloride	**0.098**	**J**	0.94	0.076	ppb v/v			11/06/14 03:17	1.18
Chlorobenzene	ND		0.35	0.076	ppb v/v			11/06/14 03:17	1.18
Dibromochloromethane	ND		0.47	0.093	ppb v/v			11/06/14 03:17	1.18
Chloroethane	ND		0.94	0.36	ppb v/v			11/06/14 03:17	1.18
Chloroform	**3.4**		0.35	0.11	ppb v/v			11/06/14 03:17	1.18
Chloromethane	**0.61**	**J**	0.94	0.23	ppb v/v			11/06/14 03:17	1.18
1,2-Dibromoethane (EDB)	ND		0.94	0.089	ppb v/v			11/06/14 03:17	1.18
1,2-Dichlorobenzene	ND		0.47	0.15	ppb v/v			11/06/14 03:17	1.18
1,3-Dichlorobenzene	ND		0.47	0.13	ppb v/v			11/06/14 03:17	1.18
1,4-Dichlorobenzene	**5.9**		0.47	0.18	ppb v/v			11/06/14 03:17	1.18
Dichlorodifluoromethane	**2.6**		0.47	0.17	ppb v/v			11/06/14 03:17	1.18
1,1-Dichloroethane	**0.17**	**J**	0.35	0.085	ppb v/v			11/06/14 03:17	1.18
1,2-Dichloroethane	ND		0.94	0.10	ppb v/v			11/06/14 03:17	1.18
1,1-Dichloroethene	ND		0.94	0.15	ppb v/v			11/06/14 03:17	1.18
cis-1,2-Dichloroethene	**68**		0.47	0.11	ppb v/v			11/06/14 03:17	1.18
trans-1,2-Dichloroethene	**1.1**		0.47	0.12	ppb v/v			11/06/14 03:17	1.18
1,2-Dichloropropane	ND		0.47	0.28	ppb v/v			11/06/14 03:17	1.18
cis-1,3-Dichloropropene	ND		0.47	0.12	ppb v/v			11/06/14 03:17	1.18
trans-1,3-Dichloropropene	ND		0.47	0.10	ppb v/v			11/06/14 03:17	1.18
1,2-Dichloro-1,1,2,2-tetrafluoroethane	**15**		0.47	0.18	ppb v/v			11/06/14 03:17	1.18
4-Ethyltoluene	**12**		0.47	0.22	ppb v/v			11/06/14 03:17	1.18
Hexachlorobutadiene	ND		2.4	0.51	ppb v/v			11/06/14 03:17	1.18
2-Hexanone	ND		0.47	0.10	ppb v/v			11/06/14 03:17	1.18
Methylene Chloride	**0.34**	**J**	0.47	0.085	ppb v/v			11/06/14 03:17	1.18
4-Methyl-2-pentanone (MIBK)	ND		0.47	0.16	ppb v/v			11/06/14 03:17	1.18
Styrene	**4.2**		0.47	0.070	ppb v/v			11/06/14 03:17	1.18
1,1,2,2-Tetrachloroethane	ND		0.47	0.081	ppb v/v			11/06/14 03:17	1.18
Tetrachloroethene	**0.42**	**J**	0.47	0.060	ppb v/v			11/06/14 03:17	1.18
Toluene	**7.1**		0.47	0.060	ppb v/v			11/06/14 03:17	1.18
1,2,4-Trichlorobenzene	ND		2.4	0.51	ppb v/v			11/06/14 03:17	1.18
1,1,1-Trichloroethane	ND		0.35	0.077	ppb v/v			11/06/14 03:17	1.18
1,1,2-Trichloroethane	ND		0.47	0.079	ppb v/v			11/06/14 03:17	1.18
Trichloroethene	**0.65**		0.47	0.12	ppb v/v			11/06/14 03:17	1.18
Trichlorofluoromethane	**0.33**	**J**	0.47	0.23	ppb v/v			11/06/14 03:17	1.18
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.47	0.19	ppb v/v			11/06/14 03:17	1.18
1,2,4-Trimethylbenzene	**49**		0.94	0.19	ppb v/v			11/06/14 03:17	1.18
1,3,5-Trimethylbenzene	**26**		0.47	0.15	ppb v/v			11/06/14 03:17	1.18
Vinyl acetate	ND		0.94	0.17	ppb v/v			11/06/14 03:17	1.18
Vinyl chloride	**17**		0.47	0.14	ppb v/v			11/06/14 03:17	1.18
m,p-Xylene	**58**		0.94	0.12	ppb v/v			11/06/14 03:17	1.18

Client Sample ID: SB-12

Lab Sample ID: 160-9039-8

Date Collected: 10/23/14 10:10
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
o-Xylene	10		0.47	0.064	ppb v/v			11/06/14 03:17	1.18

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*126*		*70 - 130*		*11/06/14 03:17*	*1.18*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*11/06/14 03:17*	*1.18*
Toluene-d8 (Surr)	*104*		*70 - 130*		*11/06/14 03:17*	*1.18*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	40	B	0.95	0.15	ppb v/v			11/07/14 02:09	2.37

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*129*		*70 - 130*		*11/07/14 02:09*	*2.37*
1,2-Dichloroethane-d4 (Surr)	*76*		*70 - 130*		*11/07/14 02:09*	*2.37*
Toluene-d8 (Surr)	*98*		*70 - 130*		*11/07/14 02:09*	*2.37*

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	1.3		1.2	0.025	% v/v			10/30/14 11:31	2.37
Methane (TCD)	1.9		1.2	0.32	% v/v			10/30/14 11:31	2.37
Nitrogen	80		2.4	0.058	% v/v			10/30/14 11:31	2.37

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 14:16	1

Client Sample ID: SB 20

Lab Sample ID: 160-9039-9

Date Collected: 10/23/14 11:15
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	5.7		0.40	0.079	ppb v/v			11/06/14 04:03	1
Benzyl chloride	ND		0.80	0.16	ppb v/v			11/06/14 04:03	1
Bromodichloromethane	ND		0.30	0.066	ppb v/v			11/06/14 04:03	1
Bromoform	ND		0.40	0.070	ppb v/v			11/06/14 04:03	1
Bromomethane	ND		0.80	0.34	ppb v/v			11/06/14 04:03	1
2-Butanone (MEK)	15		0.80	0.20	ppb v/v			11/06/14 04:03	1
Carbon disulfide	8.1		0.80	0.078	ppb v/v			11/06/14 04:03	1
Carbon tetrachloride	0.10	J	0.80	0.064	ppb v/v			11/06/14 04:03	1
Chlorobenzene	ND		0.30	0.064	ppb v/v			11/06/14 04:03	1
Dibromochloromethane	ND		0.40	0.079	ppb v/v			11/06/14 04:03	1
Chloroethane	ND		0.80	0.31	ppb v/v			11/06/14 04:03	1
Chloroform	ND		0.30	0.095	ppb v/v			11/06/14 04:03	1
Chloromethane	0.65	J	0.80	0.20	ppb v/v			11/06/14 04:03	1
1,2-Dibromoethane (EDB)	ND		0.80	0.075	ppb v/v			11/06/14 04:03	1
1,2-Dichlorobenzene	0.67		0.40	0.13	ppb v/v			11/06/14 04:03	1
1,3-Dichlorobenzene	0.26	J	0.40	0.11	ppb v/v			11/06/14 04:03	1
1,4-Dichlorobenzene	4.2		0.40	0.15	ppb v/v			11/06/14 04:03	1

Client Sample ID: SB 20

Lab Sample ID: 160-9039-9

Date Collected: 10/23/14 11:15
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	**3.8**		0.40	0.15	ppb v/v			11/06/14 04:03	1
1,1-Dichloroethane	ND		0.30	0.072	ppb v/v			11/06/14 04:03	1
1,2-Dichloroethane	ND		0.80	0.088	ppb v/v			11/06/14 04:03	1
1,1-Dichloroethene	ND		0.80	0.13	ppb v/v			11/06/14 04:03	1
cis-1,2-Dichloroethene	**4.4**		0.40	0.089	ppb v/v			11/06/14 04:03	1
trans-1,2-Dichloroethene	**0.24**	**J**	0.40	0.10	ppb v/v			11/06/14 04:03	1
1,2-Dichloropropane	ND		0.40	0.24	ppb v/v			11/06/14 04:03	1
cis-1,3-Dichloropropene	ND		0.40	0.10	ppb v/v			11/06/14 04:03	1
trans-1,3-Dichloropropene	ND		0.40	0.088	ppb v/v			11/06/14 04:03	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	**0.92**		0.40	0.16	ppb v/v			11/06/14 04:03	1
Ethylbenzene	**4.9**		0.40	0.063	ppb v/v			11/06/14 04:03	1
4-Ethyltoluene	**0.85**		0.40	0.19	ppb v/v			11/06/14 04:03	1
Hexachlorobutadiene	ND		2.0	0.43	ppb v/v			11/06/14 04:03	1
2-Hexanone	ND		0.40	0.087	ppb v/v			11/06/14 04:03	1
Methylene Chloride	**0.11**	**J**	0.40	0.072	ppb v/v			11/06/14 04:03	1
4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14	ppb v/v			11/06/14 04:03	1
Styrene	**3.1**		0.40	0.059	ppb v/v			11/06/14 04:03	1
1,1,2,2-Tetrachloroethane	ND		0.40	0.069	ppb v/v			11/06/14 04:03	1
Tetrachloroethene	**0.099**	**J**	0.40	0.051	ppb v/v			11/06/14 04:03	1
Toluene	**4.6**		0.40	0.051	ppb v/v			11/06/14 04:03	1
1,2,4-Trichlorobenzene	ND		2.0	0.43	ppb v/v			11/06/14 04:03	1
1,1,1-Trichloroethane	ND		0.30	0.065	ppb v/v			11/06/14 04:03	1
1,1,2-Trichloroethane	ND		0.40	0.067	ppb v/v			11/06/14 04:03	1
Trichloroethene	**5.1**		0.40	0.11	ppb v/v			11/06/14 04:03	1
Trichlorofluoromethane	**0.22**	**J**	0.40	0.20	ppb v/v			11/06/14 04:03	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16	ppb v/v			11/06/14 04:03	1
1,2,4-Trimethylbenzene	**4.3**		0.80	0.16	ppb v/v			11/06/14 04:03	1
1,3,5-Trimethylbenzene	**1.9**		0.40	0.13	ppb v/v			11/06/14 04:03	1
Vinyl acetate	ND		0.80	0.15	ppb v/v			11/06/14 04:03	1
Vinyl chloride	**1.8**		0.40	0.12	ppb v/v			11/06/14 04:03	1
m,p-Xylene	**6.8**		0.80	0.10	ppb v/v			11/06/14 04:03	1
o-Xylene	**2.5**		0.40	0.054	ppb v/v			11/06/14 04:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*110*		*70 - 130*		*11/06/14 04:03*	*1*
1,2-Dichloroethane-d4 (Surr)	*95*		*70 - 130*		*11/06/14 04:03*	*1*
Toluene-d8 (Surr)	*102*		*70 - 130*		*11/06/14 04:03*	*1*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**44**		9.9	0.35	ppb v/v			11/07/14 03:06	1.98

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*100*		*70 - 130*		*11/07/14 03:06*	*1.98*
1,2-Dichloroethane-d4 (Surr)	*76*		*70 - 130*		*11/07/14 03:06*	*1.98*
Toluene-d8 (Surr)	*96*		*70 - 130*		*11/07/14 03:06*	*1.98*

Client Sample ID: SB 20

Lab Sample ID: 160-9039-9

Date Collected: 10/23/14 11:15
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	1.4		1.2	0.025	% v/v			10/30/14 11:41	2.3
Methane (TCD)	2.0		1.2	0.31	% v/v			10/30/14 11:41	2.3
Nitrogen	79		2.3	0.056	% v/v			10/30/14 11:41	2.3

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 12:10	1

Client Sample ID: SB 19

Lab Sample ID: 160-9039-10

Date Collected: 10/23/14 12:39
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	1900		1900	69	ppb v/v			11/06/14 04:44	386
Benzene	120	J	150	30	ppb v/v			11/06/14 04:44	386
Benzyl chloride	ND		310	63	ppb v/v			11/06/14 04:44	386
Bromodichloromethane	ND		120	25	ppb v/v			11/06/14 04:44	386
Bromoform	ND		150	27	ppb v/v			11/06/14 04:44	386
Bromomethane	ND		310	130	ppb v/v			11/06/14 04:44	386
2-Butanone (MEK)	2800		310	77	ppb v/v			11/06/14 04:44	386
Carbon disulfide	40	J	310	30	ppb v/v			11/06/14 04:44	386
Carbon tetrachloride	ND		310	25	ppb v/v			11/06/14 04:44	386
Chlorobenzene	ND		120	25	ppb v/v			11/06/14 04:44	386
Dibromochloromethane	ND		150	30	ppb v/v			11/06/14 04:44	386
Chloroethane	ND		310	120	ppb v/v			11/06/14 04:44	386
Chloroform	ND		120	37	ppb v/v			11/06/14 04:44	386
Chloromethane	ND		310	76	ppb v/v			11/06/14 04:44	386
1,2-Dibromoethane (EDB)	ND		310	29	ppb v/v			11/06/14 04:44	386
1,2-Dichlorobenzene	ND		150	50	ppb v/v			11/06/14 04:44	386
1,3-Dichlorobenzene	ND		150	42	ppb v/v			11/06/14 04:44	386
1,4-Dichlorobenzene	2800		150	58	ppb v/v			11/06/14 04:44	386
1,1-Dichloroethane	ND		120	28	ppb v/v			11/06/14 04:44	386
1,2-Dichloroethane	ND		310	34	ppb v/v			11/06/14 04:44	386
1,1-Dichloroethene	ND		310	50	ppb v/v			11/06/14 04:44	386
cis-1,2-Dichloroethene	800		150	34	ppb v/v			11/06/14 04:44	386
trans-1,2-Dichloroethene	ND		150	39	ppb v/v			11/06/14 04:44	386
1,2-Dichloropropane	ND		150	93	ppb v/v			11/06/14 04:44	386
cis-1,3-Dichloropropene	ND		150	40	ppb v/v			11/06/14 04:44	386
trans-1,3-Dichloropropene	ND		150	34	ppb v/v			11/06/14 04:44	386
1,2-Dichloro-1,1,2,2-tetrafluoroethane	210		150	60	ppb v/v			11/06/14 04:44	386
Ethylbenzene	4700		150	24	ppb v/v			11/06/14 04:44	386
4-Ethyltoluene	850		150	72	ppb v/v			11/06/14 04:44	386
Hexachlorobutadiene	ND		770	170	ppb v/v			11/06/14 04:44	386
2-Hexanone	ND		150	34	ppb v/v			11/06/14 04:44	386
Methylene Chloride	160		150	28	ppb v/v			11/06/14 04:44	386
4-Methyl-2-pentanone (MIBK)	1500		150	52	ppb v/v			11/06/14 04:44	386

Client Sample ID: SB 19

Lab Sample ID: 160-9039-10

Date Collected: 10/23/14 12:39

Matrix: Air

Date Received: 10/25/14 08:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Styrene	380		150	23	ppb v/v			11/06/14 04:44	386
1,1,2,2-Tetrachloroethane	ND		150	27	ppb v/v			11/06/14 04:44	386
Tetrachloroethene	390		150	20	ppb v/v			11/06/14 04:44	386
Toluene	9100		150	20	ppb v/v			11/06/14 04:44	386
1,2,4-Trichlorobenzene	ND		770	170	ppb v/v			11/06/14 04:44	386
1,1,1-Trichloroethane	70	J	120	25	ppb v/v			11/06/14 04:44	386
1,1,2-Trichloroethane	ND		150	26	ppb v/v			11/06/14 04:44	386
Trichloroethene	150		150	41	ppb v/v			11/06/14 04:44	386
Trichlorofluoromethane	ND		150	76	ppb v/v			11/06/14 04:44	386
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		150	63	ppb v/v			11/06/14 04:44	386
1,2,4-Trimethylbenzene	2400		310	63	ppb v/v			11/06/14 04:44	386
1,3,5-Trimethylbenzene	1000		150	48	ppb v/v			11/06/14 04:44	386
Vinyl acetate	ND		310	56	ppb v/v			11/06/14 04:44	386
Vinyl chloride	210		150	46	ppb v/v			11/06/14 04:44	386
m,p-Xylene	11000		310	39	ppb v/v			11/06/14 04:44	386
o-Xylene	3700		150	21	ppb v/v			11/06/14 04:44	386

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*109*		*70 - 130*		*11/06/14 04:44*	*386*
1,2-Dichloroethane-d4 (Surr)	*97*		*70 - 130*		*11/06/14 04:44*	*386*
Toluene-d8 (Surr)	*104*		*70 - 130*		*11/06/14 04:44*	*386*

Method: TO-15 - Volatile Organic Compounds in Ambient Air - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	25000		310	110	ppb v/v			11/07/14 04:00	763

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*		*11/07/14 04:00*	*763*
1,2-Dichloroethane-d4 (Surr)	*78*		*70 - 130*		*11/07/14 04:00*	*763*
Toluene-d8 (Surr)	*97*		*70 - 130*		*11/07/14 04:00*	*763*

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	38		1.2	0.025	% v/v			10/30/14 11:51	2.32
Methane (TCD)	50		1.2	0.31	% v/v			10/30/14 11:51	2.32
Nitrogen	15		2.3	0.057	% v/v			10/30/14 11:51	2.32

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	1.5		0.40	0.20	ppm v/v			10/24/14 11:46	1

Client Sample ID: SB 50

Lab Sample ID: 160-9039-11

Date Collected: 10/23/14 13:45

Matrix: Air

Date Received: 10/25/14 08:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	62		58	2.1	ppb v/v			11/06/14 05:25	11.6
Benzene	7.6		4.6	0.92	ppb v/v			11/06/14 05:25	11.6

Client Sample ID: SB 50

Lab Sample ID: 160-9039-11

Date Collected: 10/23/14 13:45

Matrix: Air

Date Received: 10/25/14 08:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl chloride	ND		9.3	1.9	ppb v/v			11/06/14 05:25	11.6
Bromodichloromethane	ND		3.5	0.77	ppb v/v			11/06/14 05:25	11.6
Bromoform	ND		4.6	0.81	ppb v/v			11/06/14 05:25	11.6
Bromomethane	ND		9.3	3.9	ppb v/v			11/06/14 05:25	11.6
2-Butanone (MEK)	**13**		9.3	2.3	ppb v/v			11/06/14 05:25	11.6
Carbon disulfide	**14**		9.3	0.90	ppb v/v			11/06/14 05:25	11.6
Carbon tetrachloride	ND		9.3	0.74	ppb v/v			11/06/14 05:25	11.6
Chlorobenzene	ND		3.5	0.74	ppb v/v			11/06/14 05:25	11.6
Dibromochloromethane	ND		4.6	0.92	ppb v/v			11/06/14 05:25	11.6
Chloroethane	ND		9.3	3.6	ppb v/v			11/06/14 05:25	11.6
Chloroform	ND		3.5	1.1	ppb v/v			11/06/14 05:25	11.6
Chloromethane	ND		9.3	2.3	ppb v/v			11/06/14 05:25	11.6
1,2-Dibromoethane (EDB)	ND		9.3	0.87	ppb v/v			11/06/14 05:25	11.6
1,2-Dichlorobenzene	ND		4.6	1.5	ppb v/v			11/06/14 05:25	11.6
1,3-Dichlorobenzene	ND		4.6	1.3	ppb v/v			11/06/14 05:25	11.6
1,4-Dichlorobenzene	ND		4.6	1.7	ppb v/v			11/06/14 05:25	11.6
Dichlorodifluoromethane	**56**		4.6	1.7	ppb v/v			11/06/14 05:25	11.6
1,1-Dichloroethane	ND		3.5	0.84	ppb v/v			11/06/14 05:25	11.6
1,2-Dichloroethane	ND		9.3	1.0	ppb v/v			11/06/14 05:25	11.6
1,1-Dichloroethene	ND		9.3	1.5	ppb v/v			11/06/14 05:25	11.6
cis-1,2-Dichloroethene	ND		4.6	1.0	ppb v/v			11/06/14 05:25	11.6
trans-1,2-Dichloroethene	ND		4.6	1.2	ppb v/v			11/06/14 05:25	11.6
1,2-Dichloropropane	ND		4.6	2.8	ppb v/v			11/06/14 05:25	11.6
cis-1,3-Dichloropropene	ND		4.6	1.2	ppb v/v			11/06/14 05:25	11.6
trans-1,3-Dichloropropene	ND		4.6	1.0	ppb v/v			11/06/14 05:25	11.6
1,2-Dichloro-1,1,2,2-tetrafluoroethane	**12**		4.6	1.8	ppb v/v			11/06/14 05:25	11.6
Ethylbenzene	**2.4**	**J**	4.6	0.73	ppb v/v			11/06/14 05:25	11.6
4-Ethyltoluene	ND		4.6	2.2	ppb v/v			11/06/14 05:25	11.6
Hexachlorobutadiene	ND		23	5.0	ppb v/v			11/06/14 05:25	11.6
2-Hexanone	ND		4.6	1.0	ppb v/v			11/06/14 05:25	11.6
Methylene Chloride	ND		4.6	0.84	ppb v/v			11/06/14 05:25	11.6
4-Methyl-2-pentanone (MIBK)	ND		4.6	1.6	ppb v/v			11/06/14 05:25	11.6
Styrene	**5.2**		4.6	0.68	ppb v/v			11/06/14 05:25	11.6
1,1,2,2-Tetrachloroethane	ND		4.6	0.80	ppb v/v			11/06/14 05:25	11.6
Tetrachloroethene	ND		4.6	0.59	ppb v/v			11/06/14 05:25	11.6
Toluene	**7.4**		4.6	0.59	ppb v/v			11/06/14 05:25	11.6
1,2,4-Trichlorobenzene	ND		23	5.0	ppb v/v			11/06/14 05:25	11.6
1,1,1-Trichloroethane	ND		3.5	0.75	ppb v/v			11/06/14 05:25	11.6
1,1,2-Trichloroethane	ND		4.6	0.78	ppb v/v			11/06/14 05:25	11.6
Trichloroethene	ND		4.6	1.2	ppb v/v			11/06/14 05:25	11.6
Trichlorofluoromethane	ND		4.6	2.3	ppb v/v			11/06/14 05:25	11.6
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		4.6	1.9	ppb v/v			11/06/14 05:25	11.6
1,2,4-Trimethylbenzene	ND		9.3	1.9	ppb v/v			11/06/14 05:25	11.6
1,3,5-Trimethylbenzene	ND		4.6	1.5	ppb v/v			11/06/14 05:25	11.6
Vinyl acetate	ND		9.3	1.7	ppb v/v			11/06/14 05:25	11.6
Vinyl chloride	**5.7**		4.6	1.4	ppb v/v			11/06/14 05:25	11.6
m,p-Xylene	**2.5**	**J**	9.3	1.2	ppb v/v			11/06/14 05:25	11.6
o-Xylene	**1.4**	**J**	4.6	0.63	ppb v/v			11/06/14 05:25	11.6

Client Sample Results

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Client Sample ID: SB 50

Lab Sample ID: 160-9039-11

Date Collected: 10/23/14 13:45
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*		*11/06/14 05:25*	*11.6*
1,2-Dichloroethane-d4 (Surr)	*97*		*70 - 130*		*11/06/14 05:25*	*11.6*
Toluene-d8 (Surr)	*101*		*70 - 130*		*11/06/14 05:25*	*11.6*

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	**4.1**		1.2	0.025	% v/v			10/30/14 12:01	2.32
Methane (TCD)	**5.5**		1.2	0.31	% v/v			10/30/14 12:01	2.32
Nitrogen	**75**		2.3	0.057	% v/v			10/30/14 12:01	2.32

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 12:28	1

Client Sample ID: SB 51

Lab Sample ID: 160-9039-12

Date Collected: 10/23/14 14:20
Matrix: Air
Date Received: 10/25/14 08:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**55**		8.4	0.30	ppb v/v			11/06/14 06:09	1.68
Benzene	**7.4**		0.67	0.13	ppb v/v			11/06/14 06:09	1.68
Benzyl chloride	ND		1.3	0.27	ppb v/v			11/06/14 06:09	1.68
Bromodichloromethane	ND		0.50	0.11	ppb v/v			11/06/14 06:09	1.68
Bromoform	ND		0.67	0.12	ppb v/v			11/06/14 06:09	1.68
Bromomethane	ND		1.3	0.56	ppb v/v			11/06/14 06:09	1.68
2-Butanone (MEK)	**12**		1.3	0.33	ppb v/v			11/06/14 06:09	1.68
Carbon disulfide	**6.3**		1.3	0.13	ppb v/v			11/06/14 06:09	1.68
Carbon tetrachloride	ND		1.3	0.11	ppb v/v			11/06/14 06:09	1.68
Chlorobenzene	ND		0.50	0.11	ppb v/v			11/06/14 06:09	1.68
Dibromochloromethane	ND		0.67	0.13	ppb v/v			11/06/14 06:09	1.68
Chloroethane	ND		1.3	0.52	ppb v/v			11/06/14 06:09	1.68
Chloroform	ND		0.50	0.16	ppb v/v			11/06/14 06:09	1.68
Chloromethane	**0.61**	**J**	1.3	0.33	ppb v/v			11/06/14 06:09	1.68
1,2-Dibromoethane (EDB)	ND		1.3	0.13	ppb v/v			11/06/14 06:09	1.68
1,2-Dichlorobenzene	ND		0.67	0.22	ppb v/v			11/06/14 06:09	1.68
1,3-Dichlorobenzene	**0.19**	**J**	0.67	0.18	ppb v/v			11/06/14 06:09	1.68
1,4-Dichlorobenzene	**1.3**		0.67	0.25	ppb v/v			11/06/14 06:09	1.68
Dichlorodifluoromethane	**2.3**		0.67	0.24	ppb v/v			11/06/14 06:09	1.68
1,1-Dichloroethane	ND		0.50	0.12	ppb v/v			11/06/14 06:09	1.68
1,2-Dichloroethane	ND		1.3	0.15	ppb v/v			11/06/14 06:09	1.68
1,1-Dichloroethene	ND		1.3	0.22	ppb v/v			11/06/14 06:09	1.68
cis-1,2-Dichloroethene	**3.2**		0.67	0.15	ppb v/v			11/06/14 06:09	1.68
trans-1,2-Dichloroethene	**0.25**	**J**	0.67	0.17	ppb v/v			11/06/14 06:09	1.68
1,2-Dichloropropane	ND		0.67	0.40	ppb v/v			11/06/14 06:09	1.68
cis-1,3-Dichloropropene	ND		0.67	0.17	ppb v/v			11/06/14 06:09	1.68
trans-1,3-Dichloropropene	ND		0.67	0.15	ppb v/v			11/06/14 06:09	1.68
1,2-Dichloro-1,1,2,2-tetrafluoroethane	**16**		0.67	0.26	ppb v/v			11/06/14 06:09	1.68

Client Sample ID: SB 51

Lab Sample ID: 160-9039-12

Date Collected: 10/23/14 14:20

Matrix: Air

Date Received: 10/25/14 08:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	**2.2**		0.67	0.11	ppb v/v			11/06/14 06:09	1.68
4-Ethyltoluene	**0.38**	**J**	0.67	0.31	ppb v/v			11/06/14 06:09	1.68
Hexachlorobutadiene	ND		3.4	0.73	ppb v/v			11/06/14 06:09	1.68
2-Hexanone	ND		0.67	0.15	ppb v/v			11/06/14 06:09	1.68
Methylene Chloride	ND		0.67	0.12	ppb v/v			11/06/14 06:09	1.68
4-Methyl-2-pentanone (MIBK)	ND		0.67	0.23	ppb v/v			11/06/14 06:09	1.68
Styrene	**5.0**		0.67	0.099	ppb v/v			11/06/14 06:09	1.68
1,1,2,2-Tetrachloroethane	ND		0.67	0.12	ppb v/v			11/06/14 06:09	1.68
Tetrachloroethene	**0.13**	**J**	0.67	0.086	ppb v/v			11/06/14 06:09	1.68
Toluene	**6.1**		0.67	0.086	ppb v/v			11/06/14 06:09	1.68
1,2,4-Trichlorobenzene	ND		3.4	0.73	ppb v/v			11/06/14 06:09	1.68
1,1,1-Trichloroethane	ND		0.50	0.11	ppb v/v			11/06/14 06:09	1.68
1,1,2-Trichloroethane	ND		0.67	0.11	ppb v/v			11/06/14 06:09	1.68
Trichloroethene	ND		0.67	0.18	ppb v/v			11/06/14 06:09	1.68
Trichlorofluoromethane	ND		0.67	0.33	ppb v/v			11/06/14 06:09	1.68
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.67	0.27	ppb v/v			11/06/14 06:09	1.68
1,2,4-Trimethylbenzene	**0.91**	**J**	1.3	0.27	ppb v/v			11/06/14 06:09	1.68
1,3,5-Trimethylbenzene	**0.30**	**J**	0.67	0.21	ppb v/v			11/06/14 06:09	1.68
Vinyl acetate	ND		1.3	0.24	ppb v/v			11/06/14 06:09	1.68
Vinyl chloride	**4.1**		0.67	0.20	ppb v/v			11/06/14 06:09	1.68
m,p-Xylene	**2.5**		1.3	0.17	ppb v/v			11/06/14 06:09	1.68
o-Xylene	ND		0.67	0.091	ppb v/v			11/06/14 06:09	1.68

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*107*		*70 - 130*		*11/06/14 06:09*	*1.68*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*		*11/06/14 06:09*	*1.68*
Toluene-d8 (Surr)	*104*		*70 - 130*		*11/06/14 06:09*	*1.68*

Method: D1946 - Fixed Gases in Air (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	**2.8**		1.2	0.025	% v/v			10/30/14 12:10	2.35
Methane (TCD)	**3.9**		1.2	0.32	% v/v			10/30/14 12:10	2.35
Nitrogen	**78**		2.4	0.057	% v/v			10/30/14 12:10	2.35

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 12:50	1

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 160-152012/1-A
Matrix: Solid
Analysis Batch: 152963

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 152012

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		5.0	0.43	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,1,2,2-Tetrachloroethane	ND		5.0	0.40	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		5.0	1.7	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,1,2-Trichloroethane	ND		5.0	0.57	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,1-Dichloroethane	ND		5.0	0.39	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,1-Dichloroethene	ND		5.0	1.6	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2,4-Trichlorobenzene	ND		5.0	0.43	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2-Dibromo-3-Chloropropane	ND		10	1.5	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2-Dichlorobenzene	ND		5.0	0.28	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2-Dichloroethane	ND		5.0	0.87	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2-Dichloropropane	ND		5.0	0.38	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,3-Dichlorobenzene	ND		5.0	0.28	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,4-Dichlorobenzene	ND		5.0	0.60	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
2-Butanone (MEK)	ND		20	1.9	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
2-Hexanone	ND		20	1.8	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
4-Methyl-2-pentanone (MIBK)	ND		20	0.73	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Acetone	ND		20	6.5	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Benzene	ND		5.0	0.25	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Bromoform	ND		5.0	0.37	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Bromomethane	ND		10	1.1	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Carbon disulfide	ND		5.0	0.69	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Carbon tetrachloride	ND		5.0	0.51	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Chlorobenzene	ND		5.0	0.38	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Dibromochloromethane	ND		5.0	0.41	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Chloroethane	ND		10	0.52	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Chloroform	ND		5.0	0.38	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Chloromethane	ND		10	0.65	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
cis-1,2-Dichloroethene	ND		5.0	0.60	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
cis-1,3-Dichloropropene	ND		5.0	0.60	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Cyclohexane	ND		10	0.36	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Bromodichloromethane	ND		5.0	0.25	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Dichlorodifluoromethane	ND		10	1.3	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Ethylbenzene	ND		5.0	0.30	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
1,2-Dibromoethane (EDB)	ND		5.0	0.70	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Isopropylbenzene	ND		5.0	0.26	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Methyl acetate	ND		25	1.4	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Methyl tert-butyl ether	ND		5.0	0.48	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Methylcyclohexane	ND		10	0.26	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Methylene Chloride	ND		5.0	1.6	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
m-Xylene & p-Xylene	ND		5.0	0.57	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
o-Xylene	ND		5.0	0.34	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Styrene	ND		5.0	0.35	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Tetrachloroethene	ND		5.0	0.32	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Toluene	ND		5.0	0.70	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
trans-1,2-Dichloroethene	ND		5.0	0.94	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
trans-1,3-Dichloropropene	ND		5.0	0.35	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Trichloroethene	ND		5.0	0.39	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Trichlorofluoromethane	ND		5.0	0.50	ug/Kg		10/25/14 10:50	10/29/14 02:54	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 160-152012/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 152963 — **Prep Batch: 152012**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	ND		5.0	0.43	ug/Kg		10/25/14 10:50	10/29/14 02:54	1
Xylenes, Total	ND		10	0.85	ug/Kg		10/25/14 10:50	10/29/14 02:54	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*80 - 120*	*10/25/14 10:50*	*10/29/14 02:54*	*1*
Dibromofluoromethane (Surr)	*95*		*70 - 126*	*10/25/14 10:50*	*10/29/14 02:54*	*1*
4-Bromofluorobenzene (Surr)	*102*		*63 - 150*	*10/25/14 10:50*	*10/29/14 02:54*	*1*
1,2-Dichloroethane-d4 (Surr)	*94*		*72 - 127*	*10/25/14 10:50*	*10/29/14 02:54*	*1*

Lab Sample ID: LCS 160-152012/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 152963 — **Prep Batch: 152012**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1-Trichloroethane	50.0	47.5		ug/Kg		95	81 - 124
1,1,2,2-Tetrachloroethane	50.0	48.1		ug/Kg		96	78 - 121
1,1,2-Trichloro-1,2,2-trifluoroetha ne	50.0	48.2		ug/Kg		96	69 - 131
1,1,2-Trichloroethane	50.0	49.9		ug/Kg		100	80 - 120
1,1-Dichloroethane	50.0	46.6		ug/Kg		93	80 - 120
1,1-Dichloroethene	50.0	45.7		ug/Kg		91	80 - 120
1,2,4-Trichlorobenzene	50.0	48.6		ug/Kg		97	75 - 124
1,2-Dibromo-3-Chloropropane	50.0	50.1		ug/Kg		100	75 - 129
1,2-Dichlorobenzene	50.0	49.4		ug/Kg		99	80 - 120
1,2-Dichloroethane	50.0	49.3		ug/Kg		99	76 - 125
1,2-Dichloropropane	50.0	47.7		ug/Kg		95	80 - 120
1,3-Dichlorobenzene	50.0	48.3		ug/Kg		97	80 - 120
1,4-Dichlorobenzene	50.0	48.1		ug/Kg		96	80 - 120
2-Butanone (MEK)	50.0	51.5		ug/Kg		103	61 - 134
2-Hexanone	50.0	54.6		ug/Kg		109	71 - 127
4-Methyl-2-pentanone (MIBK)	50.0	52.6		ug/Kg		105	75 - 127
Acetone	50.0	44.3		ug/Kg		89	59 - 129
Benzene	50.0	46.2		ug/Kg		92	80 - 120
Bromoform	50.0	50.4		ug/Kg		101	84 - 126
Bromomethane	50.0	42.6		ug/Kg		85	74 - 128
Carbon disulfide	50.0	45.9		ug/Kg		92	79 - 121
Carbon tetrachloride	50.0	46.8		ug/Kg		94	80 - 125
Chlorobenzene	50.0	48.1		ug/Kg		96	80 - 120
Dibromochloromethane	50.0	49.6		ug/Kg		99	80 - 120
Chloroethane	50.0	45.2		ug/Kg		90	73 - 129
Chloroform	50.0	47.2		ug/Kg		94	80 - 120
Chloromethane	50.0	43.2		ug/Kg		86	70 - 129
cis-1,2-Dichloroethene	50.0	47.7		ug/Kg		95	80 - 120
cis-1,3-Dichloropropene	50.0	51.2		ug/Kg		102	80 - 125
Cyclohexane	50.0	47.1		ug/Kg		94	80 - 120
Bromodichloromethane	50.0	50.3		ug/Kg		101	80 - 120
Dichlorodifluoromethane	50.0	41.4		ug/Kg		83	73 - 124
Ethylbenzene	50.0	46.9		ug/Kg		94	80 - 120

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 160-152012/2-A
Matrix: Solid
Analysis Batch: 152963

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 152012

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dibromoethane (EDB)	50.0	51.3		ug/Kg		103	80 - 120
Isopropylbenzene	50.0	50.3		ug/Kg		101	80 - 120
Methyl acetate	250	249		ug/Kg		99	73 - 129
Methyl tert-butyl ether	50.0	49.6		ug/Kg		99	83 - 124
Methylcyclohexane	50.0	46.8		ug/Kg		94	80 - 120
Methylene Chloride	50.0	46.6		ug/Kg		93	80 - 120
m-Xylene & p-Xylene	50.0	49.7		ug/Kg		99	80 - 120
o-Xylene	50.0	51.5		ug/Kg		103	80 - 127
Styrene	50.0	50.1		ug/Kg		100	80 - 120
Tetrachloroethene	50.0	49.3		ug/Kg		99	80 - 120
Toluene	50.0	49.2		ug/Kg		98	80 - 120
trans-1,2-Dichloroethene	50.0	46.9		ug/Kg		94	80 - 120
trans-1,3-Dichloropropene	50.0	51.8		ug/Kg		104	82 - 124
Trichloroethene	50.0	46.3		ug/Kg		93	80 - 120
Trichlorofluoromethane	50.0	38.9		ug/Kg		78	77 - 132
Vinyl chloride	50.0	42.1		ug/Kg		84	65 - 123
Xylenes, Total	100	101		ug/Kg		101	80 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*97*		*80 - 120*
Dibromofluoromethane (Surr)	*96*		*70 - 126*
4-Bromofluorobenzene (Surr)	*98*		*63 - 150*
1,2-Dichloroethane-d4 (Surr)	*99*		*72 - 127*

Lab Sample ID: LCSD 160-152012/3-A
Matrix: Solid
Analysis Batch: 152963

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 152012

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1-Trichloroethane	50.0	48.3		ug/Kg		97	81 - 124	2	20
1,1,2,2-Tetrachloroethane	50.0	46.2		ug/Kg		92	78 - 121	4	20
1,1,2-Trichloro-1,2,2-trifluoroetha ne	50.0	48.6		ug/Kg		97	69 - 131	1	20
1,1,2-Trichloroethane	50.0	48.3		ug/Kg		97	80 - 120	3	20
1,1-Dichloroethane	50.0	47.0		ug/Kg		94	80 - 120	1	20
1,1-Dichloroethene	50.0	46.8		ug/Kg		94	80 - 120	2	20
1,2,4-Trichlorobenzene	50.0	47.9		ug/Kg		96	75 - 124	1	20
1,2-Dibromo-3-Chloropropane	50.0	48.4		ug/Kg		97	75 - 129	4	20
1,2-Dichlorobenzene	50.0	48.4		ug/Kg		97	80 - 120	2	20
1,2-Dichloroethane	50.0	47.8		ug/Kg		96	76 - 125	3	20
1,2-Dichloropropane	50.0	47.9		ug/Kg		96	80 - 120	0	20
1,3-Dichlorobenzene	50.0	47.8		ug/Kg		96	80 - 120	1	20
1,4-Dichlorobenzene	50.0	47.5		ug/Kg		95	80 - 120	1	20
2-Butanone (MEK)	50.0	48.5		ug/Kg		97	61 - 134	6	20
2-Hexanone	50.0	51.6		ug/Kg		103	71 - 127	6	20
4-Methyl-2-pentanone (MIBK)	50.0	50.3		ug/Kg		101	75 - 127	4	20
Acetone	50.0	44.2		ug/Kg		88	59 - 129	0	20
Benzene	50.0	46.9		ug/Kg		94	80 - 120	1	20

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 160-152012/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 152963 — **Prep Batch: 152012**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bromoform	50.0	49.8		ug/Kg		100	84 - 126	1	20
Bromomethane	50.0	44.8		ug/Kg		90	74 - 128	5	20
Carbon disulfide	50.0	46.3		ug/Kg		93	79 - 121	1	20
Carbon tetrachloride	50.0	47.7		ug/Kg		95	80 - 125	2	20
Chlorobenzene	50.0	47.9		ug/Kg		96	80 - 120	0	20
Dibromochloromethane	50.0	49.8		ug/Kg		100	80 - 120	0	20
Chloroethane	50.0	46.5		ug/Kg		93	73 - 129	3	20
Chloroform	50.0	47.4		ug/Kg		95	80 - 120	1	20
Chloromethane	50.0	43.8		ug/Kg		88	70 - 129	1	20
cis-1,2-Dichloroethene	50.0	48.2		ug/Kg		96	80 - 120	1	20
cis-1,3-Dichloropropene	50.0	49.7		ug/Kg		99	80 - 125	3	20
Cyclohexane	50.0	47.6		ug/Kg		95	80 - 120	1	20
Bromodichloromethane	50.0	49.3		ug/Kg		99	80 - 120	2	20
Dichlorodifluoromethane	50.0	41.6		ug/Kg		83	73 - 124	1	20
Ethylbenzene	50.0	47.0		ug/Kg		94	80 - 120	0	20
1,2-Dibromoethane (EDB)	50.0	49.5		ug/Kg		99	80 - 120	4	20
Isopropylbenzene	50.0	49.6		ug/Kg		99	80 - 120	1	20
Methyl acetate	250	237		ug/Kg		95	73 - 129	5	20
Methyl tert-butyl ether	50.0	49.0		ug/Kg		98	83 - 124	1	20
Methylcyclohexane	50.0	47.2		ug/Kg		94	80 - 120	1	20
Methylene Chloride	50.0	46.0		ug/Kg		92	80 - 120	1	20
m-Xylene & p-Xylene	50.0	49.1		ug/Kg		98	80 - 120	1	20
o-Xylene	50.0	52.1		ug/Kg		104	80 - 127	1	20
Styrene	50.0	50.0		ug/Kg		100	80 - 120	0	20
Tetrachloroethene	50.0	49.5		ug/Kg		99	80 - 120	0	20
Toluene	50.0	49.2		ug/Kg		98	80 - 120	0	20
trans-1,2-Dichloroethene	50.0	47.6		ug/Kg		95	80 - 120	1	20
trans-1,3-Dichloropropene	50.0	49.6		ug/Kg		99	82 - 124	4	20
Trichloroethene	50.0	45.9		ug/Kg		92	80 - 120	1	20
Trichlorofluoromethane	50.0	40.3		ug/Kg		81	77 - 132	4	20
Vinyl chloride	50.0	45.3		ug/Kg		91	65 - 123	7	20
Xylenes, Total	100	101		ug/Kg		101	80 - 120	0	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*99*		*80 - 120*
Dibromofluoromethane (Surr)	*95*		*70 - 126*
4-Bromofluorobenzene (Surr)	*95*		*63 - 150*
1,2-Dichloroethane-d4 (Surr)	*96*		*72 - 127*

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-57212/9 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 57212

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0	0.18	ppb v/v			11/05/14 15:47	1
Benzene	ND		0.40	0.079	ppb v/v			11/05/14 15:47	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-57212/9
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl chloride	ND		0.80	0.16	ppb v/v			11/05/14 15:47	1
Bromodichloromethane	ND		0.30	0.066	ppb v/v			11/05/14 15:47	1
Bromoform	ND		0.40	0.070	ppb v/v			11/05/14 15:47	1
Bromomethane	ND		0.80	0.34	ppb v/v			11/05/14 15:47	1
2-Butanone (MEK)	ND		0.80	0.20	ppb v/v			11/05/14 15:47	1
Carbon disulfide	ND		0.80	0.078	ppb v/v			11/05/14 15:47	1
Carbon tetrachloride	ND		0.80	0.064	ppb v/v			11/05/14 15:47	1
Chlorobenzene	ND		0.30	0.064	ppb v/v			11/05/14 15:47	1
Dibromochloromethane	ND		0.40	0.079	ppb v/v			11/05/14 15:47	1
Chloroethane	ND		0.80	0.31	ppb v/v			11/05/14 15:47	1
Chloroform	ND		0.30	0.095	ppb v/v			11/05/14 15:47	1
Chloromethane	ND		0.80	0.20	ppb v/v			11/05/14 15:47	1
1,2-Dibromoethane (EDB)	ND		0.80	0.075	ppb v/v			11/05/14 15:47	1
1,2-Dichlorobenzene	ND		0.40	0.13	ppb v/v			11/05/14 15:47	1
1,3-Dichlorobenzene	ND		0.40	0.11	ppb v/v			11/05/14 15:47	1
1,4-Dichlorobenzene	ND		0.40	0.15	ppb v/v			11/05/14 15:47	1
Dichlorodifluoromethane	ND		0.40	0.15	ppb v/v			11/05/14 15:47	1
1,1-Dichloroethane	ND		0.30	0.072	ppb v/v			11/05/14 15:47	1
1,2-Dichloroethane	ND		0.80	0.088	ppb v/v			11/05/14 15:47	1
1,1-Dichloroethene	ND		0.80	0.13	ppb v/v			11/05/14 15:47	1
cis-1,2-Dichloroethene	ND		0.40	0.089	ppb v/v			11/05/14 15:47	1
trans-1,2-Dichloroethene	ND		0.40	0.10	ppb v/v			11/05/14 15:47	1
1,2-Dichloropropane	ND		0.40	0.24	ppb v/v			11/05/14 15:47	1
cis-1,3-Dichloropropene	ND		0.40	0.10	ppb v/v			11/05/14 15:47	1
trans-1,3-Dichloropropene	ND		0.40	0.088	ppb v/v			11/05/14 15:47	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	0.16	ppb v/v			11/05/14 15:47	1
Ethylbenzene	ND		0.40	0.063	ppb v/v			11/05/14 15:47	1
4-Ethyltoluene	ND		0.40	0.19	ppb v/v			11/05/14 15:47	1
Hexachlorobutadiene	ND		2.0	0.43	ppb v/v			11/05/14 15:47	1
2-Hexanone	ND		0.40	0.087	ppb v/v			11/05/14 15:47	1
Methylene Chloride	ND		0.40	0.072	ppb v/v			11/05/14 15:47	1
4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14	ppb v/v			11/05/14 15:47	1
Styrene	ND		0.40	0.059	ppb v/v			11/05/14 15:47	1
1,1,2,2-Tetrachloroethane	ND		0.40	0.069	ppb v/v			11/05/14 15:47	1
Tetrachloroethene	ND		0.40	0.051	ppb v/v			11/05/14 15:47	1
Toluene	ND		0.40	0.051	ppb v/v			11/05/14 15:47	1
1,2,4-Trichlorobenzene	ND		2.0	0.43	ppb v/v			11/05/14 15:47	1
1,1,1-Trichloroethane	ND		0.30	0.065	ppb v/v			11/05/14 15:47	1
1,1,2-Trichloroethane	ND		0.40	0.067	ppb v/v			11/05/14 15:47	1
Trichloroethene	ND		0.40	0.11	ppb v/v			11/05/14 15:47	1
Trichlorofluoromethane	ND		0.40	0.20	ppb v/v			11/05/14 15:47	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16	ppb v/v			11/05/14 15:47	1
1,2,4-Trimethylbenzene	ND		0.80	0.16	ppb v/v			11/05/14 15:47	1
1,3,5-Trimethylbenzene	ND		0.40	0.13	ppb v/v			11/05/14 15:47	1
Vinyl acetate	ND		0.80	0.15	ppb v/v			11/05/14 15:47	1
Vinyl chloride	ND		0.40	0.12	ppb v/v			11/05/14 15:47	1
m,p-Xylene	ND		0.80	0.10	ppb v/v			11/05/14 15:47	1
o-Xylene	ND		0.40	0.054	ppb v/v			11/05/14 15:47	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-57212/9
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	105		70 - 130		11/05/14 15:47	1
1,2-Dichloroethane-d4 (Surr)	91		70 - 130		11/05/14 15:47	1
Toluene-d8 (Surr)	107		70 - 130		11/05/14 15:47	1

Lab Sample ID: LCS 320-57212/4
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	20.0	16.5		ppb v/v		83	71 - 131
Benzene	20.0	16.7		ppb v/v		83	68 - 128
Benzyl chloride	20.0	17.8		ppb v/v		89	58 - 120
Bromodichloromethane	20.0	17.2		ppb v/v		86	65 - 130
Bromoform	20.0	21.4		ppb v/v		107	64 - 144
Bromomethane	20.0	21.0		ppb v/v		105	70 - 131
2-Butanone (MEK)	20.0	15.5		ppb v/v		78	71 - 131
Carbon disulfide	20.0	17.7		ppb v/v		88	63 - 123
Carbon tetrachloride	20.0	18.6		ppb v/v		93	67 - 127
Chlorobenzene	20.0	18.4		ppb v/v		92	70 - 132
Dibromochloromethane	20.0	18.5		ppb v/v		92	68 - 128
Chloroethane	20.0	19.2		ppb v/v		96	70 - 131
Chloroform	20.0	16.8		ppb v/v		84	69 - 129
Chloromethane	20.0	21.5		ppb v/v		107	67 - 127
1,2-Dibromoethane (EDB)	20.0	18.8		ppb v/v		94	68 - 131
1,2-Dichlorobenzene	20.0	22.5		ppb v/v		112	73 - 143
1,3-Dichlorobenzene	20.0	22.1		ppb v/v		111	77 - 136
1,4-Dichlorobenzene	20.0	22.2		ppb v/v		111	73 - 143
Dichlorodifluoromethane	20.0	19.8		ppb v/v		99	69 - 129
1,1-Dichloroethane	20.0	16.2		ppb v/v		81	65 - 125
1,2-Dichloroethane	20.0	17.4		ppb v/v		87	71 - 131
1,1-Dichloroethene	20.0	16.8		ppb v/v		84	53 - 128
cis-1,2-Dichloroethene	20.0	16.7		ppb v/v		84	68 - 128
trans-1,2-Dichloroethene	20.0	17.1		ppb v/v		86	70 - 130
1,2-Dichloropropane	20.0	18.6		ppb v/v		93	74 - 128
cis-1,3-Dichloropropene	20.0	18.8		ppb v/v		94	78 - 132
trans-1,3-Dichloropropene	20.0	16.7		ppb v/v		83	56 - 136
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	18.0		ppb v/v		90	64 - 124
Ethylbenzene	20.0	17.8		ppb v/v		89	76 - 136
4-Ethyltoluene	20.0	17.2		ppb v/v		86	62 - 136
Hexachlorobutadiene	20.0	25.3		ppb v/v		127	42 - 150
2-Hexanone	20.0	18.2		ppb v/v		91	70 - 128
Methylene Chloride	20.0	16.6		ppb v/v		83	65 - 125
4-Methyl-2-pentanone (MIBK)	20.0	18.4		ppb v/v		92	73 - 133
Styrene	20.0	19.1		ppb v/v		95	76 - 144
1,1,2,2-Tetrachloroethane	20.0	19.6		ppb v/v		98	75 - 135
Tetrachloroethene	20.0	18.4		ppb v/v		92	56 - 138
Toluene	20.0	18.3		ppb v/v		91	71 - 132

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-57212/4
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2,4-Trichlorobenzene	20.0	26.6		ppb v/v		133	59 - 150
1,1,1-Trichloroethane	20.0	17.4		ppb v/v		87	65 - 124
1,1,2-Trichloroethane	20.0	18.5		ppb v/v		93	71 - 131
Trichloroethene	20.0	17.5		ppb v/v		88	64 - 127
Trichlorofluoromethane	20.0	20.0		ppb v/v		100	68 - 128
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	16.1		ppb v/v		81	50 - 132
1,2,4-Trimethylbenzene	20.0	16.4		ppb v/v		82	61 - 145
1,3,5-Trimethylbenzene	20.0	18.3		ppb v/v		91	65 - 136
Vinyl acetate	20.0	18.7		ppb v/v		93	77 - 134
Vinyl chloride	20.0	20.5		ppb v/v		103	69 - 129
m,p-Xylene	40.0	35.7		ppb v/v		89	75 - 138
o-Xylene	20.0	18.2		ppb v/v		91	77 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*112*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*98*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*

Lab Sample ID: LCSD 320-57212/5
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	20.0	16.4		ppb v/v		82	71 - 131	1	25
Benzene	20.0	16.7		ppb v/v		84	68 - 128	1	25
Benzyl chloride	20.0	17.7		ppb v/v		89	58 - 120	1	25
Bromodichloromethane	20.0	17.1		ppb v/v		86	65 - 130	1	25
Bromoform	20.0	21.1		ppb v/v		105	64 - 144	1	25
Bromomethane	20.0	21.2		ppb v/v		106	70 - 131	1	25
2-Butanone (MEK)	20.0	16.0		ppb v/v		80	71 - 131	3	25
Carbon disulfide	20.0	17.9		ppb v/v		90	63 - 123	2	25
Carbon tetrachloride	20.0	18.4		ppb v/v		92	67 - 127	1	25
Chlorobenzene	20.0	18.4		ppb v/v		92	70 - 132	0	25
Dibromochloromethane	20.0	18.3		ppb v/v		92	68 - 128	1	25
Chloroethane	20.0	18.9		ppb v/v		94	70 - 131	2	25
Chloroform	20.0	16.7		ppb v/v		84	69 - 129	0	25
Chloromethane	20.0	20.9		ppb v/v		105	67 - 127	3	25
1,2-Dibromoethane (EDB)	20.0	18.7		ppb v/v		93	68 - 131	1	25
1,2-Dichlorobenzene	20.0	22.1		ppb v/v		111	73 - 143	2	25
1,3-Dichlorobenzene	20.0	22.0		ppb v/v		110	77 - 136	1	25
1,4-Dichlorobenzene	20.0	21.9		ppb v/v		110	73 - 143	1	25
Dichlorodifluoromethane	20.0	19.5		ppb v/v		97	69 - 129	2	25
1,1-Dichloroethane	20.0	16.3		ppb v/v		82	65 - 125	1	25
1,2-Dichloroethane	20.0	17.2		ppb v/v		86	71 - 131	1	25
1,1-Dichloroethene	20.0	16.7		ppb v/v		84	53 - 128	0	25
cis-1,2-Dichloroethene	20.0	17.0		ppb v/v		85	68 - 128	1	25
trans-1,2-Dichloroethene	20.0	17.3		ppb v/v		86	70 - 130	1	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-57212/5
Matrix: Air
Analysis Batch: 57212

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dichloropropane	20.0	18.2		ppb v/v		91	74 - 128	2	25
cis-1,3-Dichloropropene	20.0	18.7		ppb v/v		93	78 - 132	1	25
trans-1,3-Dichloropropene	20.0	16.5		ppb v/v		82	56 - 136	1	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	16.5		ppb v/v		82	64 - 124	9	25
Ethylbenzene	20.0	17.8		ppb v/v		89	76 - 136	0	25
4-Ethyltoluene	20.0	18.4		ppb v/v		92	62 - 136	7	25
Hexachlorobutadiene	20.0	24.7		ppb v/v		123	42 - 150	3	25
2-Hexanone	20.0	18.4		ppb v/v		92	70 - 128	1	25
Methylene Chloride	20.0	16.5		ppb v/v		82	65 - 125	1	25
4-Methyl-2-pentanone (MIBK)	20.0	18.3		ppb v/v		91	73 - 133	1	25
Styrene	20.0	19.0		ppb v/v		95	76 - 144	0	25
1,1,2,2-Tetrachloroethane	20.0	19.6		ppb v/v		98	75 - 135	0	25
Tetrachloroethene	20.0	18.3		ppb v/v		92	56 - 138	0	25
Toluene	20.0	18.4		ppb v/v		92	71 - 132	0	25
1,2,4-Trichlorobenzene	20.0	26.2		ppb v/v		131	59 - 150	1	25
1,1,1-Trichloroethane	20.0	17.2		ppb v/v		86	65 - 124	1	25
1,1,2-Trichloroethane	20.0	18.3		ppb v/v		92	71 - 131	1	25
Trichloroethene	20.0	17.5		ppb v/v		88	64 - 127	0	25
Trichlorofluoromethane	20.0	20.0		ppb v/v		100	68 - 128	0	25
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	16.2		ppb v/v		81	50 - 132	0	25
1,2,4-Trimethylbenzene	20.0	16.5		ppb v/v		82	61 - 145	0	25
1,3,5-Trimethylbenzene	20.0	18.4		ppb v/v		92	65 - 136	1	25
Vinyl acetate	20.0	18.7		ppb v/v		93	77 - 134	0	25
Vinyl chloride	20.0	20.3		ppb v/v		101	69 - 129	1	25
m,p-Xylene	40.0	35.7		ppb v/v		89	75 - 138	0	25
o-Xylene	20.0	18.3		ppb v/v		92	77 - 132	1	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*111*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*
Toluene-d8 (Surr)	*105*		*70 - 130*

Lab Sample ID: MB 320-57324/12
Matrix: Air
Analysis Batch: 57324

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0	0.18	ppb v/v			11/06/14 23:26	1
Benzene	ND		0.40	0.079	ppb v/v			11/06/14 23:26	1
Benzyl chloride	ND		0.80	0.16	ppb v/v			11/06/14 23:26	1
Bromodichloromethane	ND		0.30	0.066	ppb v/v			11/06/14 23:26	1
Bromoform	ND		0.40	0.070	ppb v/v			11/06/14 23:26	1
Bromomethane	ND		0.80	0.34	ppb v/v			11/06/14 23:26	1
2-Butanone (MEK)	ND		0.80	0.20	ppb v/v			11/06/14 23:26	1
Carbon disulfide	ND		0.80	0.078	ppb v/v			11/06/14 23:26	1
Carbon tetrachloride	ND		0.80	0.064	ppb v/v			11/06/14 23:26	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-57324/12
Matrix: Air
Analysis Batch: 57324

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chlorobenzene	ND		0.30	0.064	ppb v/v			11/06/14 23:26	1
Dibromochloromethane	ND		0.40	0.079	ppb v/v			11/06/14 23:26	1
Chloroethane	ND		0.80	0.31	ppb v/v			11/06/14 23:26	1
Chloroform	ND		0.30	0.095	ppb v/v			11/06/14 23:26	1
Chloromethane	ND		0.80	0.20	ppb v/v			11/06/14 23:26	1
1,2-Dibromoethane (EDB)	ND		0.80	0.075	ppb v/v			11/06/14 23:26	1
1,2-Dichlorobenzene	ND		0.40	0.13	ppb v/v			11/06/14 23:26	1
1,3-Dichlorobenzene	ND		0.40	0.11	ppb v/v			11/06/14 23:26	1
1,4-Dichlorobenzene	ND		0.40	0.15	ppb v/v			11/06/14 23:26	1
Dichlorodifluoromethane	ND		0.40	0.15	ppb v/v			11/06/14 23:26	1
1,1-Dichloroethane	ND		0.30	0.072	ppb v/v			11/06/14 23:26	1
1,2-Dichloroethane	ND		0.80	0.088	ppb v/v			11/06/14 23:26	1
1,1-Dichloroethene	ND		0.80	0.13	ppb v/v			11/06/14 23:26	1
cis-1,2-Dichloroethene	ND		0.40	0.089	ppb v/v			11/06/14 23:26	1
trans-1,2-Dichloroethene	ND		0.40	0.10	ppb v/v			11/06/14 23:26	1
1,2-Dichloropropane	ND		0.40	0.24	ppb v/v			11/06/14 23:26	1
cis-1,3-Dichloropropene	ND		0.40	0.10	ppb v/v			11/06/14 23:26	1
trans-1,3-Dichloropropene	ND		0.40	0.088	ppb v/v			11/06/14 23:26	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	0.16	ppb v/v			11/06/14 23:26	1
Ethylbenzene	0.0697	J	0.40	0.063	ppb v/v			11/06/14 23:26	1
4-Ethyltoluene	ND		0.40	0.19	ppb v/v			11/06/14 23:26	1
Hexachlorobutadiene	ND		2.0	0.43	ppb v/v			11/06/14 23:26	1
2-Hexanone	ND		0.40	0.087	ppb v/v			11/06/14 23:26	1
Methylene Chloride	ND		0.40	0.072	ppb v/v			11/06/14 23:26	1
4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14	ppb v/v			11/06/14 23:26	1
Styrene	ND		0.40	0.059	ppb v/v			11/06/14 23:26	1
1,1,2,2-Tetrachloroethane	ND		0.40	0.069	ppb v/v			11/06/14 23:26	1
Tetrachloroethene	ND		0.40	0.051	ppb v/v			11/06/14 23:26	1
Toluene	ND		0.40	0.051	ppb v/v			11/06/14 23:26	1
1,2,4-Trichlorobenzene	ND		2.0	0.43	ppb v/v			11/06/14 23:26	1
1,1,1-Trichloroethane	ND		0.30	0.065	ppb v/v			11/06/14 23:26	1
1,1,2-Trichloroethane	ND		0.40	0.067	ppb v/v			11/06/14 23:26	1
Trichloroethene	ND		0.40	0.11	ppb v/v			11/06/14 23:26	1
Trichlorofluoromethane	ND		0.40	0.20	ppb v/v			11/06/14 23:26	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16	ppb v/v			11/06/14 23:26	1
1,2,4-Trimethylbenzene	ND		0.80	0.16	ppb v/v			11/06/14 23:26	1
1,3,5-Trimethylbenzene	ND		0.40	0.13	ppb v/v			11/06/14 23:26	1
Vinyl acetate	ND		0.80	0.15	ppb v/v			11/06/14 23:26	1
Vinyl chloride	ND		0.40	0.12	ppb v/v			11/06/14 23:26	1
m,p-Xylene	0.115	J	0.80	0.10	ppb v/v			11/06/14 23:26	1
o-Xylene	ND		0.40	0.054	ppb v/v			11/06/14 23:26	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*90*		*70 - 130*		*11/06/14 23:26*	*1*
1,2-Dichloroethane-d4 (Surr)	*76*		*70 - 130*		*11/06/14 23:26*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*		*11/06/14 23:26*	*1*

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-57324/4
Matrix: Air
Analysis Batch: 57324

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	20.0	17.3		ppb v/v		86	71 - 131
Benzene	20.0	18.9		ppb v/v		94	68 - 128
Benzyl chloride	20.0	19.1		ppb v/v		95	58 - 120
Bromodichloromethane	20.0	18.5		ppb v/v		92	65 - 130
Bromoform	20.0	23.4		ppb v/v		117	64 - 144
Bromomethane	20.0	17.6		ppb v/v		88	70 - 131
2-Butanone (MEK)	20.0	18.9		ppb v/v		95	71 - 131
Carbon disulfide	20.0	18.0		ppb v/v		90	63 - 123
Carbon tetrachloride	20.0	21.6		ppb v/v		108	67 - 127
Chlorobenzene	20.0	20.8		ppb v/v		104	70 - 132
Dibromochloromethane	20.0	20.6		ppb v/v		103	68 - 128
Chloroethane	20.0	17.4		ppb v/v		87	70 - 131
Chloroform	20.0	18.6		ppb v/v		93	69 - 129
Chloromethane	20.0	17.4		ppb v/v		87	67 - 127
1,2-Dibromoethane (EDB)	20.0	21.0		ppb v/v		105	68 - 131
1,2-Dichlorobenzene	20.0	21.7		ppb v/v		108	73 - 143
1,3-Dichlorobenzene	20.0	21.4		ppb v/v		107	77 - 136
1,4-Dichlorobenzene	20.0	22.3		ppb v/v		111	73 - 143
Dichlorodifluoromethane	20.0	18.6		ppb v/v		93	69 - 129
1,1-Dichloroethane	20.0	18.3		ppb v/v		91	65 - 125
1,2-Dichloroethane	20.0	17.5		ppb v/v		87	71 - 131
1,1-Dichloroethene	20.0	16.7		ppb v/v		83	53 - 128
cis-1,2-Dichloroethene	20.0	20.0		ppb v/v		100	68 - 128
trans-1,2-Dichloroethene	20.0	18.4		ppb v/v		92	70 - 130
1,2-Dichloropropane	20.0	18.5		ppb v/v		93	74 - 128
cis-1,3-Dichloropropene	20.0	21.3		ppb v/v		107	78 - 132
trans-1,3-Dichloropropene	20.0	18.2		ppb v/v		91	56 - 136
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	20.6		ppb v/v		103	64 - 124
Ethylbenzene	20.0	17.1	B	ppb v/v		86	76 - 136
4-Ethyltoluene	20.0	19.8		ppb v/v		99	62 - 136
Hexachlorobutadiene	20.0	19.1		ppb v/v		95	42 - 150
2-Hexanone	20.0	18.8		ppb v/v		94	70 - 128
Methylene Chloride	20.0	16.3		ppb v/v		82	65 - 125
4-Methyl-2-pentanone (MIBK)	20.0	16.9		ppb v/v		84	73 - 133
Styrene	20.0	21.8		ppb v/v		109	76 - 144
1,1,2,2-Tetrachloroethane	20.0	21.3		ppb v/v		106	75 - 135
Tetrachloroethene	20.0	21.1		ppb v/v		105	56 - 138
Toluene	20.0	18.3		ppb v/v		91	71 - 132
1,2,4-Trichlorobenzene	20.0	21.1		ppb v/v		106	59 - 150
1,1,1-Trichloroethane	20.0	18.7		ppb v/v		94	65 - 124
1,1,2-Trichloroethane	20.0	20.9		ppb v/v		104	71 - 131
Trichloroethene	20.0	20.2		ppb v/v		101	64 - 127
Trichlorofluoromethane	20.0	16.8		ppb v/v		84	68 - 128
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	17.5		ppb v/v		88	50 - 132
1,2,4-Trimethylbenzene	20.0	21.4		ppb v/v		107	61 - 145
1,3,5-Trimethylbenzene	20.0	21.2		ppb v/v		106	65 - 136

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-57324/4
Matrix: Air
Analysis Batch: 57324

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Vinyl acetate	20.0	21.1		ppb v/v		105	77 - 134
Vinyl chloride	20.0	18.3		ppb v/v		92	69 - 129
m,p-Xylene	40.0	33.1	B	ppb v/v		83	75 - 138
o-Xylene	20.0	16.9		ppb v/v		85	77 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*97*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*86*		*70 - 130*
Toluene-d8 (Surr)	*100*		*70 - 130*

Lab Sample ID: LCSD 320-57324/5
Matrix: Air
Analysis Batch: 57324

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	20.0	17.1		ppb v/v		86	71 - 131	1	25
Benzene	20.0	19.2		ppb v/v		96	68 - 128	2	25
Benzyl chloride	20.0	19.5		ppb v/v		98	58 - 120	2	25
Bromodichloromethane	20.0	18.3		ppb v/v		92	65 - 130	1	25
Bromoform	20.0	24.0		ppb v/v		120	64 - 144	3	25
Bromomethane	20.0	17.5		ppb v/v		87	70 - 131	1	25
2-Butanone (MEK)	20.0	18.8		ppb v/v		94	71 - 131	1	25
Carbon disulfide	20.0	18.1		ppb v/v		91	63 - 123	1	25
Carbon tetrachloride	20.0	22.1		ppb v/v		111	67 - 127	2	25
Chlorobenzene	20.0	21.3		ppb v/v		106	70 - 132	2	25
Dibromochloromethane	20.0	20.8		ppb v/v		104	68 - 128	1	25
Chloroethane	20.0	17.2		ppb v/v		86	70 - 131	1	25
Chloroform	20.0	18.6		ppb v/v		93	69 - 129	0	25
Chloromethane	20.0	18.6		ppb v/v		93	67 - 127	7	25
1,2-Dibromoethane (EDB)	20.0	21.2		ppb v/v		106	68 - 131	1	25
1,2-Dichlorobenzene	20.0	22.2		ppb v/v		111	73 - 143	2	25
1,3-Dichlorobenzene	20.0	21.9		ppb v/v		110	77 - 136	2	25
1,4-Dichlorobenzene	20.0	22.7		ppb v/v		114	73 - 143	2	25
Dichlorodifluoromethane	20.0	18.8		ppb v/v		94	69 - 129	1	25
1,1-Dichloroethane	20.0	18.4		ppb v/v		92	65 - 125	0	25
1,2-Dichloroethane	20.0	17.8		ppb v/v		89	71 - 131	2	25
1,1-Dichloroethene	20.0	16.7		ppb v/v		83	53 - 128	0	25
cis-1,2-Dichloroethene	20.0	20.2		ppb v/v		101	68 - 128	1	25
trans-1,2-Dichloroethene	20.0	18.5		ppb v/v		93	70 - 130	1	25
1,2-Dichloropropane	20.0	18.4		ppb v/v		92	74 - 128	0	25
cis-1,3-Dichloropropene	20.0	20.9		ppb v/v		105	78 - 132	2	25
trans-1,3-Dichloropropene	20.0	17.9		ppb v/v		90	56 - 136	1	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	21.2		ppb v/v		106	64 - 124	3	25
Ethylbenzene	20.0	17.4	B	ppb v/v		87	76 - 136	2	25
4-Ethyltoluene	20.0	19.8		ppb v/v		99	62 - 136	0	25
Hexachlorobutadiene	20.0	19.6		ppb v/v		98	42 - 150	3	25
2-Hexanone	20.0	18.8		ppb v/v		94	70 - 128	0	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-57324/5 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 57324

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Methylene Chloride	20.0	16.3		ppb v/v		82	65 - 125	0	25
4-Methyl-2-pentanone (MIBK)	20.0	16.5		ppb v/v		82	73 - 133	2	25
Styrene	20.0	22.4		ppb v/v		112	76 - 144	3	25
1,1,2,2-Tetrachloroethane	20.0	21.4		ppb v/v		107	75 - 135	1	25
Tetrachloroethene	20.0	21.3		ppb v/v		107	56 - 138	1	25
Toluene	20.0	18.3		ppb v/v		91	71 - 132	0	25
1,2,4-Trichlorobenzene	20.0	22.1		ppb v/v		111	59 - 150	5	25
1,1,1-Trichloroethane	20.0	18.8		ppb v/v		94	65 - 124	1	25
1,1,2-Trichloroethane	20.0	20.5		ppb v/v		102	71 - 131	2	25
Trichloroethene	20.0	20.5		ppb v/v		102	64 - 127	1	25
Trichlorofluoromethane	20.0	18.2		ppb v/v		91	68 - 128	8	25
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	17.6		ppb v/v		88	50 - 132	0	25
1,2,4-Trimethylbenzene	20.0	21.9		ppb v/v		109	61 - 145	2	25
1,3,5-Trimethylbenzene	20.0	21.6		ppb v/v		108	65 - 136	2	25
Vinyl acetate	20.0	21.1		ppb v/v		105	77 - 134	0	25
Vinyl chloride	20.0	18.1		ppb v/v		90	69 - 129	1	25
m,p-Xylene	40.0	33.9	B	ppb v/v		85	75 - 138	2	25
o-Xylene	20.0	17.4		ppb v/v		87	77 - 132	2	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*96*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*87*		*70 - 130*
Toluene-d8 (Surr)	*98*		*70 - 130*

Method: D1946 - Fixed Gases in Air (GC)

Lab Sample ID: MB 320-56731/5 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56731

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon Dioxide (TCD)	ND		0.50	0.011	% v/v			10/30/14 10:55	1
Methane (TCD)	ND		0.50	0.14	% v/v			10/30/14 10:55	1
Nitrogen	0.0900	J	1.0	0.024	% v/v			10/30/14 10:55	1

Lab Sample ID: LCS 320-56731/3 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56731

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Carbon Dioxide (TCD)	23.6	23.5		% v/v		100	80 - 120
Methane (TCD)	26.0	27.3		% v/v		105	80 - 120
Nitrogen	24.4	26.1		% v/v		107	80 - 120

Method: D1946 - Fixed Gases in Air (GC) (Continued)

Lab Sample ID: MB 320-56783/3 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56783

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane (FID)	ND		0.00010	0.000020	% v/v			10/30/14 15:12	1

Lab Sample ID: LCS 320-56783/2 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56783

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Methane (FID)	0.0250	0.0241		% v/v		97	80 - 120

Method: EPA 15_16 - Sulfur Emissions from Stationary Sources (GC/FPD)

Lab Sample ID: MB 320-56201/5 — **Client Sample ID: Method Blank**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56201

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hydrogen sulfide	ND		0.40	0.20	ppm v/v			10/24/14 08:58	1

Lab Sample ID: LCS 320-56201/3 — **Client Sample ID: Lab Control Sample**
Matrix: Air — **Prep Type: Total/NA**
Analysis Batch: 56201

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Hydrogen sulfide	2.00	1.93		ppm v/v		97	63 - 140

QC Association Summary

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

GC/MS VOA

Prep Batch: 152012

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-1	SB-11 8.5-9.0 FT	Total/NA	Solid	5035	
160-9039-2	SB-12 7-7.5 FT	Total/NA	Solid	5035	
160-9039-3	SB20 2.5-3FT	Total/NA	Solid	5035	
160-9039-4	SB19 6.5-7FT	Total/NA	Solid	5035	
160-9039-5	SB50 2-2.5FT	Total/NA	Solid	5035	
160-9039-6	SB51 3-3.5FT	Total/NA	Solid	5035	
LCS 160-152012/2-A	Lab Control Sample	Total/NA	Solid	5035	
LCSD 160-152012/3-A	Lab Control Sample Dup	Total/NA	Solid	5035	
MB 160-152012/1-A	Method Blank	Total/NA	Solid	5035	

Analysis Batch: 152963

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-1	SB-11 8.5-9.0 FT	Total/NA	Solid	8260C	152012
160-9039-2	SB-12 7-7.5 FT	Total/NA	Solid	8260C	152012
160-9039-3	SB20 2.5-3FT	Total/NA	Solid	8260C	152012
160-9039-4	SB19 6.5-7FT	Total/NA	Solid	8260C	152012
160-9039-5	SB50 2-2.5FT	Total/NA	Solid	8260C	152012
160-9039-6	SB51 3-3.5FT	Total/NA	Solid	8260C	152012
LCS 160-152012/2-A	Lab Control Sample	Total/NA	Solid	8260C	152012
LCSD 160-152012/3-A	Lab Control Sample Dup	Total/NA	Solid	8260C	152012
MB 160-152012/1-A	Method Blank	Total/NA	Solid	8260C	152012

Air - GC/MS VOA

Analysis Batch: 57212

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-7	SB-11	Total/NA	Air	TO-15	
160-9039-8	SB-12	Total/NA	Air	TO-15	
160-9039-9	SB 20	Total/NA	Air	TO-15	
160-9039-10	SB 19	Total/NA	Air	TO-15	
160-9039-11	SB 50	Total/NA	Air	TO-15	
160-9039-12	SB 51	Total/NA	Air	TO-15	
LCS 320-57212/4	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-57212/5	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-57212/9	Method Blank	Total/NA	Air	TO-15	

Analysis Batch: 57324

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-8 - DL	SB-12	Total/NA	Air	TO-15	
160-9039-9 - DL	SB 20	Total/NA	Air	TO-15	
160-9039-10 - DL	SB 19	Total/NA	Air	TO-15	
LCS 320-57324/4	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-57324/5	Lab Control Sample Dup	Total/NA	Air	TO-15	
MB 320-57324/12	Method Blank	Total/NA	Air	TO-15	

Air - GC VOA

Analysis Batch: 56201

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-7	SB-11	Total/NA	Air	EPA 15_16	

Air - GC VOA (Continued)

Analysis Batch: 56201 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-8	SB-12	Total/NA	Air	EPA 15_16	
160-9039-9	SB 20	Total/NA	Air	EPA 15_16	
160-9039-10	SB 19	Total/NA	Air	EPA 15_16	
160-9039-11	SB 50	Total/NA	Air	EPA 15_16	
160-9039-12	SB 51	Total/NA	Air	EPA 15_16	
LCS 320-56201/3	Lab Control Sample	Total/NA	Air	EPA 15_16	
MB 320-56201/5	Method Blank	Total/NA	Air	EPA 15_16	

Analysis Batch: 56731

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-7	SB-11	Total/NA	Air	D1946	
160-9039-8	SB-12	Total/NA	Air	D1946	
160-9039-9	SB 20	Total/NA	Air	D1946	
160-9039-10	SB 19	Total/NA	Air	D1946	
160-9039-11	SB 50	Total/NA	Air	D1946	
160-9039-12	SB 51	Total/NA	Air	D1946	
LCS 320-56731/3	Lab Control Sample	Total/NA	Air	D1946	
MB 320-56731/5	Method Blank	Total/NA	Air	D1946	

Analysis Batch: 56783

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-7	SB-11	Total/NA	Air	D1946	
LCS 320-56783/2	Lab Control Sample	Total/NA	Air	D1946	
MB 320-56783/3	Method Blank	Total/NA	Air	D1946	

General Chemistry

Analysis Batch: 152416

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9039-1	SB-11 8.5-9.0 FT	Total/NA	Solid	Moisture	
160-9039-2	SB-12 7-7.5 FT	Total/NA	Solid	Moisture	
160-9039-3	SB20 2.5-3FT	Total/NA	Solid	Moisture	
160-9039-4	SB19 6.5-7FT	Total/NA	Solid	Moisture	
160-9039-5	SB50 2-2.5FT	Total/NA	Solid	Moisture	
160-9039-6	SB51 3-3.5FT	Total/NA	Solid	Moisture	
160-9053-B-11 DU	Duplicate	Total/NA	Solid	Moisture	

Surrogate Summary

Client: CTI and Associates Inc.
Project/Site: LASO Airport Landfill

TestAmerica Job ID: 160-9039-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(80-120)	(70-126)	(63-150)	(72-127)
160-9039-1	SB-11 8.5-9.0 FT	98	97	107	101
160-9039-2	SB-12 7-7.5 FT	97	98	105	101
160-9039-3	SB20 2.5-3FT	97	104	103	107
160-9039-4	SB19 6.5-7FT	96	99	100	100
160-9039-5	SB50 2-2.5FT	95	100	103	103
160-9039-6	SB51 3-3.5FT	96	99	104	101
LCS 160-152012/2-A	Lab Control Sample	97	96	98	99
LCSD 160-152012/3-A	Lab Control Sample Dup	99	95	95	96
MB 160-152012/1-A	Method Blank	96	95	102	94

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
160-9039-7	SB-11	108	100	104
160-9039-8	SB-12	126	95	104
160-9039-8 - DL	SB-12	129	76	98
160-9039-9	SB 20	110	95	102
160-9039-9 - DL	SB 20	100	76	96
160-9039-10	SB 19	109	97	104
160-9039-10 - DL	SB 19	97	78	97
160-9039-11	SB 50	106	97	101
160-9039-12	SB 51	107	99	104
LCS 320-57212/4	Lab Control Sample	112	98	105
LCS 320-57324/4	Lab Control Sample	97	86	100
LCSD 320-57212/5	Lab Control Sample Dup	111	100	105
LCSD 320-57324/5	Lab Control Sample Dup	96	87	98
MB 320-57212/9	Method Blank	105	91	107
MB 320-57324/12	Method Blank	90	76	97

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)

Technical Specifications

Los Alamos County Airport Landfill Cover Replacement

Los Alamos, New Mexico

Submitted to:

U.S. Department of Energy
Environmental Management Los Alamos Site Office (EM-LA)
3747 West Jemez Road
TA-3, MS-A316
Los Alamos, NM 87544
Contract No. DE-EM 0002882

Prepared by:

Dwyer Engineering LLC.
1813 Stagecoach Rd. SE
Albuquerque, NM 87123

July, 2015

REVISION 01

Technical Specifications

Los Alamos County Airport Cover Replacement

Los Alamos, New Mexico

Contract Number DE-EM 0002882

U.S. DEPARTMENT OF ENERGY

Environmental Management - Los Alamos Site Office (EM-LA)

3747 West Jemez Road

TA-3, MS-A316

Los Alamos, NM 87544

July 2015

Reviewed and Approved by:

Stephen F. Dwyer

Stephen F Dwyer, PhD, PE

Project Engineer

Table of Contents

DIVISION 1 - GENERAL REQUIREMENTS	
Summary of Work	Section 01010
General Conduct of Work	Section 01015
Abbreviations	Section 01090
Survey Data	Section 01330
Shop Drawings, Samples, Product Data, and Other Submittals	Section 01340
Quality Control	Section 01400
Temporary Facilities	Section 01500
Temporary Controls	Section 01560
Materials and Equipment, Product Options, and Substitutions	Section 01600
Contract Closeout	Section 01700
DIVISION 2 - SITE WORK	
Surveying	Section 02005
Clearing and Stripping	Section 02100
Earthwork	Section 02200
On-Site Waste Excavation and Transport	Section 02260
Landfill Waste Placement Procedures	Section 02266
Channel Protection	Section 02270
Hot Mix Asphalt	Section 02511
Storm Drain System	Section 02720
Gas Collection System	Section 02730
Stormwater Management and Discharge	Section 02750
Erosion and Sediment Control	Section 02930
Seeding, Mulching, and Restoration	Section 02932
Chain Link Fence	Section 02980
DIVISION 3 – CONCRETE	
Cast-in-Place Concrete	Section 03300
Precast Concrete	Section 03400
DIVISION 6 – GEOSYNTHETICS	
Linear Low Density Polyethylene Geomembrane	Section 06005
Geotextiles	Section 06020

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Project is located at the Los Alamos County Airport, in Los Alamos, NM. Dwyer Engineering LLC. has been subcontracted by CTI Inc. who was contracted by the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) to design a replacement cover system for the Los Alamos County Airport Landfill to be compliant with RCRA Subtitle C regulations per 40 CFR 264.

B. The landfill covers a surface area of approximately 6.5 acres.

C. Access to the landfill is controlled by a perimeter fence around the entire airport. Access to the tarmac is limited to private airplane owners, operators, passengers, and other individuals with legitimate reasons to be there.

D. The work to be performed as described in this section is for the Contractor's general information only and is not intended to be a complete list of the work for this project. It is the Contractor's responsibility to determine the full scope of work required to complete this project on time, within budget, and in compliance with the Contract Documents. The scope of work is indicated by the requirements of each Specification.

E. The work includes, but is not limited to:

- Removal and milling of asphalt landfill cover surface;
- Removal of existing concrete hangar pads within the landfill footprint;
- Removal of concrete culvert;
- Replacement of concrete culvert;
- Borrow soil areas and stockpiles;
- Diversion channels;
- Construction of a new reinforced concrete hangar pad;
- Relocation of waste within the landfill footprint;
- Construction of an evapotranspiration (ET) soil cover for the landfill;
- Construction of runoff control and diversion channels as necessary;
- Repair/replacement of disturbed asphalt pavement areas on the airport site; and
- Seeding of cover system.

F. The Contractor will coordinate work to minimize impacts to airport operations.

G. The Contractor shall use the design documents, to include but not be limited to these Specifications and the Construction Drawings, to construct closure covers at the airport landfills

H. The Contractor is responsible for operating and maintaining all equipment, materials, systems, structures, and other physical features located within the designated construction boundary in a neat, safe, functional, and protected condition for the duration of the project. This responsibility pertains to all items

located on the project site prior to start of the work, items brought onto the site by the Contractor, and items under construction.

1.02 DEFINITIONS

A. The Owner shall mean Department of Energy (DOE).
B. The Contractor shall mean the firm contracted to install the replacement cover system.
C. The Engineer shall mean the Engineer of Record from Dwyer Engineering LLC. The Engineer of Record shall be a Professional Engineer registered in the State of New Mexico in civil engineering. The Engineer of Record may designate someone to act on his behalf, under his supervision.
D. The Subcontractor shall mean any individual or company contracted by the Contractor to provide services or perform work associated with the project.
E. Where "as shown," "as detailed," "as noted," "as indicated," or words of like meaning are used in the Contractor documents, it shall be understood that reference is being made to the drawings unless otherwise noted.

PART 2 MATERIALS

Not Applicable

PART 3 EXECUTION

3.01 SPECIFICATIONS

The priority of Contract Documents is Specifications to Drawings to Project Scoping Plans. This flow-down means that the Specifications take precedence over the Drawings which take precedence over the ancillary Project Scoping Plans.

3.02 DRAWINGS

A. An index of Project drawings is shown on the Drawings.

B. Dimensions shown on the Drawings take precedence over scaled dimensions. Large-scale details have precedence over smaller scale.

END OF SECTION

SECTION 01015

GENERAL CONDUCT OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination of Work.

B. Handling and Storage.

C. Referenced Standards.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements

1.03 COORDINATION OF WORK

A. The Contractor shall be responsible for the coordination of all work so that the Project can be completed within the time stipulated in the Contract. It is the Contractor's responsibility to review coordination of all work in detail with the Engineer and his other Contractors as necessary to avoid any misunderstanding.

B. The Contractor's Project Manager will serve as the point of contact for all communication.

C. The Contractor shall supervise and direct all work required under this Contract. The Contractor shall be solely responsible for the construction methodology, controls, techniques, sequences, procedures, or construction safety, except as required in Contract documents or in cases where written direction to the Contractor overrides the Contractor's choice. Major changes to the engineering design must be approved by the Engineer and the Owner.

D. The Contractor will restrict/control access to the site for authorized personnel, equipment, and materials to the access-control points at the site.

1.04 HANDLING AND STORAGE

A. The Contractor shall, at the Contractor's expense, handle, haul, and distribute all materials and all surplus supplies on the different portions of the Work as necessary. Contractor shall provide suitable and adequate storage room for materials and equipment during the progress of the Work and be responsible for loss of, or damage to, materials and equipment furnished by the Contractor, until the final acceptance of the Work.

B. All excavated materials, construction equipment, materials and equipment to be incorporated in the Work shall be placed so as not to contaminate, damage, or delay the Work and so that free access can be had at all times to this project, and any other project, and to all installations in the vicinity of the Work.

1.05 REFERENCED STANDARDS

A. Referenced standards used throughout the Contract Documents to specify the quality of materials or workmanship shall refer to the latest edition of such standards that is accepted by the authority having jurisdiction, except where a specific edition is indicated in the Contract Documents.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01090

ABBREVIATIONS

PART 1 GENERAL

1.01 ABBREVIATIONS

A. Abbreviations used in these Contract Documents shall refer to and designate the following, as applicable:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute
AOS	Apparent opening size
ASTM	American Society for Testing and Materials
BFM	Bonded Fiber Matrix
BGS	below ground surface
CA	Construction area
C_c	Coefficient of Gradation
CFR	Code of Federal Regulations
CLFMI	Chain Link Fence Manufacturers Institute
COC	Chain-of-Custody
COR	Contracting Office Representative
CPT	cone penetrometer testing
CQAP	Construction Quality Assurance Plan
C_u	Uniformity Coefficient
CWA	Controlled Work Area
CY	cubic yards
dBA	decibel A-weighted
DDA	Debris Disposal Area
DOE	United States Department of Energy
EA	Environmental Assessment
EFR	Engineer's Field Representative
EPA	United States Environmental Protection Agency
ET	Evapotranspiration
FAA	Federal Aviation Administration
FOD	Foreign objects debris
FS	Federal Specifications
FTB	Film Tear Bond
GTL	Geotechnical testing laboratory
H	Horizontal
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	High Density Polyethylene
HMA	hot mix asphalt

LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
LEL	Lower Explosive Limit
LLDPE	linear low density polyethylene
MARV	minimum average roll value
MatCon	Modified Asphalt Technology for Waste Containment
MDD	maximum dry density
MSL	mean sea level
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NSA	National Stone Association
OFZ	Obstacle-free zone
OGBC	Open graded base course
OSHA	Occupational Safety and Health Act
PCMP	Post-Closure Care and Monitoring Plan
PET	Potential Evapotranspiration
PID	photoionization detector
PLS	Pure live seed
PMP	Project Management Plan
PPE	Personal protective equipment
PQAP	Project Quality Assurance Plan
PRS	Potential release site
PVC	Polyvinyl Chloride
QA	Quality assurance
QC	Quality control
RA	Restricted area
RCRA	Resource Conservation and Recovery Act
RFI	Remedial Feasibility Investigation
SB	Soil Boring
SS	Site Superintendent
SSO	Site Safety Officer
SWMU	Solid Waste management Unit
SWPPP	Storm Water Pollution Prevention Plan
TA	Technical Area
TRM	Turf reinforcement matting
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
V	Vertical
VCM	Voluntary Corrective Measure
VOC	Volatile Organic Compounds
WMP	Waste Management Plan

UNITS OF MEASURE

AC	Acre
C	Centigrade
cm/sec	Centimeters per second
CY	Cubic yard(s)
dBA	Decibel A-weighted
F	Fahrenheit
Ft	Foot (feet)
ft^2	Square foot (feet)
in.	Inch(es)
lb.	Pound(s)
mph	Miles per hour
pcf	Pounds per cubic foot
psi	Pounds per square inch

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 01330

SURVEY DATA

PART 1 GENERAL

1.01 LINES, GRADES, AND MEASUREMENTS

A. The Contractor shall make all measurements and check all dimensions necessary for the proper construction of the Work called for by the Drawings and Specifications. During the execution of the Work, the Contractor shall make all necessary measurements to prevent misfitting in said work, and shall be responsible therefore and for the accurate construction of the Work.

1.02 DIMENSIONS OF EXISTING FEATURES

A. The dimensions and locations of existing structures, topography, and drainage swales are of critical importance in the installation or connection of new work, the Contractor shall verify such dimensions and locations in the field before the construction or fabrication of any structure, material or equipment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01340

SHOP DRAWINGS, SAMPLES, AS-BUILTS, AND OTHER SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Instruction.
B. Samples.
C. Shop Drawings.
D. Product Data.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.
B. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.
C. Design Health and Safety Plan for Los Alamos Airport Landfill Cover Replacement, April 2015.

1.03 GENERAL INSTRUCTIONS

A. Within ten working days after the formal execution of the contract, the Contractor shall submit a Submittal Schedule to the Engineer. The Engineer will review the schedule and return either approved or modified copies to the Contractor. Once accepted by the Engineer, the schedule shall be followed throughout the project unless superseded by a new schedule accepted by the parties involved. The Engineer will require ten working days to properly review this schedule. The Engineer will add or delete submittals required for review.
B. Information submitted as a separate submittal or as part of another submittal that has not been listed on the schedule as a required submittal will be scanned briefly by the Engineer. Such extraneous and unrequired information will be marked as "NO ACTION TAKEN" and returned.
C. When Shop Drawings are required by the various technical specification sections or elsewhere in the Contract Documents, the names and addresses of the proposed manufacturers (if different from those listed in the Contract Documents) shall be submitted prior to the submittal of the Shop Drawings so that the Engineer may consider and approve or disapprove the manufacturer and/or the supplier as to his or their ability to furnish a product meeting the requirements of the Contract Documents. This preliminary submittal is subject to final approval of the particular material or equipment. As requested, the Contractor or equipment supplier shall also submit data relating to the materials and equipment he proposes to incorporate into the work, in sufficient detail to enable the Engineer to identify the particular product in question and to form an opinion as to its conformity to the contract requirements. Such data shall be submitted in a manner similar to that specified for Shop Drawings.

D. The normal time allowed for review of Shop Drawings, and other submittals, is two calendar weeks after receipt of the submittal by the Engineer, or other party responsible for the review. Requirements for shorter review periods must be presented in writing by the Contractor.

E. Submittals shall be approved by the Engineer, as shown by the Engineer's approval marked on each copy. Submittals shall not be accepted from subcontractors, suppliers, manufacturers, or representatives. Submittals shall be identified by reference to Contract document number, drawing number, equipment number and specification section number, equipment or material schedule, or room numbers, as appropriate. Submittals shall be numbered consecutively by the Contractor, or equipment supplier, as appropriate. Resubmissions shall use the same number with a suffix added to identify each resubmission (i.e., "A" shall identify the first resubmission).

F. Minimum sheet size: 8-1/2-in. x 11-in.

G. Number of submittals required:
   1. Shop Drawings: Submit the number of opaque reproductions, which the Contractor requires, plus four copies which will be retained.
   2. As-Built Drawings: Submit one electronic version in AutoCAD most recent version and one hard copy suitable for reproduction.
   3. Product Data: Submit the number of copies which the Contractor requires, plus four copies which will be retained.
   4. Samples: Submit the number stated in each specification section.
   5. Certificates: Submit three copies which will be retained.

H. Submittals shall contain:
   1. The date of submission and the dates of any previous submissions.
   2. The Project title and number.
   3. Contract identification.
   4. The names of:
      a. Contractor.
      b. Supplier.
      c. Manufacturer.
   5. Identification of the product, with the specification section number and other appropriate information.
   6. Field dimensions, clearly identified as such.
   7. Relation to adjacent or critical features of the work or materials.
   8. Applicable standards, such as American Society for Testing and Materials (ASTM) or Federal Specification (FS) numbers.
   9. Identification of deviations from Contract Documents.
   10. Identification of revisions on resubmittals.
   11. 8 in. x 3 in. blank spaces for Contractor and the Engineer's review stamps.
   12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

1.04 SAMPLES

A. If the Engineer so requires, either prior to beginning or during the progress of the work, the Contractor or equipment supplier shall submit samples of materials for

such special tests as may be necessary to demonstrate that they conform to the Specifications. Such samples, including concrete test cylinders, shall be furnished, taken, stored, packed, and shipped as directed, at the expense of the Contractor. Except as otherwise specified, the Contractor shall make arrangements for, and pay for, the actual tests.

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 building or work and location for which the material is intended, and the name of the Contractor or equipment supplier submitting the sample.

C. To ensure consideration of samples, the Contractor or equipment supplier shall notify the Engineer in writing that the samples have been shipped and shall properly describe the samples in the letter. In no case shall the letter of notification be enclosed with the samples.

D. The Contractor or equipment supplier shall submit data and samples, or place his orders, sufficiently early to permit consideration, inspection, testing, and approval before the materials and equipment are needed for incorporation in the work.

E. When required, the Contractor or equipment supplier shall furnish to the Engineer triplicate copies of manufacturer's attesting to the accuracy of shop or Mill tests (or reports from independent testing laboratories) relative to materials, equipment performance ratings, and concrete data.

F. The materials and equipment used on the Work shall correspond with the samples submitted.

1.05 SHOP DRAWINGS

A. The Contractor or equipment supplier, as appropriate, shall submit for approval at least four (4) print copies (plus any additional copies required by the Contractor or subcontractors or equipment suppliers) of Shop Drawings of materials fabricated especially for this contract, and of equipment and materials for which such drawings are specifically requested in the Contract Documents. One copy, plus any additional copies provided, will be reviewed, stamped, and returned to the Contractor.

B. Such drawings shall show the principal dimensions, weights, structural and operating features, performance characteristics and capacities, wiring and piping diagrams, space required, clearances required, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawings. Show location, size, dimensions and embedment depth for anchor bolts. List special tools required to operate, and maintain equipment. Describe tool's purpose. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this contract.

C. The Contractor or equipment supplier shall be responsible for the prompt submission of all Shop Drawings in accordance with the Shop Drawing Schedule so that there shall be no delay to the work due to the absence or lateness of such drawings.

D. No material shall be purchased or fabricated especially for this Contract until the required Shop Drawings have been submitted and reviewed as conforming to the Contract requirements. All materials and work involved in the construction shall then be as represented by said drawings.

E. Only Shop Drawings which have been checked and corrected by the fabricator shall be submitted to the Contractor by the Contractor's subcontractors and vendors. Prior to submitting Shop Drawings to the Engineer, the Contractor shall check thoroughly all such drawings so that the subject matter thereof conforms to the Drawings and Specifications in all respects. Shop Drawings which are correct shall be marked with the date, checker's name and indication of the Contractor's approval, and then shall be submitted to the Engineer; other drawings shall be returned to the fabricator or subcontractor for correction.

F. The Engineer review of Shop Drawings will follow a general check made to ascertain conformance with the design concept and functional results of the Project and compliance with the information given in the Contract Documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site and for coordination of the work of all trades. The Contractor, or equipment supplier if appropriate, shall also be responsible for information that pertains solely to the fabrication processes or to techniques of construction.

G. The Engineer classifications are as follows:

APPROVED	(___)
APPROVED AS CORRECTED	(___)
REVISE AND RESUBMIT	(___)
REJECTED	(___)
NO ACTION TAKEN	(___)

H. The Contractor or equipment supplier shall make any corrections required by the Engineer and shall return the required number of corrected copies of Shop Drawings until approved.

I. At the time of each submission or resubmission, the Contractor or equipment supplier shall direct specific attention, in writing, to deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents or corrections required by the Engineer on previous submissions.

J. The Contractor's stamp of approval on Shop Drawings and samples shall constitute a representation to the Engineer that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data (or he assumes full responsibility for doing so) and that the Contractor has reviewed or coordinated each Shop Drawing and sample with the requirements of the Contract Documents. Submittals received without this information will be returned without being reviewed by the Engineer.

K. The approval of Shop Drawings and samples shall not relieve the Contractor or equipment supplier from responsibility for any deviations from the requirements of the Contract Documents, unless the Engineer has been notified, in writing, and has given written approval to such deviation, nor shall any approval by the Engineer relieve the Contractor or equipment supplier from responsibility for errors and omissions in Shop Drawings.

1.06 PRODUCT DATA

A. Product data may be submitted instead of Shop Drawings when the information required for Shop Drawings is contained in Manufacturer's standard literature.
B. Manufacturer's standard catalog data, schematic drawings and diagrams:
   1. Mark each copy to identify pertinent products or models.
   2. Modify drawings and diagrams to delete information which is not applicable to the work.
   3. Supplement standard information to provide information specifically applicable to the work.

1.07 CERTIFICATES

A. Types of certificates required are specified in respective Specification Sections.
B. Shop tests: Provide Manufacturer's sworn reports for actual product to be incorporated in the work.
C. Laboratory tests: Provide independent testing laboratory reports for actual product to be incorporated in the work.
D. Certificates of compliance: Provide Manufacturer's sworn statement or independent testing laboratory's report for products similar to those to be incorporated in the work with information indicating compliance with specifications. Test used to show compliance shall have been made within one year of the date of submission, unless approved otherwise by the Engineer.
E. Certified drawings: Provide certified drawings from the manufacturer as required in each specification section.
F. Refer to Section 01400 for certification requirements relative to an alternative to on-site sampling and testing.

1.08 AS-BUILT DOCUMENTS

A. The Site Superintendent will keep a record of all changes approved by the owner and all field changes, including changes to lines and grades.
B. The Contractor shall maintain one current record hard copy of all Specifications, Drawings, Addenda, Change Orders and Shop Drawings at the site. The documents shall be kept current, in good order, an annotated to show all changes made during the construction process and be clearly marked “AS-BUILT Documents.” These As-Built documents shall be available for review by the Engineer during all normal working hours.
C. The Contractor shall submit to the Engineer, within 10 days after the completion of contract, one set of the above “AS-BUILT” documents containing all changes, additions or deviations from the original set of Documents that have been incorporated into the Work. The Contractor is responsible for the accuracy of these AS-BUILT documents.
D. The Engineer, within 15 days after receipt of the As-Built documents will produce a final electronic version of the As-Built documents provided by the contractor. The electronic version will be in AutoCAD (most recent version).
E. The Contractor shall include As-Built Documents in the submitted Schedule of Values.

1.09 PROGRESS PHOTOGRAPHS

A. The Contractor shall take progress photographs throughout the duration of the contract. Photographs shall be taken at weekly intervals or as may be specifically directed by the Owner.

B. Digital photographs shall be taken of each process to document status, progress, and quality. Selected color prints (4 per 8.5 x 11 page or as approved by the Engineer) shall be provided with monthly progress reports. Additional color prints shall be provided to the Engineer upon request.

C. Each digital photograph shall contain the date taken and formatted on an electronic file to contain a description, indicating the location, direction, and what is shown.

1.10 HASP

A. Refer to the HASP for requirements regarding environmental health and safety.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor is responsible for quality control and shall establish and maintain an effective Project Quality Control Plan for the Los Alamos County Airport Landfill Cover Replacement Project.

B. The Construction Quality Control Plan shall be adhered to for the Los Alamos County Airport Landfill Cover Replacement Project

1.02 RELATED SECTIONS AND REQUIREMENTS

A. The Construction Quality Assurance Plan for the Los Alamos County Airport Landfill Cover Replacement Project, July 2015.

1.03 MATERIALS CERTIFICATION

A. For certain products, assemblies, and materials, in lieu of on-site sampling and testing procedures, the Engineer will accept from the Contractor the manufacturer's certification, with respect to the product(s) involved, upon the conditions set forth in the following paragraphs:

1. Certification shall state that the named product conforms to the Specifications and that representative samples have been sampled and tested as specified.
2. Certification shall be accompanied with a certified copy of the test results.
3. The certification shall give name and address of the manufacturer and the testing agency, the date of test, and shall set forth the means of identification which will permit field determination of the products delivered to the project as being one product covered by the certification.
4. The certification shall be duplicated with one (1) copy sent with shipment of the covered product to the Contractor and one (1) copy sent to the Engineer.
5. The Contractor shall be responsible for any additional costs for certification and for any costs of sampling and testing.
6. The Engineer reserves the right to require samples and test products to assure compliance with pertinent requirements with respect to fire certification of the products by the manufacturer thereof.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

A. The Contractor's approved Project Quality Control Plan defines the minimum construction requirements to be implemented to ensure that the approved design requirements are met or exceeded. The quality assurance (QA) team will report to the Contractor's Project Manager on behalf of the Owner.
B. A Construction Completion Report shall be prepared by the Engineer of Record following the completion of construction activities. This document shall be submitted to NMED within 90 calendar days after the final inspection of the completed project.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers the installation, maintenance, and operation of all temporary facilities and controls at the site necessary to support the Contractor operations during the course of the Contract. These temporary facilities and controls will be removed at Contract completion, and include, but are not limited to, office trailers, haul roads, drain facilities, decontamination pads, staging areas, access controls, lighting, utilities, and janitorial services.

1.02 PROJECT SIGNS

A. The Contractor shall erect a Project sign board near the Highway 502 entrance to the site. The information on the sign board shall be protected from the weather elements and the information shall be legible at all times. The sign shall be installed at a location approved by the Engineer.

1. The Project sign shall be constructed of sturdy and moisture-resistant material.
2. The following information shall be displayed in painted black lettering, clearly visible from 100 ft:

U.S. DEPARTMENT OF ENERGY

ENVIRONMENTAL MANAGEMENT - LOS ALAMOS SITE OFFICE

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

B. The Contractor shall construct and install a Project Information Board at the entrance to the Temporary Facilities Area.

1. The Project sign shall be constructed of sturdy and moisture-resistant material.
2. The following information shall be displayed in painted black lettering,
   a. Caution: Construction Area.
   b. A list containing the following telephone numbers:
      i. 911 or other local emergency telephone numbers. Location of nearest telephone.
      ii. Los Alamos County Airport Manager, David Ploeger, (505) 662-8420.
      iii. DOE Contracting Office Representative: Ramoncita N. Massey, (505) 665-7771.
      iv. Contractor Project Manager name and telephone number.
   c. Primary and alternative site evacuation routes.
   d. Hospital/emergency route map with written instructions and the route highlighted.

e. DOE Whistle Blower Protection Notification" with applicable DOE name and telephone number (provided by DOE).
f. Davis-Bacon wages for Los Alamos County, NM.
g. Map showing site landfill.
h. Equal Employment Opportunity poster.
i. Occupational Safety and Health Administration (OSHA) poster.
j. DOE Poster—Contractor Employee Occupational or Health Complaint form (provided by DOE).

1.03 PRECAUTIONS AGAINST WEATHER

A. During adverse weather conditions and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work shall be properly done and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other approved means.

B. During cold weather (below 40° degrees Fahrenheit [F]), materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by approved means which shall result in a moist or dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture shall be warm throughout when used

1.04 TEMPORARY HEAT

A. If temporary heat is required for the protection of the Work, the Contractor shall provide and install heating apparatus, shall provide adequate and proper fuel, and shall maintain fires as required. Temporary heating apparatus shall be installed and operated in such manner that the finished work will not be damaged thereby. Temporary heating apparatus shall be of the types approved by local codes and ordinances governing the Work.

1.05 WATER SUPPLY

A. The Contractor shall make all arrangements necessary to obtain water.

1.06 ELECTRICAL ENERGY

A. Suitable electrical power necessary to perform the work shall be obtained from sources at the airport, by the Contractor.
B. There shall be sufficient electric lighting, provided by the Contractor, so that all work may be properly conducted when there is not sufficient daylight in the work area.
C. The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials or supplies which it shall provide in doing the work.

1.07 SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary conveniences meeting governing local and state codes and regulations for the use of those employed on the work

site. Such conveniences shall be made available when the first employees arrive on the work site and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required or approved.

B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. The Contractor shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Government, or on adjacent property

1.08 ACCESS/CONTAMINATION CONTROL

A. As construction progresses, the Contractor shall maintain contamination control boundaries between clean areas and areas of contamination.

B. Install access-control fencing to restrict, reduce, or eliminate access by the public. Fence type(s) shall be as indicated on the drawings.

C. Contamination-control fencing around contaminated areas shall be, at a minimum, colored, plastic, safety fencing or approved equal 4-ft high. Posts and fabric shall be secure and tight at all times.

D. The Contractor shall maintain site perimeter fences, gates and signs to prevent intrusion by the general public. Maintenance includes keeping fences taut, performing all minor repairs that do not require additional materials, and placement of signs.

E. If the Contractor uncovers any archaeological or historical artifacts or bones of unknown origins during the term of the Contract, the Contractor shall immediately halt operations in the vicinity of such a discovery and immediately notify the Owner. Further work in these areas shall not resume without written authorization from the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Safety and Protection.
B. Protection of the Public.
C. Site Control and Security.
D. Maintenance of Existing Operations.
E. Maintenance of Traffic.
F. Protection of Natural Water Courses.
G. Removal of Debris during Construction.
H. Final Cleaning.
I. Dust Control.
J. Noise Control.
K. Environmental Control.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.
B. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.
C. Design Health and Safety Plan for Los Alamos Airport Landfill Cover Replacement, April 2015.
D. Storm Water Pollution Prevention Plan for Los Alamos Airport Landfill Cover Replacement, prepared by CTI & Associates.

1.03 SAFETY AND PROTECTION

A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
   1. All employees on the work and other persons who may be affected thereby.
   2. All the work and all materials or equipment to be incorporated therein, and any adjacent materials, equipment, or facilities, including that in storage on or off the site.
B. The Contractor shall notify owners of adjacent utilities when implementation of the work may affect them. All damage, injury or loss to any property referred to in paragraph 1.03 A.2 above caused, directly or indirectly, in whole or in part, by Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by the Contractor at the Contractor's expense.
C. The Contractor shall not load or permit any part of any structure to be loaded with a weight that would endanger its safety.

D. The Contractor shall provide protection of the work from freezing and other elements, which would be harmful to it. The Contractor shall furnish heat or protective shelters or temporary buildings as required for the protection of the work.

E. The Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal, state, and local safety laws and building codes, and Project requirements in order to prevent accidents or injury to persons on, about, or adjacent to the premises where the work is being performed. The Contractor shall erect and properly maintain at all times, as required by the Project and by the conditions and progress of the work, all necessary safeguards and barricades for the protection of employees on the work and the safety of others employed near the work and the public, and shall post danger signs and warning lights warning against the hazards created by dangerous features of the construction including, but not limited to, protruding nails, excavations, scaffolding, stairways, and falling materials.

F. The Contractor shall designate a responsible member of its organization on the work whose duty shall be the prevention of accidents. The name and position of the person so designated shall be reported in writing to the Owner.

G. The Contractor shall immediately report in writing to the Owner, giving full details, all serious accidents which arise out of or in connection with the performance of the work, whether on or adjacent to the site, which cause death, personal injury, or property damage. In addition, if death or serious injury or substantial property damage is caused, the accident shall be reported immediately by telephone or messenger to the Owner. If a claim is made or suit is filed by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner, giving full details of the claim.

H. The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials, or supplies which it shall provide in doing the work.

I. The Contractor shall take all precautions to prevent damage to the work by the elements, storms, or by water entering the site of the work directly or through the ground. In case of damage by the elements, storm, or water, the Contractor shall make repairs or replacements or rebuild such parts of the work as the Engineer may require in order that the work may be completed by the Contract Documents. If Contractor believes that additional work done by the Contractor, which arose from causes beyond the Contractor's control, entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim thereof as provided herein.

J. Contractor shall comply with all insurance requirements stated in the Contract Documents.

1.04 PROTECTION OF THE PUBLIC

A. The Contractor shall conduct work so as to minimize interference with the operating personnel of the site or those persons that may have business at the site. Wherever necessary or required, and at the Contractor's own expense, the Contractor shall maintain fences, furnish full-time or part-time watchmen, guards,

and like protective personnel, maintain lights, and take such additional precautions as may be necessary to protect life and property.

1.05 SITE CONTROL AND SECURITY

A. Site control and security will be maintained at the airport project site during all activities to prevent unauthorized personnel from entering the work area and to maintain airport perimeter security requirements. Entry into and exit out of the airport and construction areas (CA) will be controlled through the appropriate use of barriers, signs, and other measures in accordance with Code of Federal Regulations (CFR) 29 CFR 1910.144, "Safety Color Code for Marking Physical Hazards" (CFR 2003e) and 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags" (CFR 2003f).

B. Signs that are lost because of high winds will be replaced as soon as possible the next working day following discovery.

C. Three types of site control designations (areas) will be used to meet Hazardous Waste Operations and Emergency Response (HAZWOPER), construction, and Federal Aviation Administration (FAA) site control requirements. These areas based on the potential hazards, complexity of work tasks, duration of project tasks, location and number of non-project personnel near the project area, and to prevent entry of personnel and equipment into the obstacle-free zone (OFZ). Radiologically controlled areas are not anticipated but could be established if radioactive materials or article are encountered. The three areas are
   - CAs (general CA boundary)
   - Controlled work area (CWA) (established for higher hazard tasks within the CA)
   - Restricted area (RA) (OFZ and other areas where entry is not permitted)

D. The existing airport perimeter fence and gates provide general security and access control. This fence will be maintained during all construction activities and access to the project CA will be controlled. Only authorized project personnel and authorized visitors (visitors must have official business on site, receive HASP orientation briefing, and have proper personal protective equipment [PPE] for the area they will access) will be allowed access to the CA. Project construction and administrative areas (field trailer) will be delineated and posted to prevent inadvertent entry by persons conducting normal airport operations or maintenance tasks.

E. All personnel are required to sign in and out of the site access log located in the field trailer.

F. Where warranted, designated traffic routes may also be established. These areas also will be posted to prevent inadvertent entry by unauthorized personnel. Project personnel will also be prohibited from entering airport operational areas (not turned over for construction activities) to minimize the impact on airport operations and to reduce the likelihood of distributing foreign objects debris (FOD) on the tarmac and taxiway.

G. The CAs at the site will be the primary activity locations. The CA boundary will be delineated using the existing airport perimeter fence and other temporary construction fencing where deemed appropriate. All areas beyond the

construction field trailer will be considered a CA for site control purposes (whether delineated and posted or not) and all training, badging, and PPE requirements apply. The primary access points to the CA will be clearly posted with "Construction Area" or similar caution signs. Only authorized personnel may enter the CA.

H. CWAs will be established to alert personnel within the CA of tasks or activities with increased hazards and to limit the number of workers and equipment in these areas. CWAs will also be used when there is a potential for exposure to site contaminants beyond the immediate work area. CWAs will control the flow of equipment and personnel through the use of established entry/exit points and traffic lanes. The boundary of the CWA may be marked with a combination of stanchions or posts and delineated with rope or ribbon and include warning signs or other demarcation. Only the minimum number of personnel required to safely perform the project tasks will be allowed into the CWA. All personnel who enter the CWA will have adequate training and wear the appropriate level of PPE for the degree and type of hazards present.

I. RAs will be established to prevent access to certain areas during the course of the project. Examples of RAs include the OFZ around the active runway, the area within 6 ft of the unprotected edge of the east slope above the Pueblo Canyon wall, and other areas designated throughout the course of the project. Entry into RAs is prohibited without authorization from the Site Safety Officer (SSO), SS, and Construction Manager. Entry will not be authorized without a compelling reason and only after other options not requiring entry have been considered and deemed not feasible by the SSO, SS and Construction Manager. If the OFZ must be entered, then coordination with airport operations personnel prior to entry is also required.

J. Additional PPE, communications equipment, and materials may be required for entry into RAs. A separate personnel control log will be maintained by the SS for entry into RAs and access will be limited to only essential personnel. Name of individuals entering along with time of entry and exit will be documented. The two-person rule (buddy system) will be required for all RA with the second person positioned immediately outside the RA and entering only when required.

1.06 MAINTENANCE OF THE EXISTING OPERATIONS

A. Airport surfaces shall be swept and washed as needed.

B. The Contractor must plan and implement construction activities to ensure daily airport operations are not impacted. Operation of the other facilities cannot be interrupted, stopped, or rerouted, unless approved by the Los Alamos County Airport Manager.

C. Failure of the Contractor to comply with the requirements of this Paragraph 1.05 will be considered a sufficient cause for the Owner to shut down the work. The Contractor will not be entitled to any extra compensation resulting from such a shutdown.

1.07 MAINTENANCE OF TRAFFIC

A. The Contractor shall carry on all work so that other site traffic will have access to all existing gravel roads, driveways, and facilities.

1.08 PROTECTION OF NATURAL WATERCOURSES

A. The Contractor shall use all care possible to prevent sedimentation and other pollution of waters during construction. Prohibited practices include, but are not limited to:
   1. Dumping of soil material into streams or on stream.
   2. Operating of equipment in streams.
   3. Pumping of silt-laden water from trenches, containment sumps, or other excavations into streams.
   4. Disposing of debris in streams and surrounding areas.

B. All erosion and sediment control work shall comply with Section 02930 of these Specifications, the Contractor's approved SWPPP and all applicable requirements of governing authorities having jurisdiction. The Contractor shall provide the necessary strawbales, silt sacks, silt fence, and/or other temporary erosion-control measures to contain all work activities. The Engineer may require additional erosion control measures should conditions warrant.

C. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation are to be identified by the Contractor and will receive special attention.

D. All land-disturbing activities are to be planned and conducted so as to minimize the size of the area to be exposed at any one time and to minimize the length of the time of exposure.

E. Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

F. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

1.09 REMOVAL OF DEBRIS DURING CONSTRUCTION

A. During its progress, the work and the adjacent areas affected thereby, shall be kept clean and all rubbish, surplus materials, and unneeded construction equipment shall be properly removed and all damage repaired at the expense of the Contractor.

B. Airport taxiways and runways shall be kept free of debris. They will be swept or washed free of debris, as needed.

C. Where materials or debris has washed or flowed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations, such material or debris shall be entirely removed and properly disposed of during progress of the work, and the watercourses, ditches, gutters, drains, catch basins, and other facilities kept in neat, clean and functioning conditions.

1.10 FINAL CLEANING

A. On or before the completion of the work, the Contractor shall, unless otherwise directed in writing by the Owner, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic material and material containing organic matter in, under, and around privies, houses, and other buildings used by

him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by the Contractor's operations in a neat and satisfactory condition.

B. The Contractor shall restore or replace, subject to the approval of the Owner, any property damaged by the Contractor's work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. Suitable materials, equipment and methods shall be used for such restoration as approved by the Owner, or as required elsewhere in the Contract Documents.

1.11 DUST CONTROL

A. During the progress of the work, the Contractor shall conduct operations and maintain the area of activities so as to minimize the creation and dispersion of dust.

B. The Contractor shall control dust within the construction boundaries shown on the Drawings. Dust suppression shall include all roadways, stockpiles, and other areas.

C. Dust suppression activities shall be conducted as necessary.

D. The Contractor shall take necessary measures to eliminate dust. Visible dust is not allowed. The Contractor may use techniques that include, but are not limited to the use of a water truck and other methods described in the Contractor's Construction Plan to control dust on excavations and access roads.

E. Water for dust control sprinkling shall be clean, free of salt, oil, and other injurious materials.

1.12 NOISE CONTROL

A. Noise may not exceed 65 decibel A-weighted (dBA) at the site boundary during construction.

B. All work that would generate noise that could affect adjacent facilities is to be conducted during hours as designated by the Owner.

C. The Contractor is to review any excessively noisy activities with the Owner in sufficient time to permit a complete evaluation of the effects of such noise on the operations at the site and on adjacent facilities before the work is started.

1.13 ENVIRONMENTAL CONTROL

A. The Contractor is responsible for controlling all emissions into the environment in order to comply with all regulatory requirements

1.14 CONTAMINATED MATERIAL SPILLS

A. To avoid fuel spills during refueling, an assigned individual will always be present during refueling, and will be aware of the location and operation of the shut-off valve of the fuel tanker. Small equipment such as generators or pumps will be placed over bermed heavy mil plastic. If refueling spills or leaks occur, the bermed plastic will contain the pollutants until proper cleanup and disposal. Drip pans may also be used for refueling, or for placement under equipment that is leaking or has the potential to leak.

B. A spill kit containing a first aid kit, airhorn, PPE for cleanup activities, shovel, leather gloves, and appropriate absorbents (e.g., pillows, tubes, sand or

vermiculite, pads, paper towels, etc.) will be readily available to control and contain spills. Site personnel will be trained in the use of the spill kit and in spill notification procedures.

C. Spills of non-petroleum products (e.g., fertilizers) will be minimized by proper handling of containers. To the extent possible, transfer of material from large storage containers to small application containers will occur at the materials storage area.

D. The Contractor (all personnel including all subcontractors) shall report all spills or unauthorized discharges, regardless of amount, to the Contractor's Project Manager, the Construction Manager, and the DOE Project Manager. This notification will occur as soon as possible after the discharge, but in no event more than 24 hours after the discharge. The following information will be reported:

- The name, address, and telephone number of the person or persons in charge of the facility, as well as the owner or operator of the facility;
- The name and address of the facility;
- The date, time, location, and duration of the discharge;
- The source and cause of discharge;
- A description of the discharge, including its chemical composition;
- The estimated volume of the discharge; and
- Actions taken to mitigate immediate damage from the discharge.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT, PRODUCT OPTIONS, AND SUBSTITUTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Material and Equipment Requirements.
B. Procedures for Substitutions.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.
B. Section 1340 – Shop Drawings, Samples, As-Builts, and Other submittals.
C. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.03 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

A. Unless otherwise indicated on the Drawings or Specifications, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor, or equipment supplier as appropriate, to be incorporated in the work shall be subject to the inspection and approval of the Engineer. No material shall be processed for, fabricated for, or delivered to the work without prior approval of the Engineer.
B. For the purpose of indicating the standards of type, quality, design, and performance of materials and equipment to be provided under this contract, various materials and equipment are named in the Contract Documents, as commercial brands or equal.
C. The manufacturer(s) named are listed as the approved vendor, or equipment supplier if appropriate, in preparing the Bid. The list is based on the Engineer's knowledge of or experience with the various manufacturers and does not represent that the manufacturers listed will meet the detailed requirements of the Specification. It is the responsibility of the Contractor, or equipment supplier if appropriate, in preparing the Bid to inform and be satisfied that the manufacturer selected for each item of equipment or material will meet the detailed requirements of the Contract Documents, whether the manufacturer selected is one of the named manufacturers or not.

1.04 PRODUCT OPTIONS AND SUBSTITUTIONS

A. The Contract Documents have been prepared using particular items of equipment and material in order to provide a complete set of plans and specifications. These are the materials and manufacturer that will not be substituted unless approved by the Engineer. As- Built drawings shall be maintained by the installing contractor showing the materials actually installed.
B. The following procedures will be followed relative to substitutions:

1. The General Contractor as part of the Bid shall submit a list of requested and approved substitutions which shall be accompanied by the following information:
   a. Catalog cuts of the proposed equipment.
   b. Other drawings and manufacturer's information as necessary to fully describe the equipment or material as intended for its specific use in this project.
   c. For major equipment that is an integral part of the process, the submittal shall include a letter from the manufacturer certifying that the recommended substitution will meet the performance requirements for that piece of equipment.
   d. Identification of changes required in the installation of the substituted equipment or material compared to the information presented in the Contract Documents.
2. The Engineer shall review the requested substitution and determine the acceptability of the substituted equipment or material. This review will not relieve the Contractor of the responsibility for the proper functioning of the equipment or material. The Engineer will retain the right of final decision as to the acceptability of the substitution.
3. Substitutions cannot be made after the contract has been awarded without approval of the Engineer.
4. The Contractor will maintain accurate "As-Built" drawings showing the equipment or materials as actually installed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.
B. Final Cleaning.
C. Project Record Documents.
D. Warranties.

1.02 RELATED SECTIONS

A. Division 1 - General Requirements.

1.03 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for inspection by the Owner.
B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.04 FINAL CLEANING

A. Execute final cleaning prior to final inspection.
B. Clean interior and exterior surfaces exposed to view.
C. Clean site, sweep paved areas, rake clean landscaped surfaces.
D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain on-site, one set of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Written or verbal instructions.
   4. Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
B. Store Record Documents separate from documents used for construction.
C. Record information concurrent with construction progress.
D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.
E. Record Documents, As-Built Drawings, and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured locations of ANY internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
2. Field changes of dimension and detail.
3. Details not on original Contract Drawings.

F. Submit documents to the Owner with claim for final Application for Payment.

1.06 WARRANTIES

A. Provide notarized copies.
B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
C. Provide Table of Contents and assemble in a ring binder with durable plastic cover.
D. Submit prior to final Application for Payment.
E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02005

SURVEYING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section shall include:
   1. Project as-built surveys as required herein and elsewhere in the Technical Specification.
   2. Surveys during the life of the project as directed by the Engineer, and surveys required to measure the quantities of completed work for determining the value of partial payments as described in other sections of these Specifications.
   3. Pre-construction and construction topographic surveys.

B. The survey work shall be performed under the direction of a Land Surveyor registered in the State of New Mexico who shall be subcontracted by the Contractor to perform the survey work. Topographic, cross-sectional, and grade verification surveys will include the development by the Surveyor of topographic drawings for the use by the Engineer in verifying field conditions, measurement of quantities, and adjusting the design as necessary.

1.02 RELATED SECTIONS AND REQUIREMNTS

A. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

B. Construction Implementation Plan for the Los Alamos Airport landfill Cover Replacement, July 2015.

1.03 SUBMITTALS

A. Prior to commencement of work under this item, the Contractor shall submit the name, address, and telephone number of the Surveyor that will perform this work on the Project.

B. The Contractor shall organize the placement of the components of the landfill cover systems into manageable areas of work. The Contractor shall submit to the Engineer the pre- construction surveys before commencing excavation, fill placement, or cover system work. Additional topographic surveys of the completed work shall be submitted with each payment request and shall be a condition precedent to the Engineer's approval of the Contractor's request for partial payment. Topographic surveys and as-built surveys to be developed include the following:
   1. Pre-construction topographic survey plan shall depict the existing conditions within the limits of work prior to earth disturbance of the landfill
   2. The Contractor, at a minimum, shall also prepare construction topographic and as- built surveys for each of the following surfaces as shown on the Contract Drawings and described in the Technical Specifications.

a. Existing topography of the main landfill, including locations and elevations of any existing structure on the landfill.
b. Subgrade surface after removal of existing cover material (main landfill).
c. The top surface of the subgrade beneath the landfill cover.
d. The top surface of the landfill.
e. Top surface of the subgrade.
f. Surface water control features (ditches, culverts, etc.).
g. Concrete hangar pad.

3. The Contractor shall, at a minimum, prepare construction topographic surveys for other areas within the limit of work (but beyond the landfill surface) for each of the following surfaces as shown on the Drawings and described in the Technical Specifications:
   a. The final grades of all permanent stormwater management structures (to include all related pipe locations, sizes, and invert elevations).
4. The coordinate system requirements for deliverables are North American Datum 83 and North American Vertical Datum 088, unless otherwise directed by the Engineer.
5. All topographic survey plans shall be prepared at a scale of 1 in. = 30 ft with a 2- ft contour interval applying National Map Standards, unless otherwise directed by the Engineer.
6. The Contractor shall compile all topographic surveys performed for work during the course of the Contract into composite plans for the respective surfaces of each area surveyed. The composite plans shall be prepared at a scale of 1 in. = 30 ft with 2-ft contour intervals (with spot elevations at all tops and toes of slopes) and shall be submitted to the Engineer no later than 15 working days after the scheduled completion date for the Construction.
7. For all work under this item, the Contractor shall submit disk copies of the topographic survey plans in AutoCAD (latest version) format with executable files along with two (2) prints for each survey plan required.
8. The Engineer reserves the right to require the submittal of copies of any or all survey field notes from the Contractor.
9. Tolerance on construction shall be ±0.1 ft every 100 ft with no compounding of tolerance except for asphalt and concrete surface which shall have a tolerance of ±0.10 ft every 100 ft with no compounding of tolerance. All minimum and maximum slopes shall be maintained.

PART 2 MATERIALS

Not Applicable.

PART 3 EXECUTION

3.01.1 SURVEYING

A. The Contractor shall locate, protect, and verify survey control points established from local elevation and coordinate datum prior to starting site work and preserve these points during construction. These controls will be

permanent monuments used throughout construction and post-construction for any needed topographic, radial stakeout, and benchmark elevations. The Contractor shall promptly report to the Engineer lost, relocated or destroyed control points. The Contractor shall maintain complete and accurate field notes for all control points and survey points as work progresses.

B. The Contractor shall perform and update the as-built surveys throughout the life of the Contract as necessary and at the end of the project.

C. For all survey work, survey points shall be obtained using a 50-ft grid. Additional points shall be surveyed at toe and top of slopes and as necessary to provide accurate topography in areas where slopes vary between the above noted grid points. All point elevations shall be accurate to a tenth of a foot. All pipe invert elevations shall be accurate to a hundredth of a foot.

D. Initial Staking will include angle points for fence relocation at the northeast end of the main landfill and centerline cut and fills for proposed access routes.

E. Upon completion of survey work the Contractor shall submit to the Engineer the deliverables (including plans, drawings, electronic disks, and survey notes), in accordance with subsection 1.02.

F. All deliverables under this item shall be signed and sealed by the QA Surveyor.

END OF
SECTION

SECTION 02100

CLEARING AND STRIPPING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this Section includes all requirements for the clearing and stripping of all areas within the Contract Limit of Work in accordance with the Documents.

1.02 DEFINITIONS

A. Clearing is the removal from the ground surface and disposal, within the contract limit of disturbance, of brush, shrubs, other vegetation, rubbish, and debris (natural and man-made).

B. Stripping is the removal and stockpiling, within the contract limit of disturbance or as provided for by the Engineer, of all topsoils and cover soils that are above the limits of waste including matted roots, and organic materials.

PART 2 MATERIALS

Not Applicable.

PART 3 EXECUTION

3.01 GENERAL

A. Do not start earthwork operations in areas where clearing and stripping is not complete. Comply with erosion, sediment control, and storm management measures specified in the SWPPP and Section 02930 (Erosion and Sediment Control).

3.02 CLEARING

A. Clear all items to the limits necessary to perform construction activities and shred all cleared and grubbed material for use in topsoil applications. The Contractor is responsible to dispose of cleared and grubbed materials in accordance with State and Federal guidelines.

B. Burning of any material shall not be permitted on the Site.

3.03 STRIPPING

A. Where applicable, cut existing vegetation on the main landfill as close to the existing ground surface as possible. Remove material from the ground surface and use it as mulch for temporary stabilization.

B. Where applicable, disk the first 6 to 8 in. of cover soils, including stubble vegetation. Thoroughly mix the soils with the vegetative matter.

C. Where applicable, remove the completed disked material and stockpile as topsoil.

D. Do not over excavate the topsoil material.
E. Assure the topsoil is segregated from the waste and cover soils.

END OF SECTION

SECTION 02200
EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes

1. All labor, materials, equipment, and incidentals necessary to perform excavation, backfill, fill, grading, and compaction required for completion of the work shown on the Drawings and specified herein. The work shall include, but not be limited to:

a. Dust Control.

b. Excavation of materials from the designated area.

c. Backfill of excavated areas designated.

d. Construction of the ET Cover system.

e. Subgrade preparation for the cover system, drainage channels, concrete structures, asphalt pavement.

f. Finish grading of the site.

1.02 RELATED SECTIONS

A. Section 02100 – Clearing and Stripping
B. Section 02270 – Channel Protection
C. Section 02260 – On-site Waste Excavation and Transport
D. Section 02720 – Strom Drain System
E. Section 02930 – Erosion and Sediment Control
F. Section 02266 – Landfill Waste Placement Procedures
G. SWPPP for Los Alamos Airport Landfill Cover Replacement.
H. Construction Quality Assurance Plan (CQAP) for Los Alamos Airport Landfill Cover Replacement, July 2015.
I. Design Health and Safety Plan (HASP) for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D75 - Standard Practice for Sampling Aggregates

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

3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

4. ASTM D1140 - Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
6. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)
8. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. ASTM D3042 - Standard Test Method for Insoluble Residue in Carbonate Aggregates
10. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
11. ASTM D4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
12. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
13. ASTM D4373 - Standard Test Method for Rapid Determination of Carbonate Content of Soils
14. ASTM D4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
15. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
16. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 DEFINITIONS

A. Definitions pertinent to the earthwork requirements of this project include:

1. Excavation: Excavation is defined as excavation required to reach the lines and grades indicated on the Drawings or specified herein. It shall include excavation of soil, silt, clay, sand, gravel, talus, soft or disintegrated rock, boulders or detached pieces of solid rock.
2. Waste Materials Excavation: Any waste material excavation or contact with waste at the site shall be in accordance with the site safety and health plan.
3. Borrow Soils Excavation: Excavation of borrow materials including soil, silt, clay, sand, gravel, talus, soft or disintegrated rock, boulders and removal of detached pieces of solid rock carried out to reach lines and

grades indicated on the Drawings or specified herein. This excavation shall include excavations for cover and finish grading.

4. Over excavation: Over excavation is defined as excavation carried out beyond the lines and grades indicated on the Drawings or in the Specifications.
5. Percent Maximum Density: Percent maximum density is a percentage of the maximum density obtained by the test procedure presented in ASTM D698, as applicable.
6. Subgrade: when referencing the cover system, the subgrade refers to the top of the mine spoils and/or waste soils that were placed, graded, and/or compacted to be covered by the final cover system.
7. Subgrade Preparation: Subgrade preparation includes fine grading and compaction of excavations for the installation of the cover systems including drainage ditches, backfills, and cover upon which bedding materials, riprap, or other features are to be constructed.
8. Cover Soil: Cover soil shall consist of soil removed from the designated borrow source as shown on the Drawings.
9. Gravel/Soil Admixture: Also referred to as a 'Desert Pavement' is the top layer of the final cover system composed of a defined percent by volume of rock evenly mixed with a defined percent of cover soil from the designated cover borrows source(s).
10. Unsuitable material – unsuitable material not meeting the requirements set forth herein for fill materials or as otherwise determined by the Engineer to be inappropriate and/or unacceptable for use. Unsuitable material shall be disposed of by the Contractor in the main landfill.
11. Common fill shall include satisfactory materials from site excavation or from approved borrow for general site grading, subgrade preparation, and other activities, as needed and as directed by the Engineer.
12. Gravel. Rock larger than #4 sieve (4.75 mm) is considered gravel.

1.05 SUBMITTALS

A. All submittals shall be made in accordance with the requirements of the Project Submittal Specifications, Section 1340.

B. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, filling, compaction, and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

C. Submit to the Engineer proposed mixing method to be utilized to uniformly mix the rock and cover soil for the top 'gravel/soil admixture' layer of the cover system.

D. Submit to the Engineer proposed mixing method to be utilized to uniformly mix the two soil textures for the bottom layer of the cover system.

E. Submit to the Engineer type of nutrient amendments proposed for cover soils deficient in the required nutrients and application methods. Refer to Specifications Section 02932.

F. Dust Control Plan: Prior to any earthwork activities on the project areas (including borrow area) such as site preparation and borrow area excavation, Contractor shall submit a Dust Control Plan for approval. The plan shall identify methods and equipment to minimize/control dust generation during all earthwork operations and include the following minimum requirements:

1. Continuous control of dust generation during borrow area excavation and fill placement, etc.
2. Continuous control of wind-generated dust, including disturbed areas that are not being actively worked.
3. Keep unpaved haul roads watered or use approved tackifier to control dust.
4. Apply water or other approved dust suppressants to keep visible dust to a minimum during execution of Work. See restrictions on moisture addition for fill.
5. Appropriate hand-held hose lines, sprinklers, and other equipment as needed to access and control dust at areas difficult to access by vehicles, such as borrow and stockpile side slopes.
6. Maintain and protect native vegetation where possible, through minimization of site disturbance.
7. Limit access road development to minimum necessary to execute work.
8. Stabilization of inactive disturbed work areas by longer term methods such as matting, tack and mulch or crusting agents.
9. Implementation of permanent stabilization on a regular basis when sufficient area exists for application.
10. Contractor shall use daily field reports to document dust control measures implemented and their effectiveness.
11. Details of raw water supply, storage, and water withdrawal limiting equipment as part of the Dust Control Plan.

Part 2 PRODUCTS

2.01 COVER MATERIALS

A. General:

1. Cover soil materials shall be obtained from the borrow source(s) designated and approved by the Engineer.
2. All soil properties shall be submitted to the Engineer for approval. This includes as a minimum: grain size distribution (ASTM D422 and ASTM D1140) and moisture density relationship (ASTM D698). Other properties may be required by the Engineer.
3. The Contractor shall make his own determination of any processing that may be required, and shall perform testing as required to meet the Specifications for the various construction materials.
4. The Engineer shall be granted access to each proposed source to collect samples for testing. The Engineer may perform additional tests to determine if the materials meet the requirements specified herein.

5. Approval will be based on evidence of compliance with the requirements specified herein.

B. Cover Soil: Cover soil shall come from approved borrow sources only. Cover Soil shall be submitted, and approved by the Engineer at the borrow source before delivery to the site or after cut has been made and material is ready to be hauled to the designated site. It is the contractor's responsibility to verify there is an adequate supply of approved borrow soil. There are to be at least two borrow sources for cover material:

1. Cover soil.

   The cover profile is to be 3.0-ft thick, minimum. All materials shall be submitted to and approved by the Engineer prior to trucking to the site.

   a) The bottom 1-ft thick layer will be constructed in a single compacted lift of a mixture of high fines content soil with a sandy loam or loamy sand material from approved borrow source(s) or as approved by the Engineer. The soil shall be mixed prior to placement and compacted in place unless otherwise approved by the Engineer.

   b) The middle 18-in layer of cover soil is to be placed and compacted in two 9-inch lifts or as approved by the Engineer. This soil shall be a sandy loam or loamy sand or as approved by the Engineer.

   c) The upper layer shall be a mixture of rock and sandy loam or loamy sand or as approved by the Engineer. This layer shall be a minimum of 6 inches thick and placed without compaction or as approved by the Engineer. The mixture shall be 25% rock to 75% soil by volume or as approved by the Engineer. The rock shall be mixed with accepted cover soil to produce an erosion resistant gravel admixture top layer of the cover system. The method and mixing location are to be approved by the Engineer. All appropriate rock properties shall be submitted to the Engineer for approval. Rock to be utilized in the rock/soil admixture for the top layer of the cover system shall be durable and relatively uniform in size. The size of the rock shall have a D50 of 0.5-in or as approved by the Engineer. The rock shall contain no more than 5% material passing the #4 sieve as delivered to the site prior to mixing with cover soil.

C. Satisfactory Materials: All satisfactory materials shall be approved by the Engineer.

D. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and soil that contains roots, debris left from vegetation, or other excess organic matter or frozen material. Notify the Engineer when encountering any contaminated materials.

E. Common Fill: Common fill shall include satisfactory materials from site excavation or from approved borrow for general site grading, subgrade preparation, and other activities, as needed and as directed by the Engineer. The common fill shall contain less than 20 percent gravel, with a maximum particle size of 4 inches in the greatest dimension. Common fill shall be free from roots, debris left from vegetation or other excess organic matter, trash, debris, and frozen materials. All common fill material shall be submitted to the Engineer for approval.

2.02 OTHER MATERIALS

A. BEDDING MATERIALS
1. Aggregate Bedding for pipes shall meet the requirements for Aggregate Base Course.
2. Aggregate Bedding for storm drain pipes and precast and cast-in-place concrete structures shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class OGBC (open-graded base course) unless otherwise recommended by the manufacturer.

B. AGGREGATE BASE COURSE
1. Aggregate base course shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class I Base Course or as otherwise may be required to satisfy the design requirements.

C. STRUCTURAL FILL
1. Structural Fill used as backfill shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class I Base Course.

2.03 IMPORTED MATERIAL ACCEPTANCE

A. All imported materials specified in this section are subject to the following requirements:

1. All tests necessary for the Contractor to locate an acceptable source of imported material shall be made by the Contractor. Certification that the material conforms to the Specification requirements along with copies of the test results from a qualified independent testing laboratory shall be submitted to the Engineer for approval at least 20 days before the material is required for use. All material samples shall be furnished by the Contractor at the Contractor's expense. Samples shall be representative clearly marked to show the source of the material and the intended use on the project. Sampling of the material source shall be done by the Contractor in accordance with ASTM D75. Notify the Engineer or the Engineer's Field Representative (EFR) at least 24 hours prior to sampling. The Engineer may, at the Engineer’s option, observe the sampling procedures. Tentative acceptance of the material source shall be based on an inspection of the source by the EFR and/or the certified test results submitted by the Contractor to the Engineer, at the Engineer’s discretion. No imported materials shall be delivered to the site until accepted in writing by the Engineer.

2. Classification tests shall be made by the Contractor on samples taken at the place of production prior to shipment. Samples of the finished

product for gradation testing shall be taken from each 2,500 tons of prepared materials or more often as determined by the Engineer, if variation in gradation is occurring, or if the material appears to depart from the Specifications. Test results shall be forwarded to the Engineer within 48 hours after sampling.

3. If tests conducted by the Contractor or the Engineer indicate that the material does not meet Specification requirements, material placement will be terminated until corrective measures are taken.

4. Material which does not conform to the Specification requirements and is placed in the work shall be removed and replaced at the Contractor's sole expense.

5. Sampling and testing performed by the Contractor shall be done at the Contractor's sole expense.

2.04 EQUIPMENT: All equipment to be used for the construction of the cover systems and related monitoring equipment must be submitted to and approved by the Engineer.

PART 3 EXECUTION

3.01 GENERAL

A. All soils, waste material and fill materials shall be placed and compacted to the lines and grades shown on the Drawings. The cover layer thicknesses and slopes, as designated in these specifications and plans, shall be measured on final grade for each layer. Survey requirements shall be consistent with the Construction Quality Assurance Plan.

B. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill materials.

C. Place and spread subgrade materials in horizontal lifts (or lifts parallel to final slope) of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water. Also refer to Specification Section 02266.

D. Maximum loose lift thickness for subgrade soils to be compacted shall be 12-inches unless stated otherwise.

E. Subgrade soils to be placed and compacted as dry as possible while maintaining required minimum densities and dust control. The upper foot of subgrade soils shall be dry of their optimum moisture content as determined by ASTM D698 prior to placement of cover soil. Should these soils exceed this upper moisture content tolerance, the Contractor shall scarify these subgrade soils and allow them to dry or replace the clean subgrade soil and recompact prior to cover soil placement.

F. The Contractor shall place material to a grade as described in the Drawings while maintaining a positive drainage off of the cover systems throughout

construction to preclude the ponding of water. No fill shall be placed on any area where ponding has been allowed to occur. Where ponding has occurred and the subgrade soil is required to be placed, the water shall be removed and the subgrade reprocessed to a minimum of 95 percent of the maximum dry density and dry of the optimum moisture content per ASTM D698. Materials shall not be placed on frozen subgrade or embankment material foundations, nor shall frozen material be used as fill.

G. Do not place fill if material is frozen, or if surface upon which fill is to be placed is frozen.

H. Tolerances: The Contractor shall meet the following tolerances for thickness and grade. Tolerances will be verified by survey in accordance with the CQA Plan and Section 02005 Surveying.

I. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on water quality.

J. The Contractor is responsible for all stormwater damage including damage resulting from storms exceeding the 25-year, 24-hour storm event and shall carry All-Risk Builders Risk Insurance to cover such damage. Owner is not responsible for stormwater damage or delays.

K. If any portion of the clean fill soil used as subgrade soil does not meet the specified requirements, the Contractor shall remove such material and replace it with fill materials meeting the specification at no additional cost. Material to be removed will be determined by the Engineer.

L. EQUIPMENT. All equipment to be used for the construction of the cover systems must be submitted to and approved by the Engineer.

3.02 DUST CONTROL

A. The Contractor is to submit a Dust Control Plan for approval. Dust control shall consist of furnishing water supply, required equipment, additives, accessories and incidentals, and applying water during the completion of the Contract, as required by the Engineer. Special care must be taken so as not to apply excessive water considering a primary objective of the cover construction and immediate subgrade is to build it as dry as possible.

3.03 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as necessary, in accordance with, but not limited to the following guidelines:

1. Provide barricades, coverings or other types of protection necessary to prevent damage to existing items indicated to remain in place.

2. Protect and maintain benchmarks, monuments, or other established reference points and property corners. If disturbed or destroyed, replace at the Contractor's expense to full satisfaction of Owner and controlling authority.

3. Maintain stockpiles and excavations in such a manner to avoid inconvenience or damage to structures on-site or adjoining property, and avoid blocking access roads to or within the site.

4. Contractor may remove and replace existing items indicated to remain in place, at his option, at no additional loss to Owner. Replacement items must be approved by Owner.

3.04 EXCAVATION

A. If the bottom of any excavation is taken out below the limits shown on the Drawings, it shall be refilled at the Contractor's expense with 6-inch lifts of un-compacted common fill or other material satisfactory to the Engineer. The material shall be placed and compacted in accordance with requirements for Common Fill.

B. The Contractor shall execute all miscellaneous earth excavation related to specified tasks required under this contract.

C. Excavation for the convenience of the Contractor shall conform to the limits approved by the Engineer and shall be at no additional expense to Owner.

D. During construction, perform excavation in a manner and sequence that will provide proper drainage at all times.

E. At all times during construction, provide and maintain proper equipment and facilities to remove all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The Contractor shall, where required, design a dewatering system to remove stormwater and prevent damages resulting from storm events. The Contractor shall submit to the Engineer for review the design of the dewatering systems prior to commencing work.

F. Removal of dewatering equipment shall be accomplished after the system is no longer required.

G. The Contractor shall perform required excavation to the lines and grades indicated on the Drawings. Where practicable and as approved by the Engineer, suitable materials removed from excavation shall be used as fill in various areas of the site. Excavated material may be stockpiled for later use.

H. Preparation:

1. Required lines, levels, contours and datum shall be identified prior to the start of excavation.

2. Extracted soil, soil stockpiles, equipment, nor vehicles shall be allowed within 2 feet of an open excavation.

3. Unsatisfactory or Excess Materials: Unsatisfactory and excess excavated uncontaminated material generated during the Work and not approved for use in the Work shall be disposed of as directed by the DOE Project Manager or Engineer.

3.05 SUBGRADE PREPARATION

A. Subgrade Soil Layer: Subgrade soil shall be compacted to a minimum of 95% of maximum dry density as determined by ASTM D698. Waste material shall be placed in lifts not to exceed 1-ft and compacted to the highest density possible and determined by the Engineer. Quality assurance shall be performed on the upper foot for moisture and density criteria for the subgrade soils. The final grading of this subgrade soils shall be as designated in the Drawings and within the tolerances identified in this specification. Additionally, the subgrade soils shall be dry of the optimum moisture content as determined by ASTM D698 prior to placement of cover soil. Should these soils exceed this upper moisture content tolerance, the Contractor shall scarify these subgrade soils and allow them to dry or replace the clean subgrade soil and recompact prior to cover soil placement.

B. Fill materials shall be placed in continuous and approximately uniformly thick layers for their full length and width unless otherwise specified. Backfill shall be completed in lifts not to exceed 6-inches in thickness.

C. The method of dumping and spreading the materials shall ensure uniform distribution of the material.

D. Construction: Shape subgrade to line, grade, and cross section in accordance with the plans and compact as specified. Shape the entire subgrade to line, grade, and cross section.

E. If subgrade preparation is adversely affected prior to construction completion, the Contractor shall rework the subgrade soil or replace clean fill soil to meet specified requirements at the Contractor's expense. The repaired subgrade shall be approved by the Engineer before any work is placed thereon.

F. Provide moisture control system necessary to successfully complete compaction and construction requirements.

G. Any areas of subgrade damaged by traffic, erosion, settlement, or other cause, shall be repaired and the grades shown on the drawings shall be reestablished. Any exposed subgrade, which exhibits desiccation cracking, shall regraded and compacted prior to placement of any cover material.

H. Finish compaction shall be done by steel-wheeled rollers, vibratory compactors, or other approved equipment.

I. Field compaction and moisture testing shall be performed in accordance with ASTM D6938 at a rate consistent with the CQAP. This testing will be performed on the top lift.

3.06 BACKFILLING-COMMON FILL

A. Each layer of shaping fill materials leading to the final prepared subgrade shall be compacted to a minimum of 95 percent of maximum dry density as determined by ASTM D698. During compaction, the moisture content of shaping fill material shall be maintained to be dry of the optimum moisture content (ASTM D698).

B. Field compaction and moisture testing shall be performed in accordance with ASTM D6938 at rate consistent with the CQAP. This testing will be performed on the top lift.

C. All lift surfaces must maintain a uniform slope.

D. Fill placed at densities outside of the specified allowable density range or at moisture contents outside the specified acceptable range of moisture content shall be reworked to meet the density and moisture requirements or removed and replaced by acceptable fill compacted to meet these requirements.

E. Satisfactory materials may be used for the construction of an adequate subgrade. Material conforming to the requirements of common fill shall be placed in lifts having a maximum thickness of 6-inches measured after compaction.

F. Clods or hard lumps of earth exceeding 4 inches in greatest dimension shall be broken up or removed before compaction of the material.

G. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material.

H. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings, and no soft spots or under compacted areas shall be allowed in the work. Refer to tolerances in Section 02005 Surveying.

I. No compaction shall be performed when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

J. Backfilling shall not be performed when the soil is frozen.

3.07 COVER SOIL PLACEMENT

A. Field compaction and moisture testing shall be performed in accordance with ASTM D6938 at a rate consistent with the CQAP.

B. Soil from the approved cover soil borrow source(s) shall be tested per ASTM D698 to obtain the respective maximum dry density (MDD) and optimum moisture content for each borrow source and soil type used.

C. This soil is to be taken from the designated borrow area(s) or approved equal. Any other soils to be used must be approved by the Engineer. The cover soil depth will be that described in the Contract Drawings. No stones or clods greater than 4-inches (10 cm) in diameter shall be allowed in the Cover Soil. All lifts are to be placed and compacted (ASTM D698) to meet the applicable moisture and density placement requirements. The cover slope and slope tolerances as described in the Drawings shall be maintained. Positive drainage shall be maintained at all times during installation of the cover systems.

D. This full cover profile consists of 3.0-ft of soil placed directly on the prepared subgrade. Cover soil placement specifics for each cover layer are described below:

1. Bottom layer of cover soil. The bottom 1-ft of cover soil from the approved borrow source(s) shall be a mixture of 50% sandy loam or loamy sand mixed with 50% soil containing a higher percentage of fines (material passing the #200 sieve). *The soil textures and/or mixture percentage may change at the direction of the Engineer.*

   a. This soil is to be placed dry of the optimum moisture content as determined by ASTM D698. Quality assurance will verify the moisture content prior to placement of the subsequent lift of soil.

   b. The compacted soil density is to be 90% of the maximum dry density as determined by ASTM D698. The tolerance for this placement density is plus or minus 5 pcf.

2. Middle layer of cover soil. Directly on top of the bottom mixed soil layer shall be an 18-inch layer of sandy loam or loamy sand from an approved borrow source(s). *The soil textures may change at the direction of the Engineer.* This layer is to be placed in two equal lifts.

   a. This soil is to be placed dry of the optimum moisture content as determined by ASTM D698. Quality assurance will verify the moisture content prior to placement of the subsequent lift of soil.

   b. The compacted soil density is to be 90% of the maximum dry density as determined by ASTM D698. The tolerance for this placement density is plus or minus 5 pcf.

3. Top layer is to be a mixture of rock and cover soil.

   1) The rock shall be mixed with accepted cover soil to produce an erosion resistant gravel admixture top layer of the cover system. All rock testing and grain size distribution shall be submitted to the Engineer for approval.

   2) The rock shall be D50 of 0.5-inches. The rock to soil ratio shall be 25% rock to 75% soil by volume. *The soil textures and/or mixture percentage may change at the direction of the Engineer.*

   3) The rock and soil are to be uniformly mixed prior to placement. The mixing method and location as well as equipment to be used are to be approved by the Engineer prior to commencing. Uniformity of rock to soil throughout the material to be placed and compacted on the final cover is critical. Quality assurance activities shall verify uniformity of mixing prior to placement on the final cover.

   4) The rock/soil admixture shall be placed and compacted to the grades and depth shown on the Drawings. Positive drainage shall be maintained at all times.

   5) The rock/soil admixture shall be placed dry of the optimum moisture content as determined by ASTM D698. Quality assurance will verify the moisture content prior to placement of the subsequent lift of soil.

6) At the discretion of the Engineer, the rock/soil admixture shall be scarified or disced to a depth not to exceed 6-in prior to seeding of the final cover after the final grades and depth have been accepted. Do not recompact after this scarification or discing effort.

3.08 SUMMARY OF COVER AND SUBGRADE CONSTRUCTION

All soils and gravel shall be approved by the Engineer brought to the site.

Soil Property	**Top Layer** **Cover Rock/Soil Admixture**	**Middle Layer** **Compacted Cover Soil**	**Bottom Layer** **Compacted Soil/Clay Mixture**	**Subgrade Soil**
Depth	6 inches (minimum)	18 inches (minimum)	12 inches (minimum)	NA
Allowable soil texture	Designated borrow source(s) for cover soil - nominally sandy loam or loamy sand. Uniformly mixed with rock: 25% rock to 75% soil by volume. Rock: 0.5-inch dia. (d50) rock Cover Soil: 25% minimum passing #200 sieve. *The soil textures and/or mixture percentage may change at the direction of the Engineer.*	Designated borrow source(s) for cover soil - nominally sandy loam or loamy sand. Cover Soil: 25% minimum passing #200 sieve. *The soil textures may change at the direction of the Engineer.*	Designated borrow source(s) for cover soil . 50% mixture of nominally sandy loam or loamy sand with high fines content soil Sandy loam or loamy sand: minimum 25% passing #200 sieve. High fines content soil: 60% minimum passing #200 sieve. *The soil textures and/or mixture percentage may change at the direction of the Engineer. A substitute soil approved by the engineer is to*	Existing soil or from approved borrow source(s)

			have a minimum 45% passing the #200 sieve.	
Allowable rock size	D50 of 0.5-in diameter	NA	NA	NA
Max. object size	Nominally 4-in dia.	Nominally 4-in dia.	Nominally 4-in dia.	none
Soil compaction	No compaction	Moderate compaction	Moderate compaction	High compaction
Minimum	NA	90% of maximum dry density (ASTM D698) less 5 pcf	90% of maximum dry density (ASTM D698) less 5 pcf	95% of maximum dry density (ASTM D698).
Maximum	NA, at discretion of Engineer may require discing or scarification prior to seeding	90% of maximum dry density (ASTM D698) plus 5 pcf	90% of maximum dry density (ASTM D698) plus 5 pcf	No maximum
Soil moisture content	Dry of optimum moisture content (ASTM D698)	Dry of optimum moisture content (ASTM D698)	Dry of optimum moisture content (ASTM D698)	Dry of optimum moisture content (ASTM D698)
Minimum	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement
Maximum	Optimum moisture content (ASTM D698)	Optimum moisture content (ASTM D698)	Optimum moisture content (ASTM D698)	Optimum moisture content (ASTM D698)

3.09 GRADING

A. Installation of cover material shall be performed at all places that are indicated on the Drawings, to the lines, grades, and elevations shown or otherwise as directed by the Engineer. During the process of grading, the subgrade shall be maintained in such condition that it shall be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the prosecution or condition of the work.

B. If at the time of grading it is not possible to place any material in its proper location, it shall be stockpiled in approved areas for later use. No extra

payment shall be made for the stockpiling or double handling of the excavated material.

C. The Engineer reserves the right to make minor adjustments or revisions in lines or grades as necessary during the progress of the work.

D. All cut and fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Engineer.

E. Grading Classifications - Operations, in areas designated for grading, shall comply with the following classifications, as specified on the Drawings.

1. Rough Grading, when specified, shall produce reasonably uniform surface, free of major ruts, wind-rows and undulations. Rough grades shall match plan grades or contours within 0.5 foot.

2. Fine Grading, when specified, shall produce a uniform ground surface, free of ruts, windrows, and undulations. Finish grades shall closely match plan grades or contours within a tolerance of 0.1 foot, except as otherwise indicated on the Drawings or Specifications, or otherwise indicated by the Engineer.

3.09 SLOPE SURFACE PREPARATION

A. All slopes shall be constructed to the lines, grades, and elevations shown on the Drawings or as directed by the Engineer.

3.10 DISPOSAL OF SURPLUS MATERIAL

A. No excavated materials shall be removed from the site or disposed of by the Contractor except as directed by the Engineer. Materials shall be neatly piled so as to minimize inconveniencing operations.

B. Items and materials of salvage value as determined by the Engineer, unless incorporated in the new work, shall remain on the property of the Owner and shall be delivered to storage areas as directed by the Engineer. Such items and materials shall be carefully removed and delivered in such a manner as to permit reuse.

3.11 SAFETY

A. The Contractor shall ensure full compliance with applicable requirements of OSHA and the approved HASP.

B. Special attention is directed to Title 29 Labor, Part 1518, "Safety and Health Regulations for Construction" and detailed requirements of Subpart P "Excavations, Trenching and Shoring."

C. Comply with local and specific requirements of the State of New Mexico.

3.12 TEMPORARY STOCKPILING

A. Contractor may temporarily stockpile materials at a staging location approved by the Engineer in the vicinity of the cover system or construction areas. Confine stockpiles to approved locations only. Do not obstruct roads or streets.

B. Material shall be placed in temporary stockpiles as follows:

1. Place material in maximum 2-foot lifts and compact with a minimum four passes with earth-moving equipment.
2. Maximum slopes shall be 3H:1V. Minimum slopes shall be 3 percent to promote drainage.

3.13 STOCKPILE ACCESS AND EXCAVATION

A. Always keep stockpile neat and orderly and work there in a systematic manner. Take necessary precautions to maintain existing erosion and dust control measures and prevent offsite sediment and dust releases.

B. When work is completed in the stockpile area, grade area to drain surface water runoff to appropriate collection and discharge points.

3.14 CLEANUP AND DISPOSAL

A. Garbage, refuse, debris, oil, and any waste material which is generated by the Contractor and is harmful to the environment or offensive to the area shall be removed from the job site and disposed of offsite in a manner approved by the authority having jurisdiction over the disposal site.

B. Disposal of Materials

1. The Contractor shall dispose of all vegetative materials off-site or as directed by the Engineer or Owner.
2. Burning of cleared and grubbed materials shall not be permitted.

PART 4 QUALITY CONTROL/QUALITY ASSURANCE

4.01 QUALITY CONTROL

A. General

1. Unless otherwise indicated, all laboratory and field testing shall be performed by an independent geotechnical testing laboratory (GTL) employed by the Contractor, with test materials furnished by the Contractor under the direction of the Engineer. The GTL proposed by the Contractor shall be reviewed and approved by the Engineer. The laboratory shall, at a minimum, be in compliance with ASTM D3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rocks as Used in Engineering Design and Construction.
2. The Contractor shall test materials as set forth in the applicable referenced sections and as required herein.

B. Preconstruction Material Testing Requirements

1. Only approved borrow sources shall be used for cover soil. Should other borrow sources need to be used or evaluated, the Contractor shall arrange for an inspection by the Engineer of each proposed borrow source prior to the commencement of earthwork operations. During said inspection, the Contractor shall provide any equipment necessary to excavate test pits throughout the limits of the proposed source so as to provide the Engineer with a thorough inspection of the type(s) and uniformity of material(s) throughout the proposed source. Upon the Engineer's visual inspection and

preliminary acceptance of a proposed borrow source, the Contractor shall collect representative samples of the borrow soils for subsequent geotechnical testing in accordance with the approved CQAP. Tests identified in the CQAP can be altered or changed at the discretion of and as directed by the Engineer.

2. The Contractor is required to submit representative samples of each proposed borrow material to the GTL at the minimum frequencies specified in the CQAP. The physical property tests shall be completed for each sample and the material approved prior to use of the material at the site. The Contractor shall complete all testing on materials prior to delivery to the site at the frequency specified in the CQAP. Cover materials (soil and rock) must be pre-approved prior to delivery to the site. Additional quality control testing will be performed on samples of delivered material. If, during the course of construction, an alternative borrow source is used, the material must be pre-approved by the Engineer in accordance with the requirements of this Specification prior to delivery to the site.
3. The results of this preconstruction testing program shall be submitted to the Engineer for approval at least two (2) weeks before use of these soils at the site. These test results may be applied toward the test frequency requirements. Physical specimens of all proposed foreign borrow materials shall also be submitted to the Engineer, if requested. The Engineer shall have the authority to reject any and all soils that are believed to be inappropriate for earthwork construction.

C. Field Quality Control Testing Requirements

1. The Contractor shall provide all horizontal and vertical controls necessary for all earthworks as well as associated grid layout and staking using benchmarks and monuments, if any, shown on the Drawings and required by these Specifications.
2. Placing soil material and performing earthworks will be subject to periodic QA inspection by the Engineer. The GTL shall provide continuous quality control (QC) inspection including field moisture and density tests during the compaction of each lift of soil in accordance with the CQAP. The Contractor shall also provide labor and equipment to prepare smooth surface spot locations as designated by the independent GTL or the Engineer on which to perform field tests.
3. Following the placement and compaction of each lift of soil, said lift shall be tested in accordance with the CQAP to determine the in-place compacted dry density and moisture content of the in-place soils, and to determine conformance of these data with the project specifications, before subsequent lifts are placed.
4. Tests outside of the window shall be considered failing unless otherwise approved by the Engineer. Deficient areas shall be recompacted in accordance with approved techniques as stated herein.
5. The Engineer may direct the Contractor to provide inspection trenches or test pits be cut into the designated borrow area(s) prior to this soil's removal or into the cover system after installation to determine that the Specifications have been met. Such trenches or pits will be of limited

depth and size, and shall be backfilled with the material excavated there from, or other fill material meeting the requirements for the zones cut into. Backfill shall be compacted to a density equal to that of the contiguous fill.

END OF SECTION

SECTION 02260

ON-SITE WASTE EXCAVATION AND TRANSPORT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for the on-site transport of excavated waste materials from one area of the airport landfill to another area of the same landfill.

1.02 RELATED SECTIONS AND REFERENCES

A. Section 02100 – Clearing and Stripping.
B. Section 02200 – Earthwork.
C. Section 02266 – Landfill Waste Placement Procedures
D. SWPPP for Los Alamos Airport Landfill Cover Replacement.
E. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.
F. Design Health and Safety Plan (HASP) for Los Alamos Airport Landfill Cover Replacement, April 2015.
G. Construction Implementation Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

PART 2 MATERIALS

2.01 GENERAL

A. The Contractor shall provide all materials and equipment required for the excavation, transport and handling of waste and soil materials within the boundaries of the site.

PART 3 EXECUTION

3.01 EXCAVATION

A. The Contractor shall complete excavation of site materials as shown on the Drawings.
B. Prior to the excavation of any waste materials, test pits shall be excavated to determine the horizontal limits of waste.
C. All excavations shall be cut back to the shallower of a safe working slope of between 1H:1V and 1.5H:1V or OSHA excavation requirements or flatter if dictated by the density and composition of the materials encountered.
D. The exposed face of the excavated waste shall be closely monitored during excavation and for the period up until backfill is placed. If movement of the waste is observed or if tension cracks are observed on or near the top of the slope, measures shall be taken to stabilize the slope. These measures may include removal of additional waste material to create a flatter slope.

E. Excavated slope shall be protected from extreme precipitation and surface water run-on by the use of temporary covers (soil or plastic), berms, ditches, etc.

3.02 TRANSPORTATION

A. The Contractor shall transport the waste materials to the fill areas within the landfill footprint as shown on the Drawings. Vehicles shall be operated in a safe and controlled manner. Vehicles shall not be operated on airport roadway or taxiways without prior authorization of the airport manager.

3.03 MATERIAL PLACEMENT

A. The Contractor shall place excavated waste from the site in the fill areas as shown on the Drawings or as approved by the Engineer and in accordance with Section 02266 specifications.

3.04 CONTROL OF DUST, ODORS, AND SPILLS

A. The Contractor shall implement measures to strictly control dust, odors, and spills during the on-site transport of excavated materials. The gates of hauling vehicles shall be sealed tightly to prevent the release of materials during transport and vehicles will not be overloaded so that the waste material rolls off the tops of loaded vehicles. The Contractor shall use covers/tarps to prevent the release of dusts and odors from trucks, scrappers, etc., as necessary. Dust control measures shall be implemented as necessary to prevent hazardous conditions for aircraft operations.

END OF SECTION

SECTION 02266

LANDFILL WASTE PLACEMENT PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Capping of the airport landfill includes the relocation of waste from the northwestern portion of the landfill (beneath the area for the new hangar pad and asphalt access) and consolidation of this waste along the center or crown of the landfill (from west to east) within the limit of the landfill final cover system as shown on the Drawings.

B. The landfill footprint west boundary will be relocated approximately 101 ft eastward (as defined on the Drawings) to allow the inclusion of the landfill cap. The excavated area of waste removal will be backfilled with free-draining structural fill to allow this area to be tied into the native soil/bedrock/waste and to provide a stable foundation for the placement of the concrete hangar pad and asphalt access.

1.02 RELATED WORK

A. Section 02200 – Earthwork.
B. Section 02930 – Erosion and Sediment Control.
C. Section 02266 – On-Site Waste Excavation and Transport.
D. SWPPP for Los Alamos Airport Landfill Cover Replacement, July 2015.
E. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.
F. Design Health and Safety Plan (HASP) for Los Alamos Airport Landfill Cover Replacement, April 2015.
G. Construction Implementation Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.03 SUBMITTALS

A. All equipment, waste excavation methods, waste hauling, waste placement and compaction shall be submitted to the engineer for approval.

PART 2 MATERIALS

2.01 GENERAL

A. The Contractor shall provide all materials and equipment to place, spread, and compact the waste and soil materials within the landfill.
B. Relocated waste shall not be used as backfill.

PART 3 EXECUTION

3.01 GENERAL

A. All relocated waste shall be placed within the limits shown on the Drawings or as otherwise defined by the Engineer based on the findings of test pit excavations.

3.02 PLACEMENT AND COMPACTION

A. The excavated material shall be spread with dozers or similar earthmoving equipment under controlled lift and compaction construction.
B. Large pieces shall be isolated and filled around with soil or other smaller wastes in order to minimize voids.
C. Large, flat pieces shall be placed flat and filled around on all sides with soil/waste.
D. Compacted lifts of waste materials are to be no more than 6-inches thick.
E. Lifts are to be placed as dry as practical while compacting the materials to as dense as practical. Compaction equipment capable of dense compaction and minimizing voids shall be used.
F. At least 1 foot of waste/soil shall separate large, flat pieces. No direct stacking will be permitted.
G. Waste shall be compacted until they are visually observed to be dense, stable and unyielding, or as directed by the Construction Manager. The Contractor shall complete as many passes as necessary of the compaction equipment to achieve a satisfactory condition.
H. Placed and compacted waste shall be covered with a minimum of 6-inches of clean dry material at the conclusion of each day unless otherwise directed by the FPD.
I. The subgrade exposed after removal of waste shall be thoroughly compacted to a minimum density of 95% of maximum dry density per ASTM D698 or as approved by the Engineer.

3.03 CONDITION AREAS

A. Should excavated waste material that is saturated or very wet be placed within the landfill, the Contractor shall set aside an area to dry said wastes.
B. The Contractor shall spread the saturated material in thin lifts and dry the material by racking, tilling, liming, mixing in dry soil, or other approved methods.

END OF SECTION

SECTION 02270

DRAINAGE CHANNELS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes furnishing all labor, materials, tools, and equipment necessary for providing protection for slopes, ditches, channels, and riprap outlet protection to the configuration and extents indicated in accordance with the Contract Documents.

1.02 RELATED WORK

A. Section 02200 – Earthwork.
B. Section 02720 – Storm Drain System.
C. Section 02750 – Stormwater Management and Discharge.
D. Section 02930 – Erosion and Sediment Control.
E. Section 06005 – Liner Low Density Polyethylene Geomembrane.
F. Section 06020 – Geotextiles.
G. SWPPP for Los Alamos Airport Landfill Cover Replacement, July 2015.
H. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.03 SUBMITTALS

A. In accordance with Section 01340, submit a Certificate of Compliance before delivery of materials for the items listed below:
   1. Stone.
   2. Geotextiles and fasteners.
   3. Geosynthetic materials.
   4. Erosion control blankets.
   5. Erosion control mats.

PART 2 PRODUCTS

2.01 STONE FOR OUTLET AND CHANNEL PROTECTION

A. Stone shall be a durable rock such as a hard basalt or limestone. Sandstone is not permitted. Durability of rock is to be submitted for approval prior to delivery to the site.
B. Stone for riprap shall be composed of a crushed rock with D50 (median) size of 4 inches. Submit certification of rock size and type prior to delivery to site.
C. Riprap shall be reasonably well-graded from the smallest to the largest size specified and shall be controlled by visual inspection.
D. No broken concrete shall be used as riprap.

PART 3 EXECUTION

3.01 CHANNEL EXCAVATION

A. The drainage channels shall be excavated to the slopes and grades shown on the design Drawings. The channel widths shall be constructed to the dimensions shown on the design Drawings. The side slopes of the channels shall be 3:1 or 2:1 (horizontal to vertical) as shown on the drawings.

B. Fill material required for meeting grades and slopes shall consist of material from channel excavation or select borrow soils.

C. The final channel slope subgrades shall be prepared by removing vegetation, roots, and loose materials to provide a firm surface for geotextile/geomembrane placement. The final channel subgrades shall be compacted with approved construction equipment to form a smooth, competent foundation for the filter layer. In areas requiring fill placement to achieve final grades, after topsoil removal, the upper 6 inches shall be scarified, moisture conditioned and compacted prior to fill placement.

D. All subgrade soils shall be compacted to a minimum depth of 6 inches to a minimum of 95% of the maximum dry density per ASTM D698.

E. The completed grading for the diversion channels, in soil, shall be within 1.0 foot (horizontally) of the lines as designed, and within 0.1 foot (vertically) of the elevations as designed. The final surfaces shall be smoothed to avoid abrupt changes in surface grade or areas of runoff concentration.

F. The completed grading for the diversion channels in rock (if encountered) shall be within 2.0 feet (horizontally) of the lines as designed, and within 0.5 foot (vertically) of the elevations as designed. The final rock surfaces will be rough and should not be filled to make grade. The bedrock channel should be constructed at or below the design grades in order to meet the intent of the design.

3.02 GEOTEXTILES, GEOSYNTHETCIS, AND RIPRAP

A. Place the geosynthetics liner and weld in place over the prepared subgrade. The subgrade shall be prepared so that no stone or object greater than ½ inch in diameter shall be exposed that can damage the liner. The liner material shall be welded to the existing liner per the manufacturer's requirements and recommendations. Anchor the liner per Technical Drawings to prevent displacement during placement of the geotextiles and riprap.

B. Place geotextile loosely over the geosynthetic liner. Overlap the geotextile panels a minimum of 18 in. Place and shingle panels parallel to the flow and slope. Anchor geotextile panels per Technical Drawings to prevent displacement before or during construction. Stagger overlaps perpendicular to the flow a minimum of 5 ft. Geotextiles damaged or displaced before, during, or after placement shall be replaced or repaired by the Contractor at no cost to the Engineer.

C. Place riprap on geotextile material to its full specified thickness and to the extent shown on the Drawings. Placement shall be in one operation in such a manner as

to not disturb underlying material. End dumping of rock upon the geotextile shall not be permitted.

D. The larger stones shall be well distributed and compact. Hand placing or rearranging of individual stones by mechanical equipment may be required to secure the required results.

E. Riprap shall be placed starting at the toe of slope and proceeding upslope.

END OF SECTION

SECTION 02511

HOT MIX ASPHALT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes requirements for the design, supply, placement, and inspection of hot mix asphalt (HMA) to be installed on top of an aggregate subbase as shown on the Drawings.

1.02 RELATED SECTIONS AND REFERENCES

A. Section 02200 – Earthwork

1.03 GENERAL.

A. The requirements, materials, installation, and quality control of hot asphalt installation shall conform to *New Mexico Department of Transportation specification section 432: Hot Mix Asphalt*.

1.04 SUBMITTALS

A. Delivery Tickets
B. Delivery tickets showing the following information with each load of HMA delivered to the site shall be submitted to the Construction Manager:
C. Name and location of supplier.
D. Type and amount of material delivered.
E. Mix Design
F. Submit mix design procedure and mix design.
G. Certified Test Reports
H. Submit the results of all tests completed as part of the mix design
I. Submit the results of all tests completed on the finished pavement.

PART 2 MATERIALS

2.01 Hot Mix Asphalt

A. HMA is a mixture of asphalt binder, aggregate, blending sand, mineral filler, and hydrated lime or anhydrite based material. Unless otherwise prohibited in the Contract, the Department will allow Recycled Asphalt Pavement (RAP) in HMA mixtures as long as the resulting mixture conforms to all specification requirements.
B. Comply with *New Mexico Department of Transportation specification section 432: Hot Mix Asphalt*

PART 3 EXECUTION

3.01 Subgrade

A. The subgrade soil is to be graded to the elevations depicted on the Drawings. The soil is to be compacted to a minimum of 95% of the maximum dry density per ASTM D698.

3.02 General

A. When placing HMA on Base Course, Proof Roll the Base Course with a 27 ton roller or other approved Equipment and correct any soft areas, as directed by the Construction Manager. Correct deficient areas at the Contractor's expense. Place the HMA on the approved surface, then spread, and strike off to the specified grade and elevation. Spread and compact the HMA in 2 inch layers.

3.03 Base Course

A. Clean of loose or Deleterious Materials;
B. Free of frozen material;
C. Meet the moisture and density requirements; and
D. Place prime coat, as required in the Plans unless otherwise approved by the Construction Manager, in accordance with *New Mexico Department of Transportation specification section* 408, Prime Coat.

3.04 Weather Limitations

A. Do not place HMA on wet or frozen surfaces or if weather conditions prevent proper handling, finishing, and compacting. Place HMA when the Chill Factor is at least 40 °F and rising. If the air temperature is 60 °F or warmer, do not consider the Chill Factor.

3.05 Compaction

A. The target density for Acceptance of HMA will be 94.5% of the theoretical maximum density as determined from AASHTO T 209. Each individual density test value obtained must be from 92.0% to 97.0% of the theoretical maximum density.
B. Compact the HMA thoroughly and uniformly immediately after placement.
C. Operate rollers at speeds slow enough to minimize displacement of the HMA, including the lines and grades of the asphalt edges.
D. Remove marks from pneumatic rollers and immediately correct any displacement.
E. Do no use Equipment that crushes the aggregate excessively.
F. Prevent the HMA from sticking to the roller wheels by keeping the wheels moistened with water; water mixed with very small quantities of detergent or other approved material.
G. Do not use diesel fuel or other petroleum diluents.
H. At locations inaccessible to the rollers, compact the HMA with hot hand tampers, smoothing irons, or mechanical tampers. The Contractor may use a trench roller or cleated compression strips under the roller to transmit compression to depressed areas.
I. Remove areas that become loose, broken, mixed with dirt, segregated or defective, replace with fresh HMA, and compact to match the surrounding area, at the Contractor's expense.

J. Immediately correct areas that have excessive or deficient asphalt binder.

K. Place the HMA as continuously as possible. Do not pass rollers over the unprotected end of a freshly laid mixture. When placing open-graded friction course over HMA, stagger longitudinal joints at least six (6) inches relative to the longitudinal joints of the underlying course.

L. Unless otherwise specified, taper transverse and longitudinal joints as follows:

1. At least a three (3) ft taper for transverse joints, with a taper slope no steeper than 24:1.
2. At least a one (1) ft taper or a notched taper, for longitudinal joints, with a taper slope no steeper than 6:1 or a notched taper with a one (1) inch vertical edge at the top of the taper connected to a slope no steeper than 6:1.
3. Cut and square off transverse tapers before commencing new Work.
4. Clean and tack coat longitudinal joints from previous operations.

3.06 Interface Joints

A. The interface between the asphalt and other materials shall be sealed by applying a slurry of hot asphalt to the joint. The slurry shall be applied in a manner that will result in neat lines. Fine sand shall be spread over the slurry after it has been applied.

3.07 TESTING AND INSPECTION

A. Sample and test the aggregate production and HMA mixture in accordance with *New Mexico Department of Transportation specification section* 901, Quality Control /Quality Assurance (QC/QA), and the NM DOT "Minimum Testing Requirements."

3.08 TOLERANCES

A. Surface Tolerances

1. Smooth the surface of each completed course and prevent deviations larger than 1/8 inch using a ten (10) ft straightedge in any direction. Immediately correct deviations exceeding this tolerance.

END OF SECTION

SECTION 02720

STORM DRAIN SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes requirements to construct or modify a storm drain system completed in place to the limits indicated in accordance with the Contract Documents.

1.02 QUALITY CONTROL

A. Test materials as set forth in the applicable referenced Specifications and as required herein.

B. Requirements for inspection and testing of concrete inlets, culverts, manholes, and trenches, as required, are specified in Section 03400.

C. As part of the QA effort, the Engineer may inspect and test all pipe, fittings, and joint material upon delivery to the site or at the factory. The Engineer may perform, on a continual basis, plant certification and in-process inspections at no cost to the Contractor.

1.03 SUBMITTALS

A. Certificates of Compliance

1. Submit Certificates of Compliance and shop drawings before delivery of materials for pipe, precast concrete (manholes, inlets, etc.), and fittings furnished by the Contractor under this section. Certificates shall include the Engineer's name; job location; the Contractor's name, types, classes, and strengths of pipe; and the pipe manufacturer's name. Certificates of Compliance for concrete and masonry materials are specified in Section 03400.

B. Packing List/Invoices

1. A packing list or invoice shall accompany every shipment and shall contain the following information: Engineer's name, type and class of pipe, length, and other pertinent information.

C. Installation and Repair Recommendations

1. Submit manufacturer's recommended installation and repair methods and procedures for pipe and structures. Repairs shall be performed by the manufacture using specifically trained personnel and shall proceed only after approval of the Engineer and in his presence.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery of pipe shall be coordinated with installation or shall be unloaded with proper equipment along the line of work, outside trench limits near as practicable to point of final placement, facing in proper direction, and properly

wedged secure. It shall be stored away from brush and in an accessible area for inspection.

B. Pipe and appurtenances shall be unloaded and handled with a crane or backhoe of adequate capacity equipped with appropriate slings to protect the material from damage. If damage occurs and is deemed repairable, it shall be repaired as directed by the Engineer in accordance with the manufacturer's recommendations. If damage is not repairable in the opinion of the Engineer, such pipe will be rejected and shall be removed and replaced at the Contractor's expense.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Pipe product shall conform to NMDOT Section 570.

B. Pipe between structures or between the structure and terminus shall be of the same size and material and shall be furnished by the same manufacturer. Each pipe length and fitting shall be clearly marked with the manufacturer's name or trademark and pipe type or strength.

2.02 JOINTING MATERIAL (CONCRETE PIPE)

A. Mortar for pipe joints shall conform to NMDOT Section 570.

2.03 JOINT MATERIAL (CONCRETE TRENCH)

A. Joint gasket materials shall be Concrete Sealants Inc., type CS-440, rope gasket having a diameter of 1.5 inches.

B. Concrete Adhesive shall be Concrete Sealants Inc., type CS-75. C. Joint Sealant shall be SIKA 1A..

2.04 HIGH DENISTY POLYETHYENE (HDPE) PIPE

A. HDPE pipe properties shall be in accordance with ASTM D-3350. Only newly manufactured pipe will be accepted. The pipe shall be manufactured in accordance with ASTM F-714 and ASTM D-3261.

B. The HDPE piping shall have a wall thickness classification specified on the Drawings. The pipe shall be manufactured in accordance with ASTM F-714 and ASTM D-3261. The pipe material properties shall meet or exceed the characteristics of a Type III, Class C, Category 5, Grade P34 as defined by ASTM D-1248. The material cell classification shall be 345434C as defined by ASTM D-3350.

C. Joints for HDPE pipe shall be electro-fusion butt welded, to provide a joint that, as a minimum, has the physical properties of the pipe. All welding shall be performed by a trained individual according to the pipe manufacturer's recommendations.

2.05 GRANULAR BEDDING MATERIAL

A. Granular bedding material for pipe and structures is specified in Section 02200. Detail for bedding the pipe is shown on the Drawings.

2.06 CONCRETE INLETS

A. Concrete precast units shall meet the requirements of NMDOT Section 623
B. Concrete strengths for inlets are specified in Section 03400.

2.07 CONCRETE INLETS FRAMES, GRATES, AND COVERS

A. Frames, grates, and covers shall meet the requirements of ASTM A48-83, Gray Iron, Class 35.
B. Design wheel loading shall be HS-20 for all grating.
C. Grating will be heavy duty type and bolted down type.
D. Grating shall be an "opened type", such as Neenah Foundary Company, Type A or Type P, or an approved equal.

2.08 MANHOLES AND TRENCHES

A. Concrete manholes and trenches are specified in Section 03400.

PART 3 EXECUTION

3.01 INSTALLATION OF STORM DRAIN

A. Inspection of Delivered Materials
   1. Pipe, fittings, inlets, manholes, trenches delivered to the work site will be inspected prior to installation. Disallowed and damaged materials shall not be installed, but shall be removed or repaired, if repairable, as directed by the Engineer.

B. Handling of Pipe and Fittings
   1. Pipe and appurtenances shall be handled with a crane or backhoe of proper capacity, equipped with appropriate slings to protect the exterior of the pipe.
   2. Foreign matter shall be cleaned and removed from each pipe, fitting, and appurtenances before placing in the trench. Should foreign matter be observed in previously installed pipe, fittings, or appurtenances, cease work until foreign matter is removed. Open ends of pipes and fittings shall be closed with a cap or plug when work is not proceeding.

C. Excavation of Pipe and Fittings
   1. Trench excavation and backfill shall be performed as specified in Section 02200.
   2. Pipe between structures or between structure and terminus shall be of the same size and material and shall be furnished by the same manufacturer. Before pipe installation, excavate sufficient trench in advance so that reasonable changes in line and grade can be made where the location of existing structures vary from that shown and then to ensure that no unforeseeable obstructions exist. Work required by failure to take such precautions shall be performed at no cost to the Owner.

D. Bedding of Pipe and Fittings
   1. Provide granular bedding in accordance with the Drawings and Section 02200.

2. Provide encasement and/or concrete cradle where indicated. The entire length of each pipe shall be placed on firm bedding.

E. Placement of Pipe and Fittings

1. Prior to pipe installation, bring bedding material to grade along the entire length of pipe to be installed. Install pipe to a true uniform line and grade as indicated with continuous bearing of barrel on bedding material.
2. Install pipe upgrade with the bell or groove (for concrete pipe) pointing in the direction of upstream. Place each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to prevent sudden offsets in the flow lines. Unless otherwise specified, opening of joints more than half the depth for concrete pipe will not be permitted.
3. Place sufficient backfill on each section of pipe as it is installed to hold it firmly in place.

3.02 JOINTS

A. For reinforced concrete pipe, clean joint surfaces immediately before jointing. Joints on PVC shall be gasket collar type, constructed of the same material as the pipe, and installed according to the manufacturer's recommendations.

B. Mortar Joints.

1. Assemble mortar joints to ensure complete filling of the joint all around. Mortar shall be used within 1 hour after addition of water. All joints of pipe to concrete structures shall be mortared closed.
2. Joints for HDPE pipe shall be electro-fusion butt welded.

3.03 CONCRETE MANHOLES, TRENCHES, AND INLETS

A. Excavation

1. Perform excavation to the line and grade shown on the drawings and as specified in Section 02200.
2. Location and depth as shown on the Drawings, or as directed by the Engineer.

B. Installation

1. Manholes, trenches, and inlets shall be furnished and installed at the location and in accordance with the details shown on the Drawings.
2. All structures shall be set on a crushed stone base, at least 6 in. deep, in accordance with Section 02200, to proper grade and properly leveled and aligned.
3. All lifting holes shall be sealed tight with rubber plugs and cement mortar.
4. A mechanical, flexible, tight gasket shall be provided for pipe connections at manholes and inlets that meet the requirements of ASTM C923.
5. All structures shall be painted outside with a coal tar epoxy or approved equal.
6. All structures shall be free of visible leakage. Each manhole will be visually inspected and any leaks found shall be repaired in a satisfactory manner as approved by the Engineer.

3.04 FRAMES, GRATES, AND COVER

A. Install in accordance with manufacturer's recommendations.

B. All frames and grates shall be bolted down securely to prevent any movement of the grate(s).

C. Install cast iron frame and cover on each structure, as detailed on the Drawings. Adjust the frame and cover to proper grade by using precast concrete grade rings or brick masonry when the structure is in a space dedicated for public use, a traveled way, or when designated to meet existing grade. Transition shall be a minimum of 4 in. and a maximum of 18 in. high. Otherwise, the structure shall be built without transition. Frames shall be adjusted to within 0.5 ft of final graded area.

D. Provide precast concrete grade rings, 3 in. through 6 in. thick. If required to meet proper grade, one split grade ring 2 in. thick may be used provided that this does not exceed the maximum transition heights. Precast concrete grade rings shall be set in full beds of mortar not less than 0.25 in. or more than 1.25 in. thick. Horizontal circumferential and vertical mortar joints, inside and outside, shall be pointed the full width. Depth of pointing shall not exceed 0.375 in. The mortar shall be cured a minimum of 6 hours prior to the backfilling and setting of the manhole frame. Place manhole frame and cover in a bed of mortar not less than 1 in. thick.

E. Concrete sections shall be protected from damage while in storage at the plant, while in transit, and at the contract site. They shall be handled with the proper size equipment, using only appropriate lifting holes or eyes. Joint ends of the sections shall be kept clean and placed on wooden blocks, pallets, or other appropriate material, but never on the ground. If damage is evident, it shall be repaired or the section rejected, as directed by the Owner. Thoroughly clean joint surfaces, remove all debris and foreign matter, and keep joint surfaces clean during assembly.

F. For concrete trenches; concrete section shall be installed in accordance with the manufacturer's written assembly instructions.

G. Where the gasket material (CS-440- 1.5 diameter rope size) is to be placed on the end of the concrete trench, paint area CS-75 adhesive. Place the gasket material on the painted area in the center of the concrete trench on all three (3) sides. Install materials in accordance with manufactures recommendations.

H. After the alignment and grade of the trenches has been checked and joint sealer is in place, tighten the trenches together using the quick thread rods. Tighten quick thread rods until the trenches are firmly fix against the sealer. Paint inside joints with Sika 1A.

I. Install Concrete Sealant and Sika 1A products in accordance with the manufactures requirements.

3.02 BACKFILLING

A. Backfilling around pipes and structures shall be completed in accordance with Section 02200

END OF SECTION

SECTION 02750

STORMWATER MANAGEMENT AND DISCHARGE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for the management and discharge of waters collected during and post construction activities.

1.02 RELATED SECTIONS

A. SWPPP for Los Alamos Airport Landfill Cover Replacement, July 2015.
B. Section 02930 – Erosion and Sediment Control.

PART 2 MATERIALS

Not Applicable

PART 3 EXECUTION

3.01 STORMWATER MANAGEMENT

A. Controls to be used by the Contractor shall conform to the approved details stated in the SWPPP.

END OF SECTION

SECTION 02930

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes furnishing all labor, materials, tools, and equipment needed to install, operate, and maintain erosion and sediment controls as shown on the Drawings and specified herein.

1.02 RELATED SECTIONS

A. SWPPP for Los Alamos Airport Landfill Cover Replacement.
B. Construction Implementation Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.03 STORMWATER POLLUTION PREVENTION

A. Prior to initiating earth-moving activities, implement the soil erosion and sedimentation controls as shown on the Drawings and detailed in the SWPPP.
B. Fines and related costs resulting from failure to provide adequate protection against soil erosion and sedimentation are the obligation of the Contractor.
   1. Silt, sediment, and mud leaving the site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
   2. Damages to any property outside of the project limits due to negligence by the Contractor shall be rectified and/or restitution shall be paid by the Contractor.
C. Erosion and sedimentation control measures employed will be subject to approval and inspection by governing agencies having jurisdiction over such work.
D. The temporary control provisions proposed shall be coordinated with the project schedule, sequence of construction, and temporary and permanent site facilities to assure economical, effective and continuous erosion control throughout the construction and post construction period with no violation of the federal, state, and local regulations.
E. The Engineer may limit the active area of earthwork operations in progress commensurate with the Contractor's capability in controlling erosion and sediment-laden runoff.

1.04 SUBMITTALS

A. Samples: Submit samples of materials being used including names, sources, and descriptions.

1.05 QUALITY CONTROL

A. All erosion and sediment control work shall comply with applicable requirements of governing authorities having jurisdiction. The Specifications and Drawings are not comprehensive, but rather convey the intent to provide complete slope protection and erosion control.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive special attention.

C. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time and the length of the time of exposure.

D. Surface water runoff originating upgradient of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

E. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

PART 2 MATERIALS

2.01 STRAW BALES

A. Straw bales, if used, shall be either wire-bound or string-tied with bindings around sides rather than over and under.

2.02 CRUSHED STONE

A. Crushed stone for stabilized construction entrance(s) shall be American Association of State Highway and Transportation Officials (AASHTO) #3.

2.03 SILT FENCE

A. Prefabricated silt fence shall meet the following requirements:

1. Silt fences shall be prefabricated.
2. The geotextile for the fencing shall meet the following requirements:

Property	Test Value(1)	Test Method
Grab Tensile Strength	90 lbs	ASTM D4632
Burst Strength	190 psi	ASTM D3786
Puncture Resistance	40 lbs	ASTM D4833
Permittivity	>0.1 sec^{-1}	ASTM D4491
AOS	>30 US sieve	ASTM D4751
UV Resistance (500 hr.)	70%	ASTM D4355

[1]Minimum average roll values (MARV)

3. Posts shall be metal or hard wood.
4. The geotextile height shall be a minimum of 3 ft and shall be provided with a tensioning cord.

2.04 GEOTEXTILES

A. Filter geotextile shall meet the requirements for geotextiles contained in Section 06020.

2.05 EROSION CONTROL MATS

A. Erosion control mats shall be American Excelsior Co., type Hi-velocity Curlex Blanket; PPS Packaging Co. type Super Duty Blanket; or Engineer approved equal.

2.06 EROSION CONTROL BLANKET

A. Erosion control blanket material shall be XCELL type regular blanket (0.98 #/sy), Curlex blanket type (0.97 #/sy), or approved equal.

PART 3 EXECUTION

3.01 STRAW BALE BARRIERS

A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 in.
B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lower middle bale.
C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale.
D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.
E. Any straw bales which become clogged or otherwise deteriorate shall be properly maintained or replaced as necessary at no additional cost to the Owner.

3.02 STABILIZED CONSTRUCTION ENTRANCE

A. Specifications include:
   1. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way or landfill entrance road. When washing is required, it shall be done on any area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through use of sand bags, gravel, boards, or other approved methods.
   2. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto the landfill entrance road or public right-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout or any measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto the transfer station access road or public right-of-way must be removed immediately by the Contractor at no cost to the Engineer.

3.03 SILT FENCING

A. A 6-in. by 6-in. trench shall be excavated along the alignment of the silt fence. Excavated material shall be stockpiled on the upside of the trench.

B. Fence posts shall be positioned on the downstream side of the fence and driven into the ground. Fence posts shall be spaced no more than ten (10) ft apart.

C. The fabric flap shall be laid in the trench and backfilled with material stockpiled from excavation. The backfill shall be tamped into place.

D. The Contractor shall join fence sections together as recommended by the manufacturer and as approved by the Engineer to prevent silt from escaping through the adjoining sections.

E. The Contractor shall maintain silt fences (removing and disposing of silt, repairing fence which falls down, and replacing damaged fence, etc.) throughout the duration of the Contract at no additional cost to the Engineer. Silt shall be disposed of in such a manner that it will not erode from the site and shall be placed within the stockpile.

3.04 DUST CONTROL

A. The Contractor shall submit a Dust Control Plan to the Engineer for approval prior to any earthwork activities. Dust generated from the Contractor's performance of work, either inside or outside the limits of work, shall be controlled by the Contractor by applying water, calcium chloride, or other materials with the approval of the Engineer.

B. The Engineer has the right to stop construction activity, if in his opinion; the excavations are generating excessive amounts of dust.

3.05 SOIL STABILIZATION

A. Following initial soil disturbance or redisturbance, permanent or temporary stabilization shall be completed in accordance with: a) 7 calendar days as to the surface of all perimeter controls, dikes, swales, ditches, perimeter slopes, stockpiles, and all slopes greater than 2 horizontal to 1 vertical (2:1) and b) 14 days as to all other disturbed or graded areas on the project site. The in-place sediment control measures will be maintained on a continuing basis until the site is permanently stabilized and all permit requirements are met.

3.06 CHANNELS (Temporary), SLOPES (Temporary), AND STOCKPILES

A. All channels, swales, ditches, stockpiles, etc. shall be stabilized with permanent or temporary seeding, in accordance with Section 02932 immediately upon reaching an interim grade.

B. The channel beds shall be covered with an erosion control mat. The erosion control mat shall be installed as recommended by the manufacturer of the blanket.

C. Where slopes require temporary stabilization, the Contractor shall install erosion control blankets, as directed by the Engineer.

3.07 MAINTENANCE

A. Inspection

1. Erosion and sediment control will be inspected by the Contractor the next working day after rainfall events in excess of 0.5 in. and prior to forecasted storms.
2. At a minimum, the Contractor will perform inspections of the erosion and sediment control system once every 14 calendar days and following storm events of 0.5 in.

B. Repair

1. All erosion swales and gullies in excess of 6 in. deep will be filled and compacted to their original condition and reseeded as required.
2. Erosion and sediment control structures (i.e., silt fencing) will be replaced as required to assure the integrity of the system.

3.08 SEDIMENT TRAPS

A. The Contractor is solely responsible to construct and maintain the proposed sediment traps and their effluent upon commencing any earth disturbance activity.

B. The Engineer reserves the right to require upgrades to existing traps or installation of additional structures should any discharge released not meet quality standards.

END OF SECTION

SECTION 02932

SEEDING, MULCHING, AND RESTORATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section shall include furnishing and installing all seed, fertilizer, mulch, mulch binder, erosion mats, and initial watering of seeded areas wherever existing site surface soils will be placed as topsoil shown on the Drawings or as directed by the Engineer. This work shall also include maintaining seeded areas as shown on the Drawings until accepted by the Engineer.

B. The areas to be seeded under this item shall include all areas designated by the Engineer and as described on the Drawings. All areas outside of specified limits where the vegetative growth has been injuriously disturbed or destroyed by the Contractor shall be restored and seeded in accordance with these specifications by the Contractor at his own expense.

1.02 RELATED SECTIONS

A. LANL Master Construction Specification, Section 32 9219, Seeding.

B. Section 02200 – Earthwork.

1.03 SUBMITTALS

A. The Contractor shall submit the following items:

1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer, and erosion control blankets.
2. Certification substantiating that material complies with specified requirements.
3. Submit certified seed bag tags and copies of seed invoices identified by project name.
4. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with Engineer approval after documentation of delays.

1.04 QUALITY ASSURANCE

A. Seeding Subcontractor Qualifications:

1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Control:

1. Provide seed mixture in containers showing species percentages in seed mix; test information including, purity, germination and noxious and restricted weeds; net weight; date of packaging; and location of packaging.
2. Furnish seed labeled in accordance with the requirements of federal and New Mexico statutes and regulations governing seed labeling. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the USDA; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.
3. In addition, ensure seed mix and its application comply with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

PART 2 MATERIALS

2.01 SEED

A. Obtain native grass seed from sources whose origin would ensure site adaptability. Plant sources from New Mexico or surrounding states are preferred.
B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability. Plant sources from New Mexico or surrounding states are preferred.
C. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix.
D. Furnish certification, showing origin of seed and pure live seed (PLS) content as determined by a certified authority. Provide bags of seed that are tagged and sealed in accordance with the State Department of Agriculture or other local certification authority within the state of origin. The tag or label shall indicate analysis of seed and date of analysis, which shall not be more than 9 months prior to delivery date. Seed may be premixed by the seed dealer and appropriate data indicated on the bag label for each variety.
E. Develop seed mixture from the following guidelines. Choose a minimum of five grass species from the list. Should wildflowers be included in the mix, use a ratio of 80 to 90% grasses and 10 to 20% wildflowers. Choose 3 to 5 species from the forb and wildflowers list. These species are applicable for both undeveloped and urban-interface areas.

NATIVE PERENNIAL MIX

Common Name	*Scientific Name*	*% of Mix*
Grasses		
Blue grama*	*Bouteloua gracilis*	5 – 10%
Galleta grass*	*Hilaria jamesii*	5- 10%
Mutton grass	*Poa fendleriana*	10-15%
Sideoats grama*	*Bouteloua curtipendula*	10-15%
Arizona fescue†	*Festuca arizonica*	10 – 15%
Prairie junegrass†	*Koeleria macrantha*	5 – 10%
Bottlebrush squirreltail*	*Elymus elymoides*	15 – 20%
Little bluestem†	*Schizachyrium scoparium*	10 – 15%
Indian ricegrass*	*Oryzopsis hymenoides*	10 – 15%
Mountain brome†	*Bormus marginatus*	10 – 15%
Sand dropseed*	*Sporobolus cryptandrus*	1 - 8%
Thickspike wheatgrass	*Agropyron dasystachyum*	20 – 25%
Needle and Thread grass*	*Stipa comata*	5 – 10%
New Mexico needlegrass*	*Stipa neomexicana*	10 - 15%
Sheep fescue	*Festuca ovina*	10 – 15%
Smooth Brome	*Bromus inermis*	15 – 20%
Stream Bank Wheatgrass	*Elymus lanceolatus ssp. psammophilus*	20 – 25%
Forbs/ Wildflowers		
Firewheel	*Gaillardia pulchella*	2%
Evening primrose	*Oenothera caespitosa*	1%
Gooseberry leaf globemallow	*Sphaeralcea grossulariafolia*	1.5%
Scarlet gilia	*Ipomopsis aggregata*	1%
Plains aster	*Aster biglovii*	1%
Western yarrow	*Achillea millifolium*	½%
Fringed sage	*Artemisia frigida*	1%
Blue flax	*Linum perenne lewisii*	4%
Scarlet bulgler	*Penstemon barbatus*	2%
Palmer penstemon	*Penstemon palmerii*	2%
Prairie coneflower	*Ratibida columnifera*	1%
Showy golden-eye	*Heliomerus multiflora*	1%

Common Name	*Scientific Name*	*% of Mix*
Purple geranium	*Geranium caespitosum*	5%

*Species particularly suited for especially dry sites
†Species particularly suited for higher elevations (above 7000 ft.)

2.02 STRAW MULCH

A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65% of the herbage by weight of each bale of straw shall be 10 in. in length or longer. Rotted, brittle, or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation. If possible, provide marsh grass composed of mid to tall native grasses (usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain Region).

2.03 HYDRAULIC MULCH/TACKIFIER

A. Provide mulch material consisting of 100 percent virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre or Conwed. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Provide materials free from contaminants such as lead paint, varnish or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determining even distribution. Mulch material shall meet the following specifications:

Parameter	Value
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

B. Combine mulch with an organic plantago based tackifier, such as M-binder, etc., that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.

C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.04 ROLLED EROSION CONTROL PRODUCTS

A. Provide a Straw/ coir blend blankets around the entire perimeter of the finished landfill after seeding. The blankets shall be installed at the base of each landfill slope from the intersection with a drainage channel and/or culvert up the hill nominally 8-ft wide or as determined by the width of the erosion control blanket used. The blanket shall run perpendicular to the landfill slope around the perimeter of the landfill. A machine produced straw /coir fiber erosion control blanket using 70 percent straw /30 percent coir fibers sewn into a heavy weight photo degradable top net and a medium weight photo degradable bottom net. Enviroscape SC3000 Double Net Straw, Greenfix America CFS072R, or other may be used. Submit product literature for approval prior to delivery to site.

2.05 AMENDMENTS / SOIL ADDITIONS

A. All soil amendments shall be submitted and approved by the Engineer prior to use. Soil amendments shall be determined based on cover soils used and potential nutrient deficiencies with those soils. Amendments that might be used include:
   1. Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Osmocote, composted manure, or Engineer approved equal to minimize deficiencies of the topsoil. If composted manure is to be applied, test the nutrient content and interpret before it is used.
   2. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.
   3. Wood chips: Wood chips shall have a relatively large surface area to volume ratio to be more easily broken down in the soil. Incorporate wood chips at low rates (0.5 ton/ AC) in order to assure the carbon to nitrogen ratio in soil is at favorable conditions for plant germination and growth. If higher rates are used, add nitrogen fertilizer to assure nutrient availability to plants.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation of the surface to be seeded.
   1. If landfill surface has been compacted due to traffic or other, loosen the upper surface to a maximum depth of 4 inches to prepare it for seeding. Large clods and stones, or other foreign material should not be present on the landfill surface that could interfere with seeding equipment.
   2. Do not till on ground that is already loose to a depth of 2 in. or more.
   3. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition. To minimize dust problems for adjoining areas, do not till when wind speeds exceed 10 miles per hour (mph).
   4. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a 24-hour period.

B. Soil Amendments/Additions

1. If soil amendments are used, uniformly apply to prepared seedbed in accordance with manufacturer recommended rates.

C. Prepare seedbed again if prior to seeding, the Engineer determines that rain or some other factor has affected prepared surfaces and that it may prevent seeding to proper depth.

D. On excessively steep slopes (steeper than 2:1), hydraulic/broadcast seeding may be appropriate. If seeding in this fashion, multiply application rate of seed by a factor of 2.

E. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.02 APPLICATION OF SEED

A. General:

1. Avoid seeding between October 1 and April 15. Provide for temporary soil stabilization measures between these dates. Do not seed during windy weather, or when topsoil is dry, saturated or frozen.
2. Equip seed boxes used for drill and broadcast seeding with an agitator.
3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.
4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.
5. Seeding equipment shall be calibrated as appropriate to distribute seed at the specified rates.
6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.
7. Use markers to ensure that no gaps will exist between passes of seeding equipment.
8. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.

B. Drill Seeding (landfill surface shall be drill seeded unless otherwise approved by the Engineer):

When drill seeding, plant seed mix at a rate of 30 - 35 PLS lbs/acre. Uniformly apply prescribed mix over area to be seeded as follows:

1. Accomplish seeding operations, where practical, by drilling in a direction across slope and along the contour.
2. Plant seeds approximately 1/4 inch deep. Do not exceed 4 inches distance between drilled furrows. If furrow openers on drill exceed 4 inches, drill area twice to obtain a 4-inch distance between furrows.
3. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.
4. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
5. Prohibit vehicles from traveling over the seeded areas.

C. Broadcast Seeding (small areas may be broadcast seeded as approved by the Engineer):

When broadcast seeding, plant seed mix at a rate of 32 - 37 PLS lbs/acre.

1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.
2. Immediately following seeding operation, thoroughly rake seedbed to provide approximately 1/4 inch of soil cover over of the seed.
3. If hydraulically applying mulch as part of the broadcast seeding process, use a 2-step process. Apply seed with a tracer. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
4. Prohibit vehicles from traveling over the seeded areas.

3.03 STRAW MULCH: for slopes flatter than 3:1, Non-irrigated Projects

A. Apply straw mulch at a minimum rate of 1.5 tons per acre of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80 percent ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 inches. Do not mulch when wind velocity exceeds 10 mph.

B. Straw mulch shall only be used where use of crimping equipment is practical. Place mulch in manner noted above and anchor the straw into the soil to a minimum depth of 2 inches and not to exceed 3 inches. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges, and spaced no more than 9 inches apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in perpendicular directions. Do not use Sheep's Foot Rollers, heavy equipment tracks, and standard disc cultivators for crimping.

C. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lb. of wood fiber with a minimum 150 lbs. to 200 lbs. of tackifier to anchor straw mulch. Apply mixture at a rate of 250 - 300 lbs/acre.

D. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material

3.04 HYDRAULIC MULCHING/TACKIFIER: for slopes flatter than 2:1, Irrigated Projects

A. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2000 lbs/ acre.

B. Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.

C. When using plantago based tackifier as mulch, apply tackifier at a rate of 150 lbs/acre.
D. Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.05 EROSION CONTROL BLANKET

A. Place blankets over native grass seeding immediately following the raking/chaining operation.
B. Install per manufacturers recommendations

3.06 WATERING

A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free of oil, acid, salt or other substances harmful to plants) to previously seeded and mulched areas.
B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.
C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.
D. Apply water at a maximum of 0.5 in. per hour for 2 hours. Additional applications of water may be made as designated by the Engineer.

3.07 MAINTENANCE

A. Begin maintenance immediately after planting. Keep re-vegetated areas free of noxious weeds.
B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.09 ACCEPTANCE.
C. Reseed significant areas where vegetation has not been adequately established as determined by the Engineering Post-Closure Inspections to be performed.

3.08 CLEANUP AND PROTECTION

A. Protect seeded areas, work and materials from damage due to vehicles, pedestrians, and operations by other subcontractors. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.
B. Upon completion of all seeding operations, clean the portion of the project site used for storing materials and equipment of all debris. Remove all superfluous materials and equipment from the project site. Sweep walks and pavement clean upon completion of work in this section.

3.09 ACCEPTANCE

A. Seeded areas will be reviewed for acceptance by the Engineer when final stabilization has been achieved. Final stabilization is defined as “All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of a minimum of 70 percent of the native background vegetative cover for the

area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed." Stabilization shall be in conformance with the Storm Water Pollution Prevention Plan (SWPPP), as applicable.

B. In the event that all other work required by the Subcontract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION

SECTION 02980

CHAIN LINK FENCE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section shall consist of furnishing and erecting temporary construction fence in accordance with these specifications and the details, lines and grades shown on the plans or as established by the Engineer.

B. Any fencing disturbance to the existing permanent airport fencing shall be replaced according to this specification and coordinated with the Los Alamos County Airport Management.

C. Existing fence can be relocated and reused in its entirety as construction fencing as shown on the plans, and described herein.

1.02 QUALITY ASSURANCE

A. The Airport perimeter fencing height will comply with the FAA Landing and Taxiway obstruction requirements. Any changes to the Airport fencing shall be coordinated with the Los Alamos County Airport Manager and the Owner.

B. The fencing work and material under this section shall conform to the recommended practice outlined in the following standards and as required by this specification.

1. American National Standards Institute (ANSI)/ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
2. ANSI/ASTM F567 – Installation of Chain-Link Fence.
3. ASTM A116 – Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
4. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, or Ordinary Uses.
5. ASTM A121 – Zinc-Coated (Galvanized) Steel Barbed Wire.
6. ASTM A153 – Zinc-Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A392 – Zinc-Coated Steel Chain-Link Fence Fabric.
8. ASTM A428 – Weight of Coating on Aluminum-Coated Iron or Steel Articles.
9. ASTM A491 – Aluminum-Coated Steel Chain Link Fence Fabric.
10. ASTM A569 – Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and

a. Strip Commercial Quality.

11. ASTM A585 – Aluminum Coated Steel Barbed Wire.
12. ASTM C94 – Ready-Mixed Concrete.
13. ASTM F573 – Residential Zinc-Coated Steel Chain Link Fence Fabric.
14. ASTM F668 –PVC Coated Steel Chain Link Fence Fabric.

15. Chain Link Fence Manufacturers Institute (CLFMI) – Product Manual.
16. FS RR-F-191 – Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories).

1.03 SUBMITTALS

A. Submit copies of the manufacturer's latest published literature and data on fabric, posts, accessories, fittings, and hardware for chain link fence.
B. Submit shop drawings showing details of each element. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
C. Submit two samples of fence fabric, illustrating construction and finish for chain link fence.
D. Each roll of fabric shall carry a tag showing the kind of base metal, or plastic, the kind of coating, the gauge of the wire, the length of fencing or fabric in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal, and kind of coating.

PART 2 MATERIALS

2.01 WIRE (Fabric)

A. New fabric wire shall be of a similar height and material to the existing fence and shall have a base metal of steel with a tensile strength of 75,000 lbs per square in. and galvanized in conformance with the requirements of ASTM A392, Class II. Wire will be of 9-gauge and have a nominal diameter of 0.148 in. being woven in a 2-in. mesh. Fence for Airport perimeter to be coated to match existing fencing and fence for walls shall be galvanized.

2.02 POSTS, RAILS, GATES, AND BRACES

A. Posts, rails, gate(s), and braces shall be of galvanized steel conforming to the requirements of ASTM F1083 and shall also conform to the requirements listed in Table 02980-1. Braces shall be provided for each gate, corner, pull, and end post and shall consist of a brace extending to each adjacent line post at mid-height of the fabric and a rod not less than 3/8-in. in normal diameter, or equivalent, from line post back to gate, pull or end post, with a turnbuckle or equivalent, for adjustment as shown on plans.
B. Top rails shall be lengths not less than 10 ft and shall be fitted with expansion couplings for connecting the lengths into a continuous run. Couplings shall be not less than 6 in. long, shall allow for expansion and contraction of the rail, and shall be approved by the Engineer.

TABLE 02980-1

POSTS AND RAIL SIZES AND WEIGHTS

Use and Section	O.D.	Weight/Lb/Ft.
Gate Posts	4.00	9.11
Corner Posts	2.875	5.79
End Posts, Pull Posts	2.875	5.79
Intermediate Posts	2.375	3.65
Top Rail and Postbrace	1.660	2.27

Gate Rails (Frame)	1.90	2.72

2.03 WIRE TIES AND TENSION WIRE

A. All wire fabric ties, wire ties, hog rings, and tension wire shall be zinc-coated steel core wire. Tension wire shall have a minimum tensile strength of 80,000 psi. Zinc coating shall be .30 oz. per square foot. Tension wire shall be 6-gauge.

2.04 MISCELLANEOUS FITTINGS AND HARDWARE

A. Miscellaneous fittings and hardware shall be zinc-coated steel, wrought iron, malleable iron, or pressed steel and shall be equal to materials specified in FS RR-F-191/4B.

2.05 GATES

A. Structural members of gates shall be fully welded on all sides and faces of joints at exposed edges. Surplus welding material shall be removed. Gates shall be swing gates or sliding gate as indicated on plans and specifications. Gates shall include all hardware and appurtenances including latches, plunger pins, etc.

B. Hinges for gate(s) shall be the pin type and shall be heavy-duty, malleable iron. Shop drawings will be required with the hinges being subject to the Engineer's approval.

2.06 CONCRETE

A. Concrete for setting posts shall have a minimum compressive strength of 3,000 psi and conform to NMDOT standards.

PART 3 EXECUTION

3.01 CLEARING FENCE LINE

A. The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. All holes shall be filled with common borrow or excavated material at the direction of the Engineer. When required, the Contractor shall grade the ground surface so that the fence elevation shall conform to existing or future structures. The fence line shall be cleared to a minimum width of 10 ft on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps to be removed shall be grubbed or excavated. All holes remaining after the clearing and grubbing operations shall be refilled with suitable soil, gravel, or other material acceptable to the Construction Manager and shall be compacted properly with tampers.

B. Disturbed areas shall be seeded and mulched as directed by the Engineer and as specified in Section 02932.

3.02 CONSTRUCTION FENCE

A. Construction fence shall consist of new fence, as specified, and may be existing fence labeled as "to be removed' or "to be relocated." The existing fence may be reused and installed as construction fence to the lines and grades shown on the plans.

1. Line posts shall be spaced not more than 10 ft on centers in the line of fence. End or pull posts shall have a 500-ft maximum spacing.
2. End posts shall be installed in concrete foundations as shown on drawings. Line posts shall be installed in earth foundations. Concrete foundations shall extend one (1) in. above the ground at the posts, with a slope to match existing grade at the foundation's edge. All posts shall be set vertical, true to alignment, and securely embedded in earth or concrete foundations as required.
3. After the concrete has been allowed to cure for 2 days, for the end posts, fabric, braces, and rails shall be attached. The fabric shall be attached to the posts and rails at a sufficient number of points to ensure a firm, rigid, and unyielding attachment, and shall be a maximum of two (2) in. clear of the pavement or ground surface. The fabric shall be stretched between posts so that no bends or loose places in fabric will result. Lengths of fabric shall be spliced by bringing the fabric ends close together and weaving in a picket in such a way that it engages each individual mesh of the fabric ends. Brace rails and truss rods shall be provided at all fence corners and ends.
4. The bottom of the fence shall be placed a uniform distance above the finished ground surface except where allowance is made for the irregularities in the ground contour.

3.03 GROUNDING

A. All fence shall have at least one ground for every 500 ft of fence, at end posts, and on each side of gates. The ground shall consist of a 5/8-in. diameter copper-clad rod driven a minimum of 8 ft into the earth and attached to the fence by a copper wire and grounding clips to obtain a maximum resistance of 25 ohms and in accordance with the plans and as approved by the Engineer.

3.04 CLEANING UP

A. The Contractor shall remove from the vicinity of the completed work all tools and equipment belonging to him or used during construction. All piles of soil shall be leveled and all brush or debris of any nature shall be removed from the site.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed shall include the construction of the aircraft hangar slab, concrete box culvert, and other cast-in-place concrete. The work may also include the construction of manholes and other drainage structures if precast structures are not utilized. Mix design, sampling, testing and inspection of concrete are also included.

1.02 QUALITY ASSURANCE

A. Perform cast-in-place concrete work in accordance with ACI 301 unless specified otherwise.

1.03 TESTS

A. Testing of concrete mix will be performed by independent testing laboratory appointed by the Contractor. The Contractor shall include costs for all testing. Copies of test results will be furnished by the Contractor to the Engineer. Contractor shall submit the name of the testing laboratory to the Engineer for approval.

B. Prior to the start of concrete work:
   1. Submit concrete mix design for each classification of strength, slump and air entrainment.
   2. Mix sample batches of each concrete mix design specified.
   3. Take three test cylinders for each sample batch for compression test at seven and twenty-eight days.
   4. Cylinders will be cured and tested to determine criteria for judging quality of concrete placed during construction.

C. Sample concrete in accordance with ASTM C172.

D. Make slump test in accordance with ASTM C143 for each ten cubic yards or per truck load of delivered concrete. Furnish material and assistance required to make tests.

E. Test air content in accordance with ASTM C231.

F. Cure test cylinders in accordance with ASTM C192.

G. Make one set of three cylinders for each classification of concrete placed in one day, and for every 100 cubic yards of concrete placed. Make and test additional cylinders when deemed necessary by the Engineer. Lab cure two of the three cylinder specimens and field cure the remaining one. Make tests in accordance with ASTM C39.

H. Compression tests of test cylinders will be made in accordance with ASTM C31 at 28 days.

I. Seven-day tests may be used provided that the relation between seven and 28-day strengths of the concrete has been established by earlier testing.
J. Furnish cylinder molds, materials, and assistance required for preparation of test cylinders.
K. Single use 6 inch by 12 inch paper cylinder molds may be used if they comply with ASTM C470.
L. Do not remove forms from or apply loads to concrete structures for which strength tests have not been made and results of which have not equaled or exceeded minimum requirements.
M. In cases where average cylinder strengths are below minimum required values, the Engineer shall have the right to require conditions of temperature and/or moisture necessary to secure the required strength and may require load or core tests to be made on affected portions of the Work.

1.04 RELATED SECTIONS

A. SWPPP for Los Alamos Airport Landfill Cover Replacement.
B. Construction Quality Assurance Plan for Los Alamos Airport Landfill Cover Replacement, July 2015.

1.05 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete for Buildings.
B. ACI 305 – Hot Weather Concreting.
C. ACI 306 – Cold Weather Concreting.

1.06 SHOP DRAWINGS AND SUBMISSIONS

A. Submit shop drawings and product data for all products under the provisions of Section 01340.
B. Submit shop drawings of reinforcing steel.
C. Shop Drawings for reinforcement, for fabrication, bending and placement of concrete reinforcement shall comply with ACI SP-66 (04), "ACI Detailing Manual," ACI 315-99 and ACI 315R-04, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Indicate bar sizes, spacing, locations and quantities of reinforcing steel, and wire fabric, bending and cutting schedules, and supporting and spacing devices.
D. Submit Steel producer's certificates of mill analysis, tensile tests and bend tests.
E. Submit test results.
F. Submit color samples (if any).
G. Submit written procedures for protection of concrete construction in accordance with ACI
H. 301, ACI 305 for Hot Weather Construction, and ACI 306 for Cold Weather Construction.

PART 2 PRODUCTS

2.01 CEMENT (ACI 301 2.1)

A. Use one brand and type of cement throughout project unless otherwise specified.

B. Cement: Air entraining-type 1A. ASTM C150.

2.02 ADMIXTURES

A. Type and dosage of admixture: conform to manufacturer's instructions for temperature conditions.

B. Air entraining admixtures: conform to ASTM C260, and contain no chlorides. Maximum air content shall be six percent, plus or minus one percent of volume of concrete when tested in accordance with ASTM C173. Use air-entraining admixtures in concrete exposed to weathering and at other concrete work at Contractor's option.

C. Water reducing admixtures: hydroxylated carboxylic acid type conforming to ASTM C494, Type D with one exception that:
   1. Maximum shrinkage: maximum 100 percent of control mix.
   2. Relative durability factor: minimum 100 percent of control mix.
   3. Use only as approved by Engineer.

D. Do not use calcium chloride in concrete containing aluminum items.

2.03 MIX DESIGN (ACI 301 3.2)

A. Provide 28-day compressive strength as follows:

Location	Min. 28-Day Compressive Strength (psi)	Water-Cement Ratio by Weight
All	4,000	0.35 Air entrained

B. Provide over design factor for concrete mix of 1.15.

2.04 SLUMP

A. Slump for consolidation by vibration: 4 inches. Slump for consolidation other than by vibration: 5 inches.

2.05 PROPORTIONS (ACI 301 3.8)

A. Selection of proportions for normal weight concrete: Method 1.

2.06 REINFORCING STEEL (ACI 301 5.2)

A. Reinforcing Steel: 60 yield grade; deformed billet steel bars, ASTM A615; plain finish.

2.07 EXPANSION JOINTS (ACI 301 6.2)

A. Premolded Expansion Joint Filler: type required shown on Drawings, conforming to ASTM D1751. or ASTM D1752, Type III "Self-Expanding Cork," where indicated. The thickness and profile to match joint design.

2.08 ACCESSORIES

A. Bonding Agent: two component modified epoxy resin; Sikadur Hi-Mod manufactured by Sika Chemical Co. or Epoxtite Binder Code 2385 manufactured by W.R. Grace & Co. Polyvinyl bonding Agent shall be "Weld-Crete" manufactured by Larsen Products Corp., or approved equal.

B. Non-Shrink Grout: Grout shall be a premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing a minimum compressive strength of 2,400 PSI in two days; 7,000 PSI in 28 days.

PART 3 EXECUTION

3.01 GENERAL

A. Install concrete work in accordance with ACI 301 except as amended by this Section.
B. Notify the Engineer a minimum 24 hours prior to placement of any concrete.
C. Transport concrete from mixer to place of final deposit in a continuous manner to prevent separation or loss of material and as rapidly as practicable until the unit of operations is complete. Do not use concrete which has reached an initial set or has contained water for more than one hour.
D. Deposit concrete as nearly as practicable to final position to prevent segregation from rehandling.
E. Compact concrete immediately after placing by thoroughly agitating the mass to force out air pockets and work the mixture into corners, around reinforcement and inserts, and prevent formation of voids. Do not use vibrators to move concrete horizontally.
F. Do not deposit concrete in or under water without the permission of the Engineer.
G. Fresh concrete shall not be placed on concrete which has hardened sufficiently to cause formation of cold joints or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located at points as provided for on the Drawings or as approved by the Engineer. When work is resumed, concrete previously placed shall be thoroughly cleansed of foreign materials and laitance, using a stiff wire brush or other tools, and a stream of water if necessary, and then slushed with grout consisting of one part Portland Cement and two parts sand.
H. Free drop of concrete from more than five feet will not be allowed. Where greater drops are required, a tremie shall be employed. Discharge of the tremie shall be controlled such that the concrete may be effectively compacted into horizontal layers not exceeding twelve inch in thickness with a minimum of lateral movement.
I. Hot weather placement of concrete shall be in strict accordance with Hot Weather Concreting, ACI 305R-91. Subgrades shall be kept moist in hot weather to prevent extraction of water from the concrete.
J. Cold weather placement of concrete shall be in strict accordance with Cold Weather Concreting, ACI 306R-88.

3.02 FORMWORK (ACI 301 4.2)

A. Obtain the authorization of the Engineer for use of earth forms. When using earth forms, hand-trim sides and bottoms, and remove loose dirt prior to placing concrete.

B. Chamfer exposed edges: 3/4 in x 3/4 in unless otherwise noted on the drawings.
C. Tape or seal joints and seams to provide a smooth surface.
D. Make and erect forms so finished concrete will conform to shapes, lines, grades and dimensions shown on Drawings and to produce plumb, even, true concrete surfaces. Form all exposed concrete surfaces.
E. Tie forms together with spreader-ties. Brace and shore forms as required. Design forms to remain in correct position during and after placement of concrete and not to deflect under weight of wet concrete.
   1. Make forms tight to prevent mortar leakage.

3.03 FORM SURFACES PREPARATION (ACI 301 4.4)

A. Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices and embedded parts. Do not apply form release agent where concrete surfaces will receive applied coverings which are affected by agent.

3.04 FINISHING FORMED SURFACES (ACI 301.10.4)

A. Formed Surface Finishes: Provide rough form finish at surfaces not exposed to view. Provide smooth form finish at surfaces exposed to view.
B. Finish concrete surfaces shall meet the requirements of ACI 117-90.

3.05 FINISHING HORIZONTAL SURFACES

A. Horizontal surfaces which will be exposed after completion, i.e., hanger slabs shall receive a broom finish.

3.06 REMOVAL OF FORMS (ACI 301 4.5)

A. Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, and design loads which are liable to be imposed upon it. Verify strength of concrete by compressive test results.

3.07 RESHORING (ACI 301 4.6)

A. Remove load supporting forms only when concrete has attained 75 percent of required 28- day compressive strength, provided construction is reshored.

3.08 WELDING (ACI 5.3)

A. Welding Reinforcing Steel is not permitted without the express approval of the Owner.

3.09 CONSTRUCTION JOINTS (ACI 301 6.1)

A. Install construction joints where shown on Drawings.

3.10 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.
B. Coordinate work involved in forming and setting openings, slots, recesses, sleeves, bolts, anchors or other inserts.

3.11 REPAIR OF SURFACE DEFECTS (ACI 301 9.1)

A. Allow the Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Modify or replace concrete not conforming to required lines, detail and elevations.

C. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Do not patch, repair or replace exposed concrete except upon express direction of the Engineer.

3.12 CURING AND PROTECTION

A. Curing shall be in accordance with recommended practice for curing concrete ACI 308-92.

1. Apply specified curing and sealing compound to concrete surfaces as soon as final finishing operations are complete (within two hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

END OF SECTION

SECTION 03400

PRECAST CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes requirements for providing precast concrete structures including storm drain structures, manholes, and other specified miscellaneous structures to the size, shape, and extent in accordance with the contract documents.

1.02 QUALITY CONTROL

A. Precast concrete shall be supplied by a qualified firm with a minimum of 2 years of continuous operation experience.

B. Contractor shall not place the order for precast structures until order is reviewed and approved by the Engineer.

C. The manufacturer or supplier shall provide the Owner, prior to delivery of precast structures for an order, a Certificate of Compliance with the Contractor's name, section sizes, footage, or number of pieces required to fill the order.

D. The Owner reserves the right to inspect and test all precast structures, fittings, and joint material after delivery to the site or at the factory. The manufacturer or supplier shall furnish materials for the tests and labor as required to assist the Owner with the tests.

E. Only approved precast concrete structures shall be shipped to the contract site.

1.03 SUBMITTALS

A. Contractor's drawings.

B. Submit the following Contractor's drawings in accordance with Section 01340:

1. Shop drawings showing complete details, pertinent calculations, design loads, materials, strengths, sizes and thicknesses, joint and connection design, and details for all precast structures.

C. Installation methods for precast sections:

1. This submittal may be waived when the manufacturer has his recommended methods on file with the Owner.

D. Test reports:

1. Submit manufacturer's certified test reports.

1.04 DELIVERY, STORAGE AND HANDLING

A. Precast structures are considered suitable for handling to transport to the contract site after the concrete has cured to minimum strength of 80% of the design strength.

B. Delivery of precast structures shall be coordinated with installation or shall be unloaded with proper equipment along the line of work, outside work limits as near as practicable to point of final placement. They shall be stored off the ground on wood blocks, pallets, or other appropriate means away from brush, poison oak or ivy, and in an accessible area for inspection. Excavated material shall not be placed over or against the stored precast structures.

C. Precast structures and appurtenances shall be unloaded and handled with a crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings and lifting devices to protect the material from damage.

D. If damage occurs and is deemed repairable, it shall be repaired as directed by the Owner in accordance with approved manufacturer's recommendations. If damage is not repairable in the opinion of the Owner, such items of material will be rejected and shall be removed and replaced at the Contractor's expense.

PART 2 MATERIALS

2.01 PRECAST CONCRETE MANHOLE(S), INLETS, AND TRENCHES

A. General

1. Precast concrete shall meet requirements of ASTM C478 and be designed to withstand an HS-20 loading. In addition, the minimum compressive strength of the concrete shall be 4,000 psi and shall have a minimum compression cylinder test of 4,000 psi, any variance being in accordance with ASTM C478; and with joints meeting requirements of ASTM C443. Cement will be Portland, Type II with an Air Content of 5% to 7% as determined in accordance with ASTM C 231. Concrete shall be comprised of cementatious material, water, fine and course aggregate, and add mixtures. The cementatious material shall be Portland or blended hydraulic cement and pozzolan where appropriate.
2. Precast concrete sections shall conform to NMDOT Section 662.2. Furnish in lengths of 1-ft minimum, except not more than one 1-ft section shall be used in a manhole. Precast manhole cone section shall have bolt inserts provided. Inserts shall be embedded a minimum of 3 in., accommodate 9.75-in.-diameter bolts. Inserts shall be provided with plugs for transporting from plant to contract site.
3. Each concrete section shall be clearly marked on the inside near the top with the following information where applicable: ASTM Specification designation, manhole setting number (bases only), date of manufacture, and name or trademark of manufacturer. Markings may be engraved or stenciled with waterproof paint or ink in minimum 1-in.-high letters.
4. Precast concrete grade rings shall meet requirements of ASTM C478, except the minimum strength of the concrete shall be 5,000 psi using Type II cement. Rings shall be drilled with holes 1.5 to 2-in.-diameter to accommodate frame anchor bolts. Grade rings with cracks or fractures passing through the height of the ring and any continuous crack extending for a length of 3 in. or more will be rejected. Planes of the surfaces of the

ring shall be within the limits of plus or minus 0.25- in. of horizontal and vertical.

5. Steps shall be a minimum 1-ft wide with a 1-ft center to center spacing, drop front type, and meet the requirements of ASTM C478.
6. Precast concrete materials for trench sections shall conform to NMDOT Section
7. 662.2. Furnish in lengths to minimize number of joints. Supply a closed end on each trench. Sections to be supplied ¾" quick thread rods and steel plate.

A. Gasket Connectors

1. Each manhole precast section shall be fitted with an "O" ring type gasket that conforms to NMDOT Section 662.25.
2. Each joint of the precast trench section will be joined with a Concrete Sealants Inc., sealer type CS-440. The interior of the trench will be painted with a Sika Corporation type Sikaflex 1A material.

2.02 BITUMINOUS COATING

A. All exterior surfaces of precast structures shall be coated with bitumastic material.
B. The bituminous coating shall conform to NMDOT Section 662.26.

2.03 GRATE AND FRAME

A. Manhole covers shall conform to NMDOT Section 662.27.
B. Castings shall be suitable for AASHTO HS-2O loading.
C. Trench grate and frame will be ductile iron, 80-55-06.

PART 3 EXECUTION

3.01 GENERAL

A. Completion of the work shall be in accordance with Section 02720, Storm Drain System

3.02 BACKFILLING

A. Backfilling shall be completed in accordance with Section 02200, Earthwork.

END OF SECTION

DIVISION 6

GEOSYNTHETICS

SECTION 06005

LINEAR LOW DENSITY POLYETHYLENE GEOMEMBRANE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Work includes the manufacture, supply, delivery, testing, and installation of smooth linear low density polyethylene (LLDPE) flexible geomembrane for channel lining and vertical barrier between new airport hangar and landfill waste. The work includes furnishing all materials, labor, supervision, tools, equipment that may be necessary to construct the work in accordance with the Contract Documents. The requirements of this specification have been reduced compared to a typical specification in light of the intended use and in consideration of the limited quantity of material required.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications
   1. The LLDPE manufacturer(s) shall be a specialist in the manufacturing of LLDPE geomembrane, and shall have produced and supplied at least 5 million ft^2 of said material that were used in successful applications.

B. Contractor's Geosynthetics Installer Qualifications
   1. The Contractor's Geosynthetics Installer (Installer) shall meet the requirements of this Section. The Installer shall be responsible for the performance of the Installer and the installed geosynthetics.
   2. The Installer shall be experienced in all aspects of LLDPE geomembrane handling, storage, and installation. The Installer shall have successfully installed at least 5 million ft^2 of polyethylene geomembrane within the last 5 years, and be trained and approved by the manufacturer to install the geomembrane materials.
   3. The Installer shall employ a field supervisor experienced in the installation of polyethylene geomembrane. This individual shall have installed or supervised the installation of a minimum of 2,000,000 ft^2 of polyethylene geomembrane on a minimum of five (5) different projects.
   4. Each welder is required to have a minimum of 1 year of experience welding polyethylene geomembrane, except that the master welder shall have a minimum of three (3) years experience welding polyethylene geomembrane.

C. Geosynthetics Testing Laboratory Qualifications
   1. Independent testing of the material is not required. However, the Engineer reserves the right to require testing of the material at an independent testing laboratory. The testing laboratory, if required, shall be

accredited by the Geosynthetic Institute to perform the tests required in these Specifications.

D. Materials Testing

1. Material testing shall be completed by the manufacturer in accordance with its Quality Control/Quality Assurance Plan.

1.03 SUBMITTALS

A. General

1. The Contractor shall submit to the Engineer for review and approval the following information:
   a. Name of Manufacturer.
   b. Manufacturer's quality control test results – certified test results.
   c. A Certificate of Compliance along with QC test results from the manufacturer stating that the polymer (raw material) used to manufacture the geomembrane and the geomembrane to be delivered to the site meets all of the physical property requirements presented in Table 06005.
   d. The manufacturer shall warranty the product while the installer shall warranty the installation.
   e. Proposed installation panel layout drawings, including panel and seam identification, panel orientation, seaming details, and penetration details. Engineer or Owner approval of these drawings does not relieve the Installer of the responsibility to properly install/lay out the geomembrane. The proposed panel layout drawing is tentative and may be modified by the Engineer.
   f. Manufacturer's recommended product defect repair and construction repair procedures.
   g. Manufacturer's recommended field seaming procedures and techniques, including: methods, overlap, personnel identification, QA/QC of seaming operations, temperatures, and preparation of materials.
   h. Manufacturer's nondestructive and destructive seam testing procedures, including: type(s) of tests, a list of equipment required, frequency of tests with locations, methods, qualifications of personnel that perform the tests, and acceptance/rejection criteria for tested seams.
   i. Installer's daily quality control (QC) log and Report of Welds format to be used during geomembrane installation.
   j. Method of construction procedures for preparation of earthen subgrade and placement of earthen material above the geosynthetics including method of placement, equipment, and personnel.
   k. The Installer shall provide a Certificate of Compliance from the manufacturer stating that the resin used to produce the geomembrane to be used on this project has an environmental stress crack resistance of greater than 200 hours as tested in conformance with ASTM D5397.
   l. Copies of quality control certificates issued by the resin supplier used to manufacture the geomembrane to be used on this project. These certificates, at a minimum, shall include reports of tests conducted to

verify the material quality, including specific gravity, and melt flow index.

m. Documentation shall be submitted to demonstrate chemical compatibility of the geomembrane with typical municipal solid waste leachate. The chemical compatibility testing shall be performed using the EPA 9090 testing method with all test results submitted for approval to the Engineer.

n. The Installer shall provide a certificate from the manufacturer stating that the geomembrane to be used on this project will have been produced within one year of receipt of material at the site.

Table 06005

Physical Properties of LLDPE Geomembrane Liners

(Minimum Average Roll Values)

Property	Test Method	Units	Required Minimum Value
Gauge Thickness (nominal)	ASTM D5199	mils	40
Sheet Density	ASTM D1505 or D792	g/cm^3	0.92
Tensile Properties – Tensile strength at break–	ASTM D638 Type IV	lb/in	180
Puncture Resistance	ASTM D4833	lbs	60
Tear Resistance	ASTM D1004	lbs	22
Bonded Seam Strength, width	ASTM D4545 mod. (seam testing @ 12” per minute)	lb/in	75
Seam Peel Adhesion, width	ASTM D4545 mod. (seam testing @ 12” per minute)	lb/in	70
Carbon Black Content	ASTM D1603	%	2-3
ESCR	ASTM D5397	hrs	>400

B. Certified Test Reports

1. Certified test reports within the requirements of standards and testing methods specified herein shall be submitted to the Engineer for review and

approval prior to delivery. The geomembrane manufacturer and Installer must satisfy the Engineer that the material they offer to furnish and install shall meet in every aspect the requirements set forth in these Specifications. The Installer shall transmit to the Engineer all information given to them by the manufacturer or supplier prior to approval for furnishing and installing any such material.

2. If the manufacturer uses test methods other than those specified, an explanation of the alternate test method shall be provided.

C. Installer's Qualifications

1. At least three (3) weeks prior to commencement of geomembrane installation, the Installer shall submit written notification to the Engineer of the field supervisor and individual welders' work experience relative to polyethylene geomembrane installation and welding. No geomembrane welding shall begin until the Engineer has received the notifications and has approved the field supervisor and the individual welder qualifications

1.04 DELIVERY, STORAGE, AND HANDLING

A. Liner rolls shall be shipped to the job site in a manner not to damage the rolls. The materials shall be delivered to the site only after the required submittals have been furnished and approved by the Engineer. Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage to any part of the Work. The Installer shall provide labor and equipment to properly unload material upon arrival at the site. The rolls shall be stored and protected from puncture, dirt, grease, direct sunlight, extreme heat, or other damage. They shall be stored on a prepared smooth surface (not wooden pallets) and shall be stacked no more than two rolls high. The material shall be stored in a reasonably-level area that is well-drained, away from oils/fuels, brush, poison oak or ivy, in an accessible area for inspection, and on a smooth surface so that the material is well-supported and not resting on sharp objects that could damage it. Geomembrane rolls shall be underlain by a bedding geotextile. Individual pieces or bundles shall be stored with safe walking space and clearance between them to allow full view for inspection purposes. The protective covers used to wrap each roll of geomembrane, if used by the manufacturer, shall not be removed until immediately before the material is to be installed in the field.

B. Each roll delivered shall have a tag attached that identifies the following:

1. Manufacturer.
2. Product type and thickness.
3. Manufacturer batch code.
4. Manufacturer date.
5. Roll number.
6. Physical dimensions.

PART 2 MATERIALS

2.01 RAW MATERIAL (RESIN)

A. Raw material for the LLDPE geomembrane shall be tested for density and melt index. At a minimum, one sample shall be obtained from each shipping container (typically a railcar) compartment. One (1) test for each of the properties in Table 06005 shall be performed on each compartment sample. The material shall be accepted for production use if all test results conform to the material requirements listed in Table 06005 and are comparable within the various shipment compartments.

2.02 SHEET GEOMEMBRANE

A. The geomembrane shall be smooth LLDPE containing no fillers or extenders.

B. The LLDPE geomembrane shall be tested prior to shipment to ensure that the physical and chemical properties of the finished product are in conformance with the Specifications. The required conformance testing of geomembranes are presented in Table 06005. A 3-ft wide by width of roll (minimum) coupon of geomembrane per every 100,000 ft^2 of geomembrane produced shall be retained intact by the manufacturer until construction of the lining system, for which the geomembrane is used, is complete. These coupons shall be submitted to the Engineer upon request.

2.03 EXTRUDATE RESIN (WELDING ROD)

A. Resin used for extrusion welding adjacent sheets and pipe penetrations shall be LLDPE produced from the same resin as the sheet geomembrane. Physical properties of the extrudate shall be in conformance with Table 06005-1. The resin shall be supplied in black.

PART 3 EXECUTION

3.01 SUBBASE ACCEPTANCE

A. Subgrade soil shall be compacted to provide a firm, unyielding foundation for the liner. All surfaces shall be smooth, free of foreign and organic material, rocks larger than 1/2 inch, any angular rocks, and any sharp objects. Standing water or excessive moisture shall not be allowed.

B. Prior to installation of the geomembrane, the Installer shall verify the conditions of the installed earthen material surface to ensure that this surface represents a smooth, stable surface reasonably free of stones, organic matter, irregularities, protrusions, loose soil, and any abrupt changes in grade. The Installer shall notify the Engineer in writing of acceptance of the prepared earthen surface prior to installation of the geomembrane. This notification shall be consistent with the requirements of the geomembrane supplier for the subbase surface in order to preserve the warranty for the geomembrane.

3.02 INSPECTION OF SHEET GEOMEMBRANE AT JOB SITE

A. The Installer shall be responsible for the inspection of the geomembrane rolls upon their arrival at the job site. Should rolls show damage from transit, they shall be so identified by the Installer and set aside for either return to the manufacturer or repaired in accordance with the manufacturer's recommendations.

B. During unrolling of the geomembrane, the Installer shall carry out visual inspection of the geomembrane surface. Any faulty areas shall be repaired by the Installer using the preapproved techniques. Such repairs shall be recorded on the as-built drawings and reported to the Engineer by means of a daily QC log (see Subsection 3.06). At any point in the Work, if the daily QC log has not been submitted, the Engineer has the right to stop Work at the cost of the Installer until the daily QC log is submitted.

C. During installation of the geomembrane, the Engineer has the option to perform thickness measures at locations along the edges of the geomembrane panel. Any panel deployed having insufficient thickness shall be removed from the site by the Installer at no additional cost to the Owner.

3.03 INSTALLATION

A. General

1. The limits of geomembrane installation shall be as shown on the Drawings. The geomembrane shall be laid out and installed by the approved
2. All geomembrane shall be installed in a down gradient manner to minimize the potential of surface water flowing beneath placed geomembrane.
3. The Installer shall at all times maintain a clean work area to protect the geomembrane from incidental damage. This activity shall be done on an ongoing basis throughout the work. There shall be no smoking, glass bottles, or metal cans allowed in an area where geosynthetics are being installed.
4. When placing materials upon any geomembrane(s) or geotextile(s) the Installer shall stage his operations to minimize/eliminate any wrinkles associated with that operation. Furthermore, the Engineer shall notify the Installer when such wrinkling and associated problems are present. It shall be the responsibility of the Installer to modify his operations to minimize/eliminate this problem at no additional cost to the Owner.

B. Field Panel Placement

1. Adjacent geomembrane panels shall be overlapped a minimum of 6 inches prior to hot wedge seaming, unless the Engineer approves a lesser overlap due to limitations of the Installer's welding equipment. In no case shall an overlap of less than 3 inches be approved. The required minimum geomembrane overlap for extrusion welding shall be no less than 3 inches. If excess overlap exists, the bottom sheet shall be field cut. Areas cut to remove wrinkles or fishmouths in excess of six (6) inches shall be cut along the ridge of the wrinkle and seamed.

C. Seam Preparation

1. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material. No seaming of the LLDPE geomembrane shall be conducted when the material is exposed to moisture from either dew or precipitation. Seams shall be aligned to create the fewest possible number of wrinkles and fishmouths. All seam interfaces shall be visually examined for scratches, blemishes, flaws, and texture.

2. Trimming of seams and patches shall be accomplished using a shielded blade or hook-knife and performed such that all corners are rounded. Whenever possible, the cutting of the geomembrane shall be from the underside, in an upward motion. Any trimming of test strips or patch pieces on the geomembrane shall be performed with a scrub sheet between the geomembrane and the cutting operation. All trimming of seams shall be completed at least 50 ft ahead of seaming operations.
3. For extrusion-welded seams, a small hand-held electric rotary grinder with circular disc grit grinding paper shall be used to remove oxidation at the seam locations. The grinding plate shall be approximately 4 inches in diameter, and No. 80 or No. 100 grit paper shall be used. The depth of the grinding shall be no greater than 10% of the sheet thickness, and in general should only be approximately 5% of the sheet thickness. The grinding shall extend beneath the full width of the extrudate and no greater than 0.25 inch beyond the limit of extrudate after it is placed. Grinding shall precede welding by approximately 15 minutes, and shall be oriented perpendicular to the seam direction rather than parallel to it.

D. Seaming

1. General
   a. The approved seaming techniques for the Work are hot-wedge and extrusion fillet welding.
   b. Welding of LLDPE shall not take place when ambient temperatures are less than 41°F (5°C) or exceed 104°F (40°C), when measured 1 ft above the geomembrane. Weather conditions shall have no precipitation, dew or fog, nor shall winds be in excess of 20 mph during welding.
2. Hot-Wedge Seaming
   a. The operator shall keep constant visual contact with the temperature controls, as well as with the completed seam coming out of the machine. Occasional adjustments of the temperature or speed may be necessary to maintain a consistent weld.
   b. If an excessive amount of squeeze-out is observed, reduce the temperature and/or pressure to correct the situation. Nip/drive roller marks shall be able to be observed visually, but just barely evident to the touch.
   c. Cleaning of the hot-wedge welder shall be performed at least daily.
   d. A smooth-insulating plate or heat-insulating fabric shall be placed beneath the hot-welding apparatus after usage.
   e. Seams exhibiting burnout due to excessive heat or roller slippage shall be repaired in accordance with Subsection 3.04 as directed by the Engineer.
3. Extrusion Fillet Seaming
   a. Grinding of the sheets shall be completed in accordance with Subsection 3.03.C.3. A hot-air welder may be used to tack weld sheets together in order to hold them in proper position for extrusion welding.
   b. The extrusion welder is to be purged of all heat-degraded extrudate in the barrel prior to beginning a seam. This shall be done every time

the extruder is restarted after a 2-minute or longer downtime. The purged extrudate shall be properly disposed of.

c. Extrudate in the form of a molten, viscous bead shall be deposited over the overlapped seam. The center of the extrudate shall be directly over the edge of the upper sheet.

a. The extrudate thickness shall be approximately two times the specified sheet thickness measured from the top of the bottom sheet to the top or crown of the extrudate. Excessive squeeze-out (or flashing) is acceptable as long as it is equal on both sides and does not interfere with subsequent vacuum box testing. Excessive extrudate build-ups shall be removed, and a patch shall be placed if so directed by the Engineer.

b. After seaming, visual inspection of the extrudate bead shall be made, particularly for straight-line alignment, height, and uniformity of surface texture. There shall be no bubbles or pockmarks in the extrudate. Grind marks shall only be visible for no more than 0.25 inch beyond the extrudate. They shall be extremely faint and shall never appear as heavy gouge marks. A patch shall be placed over the entire seam where the excessive grinding is observed.

d. Seam weld runs shall terminate at a panel end or tail off gradually.

e. Where extrusion fillet welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. This restart procedure shall be followed on patches, pipes, fittings, appurtenances, and “T” or “Y” seams.

4. Trial Seams

a. Trial seams shall be made at the beginning of each seaming period (start of day, midday and at the conclusion of the day’s seaming) for each welding apparatus and operator of said apparatus. Trial seams shall be made at least every five hours and every time the seaming equipment or operator is changed. Trial seams shall be made under the same conditions as actual seams (i.e., welding apparatus, electrical cord length, operator, and ambient temperature). The Installer shall make additional trial seams if ambient temperatures vary more than 10°F (0.5°C) from initial trial seam conditions or as directed by the Engineer.

b. The trial seam sample shall be at least 3 ft long by 2 ft wide (after seaming) with the seam centered lengthwise. Seam overlap shall be nominally 4 inches, with a 3-inch minimum.

c. Six adjoining coupon specimens, each 1-inch wide, shall be cut from the trial seam sample by the Installer using a die cutter to ensure precise 1- inch wide coupons. The coupons shall be tested in peel (outside and inside track) and shear using an electronic readout field tensiometer, at a strain rate of 2 in./min, and they shall not fail in the seam (i.e., Film Tear Bond (FTB), failure in the parent sheet material, is required). The specimen shall not fail at a stress less than 25% of the break strength of the parent material in peel or no less than 30% of the break strength in shear.

d. Ideally, samples shall be conditioned at 23± 2°C at a relative humidity of
e. 50± 5% for two hours prior to testing. If test conditions vary from these conditions, a 1-inch wide coupon of the parent geomembrane material (no weld) shall be tested in the same manner as the seam specimens to determine the break strength at this condition.
f. If a coupon specimen fails, the entire operation shall be repeated. If the additional coupon specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. All welded seams installed by the seaming apparatus/operator between the period of time when an acceptable coupon specimen and a deficient coupon specimen were obtained shall be evaluated. The evaluation shall consist of cutting three 12-inch wide by 12-inch long samples from the suspect deficient seam. The samples shall be taken at locations directed by the Engineer. The samples shall be field tested by the Installer in shear and peel. If any of the three samples fail the shear and peel criteria, the entire length of deficient welding shall be repaired in accordance with Subsection 3.04.
g. The test weld samples shall be classified according to GRI-19 standards, marked with the date, roll/seam number, operator, ambient temperature, welding machine number, temperature and load at failure. A copy of this information shall be attached to each coupon specimen, which will be retained by the Engineer.

5. Nondestructive Seam Continuity Testing
   a. The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure testing, or other approved method. Continuity testing shall be carried out as the seaming work progresses in accordance with the following procedures unless otherwise recommended by the geomembrane manufacturer:
   b. Vacuum Testing
      i. A non-detergent soapy solution shall be applied to the surface of the geomembrane immediately prior to testing the seam.
      ii. Test shall be performed with a tank pressure of approximately 5 psi (10 inches of Hg) gauge.
      iii. Examine the geomembrane seam through the viewing window for 10 seconds.
      iv. The next adjoining area shall overlap the previously tested area by a minimum of 3 inches (75 mm).
      v. All areas indicating leaks shall be repaired in accordance with Subsection 3.04.
      vi. Vacuum-tested seams shall be recorded on the daily QC log (Subsection 3.06) including location, date, test unit number, name of tester, and results of test.
   c. Air Pressure Testing
      i. Sustain a pressure of 24 to 30 psi of the air channel for approximately 5 minutes.

ii. If the loss of pressure exceeds 3 psi over a five minute period or does not stabilize, locate the faulty area and repair in accordance with Subsection 3.04.

iii. Verify that the length of the tested channel is unobstructed by cutting the air channel at the end opposite the pressure gauge.

iv. Seal test holes with extrudate.

v. Air pressure tested seams shall be recorded on the daily QC log (Subsection 3.06), including location, date, test unit number, name of tester, and results of test.

3.04 Welding old to new liner.

Follow material manufacturer recommendations for attaching new liner material to existing liner material. Submit to Engineer for approval.

3.05 Anchor trench

The anchor trench shall provide permanent anchoring for the liner and shall be in accordance with the drawings. The trench shall be excavated according to a daily schedule for liner installation. It shall be backfilled incrementally as needed. Backfill soil shall be compacted by rolling with rubber-tired equipment or a manually directed power tamper to provide a stable anchor trench for the liner.

3.06 DEFECTS AND REPAIRS

A. Identification

1. All seams and nonseam areas of the geomembrane shall be evaluated by the Engineer for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane aids in the detection of defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be broomed or washed by the Installer if the amount of dust or mud inhibits inspection.

B. Evaluation

1. Each suspect location, both in seams and in nonseam areas, shall be nondestructively tested using the methods described in Subsection 3.03.D, as appropriate. Each location that fails the nondestructive testing shall be marked by the Engineer and repaired by the Installer. Scratches, abrasions, or other imperfections in the geomembrane and welds that are deemed significant by the Engineer shall be repaired.

C. Repair Procedures

1. Repair procedures shall be agreed upon between the Installer and the Engineer prior to geomembrane installation.
2. Defective seams shall be repaired by reconstruction. Seam reconstruction for the fusion welding process shall be achieved by welding a replacement strip (cap) over the failed seam. The replacement strip shall extend at least 12 inches beyond the faulty seam at all locations and shall be extrusion welded completely around its perimeter. A reconstructed seam shall not consist of extrusion welding the outside edge (flap) of the existing weld.
3. Tears or pinholes or other imperfections shall be repaired by seaming or patching. Patches shall be round or oval in shape, made of the same

material as the geomembrane, and extend a minimum of 6 inches beyond all edges of the defect.

4. Each repair shall be numbered and logged in the Installer's daily QC log.

D. Verification of Repairs

1. Each repair shall be nondestructively tested using the methods described in Subsection 3.03.D, as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs that fail shall be redone and retested until a passing test results. The Engineer shall observe all nondestructive testing of repairs, and record the number of each patch, date, name of patcher, and test outcome.
2. Seam reconstruction areas resulting from failures in destructive sampling shall also have one destructive test performed within the repair area in accordance with Subsection 3.03.D.6.

3.07 DAILY QUALITY CONTROL LOG

A. The Installer shall maintain a daily quality control (QC) log during all phases of geomembrane installation. This log shall document the daily progression of the geomembrane installation from delivery to final acceptance. The daily QC log shall designate those construction activities that influence the integrity of the geomembrane during installation. The log, at a minimum, shall include entries and detailed documentation of the following:

1. Weather (temperature, winds, precipitation).
2. Preparation activities, including removal of water, sediment, geomembrane cleaning, or subbase smoothing and repair.
3. Document that the roll number and sheet lot number are placed in the required panel locations.
4. Maps or sketches indicating material installed during that day, and material installed previously. Maps or sketches shall indicate the amount of material installed that day, the amount installed previously and the total amount installed to date.
5. Repairs and replacements.
6. Document seaming activities, including name of welder(s) for each seam and any leakage detected in testing of that seam.
7. Results and locations of destructive and nondestructive testing performed as part of geomembrane installation, including corrective action taken.
8. Equipment used to place the geomembrane.
9. Calibration dates for each piece of seaming equipment and seam test equipment.
10. Time periods, locations, and procedures administered when tents are used for geomembrane installation during periods of low temperature.

B. Prior to performing the work, the Installer shall submit the daily QC log format for approval by the Engineer.

END OF SECTION

SECTION 06020

GEOTEXTILES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Work includes the manufacture, supply, delivery, testing, storage, and installation of nonwoven geotextiles to be used within the drainage systems as indicated on the Contract Drawings. The Contractor shall supply all equipment, tools, labor, supervision, materials, and quality control required to complete the Work in accordance with the Contract Documents.

1.02 QUALITY CONTROL

A. Manufacturer Qualifications
   1. The geotextile manufacturer(s) shall be specialist(s) in the manufacturing of polyester, polyethylene, and/or polypropylene geotextile (as applicable), and shall have produced and manufactured a minimum of 5 million ft^2 of said geotextiles that were used in successful installations.

B. Materials Testing
   1. Quality control testing of materials shall be as set forth in the applicable referenced Specifications and as required herein.

C. Laboratory Testing
   1. Unless otherwise indicated, testing shall be performed by the manufacturer.

D. Visual Inspection During Installation
   1. During placement of the geotextiles, the Contractor shall carry out visual inspections of the material surface. Any faulty areas relating to material integrity, uniformity, rips or tears, sewing incompleteness, and seam overlap shall be repaired by the Contractor using pre-approved techniques and in accordance with manufacturer recommendations. Such repairs shall be reported to the Owner by means of a daily QC log. At any point in the Work, if the daily QC log has not been submitted, the Owner has the right to stop work at the expense of the Contractor until the daily QC log is submitted.

1.03 SUBMITTALS

A. Certified Test Reports
   1. Certified test reports in accordance with the standards and testing methods specified herein shall be submitted to the Engineer for approval for each geotextile proposed for this project prior to material delivery. The contractor shall provide the engineer with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein. The material

manufacturer and Contractor must satisfy the Owner that the materials they offer to furnish and install shall meet every aspect of the requirements listed in Table

06020 and as stated in PART 2, MATERIALS. The Contractor shall transmit to the Owner all information given to them by the manufacturer or supplier prior to approval for furnishing and installing any such material.

Table 06020. Physical and Mechanical Properties of Geotextiles

Property	Test Method	Required Value
		Nonwoven
Visual Inspection	--	Packaging, visible defects
Weight (typical)	ASTM D5261	16 oz/yd^2
Puncture Resistance	ASTM D6241	1080 lbs
Apparent Opening Size	ASTM D4751	≤ No. 100 Sieve
Grab Tensile Strength	ASTM D4632	380 lbs
Grab Elongation	ASTM D4632	> 50 %
Trapezoidal Tear Strength	ASTM D4533	145 lbs
Permittivity	ASTM D4491	≥ 0.25 sec^2
UV Resistance (@500 Hours)	ASTM D4355	> 70 % strength retained

[1] MARV.

[2] Manufacturer's certification required which states product exceeds required value for typical roll values.

B. Installation And Repair Recommendations
   1. Within three (3) weeks after award of the Contract, submit training or experience records of the installer personnel to the Owner for approval.

C. The Contractor shall submit to the Owner for approval within three (3) weeks after award of the Contract the following information:
   1. Contractor's daily QC log format to be used during geotextile installation. This log shall document the daily progression of geotextile installation from delivery to final acceptance. The daily log shall designate these construction activities that influence the integrity of the geotextile during installation. The log, at a minimum, shall include entries and detailed documentation of the following:
      a. Weather (temperature, winds, precipitation). Repairs and replacements
      b. Document the roll number and location of each roll when placed
      c. Quantity of material installed that day; quantity installed to date be submitted to the Owner for review prior to placement of geotextile in the field.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site only after the required submittals have been approved by the Owner. Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage to any part of the Work. The Contractor shall provide labor and equipment to properly unload material upon arrival at the site. The material shall be stored in a reasonably level, smooth, and well- drained area that is away from sharp objects or rocks that may puncture the material, away from brush, oil, grease, or fuels, and in an accessible area for inspection. Individual rolls shall be stored with safe walking space and clearance between them to allow full view for inspection purposes. To prevent ultraviolet degradation of the material, the protective wrapper on each geotextile roll shall not be removed until the material is ready for use. Any rolls that are delivered without protective wrappers shall be rejected by the Owner at no cost to the Owner. Any rolls of geotextile that will not be installed within 21 days following delivery to the site shall be covered with tarps to protect the rolls from the elements.

B. Transportation of the geotextile shall be the responsibility of the contractor.

C. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.

D. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer’s instructions as to prevent damage.

PART 2 MATERIALS

2.01 GEOTEXTILES

A. The nonwoven needlepunched geotextile specified herein shall be made from staple fiber.

B. The geotextile shall be manufactured from prime quality virgin polymer.

C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from Sun for up to 30 days without any noticeable effect on index or performance properties.

D. Geotextiles shall be provided to meet the minimum physical and mechanical properties outlined in Table 06020 and as designated on the Drawings. The properties shown represent the MARV for the installed materials, unless otherwise indicated.

E. Geotextiles shall be tested by the manufacturer prior to shipment to ensure that the physical and mechanical properties of the finished product are in accordance with these Specifications. The required material properties, test methods, values, and units are presented in Table 06020. Test frequencies shall be one (1) of each test for every 100,000 ft^2 of geotextile produced for this project or as noted in Table 06020.

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

A. The engineer shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the contractor.

B. The engineer may decide to arrange conformance testing of the rolls delivered to the job site. For this purpose, the engineer shall take a sample three feet (along roll length) by roll width according to ASTM Practice D 4354 The sample shall be properly marked, wrapped and sent to an independent laboratory for conformance testing.

C. The pass or fail of the conformance test results shall be determined according to ASTM Practice D 4759.

3.02 INSTALLATION RESPONSIBILITY

A. The Contractor shall be responsible for installing the geotextiles and all components and details associated with these materials.

3.03 GEOTEXTILE PLACEMENT

A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the contractor damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile at his own cost.

B. The geotextile shall be installed to the lines and grades as shown on the contract drawings and as described herein.

C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.

D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.

E. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the contractor, the latter shall repair the damaged materials at his own cost and to the satisfaction of the engineer.

F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the engineer.

G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct Sun light for more than 15 days after installation.

H. The geotextile shall be overlapped as recommended by the manufacturer and approved by the engineer.

I. The contractor shall not use heavy equipment to traffic above the geotextile without approved protection.

J. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.

K. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.

L. Geotextiles shall be placed by the Contractor at the locations and to the limits shown on the Drawings. All seams shall be overlapped a minimum of twelve (12) in.. Seams on slopes shall be oriented with the slope. End-of-roll seams shall be offset a minimum of 5 ft between adjacent roll ends. Cross-slope seams shall be avoided as much as possible.

M. Any damage to the fabric or other geosynthetics shall be repaired by the Contractor (using approved methods) at no expense to the Owner.

N. During periods of high winds, sandbags, or other methods approved by the manufacturer(s) shall be used by the Contractor to temporarily secure any exposed geotextile in place.

3.03 COVERING GEOTEXTILES

A. All geotextiles shall be covered within 21 calendar days, following removal of their protective wrapping and their placement in the field, to protect them from ultraviolet (UV) degradation. The Contractor shall stage construction activities to accomplish the schedule. Any geotextile left exposed longer than the 21 calendar days shall, at the Owner's direction, be removed and replaced at no cost to the Owner.

END OF SECTION

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

July 29, 2015

Joleen Hines
Daniel B. Stephens & Assoc.
4400 Alameda Blvd NE Suite C
Albuquerque, NM 87113
TEL: (505) 889-7752
FAX (505) 889-0258

RE: DBS&A-Dwyer OrderNo.: 1507119

Dear Joleen Hines:

Hall Environmental Analysis Laboratory received 2 sample(s) on 7/2/2015 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1507119**
Date Reported: **7/29/2015**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** LA Borrow
Project: DBS&A-Dwyer **Collection Date:** 7/1/2015 3:00:00 PM
Lab ID: 1507119-001 **Matrix:** SOIL **Received Date:** 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 7471: MERCURY						Analyst:	**JLF**
Mercury	0.13	0.033		mg/Kg	1	7/7/2015 3:30:56 PM	20123
EPA METHOD 6010B: SOIL METALS						Analyst:	**TES**
Arsenic	ND	12		mg/Kg	5	7/13/2015 7:44:28 PM	20147
Barium	91	0.48		mg/Kg	5	7/13/2015 7:44:28 PM	20147
Cadmium	ND	0.48		mg/Kg	5	7/13/2015 7:44:28 PM	20147
Chromium	5.5	1.4		mg/Kg	5	7/13/2015 7:44:28 PM	20147
Lead	8.2	1.2		mg/Kg	5	7/15/2015 3:03:26 PM	20147
Selenium	ND	12		mg/Kg	5	7/13/2015 7:44:28 PM	20147
Silver	ND	1.2		mg/Kg	5	7/13/2015 7:44:28 PM	20147
EPA METHOD 8081: PESTICIDES						Analyst:	**JDC**
4,4´-DDD	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
4,4´-DDE	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
4,4´-DDT	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Aldrin	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
alpha-BHC	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
beta-BHC	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Chlordane	ND	0.62		mg/Kg	1	7/17/2015 1:21:32 PM	20217
delta-BHC	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Dieldrin	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Endosulfan I	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Endosulfan II	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Endosulfan sulfate	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Endrin	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Endrin aldehyde	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
gamma-BHC	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Heptachlor	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Heptachlor epoxide	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Methoxychlor	ND	0.0099		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Toxaphene	ND	0.62		mg/Kg	1	7/17/2015 1:21:32 PM	20217
Surr: Decachlorobiphenyl	101	44.5-156		%REC	1	7/17/2015 1:21:32 PM	20217
Surr: Tetrachloro-m-xylene	108	16-149		%REC	1	7/17/2015 1:21:32 PM	20217
EPA METHOD 8260B: VOLATILES						Analyst:	**DJF**
Benzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Toluene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Ethylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Methyl tert-butyl ether (MTBE)	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2,4-Trimethylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,3,5-Trimethylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** LA Borrow
Project: DBS&A-Dwyer **Collection Date:** 7/1/2015 3:00:00 PM
Lab ID: 1507119-001 **Matrix:** SOIL **Received Date:** 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloroethane (EDC)	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2-Dibromoethane (EDB)	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Naphthalene	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1-Methylnaphthalene	ND	0.19		mg/Kg	1	7/7/2015 4:44:50 AM	20074
2-Methylnaphthalene	ND	0.19		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Acetone	ND	0.72		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Bromobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Bromodichloromethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Bromoform	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Bromomethane	ND	0.14		mg/Kg	1	7/7/2015 4:44:50 AM	20074
2-Butanone	ND	0.48		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Carbon disulfide	ND	0.48		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Carbon tetrachloride	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Chlorobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Chloroethane	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Chloroform	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Chloromethane	ND	0.14		mg/Kg	1	7/7/2015 4:44:50 AM	20074
2-Chlorotoluene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
4-Chlorotoluene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
cis-1,2-DCE	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
cis-1,3-Dichloropropene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2-Dibromo-3-chloropropane	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Dibromochloromethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Dibromomethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2-Dichlorobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,3-Dichlorobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,4-Dichlorobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Dichlorodifluoromethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1-Dichloroethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1-Dichloroethene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2-Dichloropropane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,3-Dichloropropane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
2,2-Dichloropropane	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1-Dichloropropene	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Hexachlorobutadiene	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
2-Hexanone	ND	0.48		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Isopropylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
4-Isopropyltoluene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
4-Methyl-2-pentanone	ND	0.48		mg/Kg	1	7/7/2015 4:44:50 AM	20074

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** LA Borrow
Project: DBS&A-Dwyer **Collection Date:** 7/1/2015 3:00:00 PM
Lab ID: 1507119-001 **Matrix:** SOIL **Received Date:** 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Methylene chloride	ND	0.14		mg/Kg	1	7/7/2015 4:44:50 AM	20074
n-Butylbenzene	ND	0.14		mg/Kg	1	7/7/2015 4:44:50 AM	20074
n-Propylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
sec-Butylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Styrene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
tert-Butylbenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1,1,2-Tetrachloroethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1,2,2-Tetrachloroethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Tetrachloroethene (PCE)	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
trans-1,2-DCE	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
trans-1,3-Dichloropropene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2,3-Trichlorobenzene	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2,4-Trichlorobenzene	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1,1-Trichloroethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,1,2-Trichloroethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Trichloroethene (TCE)	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Trichlorofluoromethane	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
1,2,3-Trichloropropane	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Vinyl chloride	ND	0.048		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Xylenes, Total	ND	0.096		mg/Kg	1	7/7/2015 4:44:50 AM	20074
Surr: Dibromofluoromethane	110	70-130		%REC	1	7/7/2015 4:44:50 AM	20074
Surr: 1,2-Dichloroethane-d4	108	70-130		%REC	1	7/7/2015 4:44:50 AM	20074
Surr: Toluene-d8	94.3	70-130		%REC	1	7/7/2015 4:44:50 AM	20074
Surr: 4-Bromofluorobenzene	97.0	70-130		%REC	1	7/7/2015 4:44:50 AM	20074

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** Los alamos 54-last
Project: DBS&A-Dwyer **Collection Date:** 7/1/2015 3:00:00 PM
Lab ID: 1507119-002 **Matrix:** SOIL **Received Date:** 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 7471: MERCURY						Analyst:	**JLF**
Mercury	ND	0.032		mg/Kg	1	7/7/2015 3:32:46 PM	20123
EPA METHOD 6010B: SOIL METALS						Analyst:	**TES**
Arsenic	ND	2.5		mg/Kg	1	7/13/2015 7:41:56 PM	20147
Barium	77	0.099		mg/Kg	1	7/13/2015 7:41:56 PM	20147
Cadmium	ND	0.099		mg/Kg	1	7/13/2015 7:41:56 PM	20147
Chromium	4.2	0.30		mg/Kg	1	7/13/2015 7:41:56 PM	20147
Lead	7.1	0.50		mg/Kg	2	7/17/2015 11:25:57 AM	20147
Selenium	ND	2.5		mg/Kg	1	7/13/2015 7:41:56 PM	20147
Silver	ND	0.25		mg/Kg	1	7/13/2015 7:41:56 PM	20147
EPA METHOD 8081: PESTICIDES						Analyst:	**JDC**
4,4´-DDD	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
4,4´-DDE	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
4,4´-DDT	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Aldrin	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
alpha-BHC	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
beta-BHC	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Chlordane	ND	1.2		mg/Kg	1	7/17/2015 1:39:50 PM	20217
delta-BHC	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Dieldrin	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Endosulfan I	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Endosulfan II	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Endosulfan sulfate	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Endrin	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Endrin aldehyde	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
gamma-BHC	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Heptachlor	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Heptachlor epoxide	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Methoxychlor	ND	0.019		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Toxaphene	ND	1.2		mg/Kg	1	7/17/2015 1:39:50 PM	20217
Surr: Decachlorobiphenyl	154	44.5-156		%REC	1	7/17/2015 1:39:50 PM	20217
Surr: Tetrachloro-m-xylene	179	16-149	S	%REC	1	7/17/2015 1:39:50 PM	20217
EPA METHOD 8260B: VOLATILES						Analyst:	**DJF**
Benzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Toluene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Ethylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Methyl tert-butyl ether (MTBE)	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2,4-Trimethylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,3,5-Trimethylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

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D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** Los alamos 54-last
Project: DBS&A-Dwyer **Collection Date:** 7/1/2015 3:00:00 PM
Lab ID: 1507119-002 **Matrix:** SOIL **Received Date:** 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloroethane (EDC)	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2-Dibromoethane (EDB)	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Naphthalene	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1-Methylnaphthalene	ND	0.19		mg/Kg	1	7/7/2015 5:12:10 AM	20074
2-Methylnaphthalene	ND	0.19		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Acetone	ND	0.71		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Bromobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Bromodichloromethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Bromoform	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Bromomethane	ND	0.14		mg/Kg	1	7/7/2015 5:12:10 AM	20074
2-Butanone	ND	0.47		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Carbon disulfide	ND	0.47		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Carbon tetrachloride	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Chlorobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Chloroethane	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Chloroform	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Chloromethane	ND	0.14		mg/Kg	1	7/7/2015 5:12:10 AM	20074
2-Chlorotoluene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
4-Chlorotoluene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
cis-1,2-DCE	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
cis-1,3-Dichloropropene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2-Dibromo-3-chloropropane	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Dibromochloromethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Dibromomethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2-Dichlorobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,3-Dichlorobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,4-Dichlorobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Dichlorodifluoromethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1-Dichloroethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1-Dichloroethene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2-Dichloropropane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,3-Dichloropropane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
2,2-Dichloropropane	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1-Dichloropropene	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Hexachlorobutadiene	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
2-Hexanone	ND	0.47		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Isopropylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
4-Isopropyltoluene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
4-Methyl-2-pentanone	ND	0.47		mg/Kg	1	7/7/2015 5:12:10 AM	20074

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D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: Los alamos 54-last
Project: DBS&A-Dwyer
Collection Date: 7/1/2015 3:00:00 PM
Lab ID: 1507119-002
Matrix: SOIL
Received Date: 7/2/2015 11:27:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Methylene chloride	ND	0.14		mg/Kg	1	7/7/2015 5:12:10 AM	20074
n-Butylbenzene	ND	0.14		mg/Kg	1	7/7/2015 5:12:10 AM	20074
n-Propylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
sec-Butylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Styrene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
tert-Butylbenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1,1,2-Tetrachloroethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1,2,2-Tetrachloroethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Tetrachloroethene (PCE)	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
trans-1,2-DCE	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
trans-1,3-Dichloropropene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2,3-Trichlorobenzene	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2,4-Trichlorobenzene	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1,1-Trichloroethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,1,2-Trichloroethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Trichloroethene (TCE)	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Trichlorofluoromethane	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
1,2,3-Trichloropropane	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Vinyl chloride	ND	0.047		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Xylenes, Total	ND	0.094		mg/Kg	1	7/7/2015 5:12:10 AM	20074
Surr: Dibromofluoromethane	102	70-130		%REC	1	7/7/2015 5:12:10 AM	20074
Surr: 1,2-Dichloroethane-d4	94.3	70-130		%REC	1	7/7/2015 5:12:10 AM	20074
Surr: Toluene-d8	96.5	70-130		%REC	1	7/7/2015 5:12:10 AM	20074
Surr: 4-Bromofluorobenzene	99.2	70-130		%REC	1	7/7/2015 5:12:10 AM	20074

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Qualifiers:

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D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
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504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client: HALL ENVIRONMENTAL ANALYSIS LAB
Address: 4901 HAWKINS NE SUITE D
ALBUQUERQUE, NM 87109
Attn: ANDY FREEMAN

Batch #: 150707036
Project Name: 1507119

Analytical Results Report

Sample Number	150707036-001	**Sampling Date**	7/1/2015	**Date/Time Received**	7/7/2015	11:00 AM
Client Sample ID	1507119-001D / LA BORROW			**Extraction Date**	7/15/2015	
Matrix	Soil	**Sampling Time**	3:00 PM			
Comments						

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4,5-TP (Silvex)	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4-D	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4-DB	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dacthal	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dalapon	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dicamba	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dichloroprop	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dinoseb	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
MCPA	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Pentachlorophenol	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Picloram	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
%moisture	1.16	Percent		7/16/2015	JMI	%moisture	

Surrogate Data

Sample Number 150707036-001

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4-Dichlorophenylacetic acid	EPA 8151A	78.8	30-145

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; ID:WA00169; WA:C585; MT:Cert0095; FL(NELAP): E871099

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Client: HALL ENVIRONMENTAL ANALYSIS LAB
Address: 4901 HAWKINS NE SUITE D
ALBUQUERQUE, NM 87109
Attn: ANDY FREEMAN

Batch #: 150707036
Project Name: 1507119

Analytical Results Report

Sample Number	150707036-002	**Sampling Date**	7/1/2015	**Date/Time Received**	7/7/2015	11:00 AM
Client Sample ID	1507119-002D / LOS ALAMOS 54-LAST			**Extraction Date**	7/15/2015	
Matrix	Soil	**Sampling Time**	3:00 PM			
Comments						

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4,5-TP (Silvex)	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4-D	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
2,4-DB	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dacthal	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dalapon	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dicamba	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dichloroprop	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Dinoseb	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
MCPA	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Pentachlorophenol	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
Picloram	ND	mg/Kg	0.01	7/19/2015	JMI	EPA 8151A	
%moisture	9.51	Percent		7/16/2015	JMI	%moisture	

Surrogate Data

Sample Number 150707036-002

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4-Dichlorophenylacetic acid	EPA 8151A	88.8	30-145

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; ID:WA00169; WA:C585; MT:Cert0095; FL(NELAP): E871099

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Client: HALL ENVIRONMENTAL ANALYSIS LAB
Address: 4901 HAWKINS NE SUITE D
ALBUQUERQUE, NM 87109
Attn: ANDY FREEMAN

Batch #: 150707036
Project Name: 1507119

Analytical Results Report

Quality Control Data

Lab Control Sample

Parameter	LCS Result	Units	LCS Spike	%Rec	AR %Rec	Prep Date	Analysis Date
Picloram	0.171	mg/Kg	0.2	85.5	25-188	7/15/2015	7/17/2015
Pentachlorophenol	0.134	mg/Kg	0.2	67.0	8-126	7/15/2015	7/17/2015
Dinoseb	0.113	mg/Kg	0.2	56.5	41-145	7/15/2015	7/17/2015
Dicamba	0.143	mg/Kg	0.2	71.5	33-161	7/15/2015	7/17/2015
Dalapon	0.123	mg/Kg	0.2	61.5	8-102	7/15/2015	7/17/2015
Dacthal	0.151	mg/Kg	0.2	75.5	11-133	7/15/2015	7/17/2015
2,4-D	0.153	mg/Kg	0.2	76.5	48-166	7/15/2015	7/17/2015
2,4,5-TP (Silvex)	0.142	mg/Kg	0.2	71.0	33-167	7/15/2015	7/17/2015
2,4,5-T	0.140	mg/Kg	0.2	70.0	31-142	7/15/2015	7/17/2015

Matrix Spike

Sample Number	Parameter	Sample Result	MS Result	Units	MS Spike	%Rec	AR %Rec	Prep Date	Analysis Date
150707036-002	Picloram	ND	0.214	mg/Kg	0.2	107.0	49-168	7/15/2015	7/17/2015
150707036-002	Pentachlorophenol	ND	0.133	mg/Kg	0.2	66.5	8-126	7/15/2015	7/17/2015
150707036-002	Dinoseb	ND	0.104	mg/Kg	0.2	52.0	41-141	7/15/2015	7/17/2015
150707036-002	Dicamba	ND	0.127	mg/Kg	0.2	63.5	33-161	7/15/2015	7/17/2015
150707036-002	Dalapon	ND	0.086	mg/Kg	0.2	43.0	8-102	7/15/2015	7/17/2015
150707036-002	Dacthal	ND	0.163	mg/Kg	0.2	81.5	11-133	7/15/2015	7/17/2015
150707036-002	2,4-D	ND	0.148	mg/Kg	0.2	74.0	48-166	7/15/2015	7/17/2015
150707036-002	2,4,5-TP (Silvex)	ND	0.135	mg/Kg	0.2	67.5	33-167	7/15/2015	7/17/2015
150707036-002	2,4,5-T	ND	0.152	mg/Kg	0.2	76.0	31-142	7/15/2015	7/17/2015

Method Blank

Parameter	Result	Units	PQL	Prep Date	Analysis Date
2,4,5-T	ND	mg/Kg	0.01	7/15/2015	7/17/2015
2,4,5-TP (Silvex)	ND	mg/Kg	0.01	7/15/2015	7/17/2015
2,4-D	ND	mg/Kg	0.01	7/15/2015	7/17/2015
2,4-DB	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Dacthal	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Dalapon	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Dicamba	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Dichloroprop	ND	mg/Kg	0.01	7/15/2015	7/17/2015

Comments:

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:IDC0013; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; ID:WA00169; WA:C585; MT:Cert0095; FL(NELAP): E871099

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Client: HALL ENVIRONMENTAL ANALYSIS LAB
Address: 4901 HAWKINS NE SUITE D
ALBUQUERQUE, NM 87109
Attn: ANDY FREEMAN

Batch #: 150707036
Project Name: 1507119

Analytical Results Report

Quality Control Data

Method Blank

Parameter	Result	Units	PQL	Prep Date	Analysis Date
Dinoseb	ND	mg/Kg	0.01	7/15/2015	7/17/2015
MCPA	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Pentachlorophenol	ND	mg/Kg	0.01	7/15/2015	7/17/2015
Picloram	ND	mg/Kg	0.01	7/15/2015	7/17/2015

AR Acceptable Range
ND Not Detected
PQL Practical Quantitation Limit
RPD Relative Percentage Difference

Comments:

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; ID:WA00169; WA:C585; MT:Cert0095; FL(NELAP): E871099

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID **MB-20217** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBS** Batch ID: **20217** RunNo: **27565**
Prep Date: **7/13/2015** Analysis Date: **7/17/2015** SeqNo: **827655** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4,4´-DDD	ND	0.0020								
4,4´-DDE	ND	0.0020								
4,4´-DDT	ND	0.0020								
Aldrin	ND	0.0020								
alpha-BHC	ND	0.0020								
beta-BHC	ND	0.0020								
Chlordane	ND	0.12								
delta-BHC	ND	0.0020								
Dieldrin	ND	0.0020								
Endosulfan I	ND	0.0020								
Endosulfan II	ND	0.0020								
Endosulfan sulfate	ND	0.0020								
Endrin	ND	0.0020								
Endrin aldehyde	ND	0.0020								
gamma-BHC	ND	0.0020								
Heptachlor	ND	0.0020								
Heptachlor epoxide	ND	0.0020								
Methoxychlor	ND	0.0020								
Toxaphene	ND	0.12								
Surr: Decachlorobiphenyl	0.063		0.06250		100	44.5	156			
Surr: Tetrachloro-m-xylene	0.064		0.06250		102	16	149			

Sample ID **LCS-20217** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS** Batch ID: **20217** RunNo: **27565**
Prep Date: **7/13/2015** Analysis Date: **7/17/2015** SeqNo: **827736** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4,4´-DDD	0.013	0.0020	0.01250	0	105	46.9	153			
4,4´-DDE	0.013	0.0020	0.01250	0	108	44.2	141			
4,4´-DDT	0.013	0.0020	0.01250	0	106	42.9	149			
Aldrin	0.014	0.0020	0.01250	0	108	37.2	139			
alpha-BHC	0.012	0.0020	0.01250	0	94.4	33	147			
beta-BHC	0.014	0.0020	0.01250	0	115	32.4	163			
delta-BHC	0.015	0.0020	0.01250	0	118	41	150			
Dieldrin	0.013	0.0020	0.01250	0	107	41	138			
Endosulfan I	0.013	0.0020	0.01250	0	106	36.4	146			
Endosulfan II	0.014	0.0020	0.01250	0	109	41.1	135			
Endosulfan sulfate	0.014	0.0020	0.01250	0	115	43.6	150			
Endrin	0.013	0.0020	0.01250	0	107	42.3	150			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID **LCS-20217** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS** Batch ID: **20217** RunNo: **27565**
Prep Date: **7/13/2015** Analysis Date: **7/17/2015** SeqNo: **827736** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Endrin aldehyde	0.014	0.0020	0.01250	0	114	28	151			
gamma-BHC	0.014	0.0020	0.01250	0	109	32.5	150			
Heptachlor	0.014	0.0020	0.01250	0	113	32.8	144			
Heptachlor epoxide	0.014	0.0020	0.01250	0	108	43.5	134			
Methoxychlor	0.014	0.0020	0.01250	0	108	37.7	161			
Surr: Decachlorobiphenyl	0.065		0.06250		103	44.5	156			
Surr: Tetrachloro-m-xylene	0.067		0.06250		107	16	149			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID **mb-20074**	SampType: **MBLK**	TestCode: **EPA Method 8260B: Volatiles**			
Client ID: **PBS**	Batch ID: **20074**	RunNo: **27308**			
Prep Date: **7/2/2015**	Analysis Date: **7/7/2015**	SeqNo: **818573**	Units: **mg/Kg**		

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Methyl tert-butyl ether (MTBE)	ND	0.050								
1,2,4-Trimethylbenzene	ND	0.050								
1,3,5-Trimethylbenzene	ND	0.050								
1,2-Dichloroethane (EDC)	ND	0.050								
1,2-Dibromoethane (EDB)	ND	0.050								
Naphthalene	ND	0.10								
1-Methylnaphthalene	ND	0.20								
2-Methylnaphthalene	ND	0.20								
Acetone	ND	0.75								
Bromobenzene	ND	0.050								
Bromodichloromethane	ND	0.050								
Bromoform	ND	0.050								
Bromomethane	ND	0.15								
2-Butanone	ND	0.50								
Carbon disulfide	ND	0.50								
Carbon tetrachloride	ND	0.050								
Chlorobenzene	ND	0.050								
Chloroethane	ND	0.10								
Chloroform	ND	0.050								
Chloromethane	ND	0.15								
2-Chlorotoluene	ND	0.050								
4-Chlorotoluene	ND	0.050								
cis-1,2-DCE	ND	0.050								
cis-1,3-Dichloropropene	ND	0.050								
1,2-Dibromo-3-chloropropane	ND	0.10								
Dibromochloromethane	ND	0.050								
Dibromomethane	ND	0.050								
1,2-Dichlorobenzene	ND	0.050								
1,3-Dichlorobenzene	ND	0.050								
1,4-Dichlorobenzene	ND	0.050								
Dichlorodifluoromethane	ND	0.050								
1,1-Dichloroethane	ND	0.050								
1,1-Dichloroethene	ND	0.050								
1,2-Dichloropropane	ND	0.050								
1,3-Dichloropropane	ND	0.050								
2,2-Dichloropropane	ND	0.10								

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID **mb-20074** SampType: **MBLK** TestCode: **EPA Method 8260B: Volatiles**
Client ID: **PBS** Batch ID: **20074** RunNo: **27308**
Prep Date: **7/2/2015** Analysis Date: **7/7/2015** SeqNo: **818573** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	0.10								
Hexachlorobutadiene	ND	0.10								
2-Hexanone	ND	0.50								
Isopropylbenzene	ND	0.050								
4-Isopropyltoluene	ND	0.050								
4-Methyl-2-pentanone	ND	0.50								
Methylene chloride	ND	0.15								
n-Butylbenzene	ND	0.15								
n-Propylbenzene	ND	0.050								
sec-Butylbenzene	ND	0.050								
Styrene	ND	0.050								
tert-Butylbenzene	ND	0.050								
1,1,1,2-Tetrachloroethane	ND	0.050								
1,1,2,2-Tetrachloroethane	ND	0.050								
Tetrachloroethene (PCE)	ND	0.050								
trans-1,2-DCE	ND	0.050								
trans-1,3-Dichloropropene	ND	0.050								
1,2,3-Trichlorobenzene	ND	0.10								
1,2,4-Trichlorobenzene	ND	0.050								
1,1,1-Trichloroethane	ND	0.050								
1,1,2-Trichloroethane	ND	0.050								
Trichloroethene (TCE)	ND	0.050								
Trichlorofluoromethane	ND	0.050								
1,2,3-Trichloropropane	ND	0.10								
Vinyl chloride	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: Dibromofluoromethane	0.53		0.5000		106	70	130			
Surr: 1,2-Dichloroethane-d4	0.47		0.5000		93.4	70	130			
Surr: Toluene-d8	0.49		0.5000		97.9	70	130			
Surr: 4-Bromofluorobenzene	0.49		0.5000		98.4	70	130			

Sample ID **lcs-20074** SampType: **LCS** TestCode: **EPA Method 8260B: Volatiles**
Client ID: **LCSS** Batch ID: **20074** RunNo: **27308**
Prep Date: **7/2/2015** Analysis Date: **7/6/2015** SeqNo: **818574** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.050	1.000	0	104	70	130			
Toluene	1.1	0.050	1.000	0	106	70	130			
Chlorobenzene	1.0	0.050	1.000	0	104	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID	**lcs-20074**	SampType:	**LCS**	TestCode:	**EPA Method 8260B: Volatiles**
Client ID:	**LCSS**	Batch ID:	**20074**	RunNo:	**27308**
Prep Date:	**7/2/2015**	Analysis Date:	**7/6/2015**	SeqNo:	**818574** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	1.2	0.050	1.000	0	121	60.6	134			
Trichloroethene (TCE)	1.1	0.050	1.000	0	107	70	130			
Surr: Dibromofluoromethane	0.57		0.5000		113	70	130			
Surr: 1,2-Dichloroethane-d4	0.52		0.5000		104	70	130			
Surr: Toluene-d8	0.49		0.5000		97.8	70	130			
Surr: 4-Bromofluorobenzene	0.52		0.5000		104	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID	**MB-20123**	SampType:	**MBLK**	TestCode:	**EPA Method 7471: Mercury**
Client ID:	**PBS**	Batch ID:	**20123**	RunNo:	**27331**
Prep Date:	**7/7/2015**	Analysis Date:	**7/7/2015**	SeqNo:	**819262** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.033								

Sample ID	**LCS-20123**	SampType:	**LCS**	TestCode:	**EPA Method 7471: Mercury**
Client ID:	**LCSS**	Batch ID:	**20123**	RunNo:	**27331**
Prep Date:	**7/7/2015**	Analysis Date:	**7/7/2015**	SeqNo:	**819263** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.17	0.033	0.1667	0	103	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1507119**
29-Jul-15

Client: Daniel B. Stephens & Assoc.
Project: DBS&A-Dwyer

Sample ID **MB-20147** SampType: **MBLK** TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **PBS** Batch ID: **20147** RunNo: **27383**
Prep Date: **7/8/2015** Analysis Date: **7/9/2015** SeqNo: **821512** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	ND	0.25								

Sample ID **LCS-20147** SampType: **LCS** TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **LCSS** Batch ID: **20147** RunNo: **27383**
Prep Date: **7/8/2015** Analysis Date: **7/9/2015** SeqNo: **821513** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	25	0.25	25.00	0	98.8	80	120			

Sample ID **MB-20147** SampType: **MBLK** TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **PBS** Batch ID: **20147** RunNo: **27475**
Prep Date: **7/8/2015** Analysis Date: **7/13/2015** SeqNo: **824555** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	2.5								
Barium	ND	0.10								
Cadmium	ND	0.10								
Chromium	ND	0.30								
Selenium	ND	2.5								
Silver	ND	0.25								

Sample ID **LCS-20147** SampType: **LCS** TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **LCSS** Batch ID: **20147** RunNo: **27475**
Prep Date: **7/8/2015** Analysis Date: **7/13/2015** SeqNo: **824556** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	25	2.5	25.00	0	100	80	120			
Barium	25	0.10	25.00	0	99.5	80	120			
Cadmium	26	0.10	25.00	0	103	80	120			
Chromium	25	0.30	25.00	0	101	80	120			
Selenium	25	2.5	25.00	0	101	80	120			
Silver	5.3	0.25	5.000	0	105	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: DBS LAB Work Order Number: 1507119 RcptNo: 1

Received by/date: JB 07/02/15

Logged By: **Anne Thorne** 7/2/2015 11:27:00 AM Anne Thorne

Completed By: **Anne Thorne** 7/2/2015 Anne Thorne

Reviewed By: JB 07/02/15

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Client

Log In

4. Was an attempt made to cool the samples? Yes ☐ No ☑ NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C — APPROVED BY CLIENT — Yes ☐ No ☑ NA ☐ — Approved by client.
6. Sample(s) in proper container(s)? Yes ☐ No ☑
7. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
9. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☑
11. Were any sample containers received broken? Yes ☐ No ☑
12. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
13. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
14. Is it clear what analyses were requested? Yes ☑ No ☐
15. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. **Cooler Information**

Chain-of-Custody Record

Client: Daniel B. Stephens & Associates, Inc.

Mailing Address: 4400 Alameda Blvd N.E. Suite C
Albuquerque, NM 87113

Phone #: (505) 889-7752

email or Fax#: jhines@dbstephens.com

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☐ Standard ☐ Rush _____

Project Name: DBS&A - Dwyer

Project #: NM15.0010.00
WO # 020855

Project Manager: Joleen Hines

Sampler: [illegible]

On Ice: ☐ Yes ☑ No

Sample Temperature: 25.1

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1507119	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	See Attachment				Air Bubbles (Y or N)
7/1/15	1500	soil	LA Borrow	1 bag		701												X				
7/1/15	1500	soil	Los Alamos 54-last	1 bag		702												X				

Date:	Time:	Relinquished by:	Received by:	Date	Time
7/2/15	1127	[illegible]	[illegible]	7/2/15	1127
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Please cc: ckrous@dbstephens.com

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Pesticides
Herbicides
VOC's
RCRA 8 Metals

July 2015

POST-CLOSURE CARE AND MONITORING PLAN

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F. Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

Revision 01

EXECUTIVE SUMMARY

This Post-Closure Care and Monitoring Plan (PCMP) addresses post-closure care and monitoring for the U.S. Department of Energy (DOE) Los Alamos County Airport Landfill closure. This PCMP identifies post-closure care and monitoring requirements and activities for the landfill that satisfy NMAC 20.4.1.600 and 40 CFR 265. A tentative inspection and reporting schedule is also identified.

Background information for the Airport Landfill project is provided in the ET Cover Design Report, Los Alamos County Airport Landfill (Dwyer Engineering 2015c) and Pre-Design Work Plan for the Los Alamos County Airport Landfill (Dwyer Engineering 2014).

TABLE OF CONTENTS

1.0	**PURPOSE**	**3**
2.0	**REQUIREMENTS**	**4**
3.0	**SITE ELEMENTS MONITORED**	**5**
3.1	**ET COVER**	**5**
3.1.1	**WATER BALANCE MONITORING**	**5**
3.1.2	**METHANE MONITORING**	**7**
3.1.3	**BIOINTRUSION MONITORING**	**9**
3.2	**STORM WATER CONTROL SYSTEMS**	**9**
3.3	**FENCING AND SIGNAGE**	**10**
3.4	**SURVEY BENCHMARKS**	**10**
3.4	**RETAINING WALLS**	**10**
3.5	**CONCRETE HANGAR PAD**	**10**
3.6	**EROSION AND SEDIMENTATION CONTROL**	**11**
3.7	**SITE ACCESS**	**11**
4.0	**COMMUNICATION/REPORTING REQUIREMENTS**	**12**
5.0	**REFERENCES**	**14**

FIGURES

Figure 1. Water Balance Monitoring Typical Equipment 6
Figure 2. Methane and Water Balance Monitoring Locations 7
Figure 3. Methane Monitoring Vent 8

TABLES

Table 1. Monitoring Requirements 4

1.0 PURPOSE

The Los Alamos County Airport Landfill Cover Replacement Project site elements will be inspected as outlined below during the post-closure care and monitoring period following acceptance of the Construction Completion Report. Generally, landfills regulated under the Resource Conservation and Resource Act (RCRA) are subject to a 30-year post closure monitoring period. However, under §§ 265.117, the time period may be reduced or increased dependent on findings, the integrity of the closure and agreement by applicable officials and regulators.

The landfill cover and erosion and sedimentation control measures will be inspected quarterly during the initial 5-year monitoring period to assess the general condition of the closure system and identify any maintenance or repair issues that may arise. Water balance monitoring of the cover system will also be included in these quarterly inspections. In addition to the quarterly inspections, if the site experiences a precipitation event that exceeds 1 inch in any given hour (the 100-year, 1-hour design storm event is 2.17in/hr.); the site shall also be inspected. An inspection report shall be prepared by the engineer within one week of the inspection. An annual Post-Closure Care and Monitoring Report shall be prepared and submitted to NMED. The annual report shall include all inspection reports and all monitoring performed to date along with any maintenance and/or repairs performed (if any). The quarterly monitoring will continue beyond the initial 5-year post-closure monitoring period unless DOE can provide adequate information to NMED that allows for a reduction in the number of inspections or elimination of inspections. The information will include all monitoring and inspections performed to date at the time of such a request.

Monitoring frequency may be reduced after conclusion of this initial 5-year period dependent on findings, progression of the cover system, and discussion between the Department of Energy (DOE) officials and regulators from the New Mexico Environment Department (NMED). The purpose of the inspections is to identify any areas of the site that may require repair to restore the intended functionality of the closure. This document outlines the site elements to be inspected, the inspection schedule, reporting requirements, and repair and notification procedures in the event that a repair is required.

For the first year as a minimum, methane monitoring will be performed at three locations. This monitoring will be performed on a quarterly basis. The results of this methane monitoring shall be submitted to NMED for review. This monitoring shall continue until DOE and NMED concur that it is no longer warranted.

Inspections of the individual site elements are discussed in Sections 3. Reporting requirements are outlined in Section 4. A proposed inspection checklist is provided in Attachment 1. This inspection list may be modified as the inspections progress based on findings and comments during this process.

2.0 REQUIREMENTS

The Airport Landfill project consists of design and construction of a replacement cover for the asphaltic cover previously installed in 2008. The new cover system will be a vegetated soil cover referred to as an Evapotranspiration (ET) Cover (Dwyer Engineering 2015c).

Details of the landfill design can be located in the construction drawings (Dwyer Engineering 2015a), specifications (Dwyer Engineering 2015b), and calculations (Dwyer Engineering 2015c) included in the Remedy Design Work Plan.

The PCMP follows guidance set forth in the New Mexico Administrative Code (NMAC 20.4.1.600) whereby the Code of Federal Regulations (CFR) for hazardous waste sites have been directly adopted (40 CFR 265) for design and post-closure care and monitoring.

Specifically, these requirements are summarized in Table 1.

Table 1. Monitoring Requirements

Regulation	Requirement	Method of Compliance
NMAC 20.4.1.600 (40 CFR 265.118)	PCMP	PCMP.
NMAC 20.4.1.600 (40 CFR 265.310)	Maintain cover integrity	Inspection and maintenance of cover system in accordance with this PCMP.
NMAC 20.4.1.600 (40 CFR 265.310)	Maintain and operate leachate collection system	The site is unlined and does not have a leachate collection system. Therefore, leachate collection system monitoring is not required.
NMAC 20.4.1.600 (40 CFR 265.310)	Groundwater monitoring	Groundwater monitoring not required.
NMAC 20.4.1.600 (40 CFR 265.310)	Reporting	Annual monitoring report per the PCMP.
NMAC 20.4.1.600 (40 CFR 265.310)	Prevent run-on and run-off from eroding or otherwise damaging the final cover	Inspection and maintenance of surface water controls per the PCMP
NMAC 20.4.1.600 (40 CFR 265.310)	Protect and maintain surveyed benchmarks	Annual inspection and maintenance of survey benchmarks per PCMP.
NMAC 20.4.1.600 (40 CFR 265.310)	Maintain access roads to main landfill and Debris Disposal Area	There are no permanent access roads specific for the landfill; therefore, access roads are not included in the PCMP.

3.0 SITE ELEMENTS MONITORED

This PCMP covers the following elements of the Closure at the Airport Landfill:

- Evapotranspiration (ET) Cover System
- Storm water control system
- Fencing and signage
- Survey benchmarks
- Retaining walls
- New concrete hangar pad
- Erosion and Sedimentation Control Measures
- Site access

Inspections will be performed on a quarterly basis for the initial 5-year post-closure period with these inspection reports included in an annual report to be submitted to NMED. The quarterly inspections will be performed by a registered professional engineer in the State of New Mexico with not less than 10 years of expertise in alternative cover systems. Inspection records and documentation of corrective actions will be retained in the project file and provided with the annual report.

3.1 ET COVER

The general integrity of the ET Cover system shall be inspected. The top slope and side slopes of the landfill shall be examined for potential degradation of the cover system, such as erosion (as evidenced by rilling or gullying), quality and quantity of vegetation establishment, areas of subsidence, biointrusion, cracking, slope instability, and wet areas. The overall integrity of the cover on the top slope and side slopes system shall be inspected and observations shall be recorded with digital photos in an inspection report that includes the check list contained in Attachment 1. Any maintenance or repair issues identified in an inspection shall be repaired as soon as weather permits. Any repairs requiring additional fill shall use fill from an approved borrow source.

Vegetation is a key aspect of the ET Cover. Vegetation will be inspected for success based on type of vegetation, percent bare area and size of native vegetation seeded during the cover installation. These values will be recorded by the Inspection Engineer in each inspection report. Furthermore, the vegetation will be monitored for continued robustness to ensure that there are not unintended stresses on it such as stress due to landfill gas. Digital photos will be taken during each inspection and included in the quarterly report to monitor the maturation and success of the vegetation. Should problems with vegetation be identified by the Engineer, the problem will be noted along with a recommended repair or further evaluation recommendations.

3.1.1 WATER BALANCE MONITORING

Water balance monitoring of the ET Cover shall be performed. The monitoring equipment shall be installed within three months after the completion of the cover construction. This monitoring is to include the monitoring of water content and soil suction within the cover profile. There

shall be two locations within the cover system to be monitored (Figure 2). The two locations are to be used to provide duplication in case of instrumentation or software errors. Each location shall have five water content probes and 5 soil suction probes installed within the profile to measure the respective parameters on a daily basis (Figure 1). Each set of probes shall be connected to an on-site data logger that will compile the data to be downloaded by the Inspection Engineer on a quarterly basis. The summary and analysis of the data shall be submitted with each quarterly inspection report.

Proposed Monitoring Equipment at each location (2 locations) includes:

- 5 each – GS3 water content probes by Decagon Devices Inc.
- 5 each – MPS-6 water potential probes by Decagon Devices, Inc.
- 2 each – EM50 data loggers by Decagon Devices Inc.

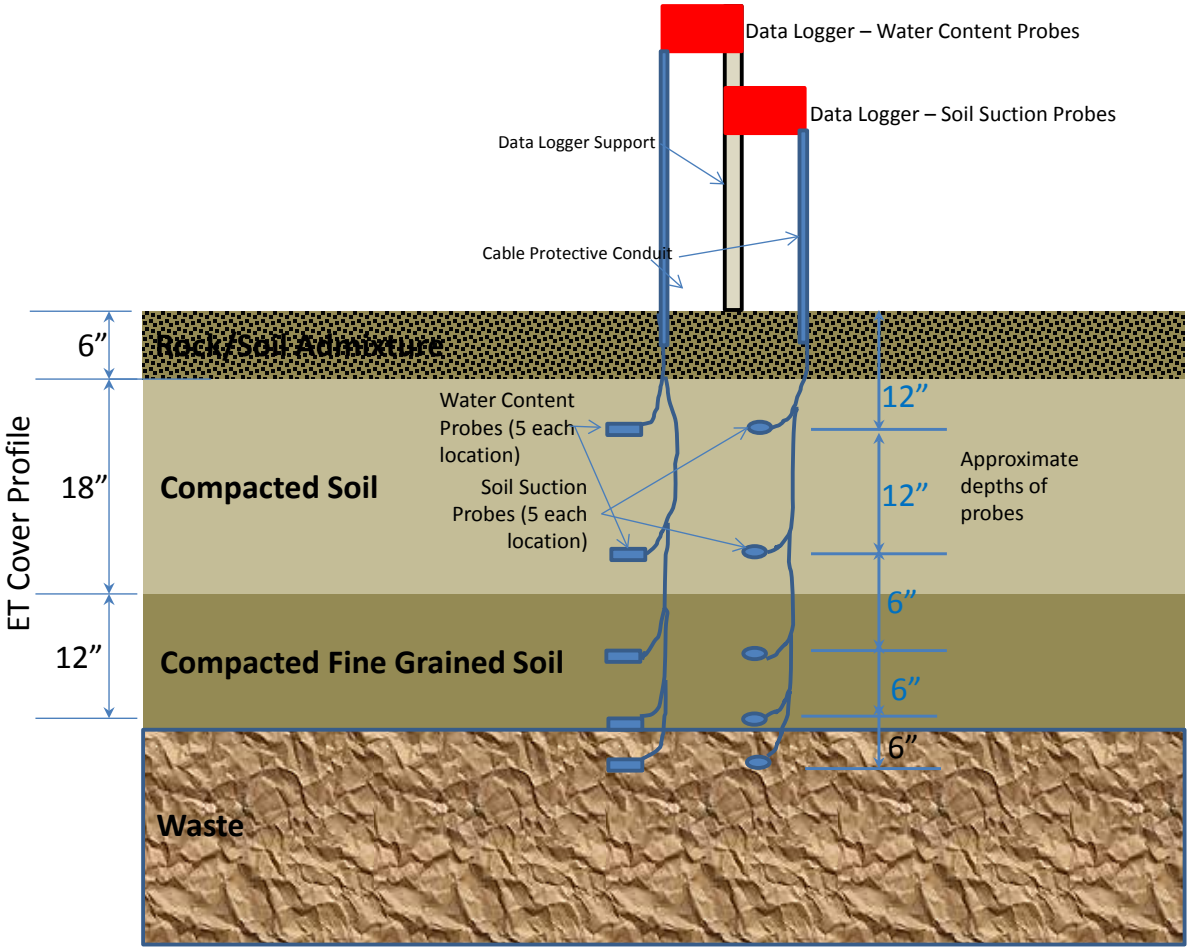

Figure 1. Water Balance Monitoring Typical Equipment

3.1.2 METHANE MONITORING

Methane monitoring shall be performed at three locations (Figures 2 and 3). The monitoring equipment shall be installed within three months after the completion of the cover construction. The monitoring shall include the installation of the three passive vent locations. Each location shall include a vertical riser installed into the underlying waste that rises above ground level where measurements can be made (Figure 3).

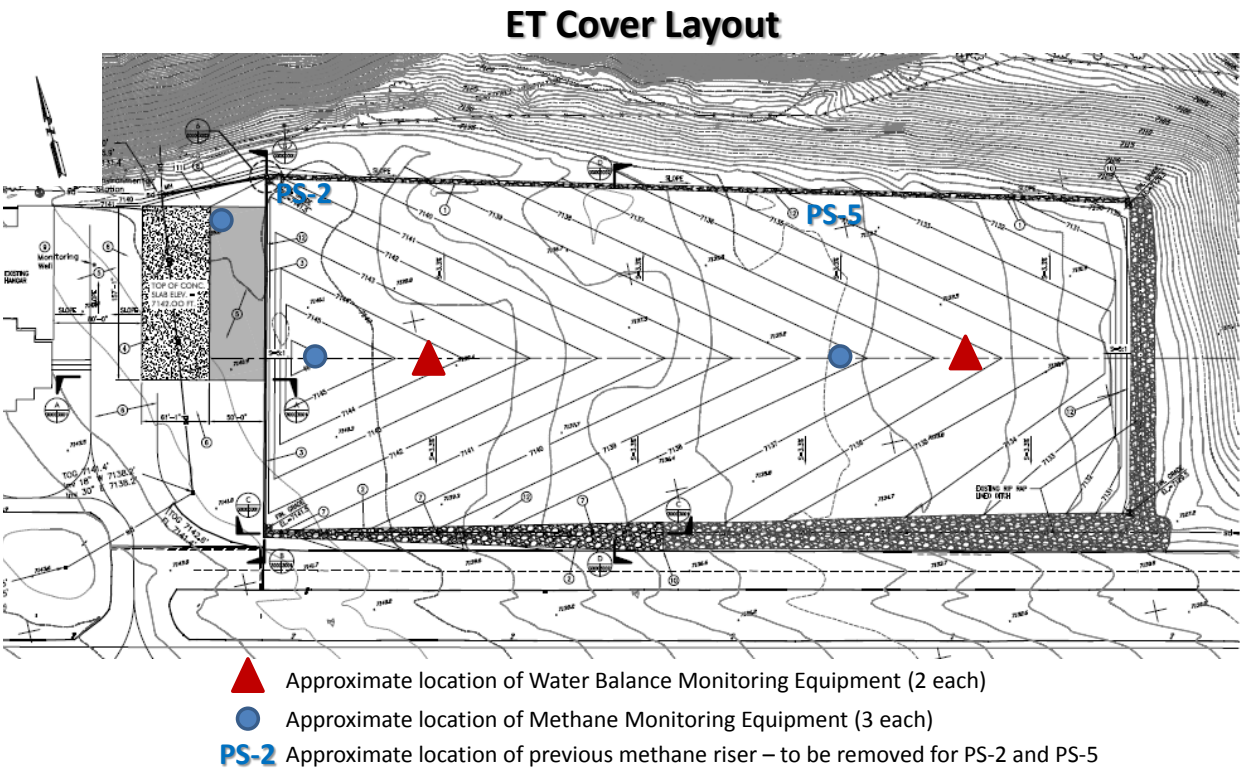

Figure 2. Methane and Water Balance Monitoring Locations

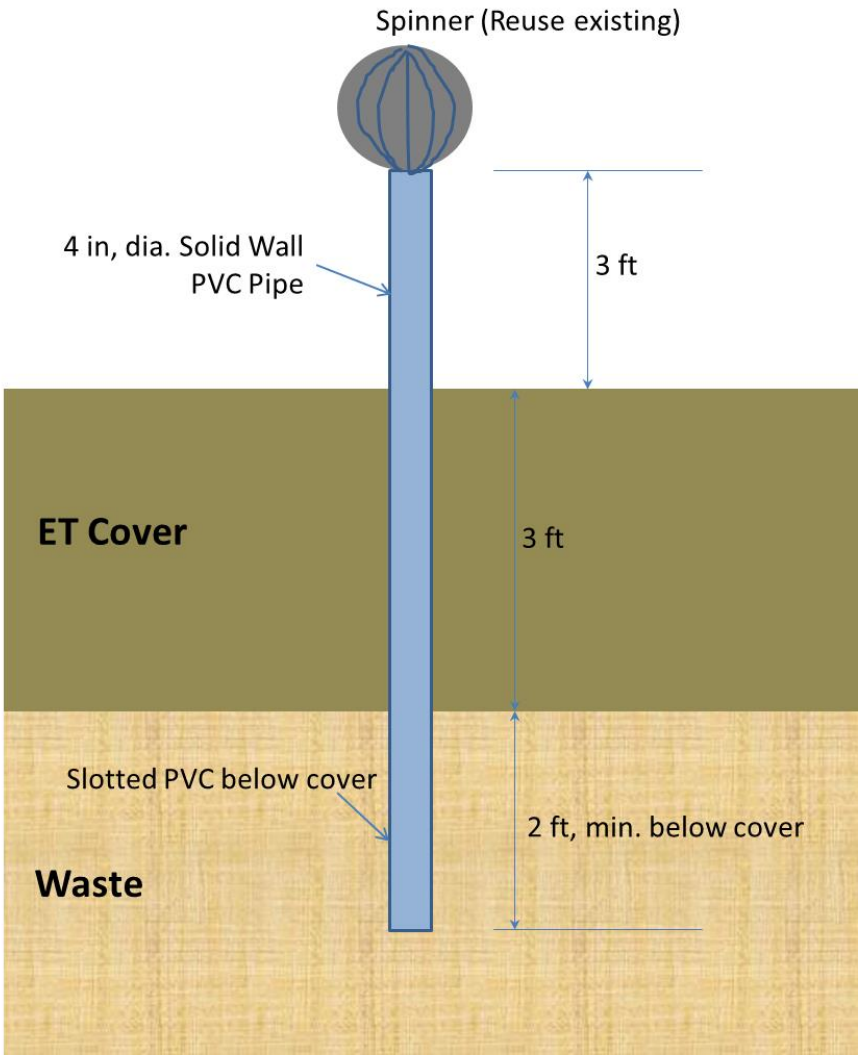

Figure 3. Methane Monitoring Vent

The methane monitoring shall be performed on a quarterly basis. If measured gas concentrations do not exceed 25% of the lower explosive limit (LEL) at any monitoring location for two years, the locations will be monitored twice the third year. If measured concentrations do not exceed 25% of the LEL the third year, monitoring will be discontinued. By mutual agreement between the NMED and DOE, if a descending trend is identified whereby the gas levels are decreasing - monitoring may also be discontinued prior to the time periods mentioned above.

If combustible gas levels exceed 25% of the LEL in any enclosed structure, or 100% of the LEL at the north edge of the cap, the owner or operator shall:

- Immediately take all necessary steps to ensure protection of public health, welfare and the environment and notify the NMED;
- Within 7 days of detection, record the methane gas levels detected and a description of the steps taken to protect public health, welfare and the environment and report them to NMED.

3.1.3 BIOINTRUSION MONITORING

As part of the periodic inspection, the ET Cover surface will be visually monitored for significant animal burrowing. Although the surface layer composed of a mixture of 25% rock to 75% soil by volume will discourage burrowing, it will not prevent it. However, the Federal Aviation Administration requires nearby fields including this landfill surface to be mowed to ensure that vegetation is less than a foot tall. The mowing to be performed under the direction of the Los Alamos County Airport has multiple advantages for the cover system. Its purpose is to disrupt the landscape required for burrowing animals to effectively survive. The taller vegetation acts as a canopy to hide the smaller animals from predators such as coyotes and birds. The FAA requires the mowing and thus discouragement of smaller burrowing animals because the presence of predators is a safety hazard. A second advantage of the mowing is that it encourages the establishment of thinner and shallower rooting vegetation such as grasses and discourage the establishment of deeper, woody rooted plants such as trees. The large woody roots of trees can provide preferential flow paths through soil covers. Significant burrowing will be reported to in the attached inspection checklist as well as to the Los Alamos County Airport manager. Any animal burrows larger than 3-icnhes in diameter will be reported. These large burrow holes will also be filled as soon as possible with soil meeting the cover soil specifications contained in the Technical Specifications, Section 02200 (Earthwork).

3.2 STORM WATER CONTROL SYSTEMS

The quarterly inspection will also satisfy the required annual storm water control system inspections as described in the approved Storm Water Pollution Prevention Plan (SWPPP). The Inspection Engineer will look for evidence of, or the potential for, degradation of and /or pollutants entering the storm water conveyance system. Discharge locations identified in the site plans will be inspected to determine whether erosion controls are effective in preventing significant impact to Pueblo Canyon.

The general integrity of the landfill drainage channels and culverts shall be inspected. The channels and the transition of the channels to the arroyo shall be inspected for evidence of degradation, erosion, subsidence, sediment accumulation, undercutting, obstructions, slope instability and other disturbances to the channels. The overall integrity of the drainage channels and culverts shall be inspected and observations shall be recorded using the table in Attachment 1. If any of the issues listed in Attachment 1 are observed to be significant by a New Mexico Professional Engineer, they are to be repaired as soon as weather permits. Any repairs requiring

additional fill shall use fill from an approved borrow source. Repairs requiring additional material such as riprap shall use locally available materials that meet the design specifications.

3.3 FENCING AND SIGNAGE

Fencing at the site includes perimeter fencing around the airport. The integrity of all fencing adjacent to the landfill and eastern retaining wall structures shall be inspected quarterly. The entire length of all fences shall be inspected for any damage, including but not limited to: bent posts, loose posts, broken links or wire, and damaged gates. Any damage noted shall be noted in the inspection report and repaired as soon as weather permits.

Signs associated with the landfill shall be visible and legible to public access areas. Damaged or obstructed signs shall be replaced, relocated, or the obstruction shall be removed. Repairs to signage shall be performed as soon as weather permits.

3.4 SURVEY BENCHMARKS

Inspections will include locating and documenting the condition of the permanent survey benchmarks. Benchmarks will be maintained in a clearly visible condition.

3.4 RETAINING WALLS

Visual inspections will be performed for both the concrete and mechanically stabilized earth (MSE) walls. Inspections shall evaluate the condition of the retaining structures and note any degradation. Inspections will investigate the existence and extent of any cracks that may exist in the concrete wall. Digital photos shall be taken of any cracking or degradation noted in the concrete wall. Measurements of the location and depth of the crack(s) (if any) shall be determined and documented in the inspection report. Also, investigate for any separation, rotation, or other movement of the MSE walls. Document location (if any) and take digital photo of extent of movement and include in the inspection report. Any soil erosion or other evidence of water damage in the vicinity of retaining walls shall be documented in the inspection report with recommended repair or maintenance.

3.5 CONCRETE HANGAR PAD

The concrete hangar pad installed with this project shall be inspected for structural integrity and degradation. Any tension cracks, spalling, or differential settlement shall be noted in the inspection report. The Los Alamos County Airport manager shall be notified should any significant degradation of the concrete hangar pad be noted. Seals between the concrete slabs and adjacent asphalt shall be inspected for continuity and weatherproofing. Degradation of these seals shall be noted in the inspection along with maintenance or repair suggested by the Engineer. Maintenance or repair of the seals shall be completed as soon as weather permits.

The Los Alamos County Airport personnel shall implement airport operating procedures to prevent damage to the concrete slabs and perimeter seals by snow removal equipment or other means.

3.6 EROSION AND SEDIMENTATION CONTROL

Condition of temporary erosion measures will be inspected for their integrity and usefulness during the time period they are deemed essential. If temporary erosion control measures such as wattles, silt fencing, or erosion control blankets are deemed to be damaged, they are to be repaired or replaced with similar materials as designated by the Engineer performing the inspection. All damage shall be noted in the inspection report along with recommend maintenance. These repairs or replacements are to be performed as soon as weather permits.

Condition of permanent erosion control measures will be inspected. These include the drainage channels, rock check dams, terraces, and rip rap protecting the areas around the retaining structures along the eastern portion of the landfill. Any degradation or damage shall be noted in the inspection reports along with recommended repair or maintenance for each occurrence. These repairs or maintenance items are to be performed as soon as weather permits.

Condition of outlet chutes, perimeter drains/berms, terrace drains, culverts, and drop inlets shall be inspected for presence of sediments, breaches in berms, presence of vegetation or debris, etc. Sediments, vegetation, or debris retarding storm water runoff will be removed as needed. Breaches in berms or chutes will be repaired using the appropriate materials.

3.7 SITE ACCESS

A permanent road dedicated to the landfill will not exist. However, access to continued monitoring shall be granted and included in the inspection report. Access shall be made available for any maintenance or repairs required as noted during the quarterly inspections.

4.0 COMMUNICATION/REPORTING REQUIREMENTS

An annual Post-Closure Care and Monitoring Report shall be submitted to the NMED during the five year initial monitoring period. These reports shall include all quarterly inspection reports (inclusive of water balance and methane monitoring performed) as well as any recommended maintenance or repairs inclusive of documentation that the recommended repair was properly performed. Attachment 1 provides a Post Closure Monitoring Check list, for guidance during the inspections. Digital Photos shall be included in each inspection report of key elements along with a summary of the condition of the site and any changes, damage or other issues, along with any maintenance or repairs recommended. The annual Post-Closure Care and Monitoring Report shall include, at a minimum, the following information for each reporting period:

1. Summary of the condition of each site element identified.
2. Photographs of the site features taken at the locations.
3. Summaries of all findings.
4. Summaries of all changes or repairs made to the site, indicating consultation with DOE and/or NMED and approval of those changes, when necessary.
5. Summaries of all contacts with representatives of the local community, public interest groups or government agencies.
6. Summaries of all problems or potential problems encountered.
7. Summaries of actions taken and being taken to rectify problems.
8. Changes in project personnel.
9. Copies of inspection reports and any other relevant records.
10. Summary of water balance monitoring and analysis performed (as long as this monitoring is performed).
11. Summary of methane monitoring results (as long as this monitoring is performed).

Each inspection report will include a list of any recommended maintenance or repairs based on findings from the recent inspection. The inspection report will also include a follow up review of previous maintenance or repairs performed verifying their effectiveness at addressing the issue. A recommendation for timeliness of the maintenance and repairs will be provided. Examples of maintenance or repairs needed may include:

- Localized areas of the cover where vegetation is deemed to be inadequate. Reseeding or further investigation may be required.
- Localized erosion including formation of grills/gullies will require repair and potential redesign to address the situation.
- Localized differential settlement that has or may create ponding will require repairs by adding additional soil in depressed area and reseeding.
- Excessive or large burrowing will need to be addressed immediately. Large burrow holes can be filled with soil, while excessive burrowing can create a hazard to the airport and must be addressed beyond repairs to the landfill.

Also to be included in each inspection report are areas of concern to be closely watched on subsequent inspection. These can vary – but include localized vegetation distress, settlement, erosion, cracking, an unexpected increase in methane production or cover moisture etc. These

issues on a case-by-case basis may trigger a more in depth review. Any of these issues will be included in the inspection report. All areas of concern will be forwarded to NMED by DOE as soon as possible for input into any corrective action that may be warranted.

A project file containing records of all inspections, monitoring, and maintenance performed will be maintained by DOE Environmental Management Los Alamos Field Office (EM-LA). The annual Post-Closure Care and Monitoring Report will be prepared and provided to the New Mexico Environmental Department (NMED) Secretary within 45 days from the end of each calendar year.

The name, address, and telephone number for the individual to contact during the post-closure period is as follows:

Ramoncita Massey, Project Manager
Department of Energy
Environmental Management - Los Alamos Field Office (EM-LA)
3747 West Jemez Road
Los Alamos, NM 87544
Phone: (505) 665-7771
Email: rmassey@em.doe.gov

5.0 REFERENCES

1. 40 CFR 265.118. 2006. "Post-closure Plan; Amendment of Plan," Code of Federal Regulations, published by the U.S. Government Printing Office, Washington, D.C.
2. 40 CFR 265.310. 2006. "Closure and Post-closure Care," Code of Federal Regulations, published by the U.S. Government Printing Office, Washington, D.C.
3. Dwyer Engineering. 2014. Pre-Design Work Plan for Los Alamos County Airport Landfill prepared by Dwyer Engineering LLC.
4. Dwyer Engineering. 2015a. Drawings (8 sheets). Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
5. Dwyer Engineering. 2015b. Technical Specifications. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
6. Dwyer Engineering. 2015c. ET Cover Design Report. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
7. LANL, 1998, "RFI Report for Potential Release Sites 73-001(a,b,c,d) and 73-004(d), Airport Landfill Areas," Vol. 1, 2, and 3, Los Alamos National Laboratory (LANL) report LA-UR-98-3824, 63070, Los Alamos, New Mexico, November 1, 1998.
8. NMAC 20.4.1.600. 2009. "Adoption of 40 CFR Part 265," New Mexico Administrative Code, published by the Commission of Public Records, Administrative Law Division, Santa Fe, New Mexico, October 1, 2003.

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ATTACHMENT 1

POST-CLOSURE MONITORING CHECK LIST

Post-Closure Monitoring Check List for the Los Alamos County Airport Landfill Closure

Site Name: Los Alamos County Airport Landfill	Date of Inspection:
City: Los Alamos	Weather:
State: New Mexico	Temperature:
Agency: Department of Energy	Site Map:
Inspector:	Note: Indicate the location of any deficiency noted below on the site map
Landfill ET Cover – Top Slope	**Remarks**
1. Settlement (Low Spots): Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Surface Cracks: Yes ( ) No ( ) Length: Width: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Biointrusion Holes: Yes ( ) No ( ) Areal Extent:	

Depth: Suspected Cause (Rodent or Other): Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Vegetation Condition: General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	
6. Rill/Gully: Yes ( ) No ( ) Areal Extent: Height: Suspected Cause Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Wet Areas: Yes ( ) No ( ) Ponding: Yes ( ) No ( ) Areal Extent: Seeps: Yes ( ) No ( ) Areal Extent: Estimated Flow Rate: Soft Subgrade: Yes ( ) No ( ) Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	

8. Slope Instability: Yes ( ) No ( ) Slides: Yes ( ) No ( ) Areal Extent: Probable Slide Interface: Suspected Cause: Exposed Cover Components: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Landfill Cover – Side Slopes	
1. Settlement (Low Spots) : Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Cracks: Yes ( ) No ( ) Length: Width: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	

4. Biointrusion Holes: Yes ( ) No ( ) Areal Extent: Depth: Suspected Cause (Rodent or Other): Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Vegetation Condition: General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	
6. Rill/Gully: Yes ( ) No ( ) Areal Extent: Height: Suspected Cause: Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Wet Areas: Yes ( ) No ( ) Ponding: Yes ( ) No ( ) Areal Extent: Seeps: Yes ( ) No ( ) Areal Extent: Estimated Flow Rate: Soft Subgrade: Yes ( ) No ( ) Areal Extent:	

Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Slope Instability: Yes ( ) No ( ) Slides: Yes ( ) No ( ) Areal Extent: Probable Slide Interface: Suspected Cause: Exposed Cover Components: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Rip Rap Lined Drainage Channels	
1. Settlement: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Material Degradation: Yes ( ) No ( ) Material Type: Areal Extent: Degree of Degradation: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent:	

Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Undercutting: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Obstructions: Yes ( ) No ( ) Type: Areal Extent: Size: Repairs Necessary Yes ( ) No ( ) If yes, explain	
6. Slope Instability: Yes ( ) No ( ) Type: Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Siltation: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Drop Inlet Structures: Working Properly Yes ( ) No ( )	

Condition: Extent of Damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Asphalt Lined Drainage Channels	
1. Settlement: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Material Degradation: Yes ( ) No ( ) Material Type: Areal Extent: Degree of Degradation: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Erosion: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Undercutting: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Obstructions:	

Yes ( ) No ( ) Type: Areal Extent: Size: Repairs Necessary Yes ( ) No ( ) If yes, explain	
6. Slope Instability: Yes ( ) No ( ) Type: Areal Extent: Repairs Necessary Yes ( ) No ( ) If yes, explain	
7. Siltation: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
8. Drop Inlet Structures: Working Properly Yes ( ) No ( ) Condition: Extent of Damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Concrete Culvert	

1. Siltation: Yes ( ) No ( ) Areal Extent: Depth: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Concrete Condition and Joints General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	
3. Grating Condition: General Condition progressing as expected: Yes ( ) No ( ) If no, explain Issues Observed: Yes ( ) No ( ) If yes, explain Repairs Necessary: Yes ( ) No ( ) If yes, explain	
Fencing/Signage	
1. Airport Fence Adjacent to Landfill: bent posts: Yes ( ) No ( ) loose posts: Yes ( ) No ( ) broken links or wire: Yes ( ) No ( ) damaged gates: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Signage: Damage or Obstruction to Viewing Yes ( ) No ( ) Description:	

Survey Benchmarks	
1.Survey Benchmarks Located: Yes ( ) No ( )	
2.Survey Benchmarks Condition:	
3.Survey Benchmarks Damage Description (if any):	
4.**Repairs Necessary** Yes ( ) No ( ) If yes, explain	
Retaining Wall	
1.Retaining Wall Condition:	
2. Retaining Wall Damage Description (if any):	
3.**Repairs Necessary** Yes ( ) No ( ) If yes, explain	
Concrete Hangar Pad	
1.Concrete Hangar Pad Condition:	
2. Settlement Yes ( ) No ( ) If yes, explain	
3. Cracking Yes ( ) No ( ) If yes, explain	
4.**Repairs Necessary**	

Yes ( ) No ( ) If yes, explain	
Temporary Erosion & Sedimentation Control Measures	
1. Silt Fence or Waddle: Functional Yes ( ) No ( ) if no, describe locations Loose posts: Yes ( ) No ( ) Broken or ripped fabric: Yes ( ) No ( ) Gap between fabric and ground: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Erosion Control Blanket: Functional Yes ( ) No ( ) if no, describe locations Damaged Blanket: Yes ( ) No ( ) Other damage: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Permanent Erosion & Sedimentation Control Measures	
1. Rip Rap Reinforced Side Slope near Retaining Wall: Functional Yes ( ) No ( ) if no, describe locations Damage or degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Rock Check Dams near Retaining Wall: Functional Yes ( ) No ( ) if no, describe locations Damage, displaced rock, or other damage: Yes ( ) No (	

) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
3. Landfill Terrace above Retaining Wall: Functional Yes ( ) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
4. Drainage Channels adjacent to Retaining Wall: Functional Yes ( ) No ( ) if no, describe locations Damage, adjunct erosion, slope problem, or other damage/degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
5. Gabion above Drainage Channels adjacent to Retaining Wall: Functional Yes ( ) No ( ) if no, describe locations Damage or degradation: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Site Access	
1.Access Restrictions: Yes ( ) No ( ) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	
General	

1. Vandalism: Yes ( ) No ( ) Description of damage: Repairs Necessary Yes ( ) No ( ) If yes, explain	
2. Land Use Change: Yes ( ) No ( ) Description: Repairs Necessary Yes ( ) No ( ) If yes, explain	
Summary of Recommended Maintenance and/or Repairs	
1. Maintenance / Repairs Necessary Yes ( ) No ( ) If yes, explain	
Other	
1. Describe	

April 2015

DESIGN HEALTH AND SAFETY PLAN (HASP)

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F. Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

REVISION 00

Table of Contents

LIST OF ACRONYMS 5

CHANGE SUMMARY PAGE 6

EXECUTIVE SUMMARY 7

1.0 INTRODUCTION 8

1.1 PURPOSE OF HEALTH AND SAFETY PLAN 8

1.2 MODIFYING THE HEALTH AND SAFETY PLAN 9

1.3 SITE LOCATION AND DESCRIPTION 9

1.4 SCOPE OF WORK 9

1.5 CHEMICALS OF CONCERN 10

1.5.1 CHEMICALS BROUGHT TO SUPPORT WORK 10

2.0 PROJECT ROLES AND RESPONSIBILITIES 11

2.1 ROLES AND RESPONSIBILITIES 11

2.2 HEALTH AND SAFETY RESPONSIBILITIES 11

2.2.1 PROJECT ENGINEERING MANAGER 11

2.2.2 ON-SITE SAFETY OFFICER 11

2.2.3 SUBCONTRACTOR SAFETY PERSONNEL 12

2.2.4 FIELD PERSONNEL 12

2.2.5 SITE VISITORS 12

3.0 STANDARD OPERATING GUIDELINES 14

3.1 DWYER ENGINEERING SAFETY AND HEALTH POLICY STATEMENT 14

3.2 DWYER ENGINEERING SAFETY RECORD 14

3.3 RECORDKEEPING 15

3.4 GUIDELINES FOR OBSERVED OR IDENTIFIED HAZARDS 15

3.4.1 HAZARDS CREATED BY OR IDENTIFIED DURING WORK CONTROLLED BY DWYER ENGINEERING OR OTHER CONTRACTORS 15

3.4.2 HAZARDS IDENTIFIED WITH OTHER THIRD PARTY WORK ACTIVITIES16

3.5 ENFORCEMENT OF SAFE WORK PRACTICES IN A MULTI-EMPLOYER JOB SETTING 16

3.6 FIRE PROTECTION PLAN 17

3.6.1 WILDFIRES 17

3.6.2 FIRE OR EXPLOSION RESPONSE ACTION 18
3.6.3 FIRE EXTINGUISHER INFORMATION 18
3.7 EARTHQUAKE AND DISASTER PREPAREDNESS 19
3.8 SANITATION 19
3.9 HOUSEKEEPING 20
3.10 EMERGENCY RESPONSE PLAN 21
3.10.1 SITE AND EMERGENCY COMMUNICATIONS 21
3.10.2 EMERGENCY HOSPITAL AND ROUTE INFORMATION 21
3.10.3 EMERGENCY HOSPITAL DIRECTIONS FROM THE AIRPORT 22
3.10.4 RESPONSE TO CHEMICAL SPILL INCIDENT 22
3.10.5 ACTION FOR MEDICAL EMERGENCY 22
4.0 TRAINING REQUIREMENTS 24
4.1 SITE ORIENTATION BRIEFING 24
4.2 DAILY SAFETY MEETINGS 25
4.3 REFRESHER TRAINING 25
5.0 REQUIRED MEETINGS 26
6.0 HAZARD COMMUNICATION PROGRAM 27
7.0 SITE SPECIFIC HAZARDS AND CONTROLS 28
7.1 FIELD SITE ACCESS 28
7.2 BIOLOGICAL HAZARDS 28
7.2 CHEMICAL HAZARDS 30
7.3 PHYSICAL HAZARDS 31
7.3.1 GENERAL PHYSICAL HAZARDS 31
7.3.1.1 HOUSEKEEPING 31
7.3.1.2 SLIPS, TRIPS, AND FALLS 31
7.3.1.3 PINCH POINTS 32
7.3.2 HEAVY EQUIPMENT OPERATION 32
7.3.3 VEHICLE AND EQUIPMENT TRAFFIC CONTROL 32
7.3.4 FIRE PROTECTION AND PREVENTION 32
7.3.5 INCLEMENT WEATHER AND ADVERSE ENVIRONMENTAL CONDITIONS 33
7.4 TEMPERATURE EXTREMES 35
7.4.1 HEAT STRESS 35

7.4.2 COLD STRESS 37
7.5 NOISE EXPOSURE 39
7.6 DUST 39
8.0 PERSONAL PROTECTIVE EQUIPMENT 40
8.1 STANDARD LEVEL D PPE 40
8.2 STANDARD LEVEL C PPE 41
9.0 EMERGENCY CONTACT INFORMATION 43
9.1 ALWAYS PROVIDE YOUR EXACT LOCATION TO A 911 OPERATOR 43
9.2 SITE-SPECIFIC INFORMATION 43
9.3 24-HOUR EMERGENCY HOSPITAL 43
9.4 24-HOUR EMERGENCY 43
10.0 REFERENCES 44
APPENDIX 45

FIGURES

Figure 1. Route to Hospital from Airport 22

TABLES

Table 1. Emergency Contacts 21
Table 2. Required Meetings 26
Table 3. Monitoring Frequency for Heat Stress 35
Table 4. Level D PPE 40
Table 5. Level C PPE 41
Table 6. Project Personnel Contact List 43

LIST OF ACRONYMS

ANSI	American National Standards Institute
APR	Air Purifying Respirator
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
COC	Chemical of Concern
COR	Contracting Officer Representative
CPR	Cardiopulmonary Resuscitation
dBA	Decibels on the 'A' Weighted Scale
DOE	US Department of Energy
GFCI	Ground Fault Circuit Interrupter
ET	Evapotranspiration
F	Degree Fahrenheit
FPD	Federal Project Designate
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
LAC	Los Alamos County
LAMC	Los Alamos Medical Center
LASO	Los Alamos Site Office
MSDS	Materials Safety Data Sheets
MSL	Mean Sea Level
NM	New Mexico
NMAC	New Mexico Administrative Code
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSO	On-Site Safety Officer
PE	Professional Engineer
PM	Project Manager
PPE	Personal Protective Equipment
PSO	Project Safety Officer
PVC	Polyvinyl Chloride
SOP	Standard Operating Procedure
S&H	Safety and Health
US EPA	United States Environmental Protection Agency

CHANGE SUMMARY PAGE

Procedure/Plan No: Design HASP - Los Alamos County Airport Cover Replacement

Change No.	Date	Affected Page(s)	Change Summary
REV. 0	04/2015	ALL	Original Issuance

Executive Summary

This Site Safety and Health Plan has been prepared to meet the requirements of: Occupational Safety and Health Administration Standards, 29 CFR Part 1910 and 29 CFR Part 1926; United States Army Corps of Engineers "Safety and Health Requirements Manual" (EM 385-1-1; 15 Sep 2008 edition) and "Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities (ER 385-1-92, dated May 2007) requirements. All daily safety briefings and project safety meeting shall be conducted by the construction contractor CTI & Associates assigned safety officer.

1.0 Introduction

This site-specific design Health and Safety Plan (HASP) is a Plan intended to help Dwyer Engineering personnel safely perform tasks associated with the replacement of the final cover and associated storm water control system at the Los Alamos County (LAC) Airport Landfill located in Los Alamos, New Mexico. This HASP was developed in accordance with relevant occupational safety and health regulations and requirements.

All Dwyer Engineering personnel involved in tasks on this project shall adhere to worker safety and health requirements set forth in 10 CFR 851 for conduct of contactor activities at DOE sites. This entitles anyone to stop unsafe activities or activities that put the health of nearby personnel at risk. All daily safety briefings and project safety meetings shall be conducted by the construction contractor CTI & Associates assigned safety officer.

1.1 Purpose of Health and Safety Plan

The purpose of the HASP is to provide guidance for field personnel working on site to complete project objectives in a safe and healthful manner. The evaluation of hazards, levels of protection and procedures specified in this HASP are based on the best information available during the development of this plan. It is recognized that every feasible safety or health hazard faced on site may not be contained in this document and that site conditions change. Therefore, it is part of every employee's job to continuously assess site conditions in relation to his/her own knowledge of how to perform a task safely. If at any time an employee lacks clarity in how to do a job safely or is unsure of the potential for adverse exposure to a contaminant, that employee shall bring their concerns to the attention of the On-Site Safety Officer (OSO), an employee of CTI & Associates, or his/her direct supervisor. No employee is expected to perform work that he/she does not know how to perform properly and safely.

All project activities will be performed in accordance with applicable sections of the Code of Federal Regulations (CFRs), including: relevant requirements in 10 CFR 851, CFR Title 40; Occupational Safety and Health Administration (OSHA) Standards 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926; and applicable sections of the New Mexico Administrative Code (NMAC) Title(s) 20. All Dwyer Engineering employees, contractors, and visitors must comply with the requirements of this HASP. The HASP was prepared in accordance with EPA's Standard Operating Safety Guide (PUB 9285.1-03, PB 92-963414, June 1992).

The information in this HASP is provided solely for the protection of the health and safety of Dwyer Engineering LLC employees and to establish minimum health and safety requirements for contractors working under the direct supervision and control of DOE on this project. Dwyer Engineering assumes no liability for, or responsibility to, any other parties for the accuracy or completeness of the information contained herein for any use or reliance upon this HASP by any other party. Other DOE subcontractors working on this project are to independently evaluate this HASP to determine any additional health and safety safeguards may be necessary or appropriate to protect their employees and others within the context of their own scope of work.

1.2 Modifying the Health and Safety Plan

This HASP must be modified if, new hazards are identified, the scope of work is revised, or the provisions specified in the HASP are not adequate to protect the health and safety of all personnel. Modifications will be accomplished by consultation with all project Health and Safety personnel, who in turn shall recommend appropriate modifications after approval by the Dwyer Engineering Project Manager or his designee. All HASP modifications shall be documented on the form included at the beginning of this document (HASP Change Summary Page). The form must have referenced verbal concurrence, or the signature from the OSO.

All changes to the HASP shall be documented with the appropriate revision number. The Project Manager must approve the changes to this document. This process is to be documented in the HASP and the project files. The Project Manager will be responsible for informing staff and contractors of all changes.

1.3 Site Location and Description

The LAC airport is situated on one of the narrow mesas of the Pajarito Plateau that flank the eastern edge of the Jemez Mountains. The airport covers approximately 89 acres. Ground elevations range from approximately 7170-ft above mean sea level (MSL) on the western end of the airport to approximately 7050-ft on the eastern end. The runway grade is approximately 1.5-degrees toward the east. The airport is bounded on the north and east by steep slopes of the Pueblo Canyon. New Mexico State Road 502 trends along the south side of the property. Single unit housing is located west of the airport.

The LAC airport landfill operated from 1943 to 1973 for the disposal of solid waste consisting of household trash from the Los Alamos town site and office trash from Los Alamos Scientific Laboratory. Prior to 1965, some waste was incinerated and subsequently buried in the airport landfill. Approximately 489,500 cubic yards of waste was disposed of in the landfill. The LAC airport landfill continued to receive waste until June 1973. In late 2006 and early 2007, the asphalt landfill cover system was installed on the airport landfill. Starting in 2009, significant differential settlement and degradation of the asphalt cover and associated concrete hangar pads was identified and monitored. In 2013, DOE decided to replace the asphalt cover system with an Evapotranspiration (ET) Cover. The focus of this project is to replace the asphalt cover with an ET Cover.

1.4 Scope of Work

This HASP applies to construction activities, including:

- Removal and milling of asphalt cover;
- Removal of concrete hangar pads;
- Excavation and relocation of waste from the western portion of the landfill to the center of the landfill;
- Removal of exposed gas collection system;
- Regrading of the site subgrade after asphalt /concrete removal;

- Placement and compaction (inclusive of soil mixing if required) of soil cover;
- Placement of fabric and rip rap in drainage ditches;
- Placement of new reinforced concrete hangar pad;
- Placement of vertical impermeable liner between the landfill and new concrete hangar pad;
- Removal of concrete culvert;
- Placement of new concrete culvert;
- Placement of temporary erosion control materials;
- Seeding of soil cover surface;
- Modifications to existing storm water control system.

1.5 Chemicals of Concern

This section provides site hazard characterization information so that initial levels of personal protective equipment (PPE) can be selected, as well as appropriate monitoring for chemical and physical hazards. Section 8.0 describes initial and up-grade PPE ensembles and describes the monitoring program with action levels for up- or down-grading PPE or evacuating the site.

1.5.1 Chemicals Brought to Support Work

Dwyer Engineering personnel are not anticipated to introduce hazardous chemicals to the site. However, during construction operations, the construction contractor (CTI & Associates) is likely to introduce some chemicals that all personnel must to be aware of. These may include:

- Gasoline fuel
- Diesel Fuel
- Alconox

Material Safety Data Sheets (MSDSs) for these chemicals and any others chemicals used in the course of the field work will be kept at the job site by the contractor installing the new cover system. All containers must be labeled with the identity of the contents, as well as, a hazard warning and emergency notices.

2.0 Project Roles and Responsibilities

2.1 Roles and Responsibilities

Dwyer Engineering is responsible for verifying that the project activities are carried out in accordance with the agreed upon scope of work and related contract documents. Along with this responsibility, Dwyer Engineering will verify that project activities are carried out in a manner consistent with applicable health and safety regulations as well as this HASP for its workers and contractors.

2.2 Health and Safety Responsibilities

Safety, loss prevention and strict adherence to this HASP are the direct responsibility of all levels of management, under all projects. The efforts of multiple organizations are necessary for completing the tasks associated with this project. Each individual assigned to oversee or conduct field work will be responsible for conducting his/her job in a safe and healthful manner.

2.2.1 Project Engineering Manager

The Dwyer Engineering Project Manager is Dr. Stephen Dwyer.

2.2.2 On-Site Safety Officer

CTI & Associates will perform construction activities on the project. As such, they will assign an OSO that will be on-site full-time during these construction activities. The responsibilities of the OSO include:

- Serve as the project lead for all health and safety issues.
- Conduct a daily safety meeting held by the project contractor.
- Maintain necessary project health and safety documentation and records.
- Verify that employees wear the prescribed level of personal protective equipment.
- Verify that the project bulletin board, where applicable, contains the necessary health and safety postings and that the information is current (placement and updating of this board is the responsibility of the contractor performing the cover replacement).
- Prepare incident reports for near miss accidents and actual work-related injuries, illnesses or losses involving the environment or property.
- Ensuring general implementation of the HASP, including necessary coordination and integration of subcontractors into the site safety program.
- Conducting regular inspections of the work areas, whether formally documented or visually observed, to ensure implementation of the safety plan and safe and healthful work conditions.
- Ensuring adequate first aid supplies and fire extinguishers, etc. are available at the site and that access (phone number if not 911, route map) to an ambulance or emergency services provider is known and posted for all team members to see.

- Halting or modifying any working conditions, or removing personnel from the site, if conditions are considered to be unsafe.
- Leading during any on-site emergency situation.
- Seeking guidance from the Engineer when unanticipated conditions develop, or completing a HASP Change of Summary page.
- Knowing how to safely implement the project objectives, including familiarization with the site background and equipment operation.
- Leading by example the safe way to complete the job.
- Immediately halting any unsafe acts or activity.
- Ensuring lines of communication and points of contact are known to all team members.
- Notifying the DOE and Dwyer Engineering Project Manager of any site evacuation, injury or site-related illness, property damage, or near miss.

2.2.3 Subcontractor Safety Personnel

The contents of this plan are written to include Dwyer Engineering employee activities while on site. Other subcontractors are required to prepare their own HASP, to work under while performing activities on site.

2.2.4 Field Personnel

Specific actions of field personnel include:

- Understanding and complying with this HASP.
- Bringing all perceived unsafe site conditions to the attention of the OSO. This includes situations when the person does not know how to perform a job or task safely.
- Having stop-work authority if imminent danger exists.

2.2.5 Site Visitors

Personnel visiting the site who are invitees (visitors), employees, or subcontractors will be permitted to enter work areas only with prior approval by the Project Manager or designee. The Project Manager or OSO must adequately inform the visitors of the current hazards and controls, including the protective equipment required.

Unless prior arrangements are made, PPE other than hard hat, safety glasses and high visibility vests will not be provided to visitors. Prior to entry, this HASP must be reviewed and a Personal Acknowledgement form signed (Appendix).

Provided below are the names and contact information for key personnel involved in the project:

United States Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA)

Ms. Ramoncita Massey
Contracting Officer Representative (COR)
505-665-7771
Ramoncita.Massey@em.doe.gov

Dwyer Engineering LLC
Dr. Stephen F. Dwyer, PE
Project Manager and PSO
505-270-0215
dwyerengineering@yahoo.com

Communication among applicable parties should be initiated prior to, during and after execution of the scope of work. Onsite personnel will notify applicable personnel in the event of scope of work change, potential safety concerns, spill incidents, traffic problems, equipment failures, injures, and/or emergencies.

3.0 Standard Operating Guidelines

Dwyer Engineering and its subcontractors will implement and enforce the requirements of the HASP and comply with relevant OSHA requirements in Safety and Health Regulations for the Construction Industry (29 CFR Part 1926), Safety and Health Regulations for General Industry (29 CFR Part 1910), the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard (29 CFR § 1910.120 and 29 CFR § 1926.65) and relevant requirements in CFR Titles 10, and 40, and applicable sections of the New Mexico Administrative Code (NMAC) Title(s) 19 and 20.

3.1 Dwyer Engineering Safety and Health Policy Statement

It is the policy of Dwyer Engineering to perform work in a safe and healthful manner. The safety and health of employees is considered to be of paramount concern in performance of company operations as employees are our most important asset and their well-being our greatest responsibility. The safety and health of every worker must be a primary consideration in every business decision and plan.

One of the primary objectives of the Safety and Health (S&H) Program is to prevent incident occurrence. There is no phase of company operations of greater importance than incident prevention. The S&H goal is to have incident-free operations. This goal can only be achieved through total and demonstrated commitment to this safety and health policy from each individual member. We must all recognize and understand that incidents and injuries are preventable.

To establish and maintain an effective safety and health program, the following shall be accomplished:

- We shall provide a safe work environment by having a safe workplace, equipment, and materials
- We shall establish safe work operations, safe work rules and procedures, and comply with accepted safe work practices and safety and health regulations
- We shall provide effective safety and health training so that every staff member has the necessary knowledge to identify potential hazards and the necessary protocols, tools and equipment to appropriately mitigate identified hazards
- We shall all understand that we have a duty and responsibility to maintain our own safety and the safety of our co-workers, at all times and in all situations
- Everyone must actively support the S&H Program and embrace the philosophy that "Incidents Can Be Prevented."

3.2 Dwyer Engineering Safety Record

Dwyer Engineering considers safe operations and incident prevention to be a priority. A key goal for incident prevention is to maintain its excellent safety record. Dwyer Engineering has never had an accident on any project nor had any safety infraction of any kind. Dwyer

Engineering intends to maintain this perfect safety record.

3.3 Recordkeeping

Documentation is one of the methods of ensuring that the site safety program is implemented properly. The Project shall establish reporting and recordkeeping requirements in accordance with Federal and/or State law. It is the OSO's responsibility to maintain and update these documents. Appropriate regulatory agency and Dwyer Engineering personnel shall be granted ready access to these records. Listed below are the minimum project health and safety compliance documentation requirements:

- A copy of this HASP must be on site.
- OSHA Job Safety and Health Protection poster, posted at the site by the contractor performing the cover replacement.
- OSHA Injury and Illness Recordkeeping Form 300 (required for remedial and clean construction job sites only).
- Incident reports, including near misses, for the project.
- Inspections (daily visual inspections recorded in a field log book or daily report sheet).
- Daily tailgate safety meeting forms (maintained by CTI & Associates OSO).
- Visitor sign-in sheet (typically maintained by contractor performing cover replacement).
- Permits, if required, for the job:
  - Lockout / Tagout
  - Excavation entry
- Training certifications:
  - 8-hour refresher HAZWOPER training
  - On-the-job site-specific training

3.4 Guidelines for Observed or Identified Hazards

3.4.1 Hazards Created By or Identified During Work Controlled By Dwyer Engineering or other Contractors

When apparent non-compliance to the HASP or unsafe conditions or practices is observed, the Dwyer Engineering Project Manager will be notified and corrective actions completed. For Dwyer Engineering subcontractors, the Dwyer Engineering Project Manager will be notified and corrective actions will be required. For work activities performed by the subcontractor, the subcontractor is responsible for determining and implementing necessary controls and corrective

actions.

When Dwyer Engineering employees or subcontractors may be exposed to an apparent imminent danger, immediately stop work and alert all affected individuals. Remove all affected Dwyer Engineering and subcontractor employees from the danger and notify the Project Manager, and the subcontractor's H&S Representative or Project Manager where appropriate. Do not allow work to resume until adequate corrective measures are implemented and documented and accepted by the H&S Representative or his/her designee.

3.4.2 Hazards Identified with Other Third Party Work Activities

In carrying out Dwyer Engineering's responsibilities of assuring safety compliance for Dwyer Engineering and subcontractor employees, the following guidelines are implemented when employees identify hazardous conditions created by the Dwyer Engineering or subcontractors (third party) within or adjacent to their work area:

- If a condition is identified that could immediately result in an accident causing severe injury or death:
  - Take appropriate measures to ensure your own safety and all other Dwyer Engineering and subcontractor employees by immediately removing yourself from the immediate danger of the hazard zone.
  - Advise others in the area of your potential concern. This would include notifying the client representative. Do not advise how to correct the immediate hazard, only that one appears to exist.
  - If the potential concern is not addressed, the Dwyer Engineering employee should notify the Project Manager or his/her designee, who then may notify the DOE Project Manager of the potential concern.
- If a condition is identified that may not be an immediate danger, but could result in an accident involving less serious or minor injury, damage to equipment, or environmental release:
  - Take appropriate measures to ensure your own safety and the safety of all other Dwyer Engineering and/or subcontractor employees in immediately removing yourself/them from the immediate hazard zone.
  - Advise others in the area of your concern. This would include notifying the client representative. Do not advise how to correct the deficiency; only that it appears that one exists.

In either case, notify the Dwyer Engineering Project Manager. The situation will be evaluated and protective actions taken to ensure the safety of Dwyer Engineering and subcontractor employees during the performance of their work activities.

3.5 Enforcement of Safe Work Practices in a Multi-Employer Job Setting

Enforcement of safe work practices starts with a disciplinary action program. All persons

assigned to the field are expected to conduct themselves in a manner that promotes the health and safety of themselves and their fellow workers. Employees not able to conform to the safety and health protocols contained in this document will be subject to disciplinary action, up to and including termination. Personnel who knowingly disobey safe operating procedures will be disciplined. Depending on the nature of the infraction, the disciplinary action will progress from a verbal warning, to a written warning, to a suspension from site activities, to dismissal from the site.

Enforcing safe work practices at a multiple employer job setting presents many challenges. Dwyer Engineering recognizes its responsibility to create and enforce a work environment that is safe and healthful. According to OSHA, each employer is required to provide a safe and healthful working environment for its employees. Dwyer Engineering will be responsible for its own employees, and will oversee that of their subcontractors. The construction contractor will be responsible for and implementation of their own health and safety program. All site activities will be conducted by Dwyer Engineering and subcontractors in accordance with HAZWOPER regulations (CFR 1910.120).

Most hazardous waste site activities require that more than one subcontractor work simultaneously on a given work site. In this situation, activities of one company could potentially cause a hazard to employees of another company, and so forth. It is not possible to present every subtle hazard associated with a particular piece of equipment or process or site condition in an HASP; therefore, it is necessary for each company to inform site workers of the particular safety and health issues associated with the means and methods of accomplishing site tasks. The forum for disseminating this information is through safety meetings and Activity or Job Hazard Analyses.

When conducting site activities, it is possible for personnel to forget or ignore certain provisions of the HASP. Project staff noticing deviations from accepted safe work practices will remind personnel of the proper procedures. Should this fail to correct the deviation, the OSO and/or Project Manager (and Subcontractor designated competent person[s], as appropriate) will be informed of the circumstances. Under no conditions are deviations from safe work practices to be tolerated by anyone on site. Unsafe behavior or unsafe conditions at the site shall be corrected in accordance with this HASP. Should this attempt fail, Dwyer Engineering will halt site activities. Non-cooperative subcontractors may be terminated.

3.6 Fire Protection Plan

Field activities could result in a fire at a site. Cigarette smoking is expressly forbidden in the exclusion zone. At least one Class ABC dry chemical fire extinguisher will be available for use at the site. This fire extinguisher shall be a topic in each daily safety meeting.

All electrical wiring will be free from frayed ends and sections, and all hook-ups will be checked for loose fittings. Portable power tools will be connected to a ground fault circuit interrupter and care will be taken to ensure that electrical connections do not exceed the maximum load capacity for any one circuit.

3.6.1 Wildfires

Areas (particularly the southwestern United States) with wide open spaces of natural brush

present the danger of wildfires when dry grasses and brush catch fire. As warranted, the OSO will check regularly with the local fire department during the most common wildfire months (July through November). Should a wildfire threaten a work site, the OSO will watch for changing conditions and evacuate and secure the site, in accordance with local fire department instructions.

3.6.2 Fire or Explosion Response Action

The actions listed below are in a general chronological sequence. Conditions and common sense may dictate changes in the sequence of actions and the addition, elimination, or modification of specific steps.

1. Upon detecting a fire/explosion, employees will notify the OSO and one person will be directed to notify the fire department.
2. A determination will be made as to whether or not the fire is small enough to extinguish readily with immediately available portable extinguishers or water, or if other fire-fighting methods are necessary.
3. Non-essential personnel will be directed away from the area of the fire.
4. Someone will be directed to greet the fire crew and show them the way to the site over non-contaminated ground if possible. Once the fire department arrives, the senior fire official is now in charge of the site.
5. If it is judged that a fire is small enough to fight with available extinguishing media, employees will attempt to extinguish the fire provided that:
   - They are able to approach the fire from the upwind side, or opposite to the direction of the fire's progress.
   - The correct extinguisher is readily available or a water source or heavy equipment operator that can put soil on the fire is available.
   - No known complicating factors are present, such as likelihood of rapid spread, imminent risk of explosion, or gross contamination.
6. The OSO or designee will perform a head count for that work area.
7. The OSO will assist the fire crew in performing any necessary decontamination of the fire equipment.

3.6.3 Fire Extinguisher Information

The four classes of fire, along with their constituents, are as follows:

Class A - Wood, cloth, paper, rubber, many plastics, and ordinary combustible materials. Extinguish with water or ABC dry chemical extinguisher or other A-rated extinguishing media.

Class B - Flammable liquids, gases, and greases. Extinguish with ABC dry chemical, Purple K, carbon dioxide or other B-rated media.

Class C - Energized electrical equipment. Extinguish with ABC dry chemical, carbon dioxide or other C-rated media.

Class D - Combustible metals such as magnesium, titanium, sodium, and potassium. Extinguish with Metal-X Dry Chemical.

The OSO shall conduct an initial inspection of the fire extinguisher(s) and on a monthly basis to ensure that the unit is adequately charged with extinguishing media. Do not store a fire extinguisher on its side. To use the extinguisher, follow the acronym PASS for instructions listed below:

1. **P**ull the pin on the top of the unit.
2. **A**im at the base of the fire.
3. **S**queeze the handle on the top of the unit.
4 **S**weep the extinguishing media along the base of the fire until the fire is out. Ensure that the fire is fully cooled before assuming it is completely extinguished.

3.7 Earthquake and Disaster Preparedness

If an earthquake or other disaster occurs during working hours and the magnitude is such that site personnel may be in danger, the OSO will initiate the site evacuation procedure. This action is to be taken only if in the judgment of project personnel and/or OSO that the earthquake is large enough to have potentially caused damage to any of the structures or equipment being used on the site.

If the earthquake or disaster occurs during non-working hours, the OSO will determine whether safe entry into the exclusion zones can be made, or if an inspection is needed first. If at any time, the inspection team feels that they need the assistance of the fire department, the inspection shall cease until the fire department is able to assist. The inspection will be conducted using the buddy system. The team will look at all structures, equipment, and any chemical storage areas for signs of cracks or deterioration. When assessing areas known to contain chemicals, appropriate air monitoring equipment will be used to ensure that leaks are detected quickly and without injury to the inspection team. When inspecting areas where chemical releases could have occurred as a result of a breach of containment, Level B PPE is recommended. (Note: Dwyer Engineering personnel are not authorized to don Level B PPE). Level B PPE is not anticipated to be required for use during the field work. However, in the event that site conditions change and the use of Level B becomes warranted, a specialty contractor will be subcontracted to provide assistance with the Level B equipment and work tasks.

3.8 Sanitation

Work breaks, eating, drinking, and conducting paperwork tasks will be performed in the field vehicle or other suitable location outside of the exclusion zone. Field personnel will wash their hands prior to eating or drinking.

Project site toilet facilities may be available to site workers. If it is determined that an existing

toilet facility is not located within a suitable distance (up to 5 minutes vehicle ride) to a particular site, portable toilet facilities will be rented and brought to the project site. All rented toilets will be equipped with a door that is lockable from the inside. Rental toilets will include at a minimum, a weekly cleaning service. A visual search for spiders (particularly black widow spiders) should be conducted prior to using any portable toilet.

Potable water will be available in the support zone for all field team members. The OSO is responsible for ensuring that an adequate supply of water is available at the site. During times of heavy labor and hot temperatures, it is recommended that approximately 1 liter of water per hour be ingested. Electrolyte replacement beverages also may be provided for site personnel. Non-potable water outlets must be clearly identified. When decontamination procedures are prohibitive for the purpose of ingesting water during work, field team members may drink water without prior personnel decontamination under the following stipulations:

- Water is dispensed from a cooler with a pull-lever or top push pouring spout. Push-button pouring spouts are unacceptable as dirty fingers can easily contaminate the pouring spout.
- Disposable drinking cups must be used and discarded after each use.
- Drinking cups must be dispensed out of a plastic or metal dispenser attached to the cooler allowing the bottom of the cup to be grabbed without touching the rim of the top.

Support zone food handling activities must comply with local requirements governing the use of barbecues and vending. Remember to store food at above 140 degrees F or below 40 degrees F to kill or retard food-borne pathogenic microorganisms.

3.9 Housekeeping

One of the best ways to keep a safe site is to keep a clean and orderly site. The OSO shall remind all site workers that it is their responsibility to ensure that housekeeping is kept up and that the sites, staging areas and parking areas where Dwyer Engineering and its contractors work are free from trash, debris and cluttered walkways. This includes the following:

- The OSO will designate trash receptacles.
- Smoking is prohibited by all personnel on the site including Dwyer Engineering personnel.
- All materials shall be stored such that it is stacked, braced, racked, blocked, interlocked, or otherwise secured to prevent sliding, rolling, falling or collapse.
- Any protruding materials (e.g., nails) will be kept clear from walkways and positioned such that someone will not accidentally lean on them.
- Dangerous depressions in the ground shall be avoided by setting up work so that people are not required to walk over them. If that cannot be done, the depression should be temporarily covered or otherwise made safe.
- Any combustible scrap (e.g., cardboard boxes) shall be removed at regular intervals.

- Hoses and cords shall be run the minimum distance necessary and if they must pass over walkways, they must be secured or passed overhead.

3.10 Emergency Response Plan

The objective of this HASP is to minimize the potential for chemical, biological, and physical hazards, and operational incidents. As part of this program, emergency response planning provides procedures for responding to emergencies that may occur during the project. ***It is not the intention of this program to include professional emergency response activities as part of the field operations. Thus, all site personnel are instructed to assess emergencies in terms of whether the problem can be solved safely with the personnel and equipment at the site. If it is determined that site personnel are able to contain the emergency safely, they should do so. If it is determined that the emergency is beyond the abilities of site personnel, evacuation and notification must take place immediately.*** This section provides general information for responding to emergency situations.

An Emergency/Contingency Plans has been established to address possible site emergencies. For major emergency events (e.g., large fires, gas line or electrical line breaks, etc.) personnel will be evacuated to a designated refuge area and local fire, police, and/or emergency medical service personnel notified. All site personnel are required to immediately notify the OSO and/or PM immediately in the event of any type of site emergency. A copy of the emergency numbers and hospital map will be kept in all vehicles and a copy of hospital map and emergency contact info will be provided to each employee on site.

3.10.1 Site and Emergency Communications

Cellular telephones will be used for site and emergency communications. If not available, the closest land line telephone will be located before work is initiated. The OSO will maintain an emergency contact list, which is presented in the table below.

Table 1. Emergency Contacts

Emergency Contact	***Phone Number***
Contracting Officer Representative (COR) Ms. Ramoncita Massey (DOE Los Alamos Site Office)	(505) 665-7771
Dwyer Engineering Project Manager Stephen F. Dwyer, PhD, PE	(505) 270-0215

3.10.2 Emergency Hospital and Route Information

Hospital Address:

Los Alamos Medical Center

3917 West Road Los Alamos, NM (505) 662-3450

3.10.3 Emergency Hospital Directions from the Airport

- Head West on Airport Road toward East Drive for 0.3 miles
- Turn Right onto East Road/NM-502
- Continue on NM-502 for 2.3 miles
- Turn Left onto Diamond Drive/NM-501
- Immediately turn Left onto West Road
- Los Alamos Medical Center is immediately

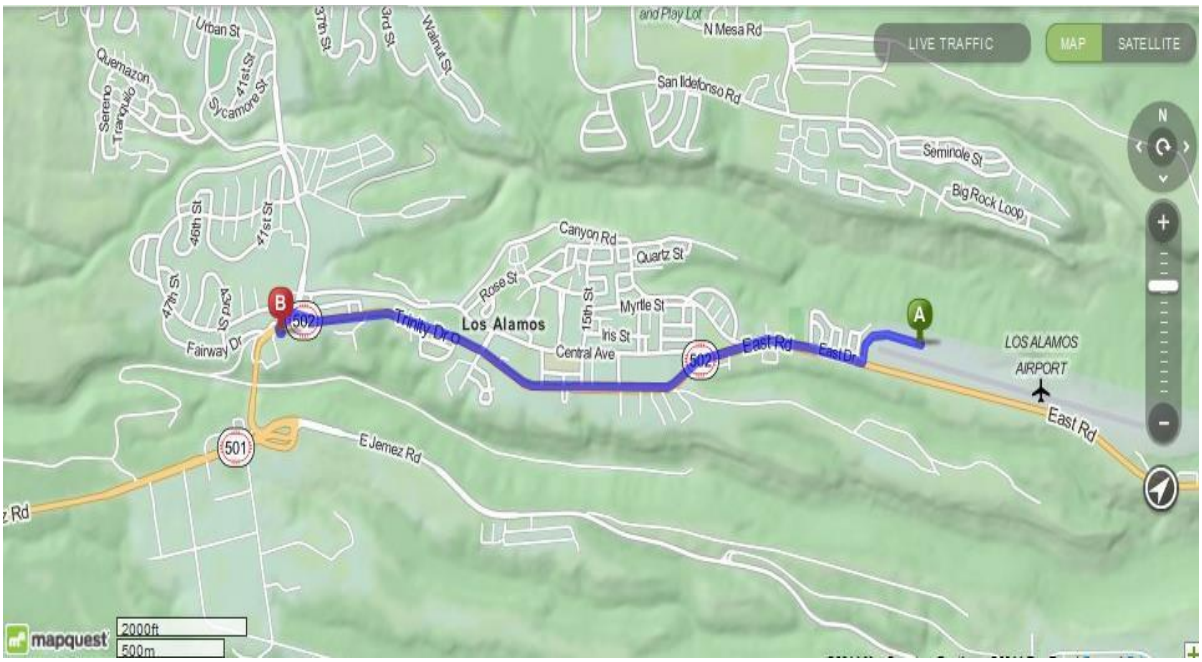


Figure 1. Route to Hospital from Airport

3.10.4 Response to Chemical Spill Incident

Chemical spills can potentially occur on site from heavy equipment and vehicles during fueling operations or due to leaks, or even possibly if equipment (such as a trench compactor) rolls over while being used on the steep slopes.

In the event of a small chemical spill incident, Dwyer Engineering personnel will alert the OSO and construction contractor project manager immediately, as well as the FPD.

3.10.5 Action for Medical Emergency

In the event of a medical emergency, the following procedures will be implemented:

- The exposed or injured person will be removed from immediate danger, and first-aid and/or CPR will be administered by trained site personnel.
- Emergency medical assistance will be called to the site if necessary and will be informed of the following: name and location of person reporting; location of accident or incident;

specific directions to the emergency location, as needed; phone number from which the person is calling; number persons needing help; what is currently being done for the victim (for life-threatening injuries, request instructions from emergency services dispatcher); name and affiliation of injured party; description of injuries; details of any chemical involved; summary of the accident, including suspected causes and time of occurrence; and temporary control measures taken to minimize further risk.

- After emergency services have been notified, one member of the team will be designated to escort emergency personnel to location of accident.
- Nonessential personnel will be evacuated from the work area until the OSO determines that it is safe for work to resume.
- A medical emergency involving chemical exposure will require communication between the OSO and emergency hospital personnel regarding chemicals involved.
- The OSO will designate an individual to accompany or follow the victim to the emergency hospital to assist with any needs that arise and to report back regarding the victim's status.

4.0 Training Requirements

Health and safety training is an integral part of the total project health and safety program. The objectives of such training are to educate workers about the potential health and safety hazards associated with working at the project site. The Project Manager is expected to instruct Dwyer Engineering employees about the hazards of the project and site before allowing them to perform work on site. The site orientation should include an overview of this HASP, emergency information, and other relevant information that would provide the worker with safety and health information prior to entering the project site. Examples of health and safety training that apply to work activities, as applicable:

- Excavation and Trenching
- Fall Protection
- First Aid and CPR
- Hazard Communication
- Hearing Protection
- Lockout/Tagout
- Personal Protective Equipment
- OSHA Construction/Forklift

This is not an all-inclusive list of training requirements; as work scope changes and new training requirements are identified, they will be incorporated into the program.

Prior to commencement of site activities, the OSO will ensure that all Dwyer Engineering personnel and its subcontractor's employees engaged in a work activity are informed of the nature and degree of exposure to chemical and physical hazards that are likely to result from performance of work. All Dwyer Engineering and subcontractor employees must also complete any other training that may be required for the project and by OSHA-specific standards or other applicable standards before initiating work requiring specific training.

It is the responsibility of each subcontractor to ensure that the particular safety and health hazards associated with the subcontractor's work are made known to all other affected site personnel - this will be accomplished by means of ad hoc safety meetings, or by holding a pre-project briefing.

Employees receive safety training regarding potential hazards associated with their work assignments. Site orientation safety meetings, that involve review of pertinent aspects of the HASP, are completed for personnel before project fieldwork. Daily safety meetings are conducted for field operations. Meeting information and attendance is documented.

4.1 Site Orientation Briefing

Before the start of work, the OSO provides a site orientation briefing (or the safety officer from the contractor performing cover replacement) to workers related to project operations and HASP requirements. The briefing includes review of (as applicable):

- Provisions of the HASP

- Facility background and scope of work
- Key personnel and S&H responsibilities
- Site hazards
- Site control procedures
- Personal protective equipment (PPE) requirements
- Procedures for reporting unsafe conditions or unsafe work practices
- Procedures for reporting an injury or illness
- Emergency procedures including warning signals and evacuation procedures
- Location and route to the emergency hospital
- Training requirements
- Medical surveillance requirements
- Recordkeeping procedures.

New workers must receive a site orientation briefing and review the HASP before start of work. Site personnel will sign a form documenting that they have reviewed the plan, understand the HASP requirements, and agree to follow the plan (Appendix).

4.2 Daily Safety Meetings

Daily safety meetings are conducted at the beginning of each work shift to discuss operational tasks to be completed and pertinent site safety topics. These meetings are to be held by the Contractor's (CTI & Associates) Safety Officer while construction activities are ongoing. Content of meetings are documented and those in attendance are required to sign a "Tailgate Safety Meeting Record" (provided by the contractor performing the cover replacement) or equivalent form. A summary of the daily meeting is to be authored by the CTI Safety Officer with a copy provided to FPD.

4.3 Refresher Training

All site workers shall complete eight hours of off-site OSHA HAZWOPER refresher training annually on the items covered in the 40-hour or 24-hour initial training program. Additional topics include a review of site incidents and lessons learned during the previous year. This training must be documented with a certificate of completion signed by the instructor.

5.0 REQUIRED MEETINGS

Dwyer Engineering and its subcontractor employees are required to attend a project safety orientation, as well as daily safety meetings. Dwyer Engineering meeting safety topics discussed are to be documented accompanied with an attendance signature sheet. The site safety meetings to be conducted are as follows:

Table 2. Required Meetings

Meeting Type	Purpose	Length	Frequency
Project Orientation	To acquaint employees with the Project scope of work and field activities.	Approximately 15 minutes to 1 hour.	At time of first assignment to the Project.
Monthly Safety Meeting or Pre-Task review of field work.	To cover specific safety topics; or to review hazards and safety practices, as required.	Approximately 10-30 minutes.	Monthly or at the beginning of new field activities, as required
Daily Tailgate Safety Meeting	To discuss work to be done that day; anticipated chemical, physical, radiological, ergonomic, and biological hazards and controls; methods of communication and emergency reporting; review of applicable orientation topics; and employee issues and concerns. These meetings may be held in conjunction with that of the construction contractor.	Approximately 10 minutes.	Daily.

6.0 HAZARD COMMUNICATION PROGRAM

Dwyer Engineering personnel will not bring any hazardous materials to the site. However, during construction, the construction contractor may introduce potentially hazardous materials and equipment. The OSO will obtain copies or make the contractor's copies available to all personnel including: a hazardous substance inventory list, map, and copies of MSDSs for hazardous substances to be used during project work. Site personnel will be informed of any hazardous substances they will be working with through HASP review and attendance at daily safety meetings.

The construction contractor performing the cover replacement will maintain a "Hazardous Substance Inventory List". The Inventory will be updated as frequently as necessary to accurately reflect those substances on site. The Hazardous Substance Inventory List documents the following;

- Product Name;
- Manufacturer;
- Quantity;
- Location and container type where substance will be stored;
- Verification that an MSDS is on file;
- Date in and date out (for chemicals and other substances that may not be present for all phases of work);
- A map showing specific equipment and chemical storage locations will be generated for each mobilization. Hazardous substance inventory list and map will be updated as necessary to accurately reflect locations of those substances on site;
- The construction contractor safety person will update copies of MSDSs for hazardous substances that are to be used during project work;
- Copies of MSDS sheets will be included with AHA's as applicable;
- Site personnel will be informed of any hazardous substances that they will be working with through attendance at daily safety meetings;
- Local Emergency Response personnel will be notified of location of work, and hazards as necessary before work begins.

7.0 SITE SPECIFIC HAZARDS AND CONTROLS

Field personnel may be subject to the hazards posed by various activities taking place. This section of the HASP is meant to provide a brief description of the controls that should be taken to prevent injury to employees observing or participating in such tasks. The following types of hazards anticipated on the project may include, but are not limited to the following:

- Biological Hazards
- Common Physical Hazards
- Traffic Safety
- Excavation
- Noise
- Heavy Equipment
- Nuisance Dust
- Hand and Power Actuated Tools
- Temperature Extremes
- Severe Weather

7.1 Field Site Access

Any staff member entering a project area managed by the construction contractors will comply with their health and safety requirements. Staff will inquire as to the work activities being performed, potential hazards, policies and site requirements and the protocol for site visitors entering the site. A site briefing will be provided by the construction contractor prior to entering the site.

Staff making a single day or occasional field or facility visit will receive a project site/safety briefing regarding site conditions and safety practices. Staff shall wear the proper PPE while performing their tasks. All visitors must sign in and out when entering and exiting the work area.

Personnel who are not familiar with the site or current remedial activities will be escorted through the Site. Personnel should request an escort or site familiarization tour if they are uncertain of current remedial activities or site conditions and travel ways.

7.2 Biological Hazards

Potential biological hazards may include snakes, spiders, fleas, bees, wasps, poisonous plants, and microorganisms such as the Hantavirus or yeasts left in dried bird excrement. There are no unique or significant biological hazards observed at this site. However, due to the desert location of the site, rattlesnakes and scorpions may be encountered as well as black widow or brown recluse spiders. Detailed information on possible biological hazards at work sites are discussed below.

Insects such as bees, wasps, ticks, and fleas are potential biological hazards that may be

encountered at the Site. Field personnel shall be aware of their surroundings and avoid contact with all insects. An insect repellent with the active ingredient DEET (no more than 35 percent) should be considered if insects are a hazard. The repellent can be applied to clothing or hard hats if skin contact is undesirable. Avoiding the use of perfumes/colognes and choosing light colored clothing or wearing paper Tyvek suits can also help prevent insect bites or stings. Do not swat at bees or wasps as agitation may result in stinging. If stung, move away from the site of the incident, remove the stinger immediately, and apply an ice pack to control pain and swelling. Anti-inflammatory medication may also be administered. Individuals with an allergy to bee or wasp stings must be identified prior to performing field work so that in the case of a sting, the proper medical treatment actions can be taken quickly and effectively. In the case of tics it is a good habit to check oneself at the end of each field day paying close attention to the hair, neck and cuff areas (e.g., pant leg bottoms, wrists). Medical attention should be sought if symptoms persist or if one has an allergy or if an infection is starting to appear.

Venomous spiders may also pose a hazard during fieldwork. The black widow (*Latrodectus mactans*) is a large spider that is easily recognized by its shiny bulbous abdomen. The brown recluse (*Loxosceles reclusa*), or "fiddleback" spider is a brown spider with a fiddle-shaped marking on the head. Both spiders can be found in brush and loose debris. Hazard controls for spider bites are the same as those for snakebite and scorpion stings. In the event of a spider bite, the victim should contact the OSO immediately for assistance. The OSO should transport the victim to the nearest medical facility where antivenin or other medical treatment can be administered.

Rattlesnakes and scorpions are indigenous to many parts of the United States. Spiders and snakes exist in cool, dark, moist areas. The potential for encounters exist when reaching into dark, covered places and a flashlight should be used when reaching into these environments. The OSO will inform field team members at the daily tailgate safety meetings to be on the lookout for rattlesnakes and scorpions if they may be present. It should be noted that the American Red Cross does not advocate the use of snake bite kits for snake bite injuries. Rather, experience has shown that the victim has a better chance of recovery without permanent damage when the site of the wound is immobilized and the victim rushed to the closest emergency medical facility (preferably within 30 minutes).

Hantavirus has resulted in several deaths in the southwestern part of the United States. Most infections result from exposure in closed spaces to active infestations of infected rodents. While there may not have been any outbreaks or notices of the virus at a particular project site, field team members should be aware of the cause and potential control methods. The Hantavirus has been shown to be transmitted through the aerosolization of dried rodent excreta. The Hantavirus-associated disease begins with one or more symptoms including fever, muscle aches, headache, and cough and progresses rapidly to severe lung disease, often requiring intensive care treatment. To control potential contact with dust that may be carrying the rodent excreta, the field team will conduct a visual survey of the area around each site to note whether rodents are thriving in the area. If it is determined that non-domesticated rodents may be living near the work area, or the area is affected by wind blowing dust into the work area, dust suppression techniques and/or respiratory protection (dust mask or dual cartridge air purifying respirator [APR] with dust filters) will be required. The Center for Disease Control, in Atlanta Georgia, has established a hotline for inquiries regarding the Hantavirus: (800) 532-9929.

Other microbiological hazards can exist at projects sites such as landfills and include yeasts from

bird excrement and medical (biological) wastes. If these hazards are suspected, this HASP will be updated to include specific information about the site specific conditions.

7.2 Chemical Hazards

Dwyer Engineering personnel will generally not introduce hazardous materials to the worksite. However, during construction activities, the construction contractor may introduce hazardous materials and equipment and thus knowledge of these is important. A general listing of hazardous substances with anticipated use during site fieldwork is provided below. Access to the construction contractor's "Hazardous Substances Inventory List" will be made available to all personnel by the OSO including MSDSs.

- Fuels: Diesel and gasoline fuel for vehicles and drill equipment.
- Lubricants: Oil, grease, and other lubricants for drill equipment.
- Antifreeze: Antifreeze liquid for vehicles and drill equipment.
- Fire Extinguishing Agent: Dry chemical for fire extinguishers.

Based upon historic air sample results collected from the extraction manholes, landfill gasses (specifically methane) in the areas of the methane monitoring points exceeded the New Mexico Environment Department action levels. Based upon these concentrations, this HASP has been prepared to address safe work practices associated with potential exposure to hazardous materials. Potential exposure to site contaminants may occur via the following exposure pathways:

- Ingestion of soil/liquids/groundwater
- Potentially explosive and flammable atmospheres and the possibility of exposure to volatile compounds.

Dwyer Engineering is aware that several landfill vent pipes are currently producing methane. Methane is an odorless gas that can displace oxygen in enclosed spaces. Methane is highly flammable and can form explosive mixtures with air if it concentrates in an enclosed space with poor ventilation. Health effects associated with methane result from lack of oxygen rather than direct exposure, and landfill gas explosions are not common occurrences. Because the landfill work will occur in an open area, Dwyer Engineering does not anticipate any hazardous situations arising from the methane production; however, employees should be aware of the potential dangers.

Exposure potential is minimal. However, if any signs of contamination or exposure are observed or suspected, exposed workers will be removed to a location upwind and away from the work area, decontamination and first aid of personnel will be administered (as needed), and all work will be stopped until the OSO can implement additional safety precautions.

7.3 Physical Hazards

Dwyer Engineering anticipates that the primary physical hazards that may be encountered during fieldwork include: cold or heat stress; risks (rollover, struck by, slips and falls, etc.) from heavy equipment and people operating on steep slopes with heavy loads; and musculoskeletal strain from heavy lifting associated with the work and materials. These hazards, as well as others, are described in more detail in the following sections, along with safety measures that will be implemented to control and mitigate the hazards.

7.3.1 General Physical Hazards

General safety hazards will be present during all project tasks. General safety information, physical hazards, and safety procedures will be reviewed with onsite personnel during daily safety meetings and may include discussion of the following topics:

- Poor housekeeping;
- Poor illumination;
- Sharp objects;
- Uneven walking surfaces;
- Slippery work surfaces;
- Tripping hazards;
- Fall hazards;
- Pinch points;
- Suspended load safety;
- Backing mishaps;
- Unloading and unsupported load handling;
- Pedestrian traffic safety in work area;
- Electrical safety and use of GFCI; and
- Excavation safety.

7.3.1.1 Housekeeping

In addition to identifying site hazards, Dwyer Engineering employees will use good housekeeping practices while on site. Dwyer Engineering employees will maintain work areas in a clean and organized manner and will prevent the accumulation of debris or other tripping hazards. Tools and equipment will be properly stored when not in use, and routes to access emergency equipment will be well maintained. Spilled materials will be cleaned up immediately and obstacles will be removed from walkways in order to minimize slips, trips, and falls.

7.3.1.2 Slips, Trips, and Falls

Slips, trips and falls can occur anywhere and caution must be taken to avoid these potential hazards. The first and simplest safety precaution during all activities is situational awareness. Employees should always be aware of what is going on around them, and they should stop work if someone is walking through an active work area to make sure it is safe before continuing. If

something looks unsafe, employees are required to report it to the OSO and to discontinue work until the matter is resolved. Every employee will pick up after himself in an effort to avoid slips, trips and falls. Employees should take caution when navigating steep terrain to avoid slipping and potential ankle and leg injuries.

7.3.1.3 Pinch Points

A pinch point is any point at which it is possible for a person or part of a person's body to be caught between moving parts of a machine, or between the moving and stationary parts of a machine, or between material and any part of the machine. A pinch point does not have to cause injury to a limb or body part, although it might cause injury – it only has to trap or pinch the person to prevent them from escaping or removing the trapped part from the pinch point.

The OSO, in conjunction with onsite employees, will evaluate the heavy equipment and project operations to identify potential pinch points. After identifying them, the next step is to eliminate or guard the pinch points to prevent employee contact with the pinch points. After eliminating or guarding the pinch points, all affected employees will be trained about the reasons for the guarding and the hazards created by the pinch points and what injury a pinch point might cause. Guards are intended to create a physical barrier to prevent anyone from making contact with the pinch point.

7.3.2 Heavy Equipment Operation

Dwyer Engineering personnel will not operate heavy equipment on this site. However, heavy equipment will be operated during construction activities, therefore, Dwyer Engineering personnel are to be aware of all equipment operating in the area and its potential hazards.

7.3.3 Vehicle and Equipment Traffic Control

Dwyer Engineering personnel will operate their own personal auto and park in designated areas only away from hazards offered from ongoing construction activities. These areas will be established and adhered to prior to the commencement of construction activities. Use of cell phones near construction activities is prohibited.

7.3.4 Fire Protection and Prevention

The risk of fire or explosion may exist during field activities involving the use and short-term storage of materials which are flammable, or cause flammable environments, including, but not limited to, gasoline, and diesel fuel. Heavy equipment, smoking, electricity or anything that may cause a spark provides a potential ignition source.

Fire extinguishers appropriate to potential workplace fire hazards will be available on site. Fire extinguishers will be stored in vehicles located on site, when applicable, and available to all site personnel. Personnel will be trained in the location and proper use of fire extinguishers, techniques for smothering fires, and emergency evacuation procedures. A muster point shall be identified by the CTI OSO and communicated to all site personnel.

All employees are responsible for good housekeeping practices as outlined in this document to

enhance fire prevention methods. It is the responsibility of the OSO to verify extinguishers are located as needed on site and maintained in a fully charged, ready to operate state, with inspection tag attached. The OSO will have responsibility of making sure housekeeping practices are enforced and that waste materials are removed.

Flammables will be stored in compliance with OSHA and other applicable regulations. The quantity of flammable/combustible material will be kept to a minimum on the job site. OSHA-approved metal safety cans, painted red with a yellow stripe, that have self-closing lids and flame arrestors should be used to store small quantities of flammable liquids. Report all spills or suspicious odors to the OSO immediately.

The following fire prevention best practices will be adhered to:

- Good housekeeping practices will be employed to reduce the likelihood of fire and/or explosion.
- Smoking is prohibited at or in the vicinity of combustible materials.
- Do not put yourself or others a risk while attempting to extinguish a fire.
- If the fire cannot be extinguished, evacuate the area
- Large fire (beyond the immediate control of a small onsite fire extinguisher): The fire department will be called, and personnel will evacuate the fire area and wait for fire department to arrive.

7.3.5 Inclement Weather and Adverse Environmental Conditions

Heavy rain or lightning and strong winds could occur during field efforts and provisions will be made to shut down outdoor operations should this occur, severe weather conditions may occur at any time. The OSO will monitor weather conditions and shut down operations if conditions require it. In cases of inclement weather or other adverse environmental conditions (i.e., strong winds, rain, snow, lightning, hurricane, tornado, earthquake) the following safety instructions are required:

- Local weather forecasts, NOAA weather radio, or the Weather Channel should be monitored prior to the outdoor event to ascertain if thunderstorms or other severe weather events are in the forecast. During the event, the OSO will monitor the site relative weather condition changes. The OSO will monitor the local weather conditions and advise the PM when the U.S. Weather Service issues severe weather warnings

    - Presence of strong winds requires stoppage of affected work activities and stoppage of use of equipment whose safe operation can be affected by high winds.

    - Occurrence of a tornado or earthquake requires stoppage of affected work activities and evacuation of personnel from excavations and trenches, confined spaces, and buildings of questionable stability.

    - Presence of heavy rain or snow requires stoppage of affected work activities where the heavy rain or snow can create safety hazards due to limited visibility, wet work surfaces, slippery equipment controls, cold stress, etc.

- Presence of lightning requires stoppage of affected work activities where lightning presents an increased safety hazard of electrocution (e.g., drill rigs). In general, a significant lightning threat extends outward from the base of a thunderstorm cloud about six to ten miles. Therefore, people should be in a safe place when a thunderstorm is six to ten miles away. At a minimum activity should be stopped when:
    - Lightning is seen: The ability to see lightning varies depending on the time of day, weather conditions, and obstructions such as trees, mountains, etc. In clear air, and especially at night, lightning can be seen from storms more than ten miles away provided that obstructions don't limit the view of the thunderstorm.
    - Thunder is heard: Thunder can usually be heard for a distance of than ten miles. If you hear thunder, though, it's a safe bet that the storm is within ten miles.
    - Lightning safety experts recommend that by the time the monitor observes 30 seconds between seeing the lightning flash and hearing its associated thunder, all individuals should have left the site and reached a safer structure or location.
- Occurrence of a tornado or earthquake requires stoppage of affected work activities and evacuation of personnel.

- In the case of severe weather conditions, emergency evacuation procedures will be established in the event high winds, strong storms, lightning, tornadoes, and floods are a potential occurrence.
    - When a severe weather warning is issued, the OSO will begin taking actions to secure the worksite and seek appropriate shelter.
    - In the event of impending severe weather conditions, personnel will be advised of the hazard, and an evacuation order will be issued by the OSO.
    - The OSO will notify the PM and advise him that all site personnel are evacuating the area.
    - The OSO will maintain contact with site personnel and provide the PM with periodic updates.
- All site personnel will immediately evacuate the work area to a designated location (i.e., hotel). Site personnel will be notified of nearest shelters and specific evacuation procedures during safety tailgate meetings.
    - Large enclosed structures (substantially constructed buildings) tend to be much safer than smaller or open structures.
    - If necessary, fully enclosed metal vehicles such as cars, trucks, buses, vans, fully enclosed farm vehicles, etc. with the windows rolled up provide good shelter from lightning and storms. Avoid contact with metal or conducting surfaces outside or inside the vehicle.
    - During severe weather and lighting events AVOID being in or near: High places and open fields, isolated trees, unprotected gazebos, rain or picnic shelters, baseball, etc.).
- During lightning events AVOID the following when inside a structure: Use of the telephone, washing your hands, or any contact with conductive surfaces with exposure to the outside such as metal door or window frames, electrical wiring, telephone wiring, plumbing, etc. The OSO will determine when it is safe to return to the work area.

  - In case of work stoppage due to inclement weather conditions or other adverse environmental conditions, work will not resume until an all clear signal has been communicated by the OSO.
  - In case of work stoppage due to lightning, an all-clear will not be given until no lightning has appeared in the area for a period of 30 minutes and local weather conditions have been verified.
- Weather related first aid
  - Emergency medical assistance (911) should be immediately notified.
  - People who have been struck by lightning do not carry an electrical charge.
  - Therefore, cardiopulmonary resuscitation (CPR) is safe for the responder.
  - If possible, an injured person should be moved to a safer location before starting
  - First Aid/CPR.

7.4 Temperature Extremes

Hot or cold weather is generally a consideration at any site and cannot be controlled. Site workers need to be aware of controls that can reduce temperature stress, the signs and symptoms of temperatures stress, and first aid measures for victims of temperature stress.

The project site is located in New Mexico, in a typical desert climate. Heat stress is a major concern at this jobsite and should be closely monitored in all field personnel. Heat stress is discussed in detail in below.

7.4.1 Heat Stress

The OSO shall determine the extent to which heat stress monitoring and control is needed based on the guidance provided in this section. The stress of working in a hot environment can cause a variety of illnesses including heat exhaustion or heat stroke; the latter can be fatal. PPE (i.e., U.S. Environmental Protection Agency [USEPA] Level C protection) can increase heat stress significantly. To reduce or prevent heat stress, frequent rest periods and beverage consumption to replace body fluids and salts is required. It should be noted that heat stress can occur in people wearing regular, permeable work clothing.

Quantitative physiological monitoring for heat stress may be conducted. Physiological monitoring for heat stress includes heart rate as a primary indicator and oral temperature as a secondary indicator. The frequency of monitoring depends on the ambient temperature and the level of protection used on site. To determine the initial monitoring frequency, after a work period of moderate exertion, use the table below (source, NIOSH/OSHA/United States Coast Guard/USEPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, 1985).

Table 3. Monitoring Frequency for Heat Stress

Adjusted Temperature*	Level D	Level C
90 F or above	After 45 minutes	After 15 minutes
87.5 to 90 F	After 60 minutes	After 30 minutes

82.5 to 87.5 F	After 90 minutes	After 60 minutes
77.5 to 82.5 F	After 120 minutes	After 90 minutes
72.5 to 77.5 F	After 150 minutes	After 120 minutes

F – Degrees Fahrenheit
*Adjusted air temperature (F) = observed temp + (0.13 x percent sunshine)
Observed temp = air temperature measured with bulb shielded from radiant heat.
Percent sunshine = the time sun is not covered by clouds thick enough to produce a shadow (100 percent = no cloud cover and a sharp, distinct shadow; 0 percent = no shadows).

Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle one-third and keep the rest period the same. If the heart rate exceeds the 110 beats per minute at the next rest period, shorten the following work cycle by another one-third and also monitor oral temperature.

Oral temperature: Use a clinical thermometer (three minutes under the tongue), temperature strip or ear thermometer to measure the temperature at the end of the work period (before drinking). If the temperature exceeds 99.6 F, shorten the next work cycle by one-third without changing the rest period. If the temperature exceeds 99.6 F at the beginning of the next rest period, shorten the following work cycle by one-third. ***DO NOT*** allow a field team member to wear US EPA Level C protection when the measured temperature exceeds 100.6 F (Level C PPE is not anticipated to be utilized on this project).

Personnel will pay particular attention to the information in this section in order to recognize the symptoms of heat stress and the appropriate action to take upon recognition. Even though physiological monitoring is not always necessary, it is essential that personnel understand the significance of heat stress and its recognition.

Symptoms that indicate **heat exhaustion** are:

- Clammy skin
- Weakness, fatigue
- Lightheadedness
- Confusion
- Slurred speech
- Fainting
- Rapid pulse
- Nausea (vomiting)

If these conditions are noted, the following steps should be taken:

- Remove the victim to a cool and uncontaminated area
- Remove protective clothing
- Give water to drink, if conscious.

Symptoms that indicate **heat stroke** include:

- Staggering gait
- Mental confusion
- Hot skin, high temp (yet may feel chilled)
- Convulsions

- Unconsciousness
- Incoherent, delirious

If heat stroke conditions are noted, immediately perform the following steps:

- Remove victim to a cool, uncontaminated area
- Cool the victim, whole body, with water, compresses and/or rapid fanning
- Give water to drink, if conscious
- Transport the victim to the designated medical facility for further cooling and monitoring of body functions. ***HEAT STROKE IS A MEDICAL EMERGENCY!***

Sunburns are another hazard of performing outdoor work. If hard hats are not necessary, team members should consider a brimmed hat and possibly neck flaps. Many weather reports now include an ultraviolet index to aid in the determination to apply sunscreen. When using sunscreen it is important to get one with a sun protection factor of about 30. Apply the sunscreen at least 30 minutes prior to going outdoors and reapply during the day. The OSO is responsible for ensuring that sunscreen is brought to the site and available for use.

7.4.2 Cold Stress

Severe cold exposure can be life threatening. Several factors increase the harmful effects of cold: being very young or very old, wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress, and certain diseases and medications.

Cold weather injuries may be local or systemic. Local cold weather injuries include chilblains (chronic injury of the skin and peripheral capillary circulation) and frostbite. Frostbite occurs in three progressive stages: frostnip, superficial frostbite, and deep frostbite. Systemic cold injuries, due to hypothermia, are those that affect the entire body system. Hypothermia is caused by exposure to cold and is aggravated by moisture, cold winds, fatigue, hunger and inadequate clothing or shelter. Precautionary measures that will be taken include:

- Providing field shelters or wind screens.
- Monitoring temperature and wind speed to determine appropriate cold stress personal safety measures.
- Adjusting work schedule based on weather conditions and temperature.
- Providing insulated clothing for field workers.
- Adhering strictly to the buddy system so that workers can assess cold stress symptoms in their co-workers.

Frostbite Monitoring. Frostbite is a potentially crippling condition that can occur when inadequately protected skin or body parts are subjected to freezing weather. All team members should continually be alert for signs of frostbite in coworkers and bring it to the attention of the OSO. A cold feeling, pain, and numbness precede the onset of frostbite. Frostbite usually appears as gray or white waxy spots on skin. Areas most susceptible are nose, ears, and cheeks. The following steps should be taken to avoid frostbite:

- Dress warmly (avoid cotton, wear polypropylene, wool, gortex or other moisture wicking materials instead).
- Wear layers of clothes.
- Keep boots and gloves loose-fitting.

- Stay dry; carry extra clothing.
- Avoid touching cold metal with bare hands.
- Avoid spilling cold fuel, alcohol, or other liquids that freeze below 32 degrees F on your body or clothing.

If a person suffers frostbite, get them to a hospital as soon as possible. If transport to a hospital is not immediately available, get the person to a warm shelter and immediately perform the following:

- Cover exposed areas with additional clothing while still exposed to the elements.
- Wrap the person in blankets or a sleeping bag.
- Give the person warm drinks (no liquor).
- Undress the frozen part and submerge the frozen part in a tub of warm water (102°F to 105°F), or put the frostbitten person in a large tub of warm water, if available, and stir the water.
- Warm with skin to skin contact, such as placing warm hands on frozen nose or ears, but do not rub.
- Get the person to a hospital as soon as possible.

Do ***not*** allow the following to occur:

- Do not rub the frozen part.
- Do not give the person liquor.
- Do not allow the person to walk on thawed feet.
- Do not let the person smoke.
- Do not break any blisters that may form.
- Do not let the thawed part freeze again.
- Do not warm the frozen part in front of a source of dry heat (open fire, oven, etc.).

Hypothermia Monitoring. Hypothermia is a lowering of the body's temperature due to exposure to cold or cool temperatures. All team members should continually be alert for signs of hypothermia in co-workers and bring it to the attention of the OSO. Most cases of hypothermia occur at temperatures between 30 degrees F and 50 degrees F. If not properly treated, hypothermia can cause death. Safety equipment for hypothermia should include a synthetic sleeping bag and a hypothermia thermometer. ***HYPOTHERMIA IS A MEDICAL EMERGENCY!*** Transport to a hospital as soon as possible, even if victim appears to be recovering.

To prevent hypothermia:

- Eat well prior to exposure.
- Dress warmly (avoid cotton, wear polypropylene, wool, gortex or other moisture wicking materials instead).
- Avoid becoming wet due to sweating, rain or snow, or falling in water.

Early signs of hypothermia may include:

- Violent shivering.
- Slurred speech.
- Decrease in coordination.
- Confusion, inability to answer simple questions.
- Unusually irritable behavior.

- Strange behavior.
- Tendency to drop or lose clothing or equipment.

As hypothermia progresses into more serious stages victims typically:

- Develop trouble seeing clearly.
- Become sleepy and numb.
- Move with difficulty.
- Eventually become unconscious, if not properly cared for.

The following actions should be taken to treat a hypothermia victim:

- Get the victim to a warm, dry shelter as soon as possible.
- Remove any wet or cold garments and dry the person thoroughly.
- Wrap the victim in blankets, sleeping bags or dry clothing to prevent more heat loss.
- If a warm area is not available:
  - Build a shelter and put the victim in the warmest, driest area available.
  - Remove any wet or cold garments.
  - Have one or more persons remove their clothing and lay next to the victim, providing skin to skin contact.
  - Wrap the victim and rescuers in dry warm blankets, sleeping bags or clothing.
  - When the victim becomes conscious, place warm objects along the victim's sides to warm vital areas.
- When the victim is able to swallow easily, provide warm, sweetened drinks and food (preferably candy or sweetened food).
- Do not give the victim alcohol or allow to smoke.
- Do not rub the victim's skin.
- Keep checking the victim and give additional assistance as needed.

7.5 Noise Exposure

Noise exposure above 85 decibels on the A-weighted scale (dBA) may occur during equipment operations. Earplugs will be used for worker protection. The operation of equipment and machinery at the site may generate excessive noise levels and require site personnel working in the immediate area of operating equipment to use hearing protection (e.g., foam ear plugs) whenever noise exposures exceed 85 dBA.

Noise monitoring is not anticipated, but noise exposures in excess of 85 dBA are assumed to be present when voices must be raised to be heard in normal conversation at three feet apart and also whenever working in the immediate areas of operating generators, compressors, powered hand tools and similar equipment. Hearing protection will be required for all persons exposed to the above conditions.

7.6 Dust

Dust related may be a concern during earthwork activities. Avoid heavy dust when visually apparent. Alert the construction contractor of dust concerns to ensure adequate water is applied to minimize dust creation during earthwork activities.

8.0 Personal Protective Equipment

Work conducted as part of a HAZWOPER program must meet a minimum level of personal protection. OSHA and the US EPA have identified standard levels of PPE. This section indicates the specific PPE ensembles for work at the Site.

The proper selection, fit-testing, use, maintenance, disposal and limitations of each piece of PPE shall be reviewed during the training programs described in Section 4. These training topics should be reviewed periodically during tailgate safety meetings. All footwear, hard hats and safety glasses/goggles shall be American National Standards Institute (ANSI) approved. There is no longer an OSHA prohibition for the use of contact lenses with respiratory protective devices. Individuals who feel that the contact lens provides them superior vision and comfort may use them on-site and with respirators.

All of the work conducted at the Site is anticipated to be completed in Level D PPE. The standard PPE ensemble for work is Level D as specified in Table 4. Tasks with a deviation from the standard are listed in the table, with only the changed information. If a sign posted by the OSO indicates that a piece of PPE is needed, obey the posted sign regardless of what the task is or the table below indicates.

8.1 Standard Level D PPE

The following items must be available for use during all field programs. Individual items may not be necessary if the hazard is not present (e.g., no overhead machinery or hazards means no hard hat required, unless posted signs state the area as hard hat required, or moving heavy equipment is present). It is acceptable when exposures above occupational exposure limits are not anticipated, immersion or engulfment is not expected and the atmosphere contains between 19.5 and 22 percent oxygen. The standard Level D PPE ensemble includes:

Table 4. Level D PPE

Item	Description
Boots	Steel-toed work boots or steel toed rubber or polyvinyl chloride (PVC) boots meeting ANSI or ASTM specifications.
Clothing	Dedicated work clothing includes long pants or coveralls. Can be cotton, poly-cotton blend or Tyvek.
Gloves	Thin nitrile gloves (e.g., N-Dex) when handling potentially contaminated soil, water, debris, equipment or articles. Heavy work gloves are to be available for handling sharp objects or when using a sharp cutting tool.
Safety glasses	Side shields (plain or sun glass tint depending on brightness).
Hard hat	When overhead hazard or working around heavy equipment (ANSI Z89.1).
Safety vest	Brightly colored traffic-type safety vest when working in roadways or around moving heavy equipment.

Item	Description
Hearing protection	When working in areas where noise levels exceed 85 decibels on the "A" weighted scale (dBA). If unsure, have the task or area tested. A rule of thumb is having to shout to be heard at a distance of three feet.

8.2 Standard Level C PPE

In the event that air monitoring indicates the need to upgrade into Level C PPE, additions shall be made to the existing standard Level D PPE ensemble. A half-face piece or full-face piece APR will be used in combination with /P100 (yellow cartridges). The cartridges should be changed at the end of every shift. Double gloves with thin Nitrile under thick Nitrile will be worn and taped to the sleeves of a disposable coverall. Either boot covers, with substantial tread, or PVC or rubber steel-toed boots will be worn, taped to a disposal coverall. A poly-coated Tyvek or equivalent coverall will be worn.

Table 5. Level C PPE

Item	Description
Boots	Steel-toed work boots or steel toed rubber or polyvinyl chloride (PVC) boots meeting ANSI or ASTM specifications.
Clothing	Chemical resistant coveralls as specified. Cuffs duct-taped to hand and foot protection.
Gloves	Inner and outer chemical resistant gloves as specified are to be used with work gloves and cut resistant gloves.
Safety glasses	Safety glasses with side shields or goggles (ANSI Z87.1).
	Face shield over safety glasses or goggles, when saw cutting, working with pressure devices or when splash is likely. If corrective lenses are needed when wearing a full-face APR, brand-specific inserts must be purchased in advance.
Hard hat	When overhead hazard or working around heavy equipment (ANSI Z89.1).
Safety vest	Brightly colored traffic-type safety vest when working in roadways or around moving heavy equipment.
Hearing protection	When working in areas where noise levels exceed 85 decibels on the "A" weighted scale (dBA). If unsure, have the task or area tested. A rule of thumb is having to shout to be heard at a distance of three feet.

Individual items may not be necessary if the hazard is not present (e.g., no overhead machinery

or hazards means no hard hat required, unless posted signs state the area as hard hat required, or moving heavy equipment is present). It is acceptable when exposures above occupational exposure limits are not anticipated, immersion or engulfment is not expected and the atmosphere contains between 19.5 and 22 percent oxygen.

9.0 EMERGENCY CONTACT INFORMATION

9.1 ALWAYS PROVIDE YOUR EXACT LOCATION TO A 911 OPERATOR

The Project Manager, or designee, will be responsible for taking necessary action and contacting the appropriate emergency contacts in the event of an emergency. The following are contacts for emergencies that may occur during fieldwork activities at Los Alamos, NM.

9.2 Site-Specific Information

Site Location Los Alamos County Airport
1040 Airport Road
Los Alamos, New Mexico 87544

9.3 24-Hour Emergency Hospital

Los Alamos Medical Center
3917 West Road
Los Alamos, NM 87544
Phone: (505) 662-4201

Directions (See Figure 1, Hospital Route Map): State Road 502 becomes Trinity Drive. Follow Trinity Drive to the hospital. LAMC is located on the south side of Trinity, at the intersection of Trinity and Diamond Drives.

Table 6. Project Personnel Contact List

Project Personnel Contact List		
Position	**Name**	**Phone Numbers**
Project Manager	Steve Dwyer	(505) 270-0215
On-site Safety Officer (OSO)	Steve Dwyer	(505) 270-0215
DOE Project Manager	Ramoncita Massey	(505) 665-7771 (w) (505) 553-1402 (c)

9.4 24-Hour Emergency

Emergency Contact Numbers

Ambulance	911
Fire Department	911

Police Department	911
Poison Control	(800) 876-4766
National Response Center	(800) 424-8802
Utilities Underground Service Alert	(800) 227-2600
OSHA Regional Center	(800) 321-6742

10.0 References

1. 10 CFR 851. Worker Safety and Health Program. April 10, 2015.
2. NMAC. Title 20. Environmental Protection. 2015.
3. US EPA. Standard Operating Safety Guides, June 1992.
4. US EPA, NIOSH, OSHA, USCG. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985.
5. U.S. Department of Labor - Occupational Safety and Health Administration. 29 Code of Federal Regulations, Part 1910, and Part 1926.

APPENDIX

(HASP Briefing Form)

TASK HEALTH & SAFETY BRIEFING FORM

Design Health & Safety Plan Briefing Form

Project Title: **Cover Replacement Project, Los Alamos County Airport Landfill**

HASP Rev. 0

Conducted by:

Printed Name **Title** **Employer**

Signature **Date**

I acknowledge that I understand this HASP, including the hazards related to performing my job duties and the ways I can eliminate the hazards or protect myself from injury or illness on the job.

Name	Employer	Signature/Date

ClientID	ProjectName	SampID	ClientSampID	AnalDate	TestNo	CAS	Analyte	R_Rslt	PQL	MDL	DF	Units	DateCollec
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	630-20-6	1,1,1,2-Tetrachloroethane	< 0.048	0.048216	0.003954	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	71-55-6	1,1,1-Trichloroethane	< 0.048	0.048216	0.007323	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	79-34-5	1,1,2,2-Tetrachloroethane	< 0.048	0.048216	0.005844	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	79-00-5	1,1,2-Trichloroethane	< 0.048	0.048216	0.005794	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-34-3	1,1-Dichloroethane	< 0.048	0.048216	0.019286	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-35-4	1,1-Dichloroethene	< 0.048	0.048216	0.003319	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	563-58-6	1,1-Dichloropropene	< 0.096	0.096432	0.00718	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	87-61-6	1,2,3-Trichlorobenzene	< 0.096	0.096432	0.010291	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	96-18-4	1,2,3-Trichloropropane	< 0.096	0.096432	0.008089	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	120-82-1	1,2,4-Trichlorobenzene	< 0.048	0.048216	0.008897	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	95-63-6	1,2,4-Trimethylbenzene	< 0.048	0.048216	0.002406	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	96-12-8	1,2-Dibromo-3-chloropropane	< 0.096	0.096432	0.008282	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	106-93-4	1,2-Dibromoethane (EDB)	< 0.048	0.048216	0.00384	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	95-50-1	1,2-Dichlorobenzene	< 0.048	0.048216	0.002908	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	107-06-2	1,2-Dichloroethane (EDC)	< 0.048	0.048216	0.019286	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	78-87-5	1,2-Dichloropropane	< 0.048	0.048216	0.002695	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	108-67-8	1,3,5-Trimethylbenzene	< 0.048	0.048216	0.003169	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	541-73-1	1,3-Dichlorobenzene	< 0.048	0.048216	0.005677	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	142-28-9	1,3-Dichloropropane	< 0.048	0.048216	0.006641	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	106-46-7	1,4-Dichlorobenzene	< 0.048	0.048216	0.006006	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	90-12-0	1-Methylnaphthalene	< 0.19	0.192864	0.028923	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	594-20-7	2,2-Dichloropropane	< 0.096	0.096432	0.007019	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	78-93-3	2-Butanone	< 0.48	0.48216	0.030999	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	95-49-8	2-Chlorotoluene	< 0.048	0.048216	0.00545	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	591-78-6	2-Hexanone	< 0.48	0.48216	0.011858	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	91-57-6	2-Methylnaphthalene	< 0.19	0.192864	0.031697	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	106-43-4	4-Chlorotoluene	< 0.048	0.048216	0.003646	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	99-87-6	4-Isopropyltoluene	< 0.048	0.048216	0.003429	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	108-10-1	4-Methyl-2-pentanone	< 0.48	0.48216	0.008366	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	67-64-1	Acetone	< 0.72	0.72324	0.035954	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	71-43-2	Benzene	< 0.048	0.048216	0.00715	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	108-86-1	Bromobenzene	< 0.048	0.048216	0.003579	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-27-4	Bromodichloromethane	< 0.048	0.048216	0.003944	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-25-2	Bromoform	< 0.048	0.048216	0.003876	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	74-83-9	Bromomethane	< 0.14	0.144648	0.009307	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-15-0	Carbon disulfide	< 0.48	0.48216	0.034698	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	56-23-5	Carbon tetrachloride	< 0.048	0.048216	0.004696	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	108-90-7	Chlorobenzene	< 0.048	0.048216	0.003711	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-00-3	Chloroethane	< 0.096	0.096432	0.037323	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	67-66-3	Chloroform	< 0.048	0.048216	0.005026	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	74-87-3	Chloromethane	< 0.14	0.144648	0.005582	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	156-59-2	cis-1,2-DCE	< 0.048	0.048216	0.0061	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	10061-01-5	cis-1,3-Dichloropropene	< 0.048	0.048216	0.003345	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	124-48-1	Dibromochloromethane	< 0.048	0.048216	0.003615	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	74-95-3	Dibromomethane	< 0.048	0.048216	0.005077	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-71-8	Dichlorodifluoromethane	< 0.048	0.048216	0.012127	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	100-41-4	Ethylbenzene	< 0.048	0.048216	0.00442	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	87-68-3	Hexachlorobutadiene	< 0.096	0.096432	0.006696	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	98-82-8	Isopropylbenzene	< 0.048	0.048216	0.004072	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	1634-04-4	Methyl tert-butyl ether (MTBE)	< 0.048	0.048216	0.006819	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-09-2	Methylene chloride	< 0.14	0.144648	0.019286	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	104-51-8	n-Butylbenzene	< 0.14	0.144648	0.004155	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	103-65-1	n-Propylbenzene	< 0.048	0.048216	0.003607	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	91-20-3	Naphthalene	< 0.096	0.096432	0.011474	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	135-98-8	sec-Butylbenzene	< 0.048	0.048216	0.006873	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	100-42-5	Styrene	< 0.048	0.048216	0.00885	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	98-06-6	tert-Butylbenzene	< 0.048	0.048216	0.005523	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	127-18-4	Tetrachloroethene (PCE)	< 0.048	0.048216	0.004178	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	108-88-3	Toluene	< 0.048	0.048216	0.005738	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	156-60-5	trans-1,2-DCE	< 0.048	0.048216	0.003133	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	10061-02-6	trans-1,3-Dichloropropene	< 0.048	0.048216	0.008681	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	79-01-6	Trichloroethene (TCE)	< 0.048	0.048216	0.004697	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-69-4	Trichlorofluoromethane	< 0.048	0.048216	0.014554	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	75-01-4	Vinyl chloride	< 0.048	0.048216	0.019286	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001a	LA Borrow	7/7/2015	SW8260B	1330-20-7	Xylenes, Total	< 0.096	0.096432	0.013362	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	72-54-8	4,4´-DDD	< 0.0099	0.009877	0.003982	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	72-55-9	4,4´-DDE	< 0.0099	0.009877	0.00422	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	50-29-3	4,4´-DDT	< 0.0099	0.009877	0.004106	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	309-00-2	Aldrin	< 0.0099	0.009877	0.004022	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	319-84-6	alpha-BHC	< 0.0099	0.009877	0.003897	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	319-85-7	beta-BHC	< 0.0099	0.009877	0.003069	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	57-74-9	Chlordane	< 0.62	0.617284	0.212642	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	319-86-8	delta-BHC	< 0.0099	0.009877	0.003883	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	60-57-1	Dieldrin	< 0.0099	0.009877	0.003891	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	959-98-8	Endosulfan I	< 0.0099	0.009877	0.003771	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	33213-65-9	Endosulfan II	< 0.0099	0.009877	0.003962	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	1031-07-8	Endosulfan sulfate	< 0.0099	0.009877	0.004343	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	72-20-8	Endrin	< 0.0099	0.009877	0.003896	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	7421-93-4	Endrin aldehyde	< 0.0099	0.009877	0.003488	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	58-89-9	gamma-BHC	< 0.0099	0.009877	0.003597	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	76-44-8	Heptachlor	< 0.0099	0.009877	0.003731	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	1024-57-3	Heptachlor epoxide	< 0.0099	0.009877	0.00376	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	72-43-5	Methoxychlor	< 0.0099	0.009877	0.004249	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001B	LA Borrow	7/17/2015	SW8081	8001-35-2	Toxaphene	< 0.62	0.617284	0.153778	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/7/2015	SW7471	7439-97-6	Mercury	0.13	0.032695	0.002875	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7440-38-2	Arsenic	< 12	11.99846	1.410539	5	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7440-39-3	Barium	91	0.479939	0.143022	5	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7440-43-9	Cadmium	< 0.48	0.479939	0.133423	5	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7440-47-3	Chromium	5.5	1.439816	0.288923	5	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7782-49-2	Selenium	< 12	11.99846	7.360338	5	mg/Kg	7/1/2015

DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/13/2015	SW6010B	7440-22-4	Silver	< 1.2	1.199846	0.143022	5 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001C	LA Borrow	7/15/2015	SW6010B	7439-92-1	Lead	8.2	1.199846	0.523133	5 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	93-76-5	2,4,5-T	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	93-72-1	2,4,5-TP (Silvex)	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	94-75-7	2,4-D	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	94-82-6	2,4-DB	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	1861-32-1	Dacthal	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	75-99-0	Dalapon	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	1918-00-9	Dicamba	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	120-36-5	Dichlorprop	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	88-85-7	Dinoseb	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	94-74-6	MCPA	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	87-86-5	Pentachlorophenol	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-001D	LA Borrow	7/19/2015	SW8151	1918-02-1	Picloram	< 0.010	0.01	0.01	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	630-20-6	1,1,1,2-Tetrachloroethane	< 0.047	0.047125	0.003865	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	71-55-6	1,1,1-Trichloroethane	< 0.047	0.047125	0.007157	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	79-34-5	1,1,2,2-Tetrachloroethane	< 0.047	0.047125	0.005712	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	79-00-5	1,1,2-Trichloroethane	< 0.047	0.047125	0.005663	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-34-3	1,1-Dichloroethane	< 0.047	0.047125	0.01885	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-35-4	1,1-Dichloroethene	< 0.047	0.047125	0.003244	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	563-58-6	1,1-Dichloropropene	< 0.094	0.094251	0.007018	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	87-61-6	1,2,3-Trichlorobenzene	< 0.094	0.094251	0.010058	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	96-18-4	1,2,3-Trichloropropane	< 0.094	0.094251	0.007906	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	120-82-1	1,2,4-Trichlorobenzene	< 0.047	0.047125	0.008696	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	95-63-6	1,2,4-Trimethylbenzene	< 0.047	0.047125	0.002351	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	96-12-8	1,2-Dibromo-3-chloropropane	< 0.094	0.094251	0.008095	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	106-93-4	1,2-Dibromoethane (EDB)	< 0.047	0.047125	0.003753	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	95-50-1	1,2-Dichlorobenzene	< 0.047	0.047125	0.002843	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	107-06-2	1,2-Dichloroethane (EDC)	< 0.047	0.047125	0.01885	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	78-87-5	1,2-Dichloropropane	< 0.047	0.047125	0.002634	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	108-67-8	1,3,5-Trimethylbenzene	< 0.047	0.047125	0.003097	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	541-73-1	1,3-Dichlorobenzene	< 0.047	0.047125	0.005549	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	142-28-9	1,3-Dichloropropane	< 0.047	0.047125	0.00649	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	106-46-7	1,4-Dichlorobenzene	< 0.047	0.047125	0.00587	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	90-12-0	1-Methylnaphthalene	< 0.19	0.188501	0.028269	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	594-20-7	2,2-Dichloropropane	< 0.094	0.094251	0.00686	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	78-93-3	2-Butanone	< 0.47	0.471254	0.030298	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	95-49-8	2-Chlorotoluene	< 0.047	0.047125	0.005326	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	591-78-6	2-Hexanone	< 0.47	0.471254	0.01159	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	91-57-6	2-Methylnaphthalene	< 0.19	0.188501	0.03098	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	106-43-4	4-Chlorotoluene	< 0.047	0.047125	0.003564	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	99-87-6	4-Isopropyltoluene	< 0.047	0.047125	0.003352	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	108-10-1	4-Methyl-2-pentanone	< 0.47	0.471254	0.008177	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	67-64-1	Acetone	< 0.71	0.70688	0.035141	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	71-43-2	Benzene	< 0.047	0.047125	0.006989	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	108-86-1	Bromobenzene	< 0.047	0.047125	0.003498	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-27-4	Bromodichloromethane	< 0.047	0.047125	0.003854	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-25-2	Bromoform	< 0.047	0.047125	0.003789	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	74-83-9	Bromomethane	< 0.14	0.141376	0.009096	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-15-0	Carbon disulfide	< 0.47	0.471254	0.033913	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	56-23-5	Carbon tetrachloride	< 0.047	0.047125	0.00459	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	108-90-7	Chlorobenzene	< 0.047	0.047125	0.003627	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-00-3	Chloroethane	< 0.094	0.094251	0.036479	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	67-66-3	Chloroform	< 0.047	0.047125	0.004912	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	74-87-3	Chloromethane	< 0.14	0.141376	0.005456	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	156-59-2	cis-1,2-DCE	< 0.047	0.047125	0.005962	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	10061-01-5	cis-1,3-Dichloropropene	< 0.047	0.047125	0.00327	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	124-48-1	Dibromochloromethane	< 0.047	0.047125	0.003533	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	74-95-3	Dibromomethane	< 0.047	0.047125	0.004962	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-71-8	Dichlorodifluoromethane	< 0.047	0.047125	0.011853	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	100-41-4	Ethylbenzene	< 0.047	0.047125	0.00432	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	87-68-3	Hexachlorobutadiene	< 0.094	0.094251	0.006544	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	98-82-8	Isopropylbenzene	< 0.047	0.047125	0.003979	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	1634-04-4	Methyl tert-butyl ether (MTBE)	< 0.047	0.047125	0.006665	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-09-2	Methylene chloride	< 0.14	0.141376	0.01885	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	104-51-8	n-Butylbenzene	< 0.14	0.141376	0.004061	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	103-65-1	n-Propylbenzene	< 0.047	0.047125	0.003525	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	91-20-3	Naphthalene	< 0.094	0.094251	0.011215	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	135-98-8	sec-Butylbenzene	< 0.047	0.047125	0.006717	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	100-42-5	Styrene	< 0.047	0.047125	0.00865	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	98-06-6	tert-Butylbenzene	< 0.047	0.047125	0.005398	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	127-18-4	Tetrachloroethene (PCE)	< 0.047	0.047125	0.004083	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	108-88-3	Toluene	< 0.047	0.047125	0.005608	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	156-60-5	trans-1,2-DCE	< 0.047	0.047125	0.003062	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	10061-02-6	trans-1,3-Dichloropropene	< 0.047	0.047125	0.008484	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	79-01-6	Trichloroethene (TCE)	< 0.047	0.047125	0.00459	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-69-4	Trichlorofluoromethane	< 0.047	0.047125	0.014225	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	75-01-4	Vinyl chloride	< 0.047	0.047125	0.01885	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002a	Los alamos 54-la	7/7/2015	SW8260B	1330-20-7	Xylenes, Total	< 0.094	0.094251	0.01306	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	72-54-8	4,4´-DDD	< 0.019	0.019446	0.00784	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	72-55-9	4,4´-DDE	< 0.019	0.019446	0.008308	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	50-29-3	4,4´-DDT	< 0.019	0.019446	0.008084	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	309-00-2	Aldrin	< 0.019	0.019446	0.007919	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	319-84-6	alpha-BHC	< 0.019	0.019446	0.007673	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	319-85-7	beta-BHC	< 0.019	0.019446	0.006043	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	57-74-9	Chlordane	< 1.2	1.215362	0.418668	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	319-86-8	delta-BHC	< 0.019	0.019446	0.007644	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	60-57-1	Dieldrin	< 0.019	0.019446	0.007661	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	959-98-8	Endosulfan I	< 0.019	0.019446	0.007425	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	33213-65-9	Endosulfan II	< 0.019	0.019446	0.007801	1 mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	1031-07-8	Endosulfan sulfate	< 0.019	0.019446	0.00855	1 mg/Kg	7/1/2015

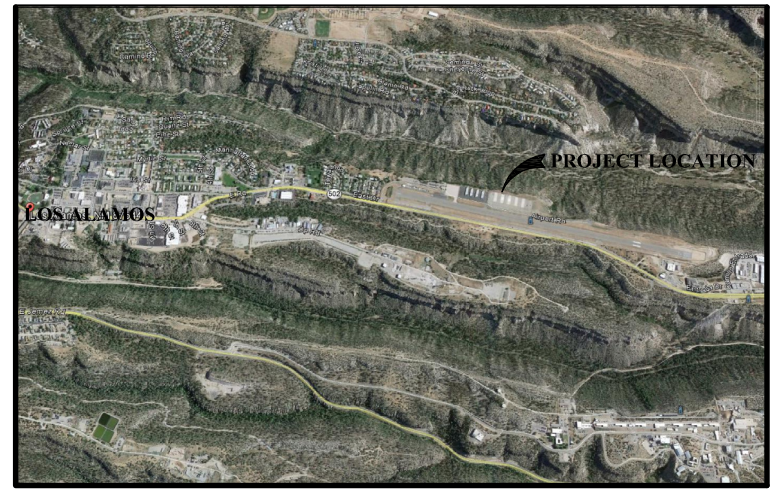
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	72-20-8	Endrin	< 0.019	0.019446	0.00767	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	7421-93-4	Endrin aldehyde	< 0.019	0.019446	0.006867	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	58-89-9	gamma-BHC	< 0.019	0.019446	0.007082	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	76-44-8	Heptachlor	< 0.019	0.019446	0.007346	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	1024-57-3	Heptachlor epoxide	< 0.019	0.019446	0.007402	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	72-43-5	Methoxychlor	< 0.019	0.019446	0.008366	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002B	Los alamos 54-la	7/17/2015	SW8081	8001-35-2	Toxaphene	< 1.2	1.215362	0.302771	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/7/2015	SW7471	7439-97-6	Mercury	< 0.032	0.031905	0.002805	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7782-49-2	Selenium	< 2.5	2.483855	1.523696	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7440-22-4	Silver	< 0.25	0.248385	0.029608	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7440-38-2	Arsenic	< 2.5	2.483855	0.292002	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7440-39-3	Barium	77	0.099354	0.029608	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7440-43-9	Cadmium	< 0.099	0.099354	0.02762	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/13/2015	SW6010B	7440-47-3	Chromium	4.2	0.298063	0.059811	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002C	Los alamos 54-la	7/17/2015	SW6010B	7439-92-1	Lead	7.1	0.496771	0.216592	2	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	93-76-5	2,4,5-T	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	93-72-1	2,4,5-TP (Silvex)	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	94-75-7	2,4-D	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	94-82-6	2,4-DB	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	1861-32-1	Dacthal	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	75-99-0	Dalapon	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	1918-00-9	Dicamba	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	120-36-5	Dichlorprop	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	88-85-7	Dinoseb	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	94-74-6	MCPA	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	87-86-5	Pentachlorophenol	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015
DBS LAB	DBS&A-Dwyer	1507119-002D	Los alamos 54-la	7/19/2015	SW8151	1918-02-1	Picloram	< 0.010	0.01	0.01	1	mg/Kg	7/1/2015

:ted

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE

LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

LOS ALAMOS COUNTY, N.M.
DE - EM0002882
APRIL, 2015



LOCATION MAP

LEGEND

7140	EXISTING CONTOUR
7140	NEW CONTOUR
sd	EXISTING STORM DRAIN
	SPOT ELEVATION OF FINISHED GRADE
	EXISTING RIPRAP CHANNEL
	NEW RIPRAP CHANNEL
S=3.3%	INDICATES PERCENT OF SLOPE
	INDICATES MATERIAL TO BE REMOVED
	INDICATES MATERIAL TO BE RELOCATED
	LOCATION OF EXISTING WASTE TO BE RELOCATED
x x	FENCE LINE
P	EXISTING UTILITY POLE
MH	EXISTING MANHOLE
	NEW ASPHALT PAVING
	NEW CONCRETE HANGAR PAD

INDEX OF SHEETS

SHEET NO.	TITLE
–	COVER, TITLE, LOCATION MAP, INDEX OF SHEETS AND LEGEND
2000	SURFACE MATERIAL REMOVAL PLAN
2001	WASTE REMOVAL PLAN
3000	SITE PLAN
3001	SECTIONS AND DETAILS
3002	DETAILS
3003	HANGAR PAD FOUNDATION PLAN
3004	HANGAR PAD ANCHOR BOLT LAYOUT

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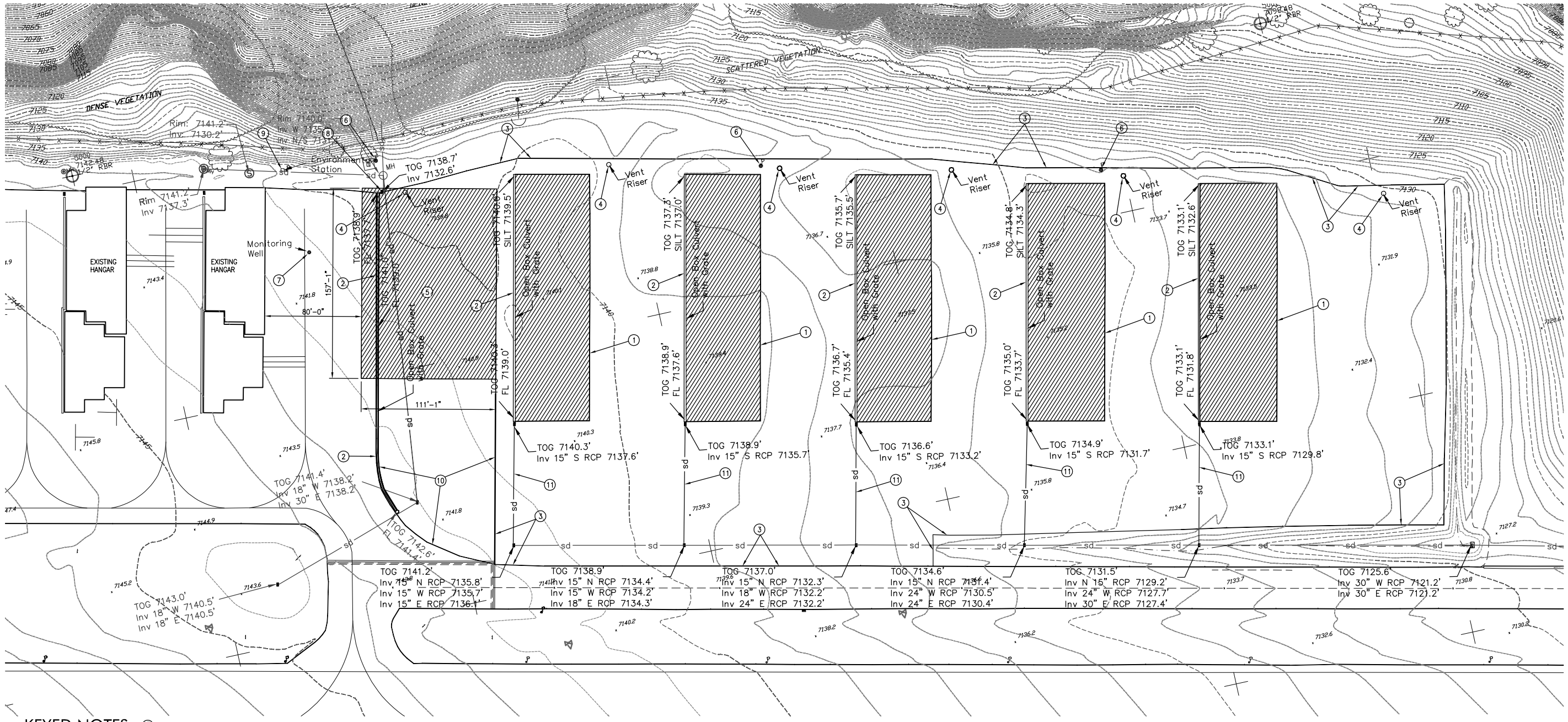


KEYED NOTES: ⓘ

1. REMOVE REINFORCED CONCRETE HANGER PADS. TRANSPORT REMOVED DEBRIS TO LOS ALAMOS COUNTY LANDFILL FOR CRUSHING.
2. REMOVE REINFORCED CONCRETE OPEN BOX CULVERT. TRANSPORT REMOVED DEBRIS TO LOS ALAMOS COUNTY LANDFILL FOR CRUSHING. SAVE METAL GRATING COVER FROM CILVERT.
3. REMOVE AND MILL ON-SITE ASPHALT SURFACE (APPROXIMATELY 4 INCHES DEEP). STOCKPILE MILLED ASPHALT ON-SITE AS DESIGNATED BY CONSTRUCTION MANAGER. REMOVE AND STOCKPILE BASE COURSE (APPROXIMATELY 8 INCHES DEEP); ON-SITE AS DESIGNATED BY CONSTRUCTION MANAGER.
4. REMOVE GAS VENT RISERS AND CONCRETE BARRIERS. RECYCLE MATERIAL AS APPROPRIATE; DISPOSE OF REMAINDER OF MATERIAL.
5. REMOVE ASPHALT SURFACE IN AREA WHERE NEW CONCRETE HANGAR PAD AND ASPHALT ACCESS IS TO BE CONSTRUCTED AND ABOVE WASTE REMOVAL AREA. ASPHALT FROM ADJACENT AREA TO BE REMOVED AS REQUIRED TO MEET OSHA REQUIREMENTS FOR EXCAVATION. ASPHALT TO BE MILLED AND STOCKPILED ON-SITE IN A LOCATION DESIGNATED BY CONSTRUCTION MANAGER.
6. REMOVE UTILITY POLES. (TOTAL OF 3).
7. PROTECT MONITORING WELL DURING CONSTRUCTION ACTIVITIES.
8. REMOVE MANHOLE AND CONNECT SUBSURFACE DRAIN LINES WITH CONTINUOUS CULVERT. FIELD FIT.
9. PROTECT ENVIRONMENT STATION AND POWER CONNECTION DURING CONSTRUCTION ACTIVITIES. CONTACT LANL AIRNET (505) 667-5694 BEFORE DISTURBING (IF REQUIRED).
10. DO NOT REMOVE MATCON ASPHALT IN THIS AREA.
11. REMOVE STORM DRAINS WITHIN FOOTPRINT OF LANDFILL. PLUG ENDS OF REMAINING STORM DRAIN SYSTEM WATER TIGHT.

SCALE: 1" = 40'
0 20 40 80

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE
SURFACE MATERIAL REMOVAL PLAN

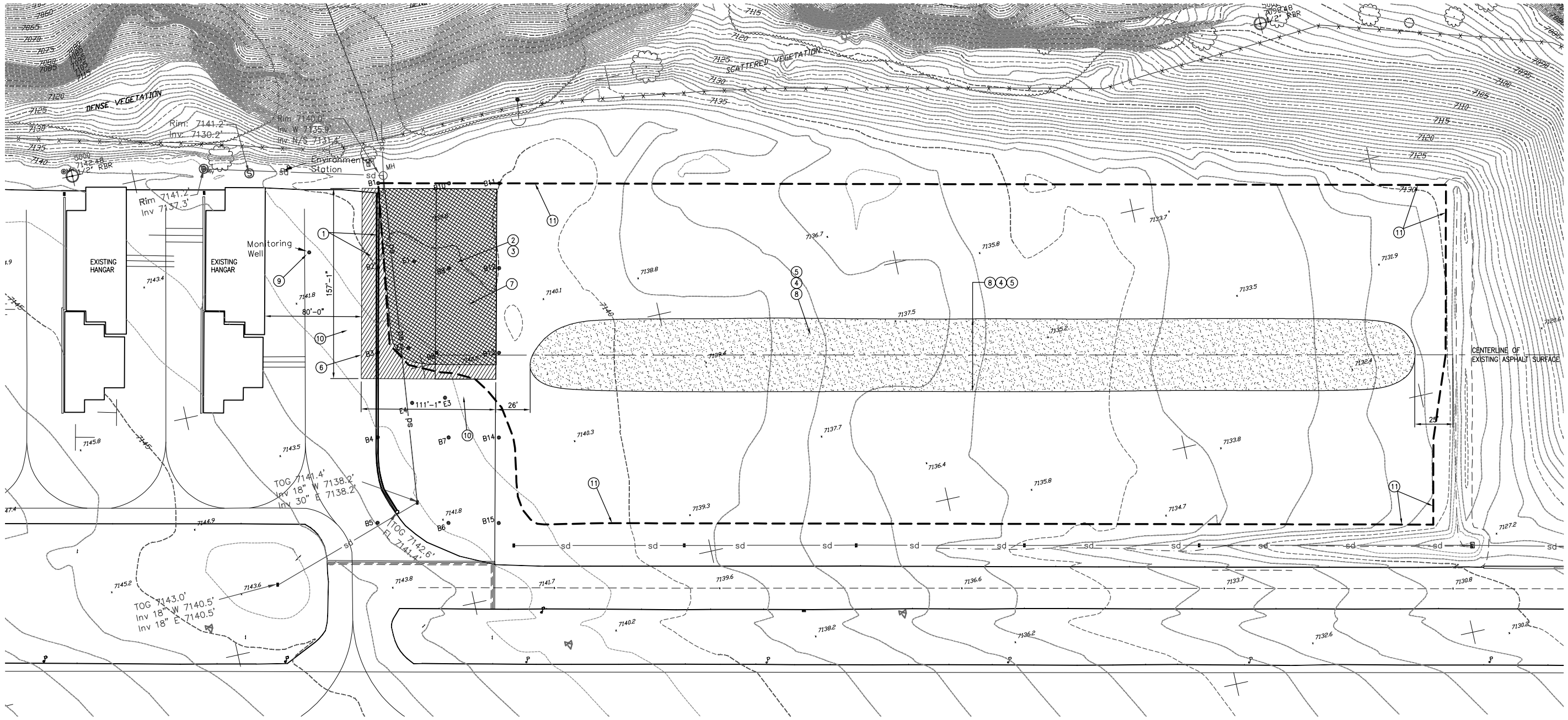
DRAWN	M.W.M.
DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

SUBMITTED
APPROVED FOR RELEASE

Dwyer Engineering, LLC
Environmental, Geotechnical, Civil, Structural Engineering

SHEET —
— OF —

CONTRACT NO. DE-EM0002882
DRAWING NO 2000
REV



KEYED NOTES:

1. REMOVE CONCRETE OPEN BOX CULVERT AND ASPHALT IN AREA DESIGNATED FOR INSTALLATION OF NEW CONCRETE HANGAR SLAB AND ASPHALT APRON.
2. EXCAVATE WASTE IN AREA WITHIN FOOTPRINT OF THE NEW CONCRETE HANGAR SLAB AND ASPHALT APRON.
3. REPLACE ALL SOIL EXCAVATED THAT DOES NOT CONTAIN WASTE. COMPACT ALL SOIL AND MATERIAL PLACED TO A MINIMUM OF 95% MAXIMUM DENSITY PER ASTM D698. COMPACTED LIFTS ARE NOT TO EXCEED 6–INCHES.
4. RELOCATE REMOVED WASTE ALONG SURFACE OF THE LANDFILL AS DESIGNATED. ALL PLACED MATERIAL TO BE COMPACTED TO A MINIMUM 95% MAXIMUM DRY DENSITY PER ASTM D698 IN LIFTS NOT TO EXCEED 6–INCHES.
5. ALL WASTE IS TO RECEIVE A DAILY COVER OF NOT LESS THAN 1–FOOT OF SOIL UNLESS OTHERWISE DIRECTED BY THE CONSTRUCTION MANAGER.
6. LOCATION OF NEW CONCRETE HANGAR SLAB AND ASPHALT APRON.
7. APPROXIMATE EXTENT AND DEPTH OF WASTE BENEATH NEW CONCRETE HANGAR SLAB.
8. RELOCATE WASTE TO THIS GENERAL AREA.
9. PROTECT MONITORING WELL DURING WASTE EXCAVATION.
10. REMOVE ASPHALT AND BASE COARSE AS REQUIRED.
11. APPROXIMATE WASTE LIMITS.

WASTE LOCATION/DEPTH TABLE

BORING	NORTH	EAST	TOP OF WASTE	BOT. OF WASTE
E1	1776886.15	1634611.75	5.0	22.5
E2	1776817.30	1634591.63	4.5	8
E3	1776798.44	1634618.33	NO WASTE	NO WASTE
E4	1776800.08	1634590.91	NO WASTE	NO WASTE
B1	1776955.50	1634596.49	3	11
B2	1776887.24	1634581.41	NO WASTE	NO WASTE
B3	1776818.97	1634566.32	NO WASTE	NO WASTE
B4	1776750.71	1634551.24	4	4.3
B5	1776681.83	1634536.02	NO WASTE	NO WASTE
B6	1776669.21	1634593.13	NO WASTE	NO WASTE
B7	1776738.09	1634608.35	NO WASTE	NO WASTE
B8	1776808.51	1634613.67	4	11.5
B9	1776874.62	1634638.52	4.5	16
B10	1776942.88	1634653.60	7	10
B11	1776933.93	1634694.14	9	13
B12	1776865.66	1634679.05	7.5	17
B13	1776797.40	1634663.97	6	12
B14	1776729.13	1634648.89	NO WASTE	NO WASTE
B15	1776660.25	1634633.66	NO WASTE	NO WASTE

SCALE: 1" = 40'

0 20 40 80

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE

WASTE REMOVAL PLAN

DRAWN	M.W.M.
DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

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Dwyer Engineering, LLC
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SHEET — OF —

CONTRACT NO. DE–EM0002882

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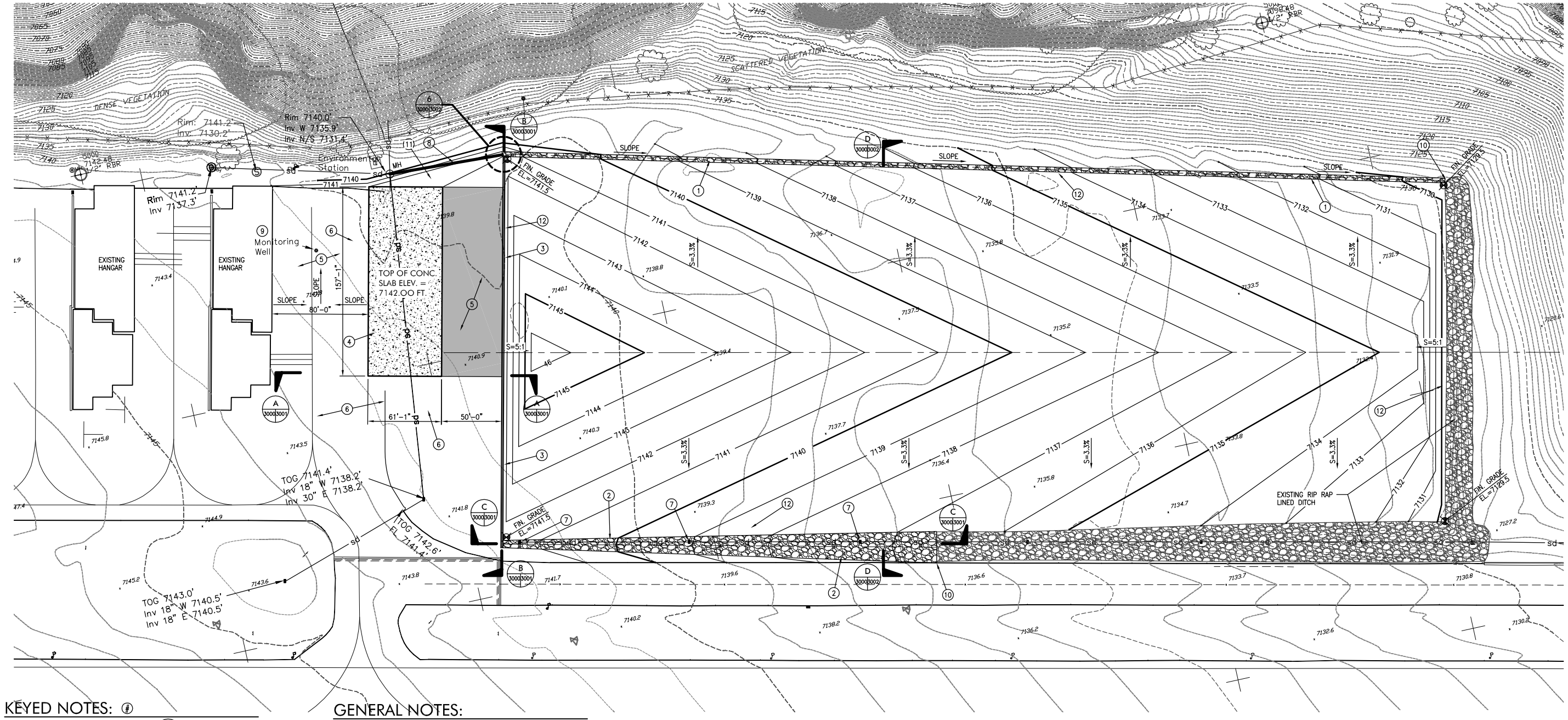

KEYED NOTES:

1. NEW DRAINAGE CHANNEL, SEE DETAIL 1/3000/3001. SLOPE OF DRAINAGE CHANNEL TO MATCH SLOPE OF BASE LANDFILL FROM WEST TO EAST. APPROXIMATELY 1.5% SLOPE FROM WEST TO EAST.
2. NEW DRAINAGE CHANNEL, SEE DETAIL 2/3000/3001. TRANSITION WIDTH OF DRAINAGE CHANNEL FROM WEST TO EAST TO MATCH WIDTH OF EXISTING DRAINAGE CHANNEL ON EAST.
3. INSTALL NEW OPEN BOX CULVERT. SEE DETAIL 3/3000/3001. CULVERT TO HAVE NOMINAL SLOPE FROM SOUTH TO NORTH.
4. NEW CONCRETE HANGAR PAD, SEE SHEETS 3003 AND 3004.
5. NEW ASPHALT SURFACE TO SLOPE AWAY FROM HANGAR PADS AND TOWARD NORTH. SEE DETAIL 5/3000/3002.
6. REPLACE/REPAIR ASPHALT SURFACE AFTER WASTE EXCAVATION AND NEW CONCRETE HANGAR PAD INSTALLATION. SEE DETAIL 5/3000/3002
7. CUT CONCRETE DROP INLET STRUCTURES AND REPLACE GRATING TO MATCH BASE OF NEW RIPRAP CHANNEL. FIELD FIT.
8. NEW 12" DIA. PVC SDR35 SEWER PIPE. SLOPE PIPE FROM NEW DROP INLET TO EXISTING MANHOLE WITH A SLOPE OF 0.5% MIN.
9. PROTECT MONITORING WELL DURING CONSTRUCTION.
10. LINER AND GEOTEXTILE OF NEW RIPRAP DRAINAGE CHANNEL TO OVERLAP GEOTEXTILE AND LINER OF EXISTING RIPRAP DRAINAGE CHANNEL A MINIMUM OF TWO FEET.
11. CONTOUR SLOPE TOWARD CANYON AFTER SEWER PIPE WORK IS COMPLETE. SEED AND COVER DISTURBED AREA WITH EROSION CONTROL BLANKET.
12. INSTALL EROSION CONTROL BLANKET AFTER SEEDING PER TECHNICAL SPECIFICATIONS.

GENERAL NOTES:

1. FINISHED LANDFILL COVER SURFACE TO RISE NOMINALLY 5 FEET FROM BASE (NORTH AND SOUTH BOUNDARY) TO PEAK (CENTERLINE).
2. EAST AND WEST END SLOPES OF FINISHED LANDFILL COVER SURFACE TO HAVE A NOMINAL 5:1 SLOPE.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE: SITE PLAN

DRAWN	M.W.M.
DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

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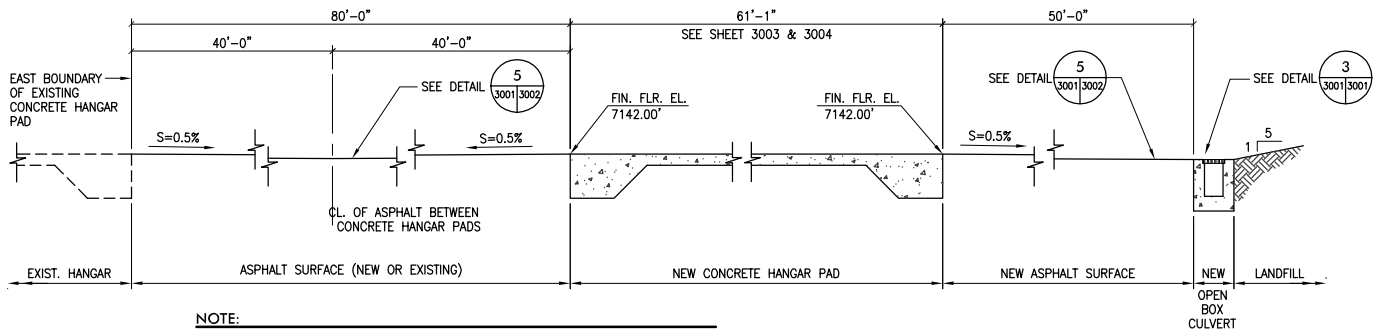
CONTRACT NO. DE-EM0002882 | DRAWING NO 3000 | REV

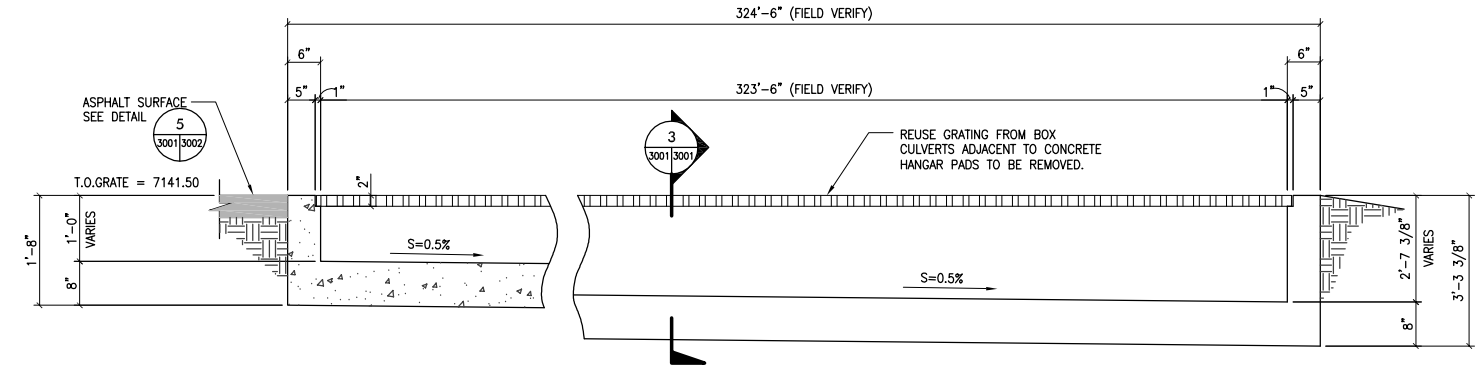


NOTE:

1. SURFACE OF NEW CONCRETE HANGAR PAD WILL BE ABOUT 3 INCHES ABOVE THE EXISTING ASPHALT SURFACE (TO BE REMOVED) TO ALLOW FOR A 0.5% SLOPE AWAY FROM HANGAR.

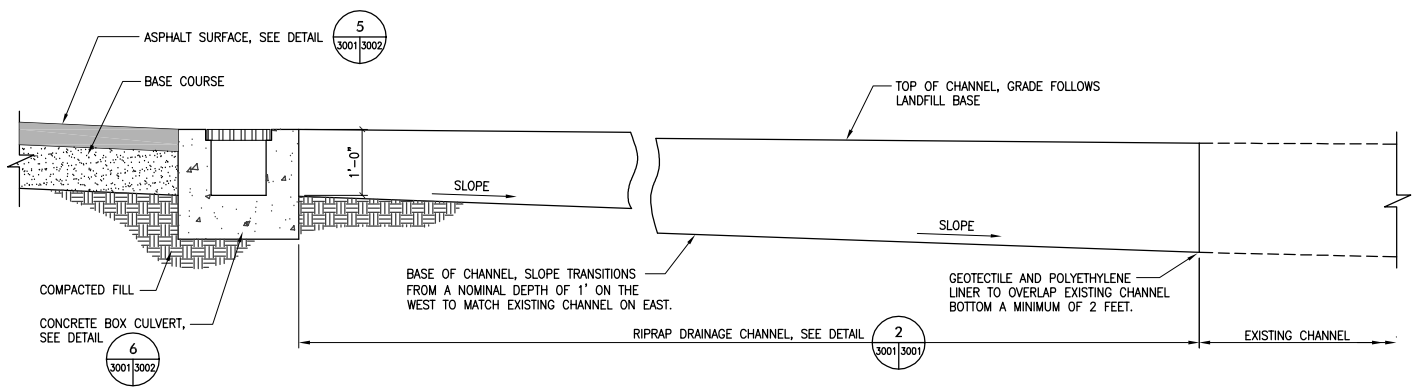
A 3000 3001 SECTION A-A

SCALE: 1/4" = 1'-0"



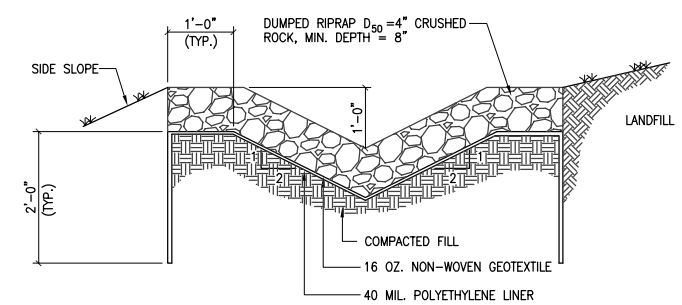
B 3000 3001 CONCRETE BOX CULVERT SECTION

SCALE: 3/4" = 1'-0"



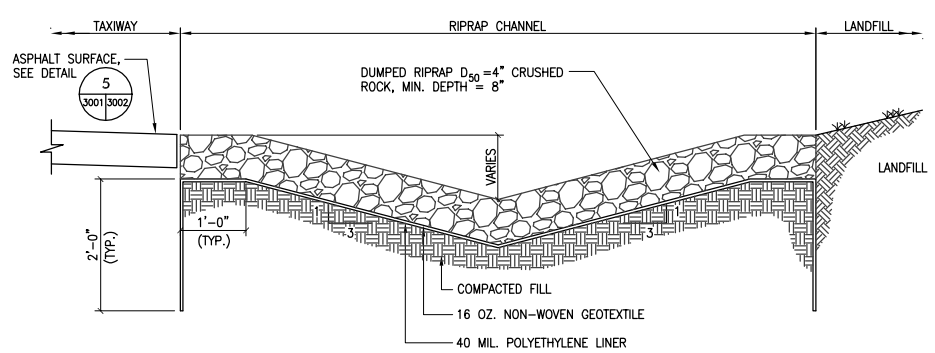
C 3000 3001 SOUTH DRAINAGE CHANNEL SECTION

SCALE: 3/4" = 1'-0"



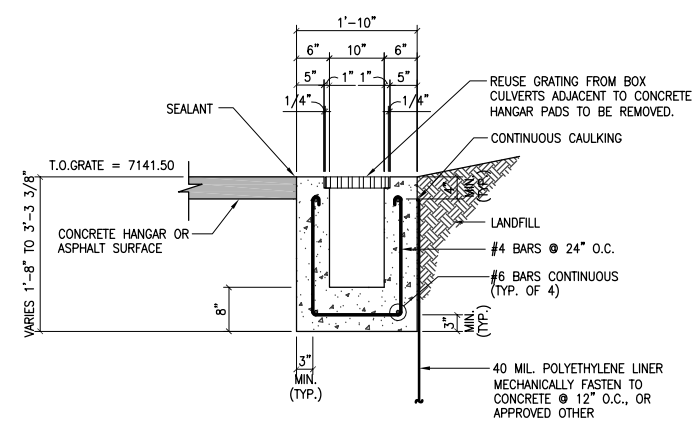
1 3000 3001 NORTH DRAINAGE CHANNEL

SCALE: 3/4" = 1'-0"



2 3000 3001 SOUTH DRAINAGE CHANNEL

SCALE: 3/4" = 1'-0"



3 3000 3001 CONCRETE BOX CULVERT DETAIL

SCALE: 3/4" = 1'-0"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE: SECTIONS AND DETAILS

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DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

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DRAWING NO 3001

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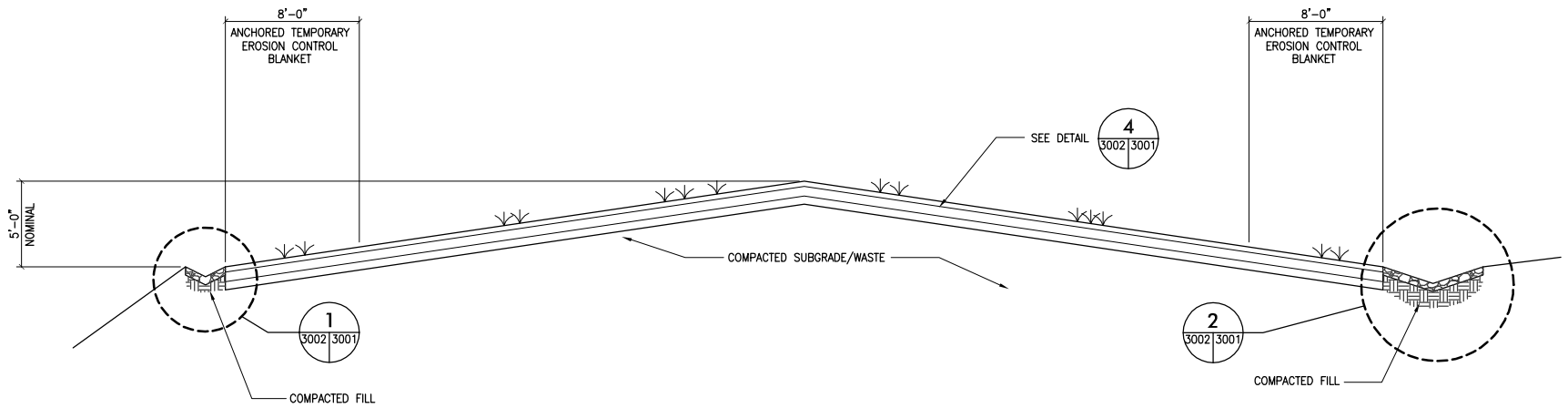
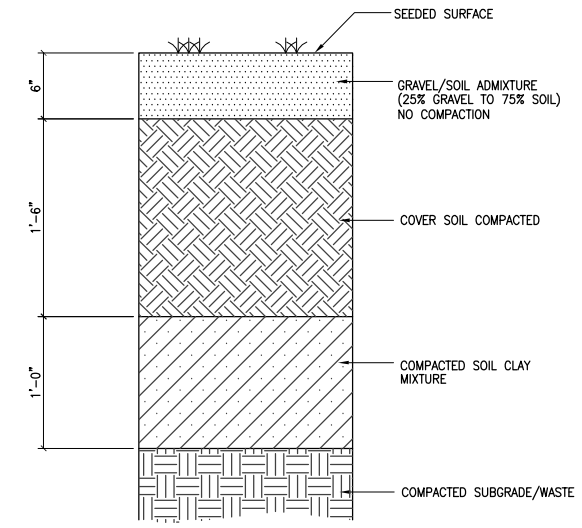


NOTE:

1. BASE OF LANDFILL TO NOMINALLY MATCH EXISTING ELEVATION.
2. ANCHORED TEMPORARY EROSION CONTROL BLANKET TO BE ANCHORED TO THE ENTIRE INSIDE PERIMTER OF THE LANDFILL COVER FINAL SURFACE AFTER SEEDING.

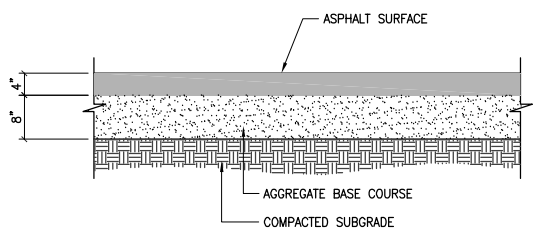
D 3000 3002 LANDFILL COVER TYPICAL SECTION

NOT TO SCALE



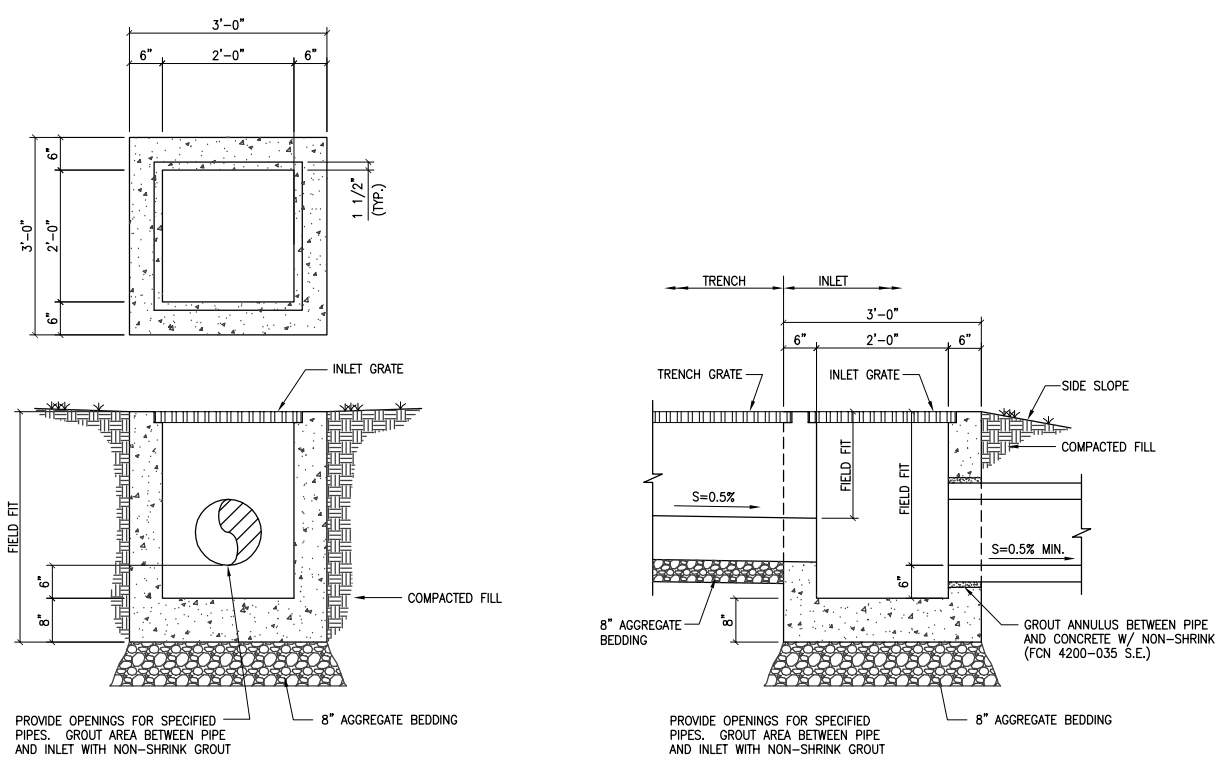
4 3002 3002 TYPICAL COVER PROFILE

SCALE: 1 1/2" = 1'-0"



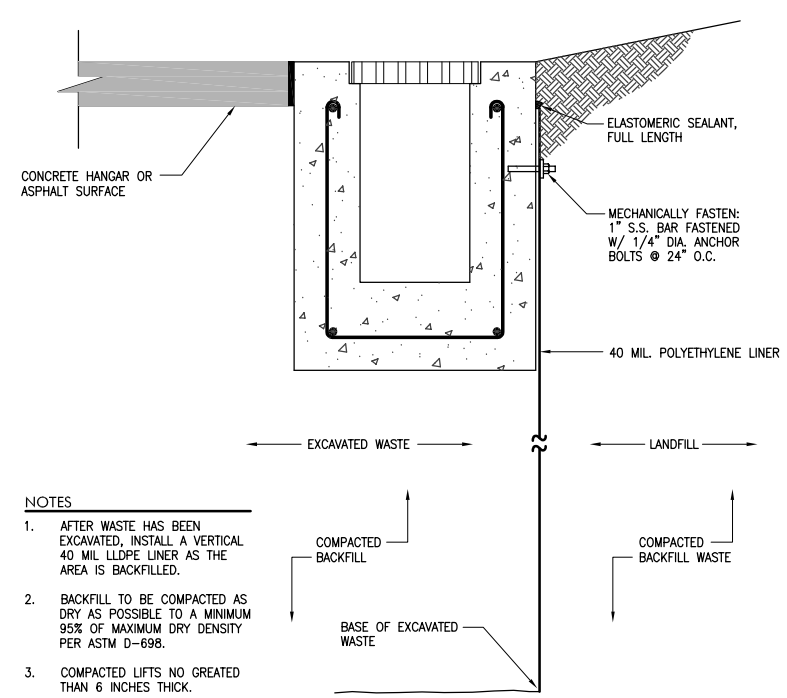
5 3001 3002 TYPICAL ASPHALT PAVEMENT PROFILE

SCALE: 3/4" = 1'-0"



6 3001 3002 CONCRETE CULVERT AND INLET

SCALE: 3/4" = 1'-0"



NOTES

1. AFTER WASTE HAS BEEN EXCAVATED, INSTALL A VERTICAL 40 MIL LLDPE LINER AS THE AREA IS BACKFILLED.
2. BACKFILL TO BE COMPACTED AS DRY AS POSSIBLE TO A MINIMUM 95% OF MAXIMUM DRY DENSITY PER ASTM D-698.
3. COMPACTED LIFTS NO GREATED THAN 6 INCHES THICK.

7 3001 3002 TYPICAL COVER PROFILE

SCALE: 1 1/2" = 1'-0"

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ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE		
DETAILS	DRAWN	M.W.M.
	DESIGN	S.F.D.
	CHECKED	S.F.D.
	DATE	3/15
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Environmental, Geotechnical, Civil, Structural Engineering

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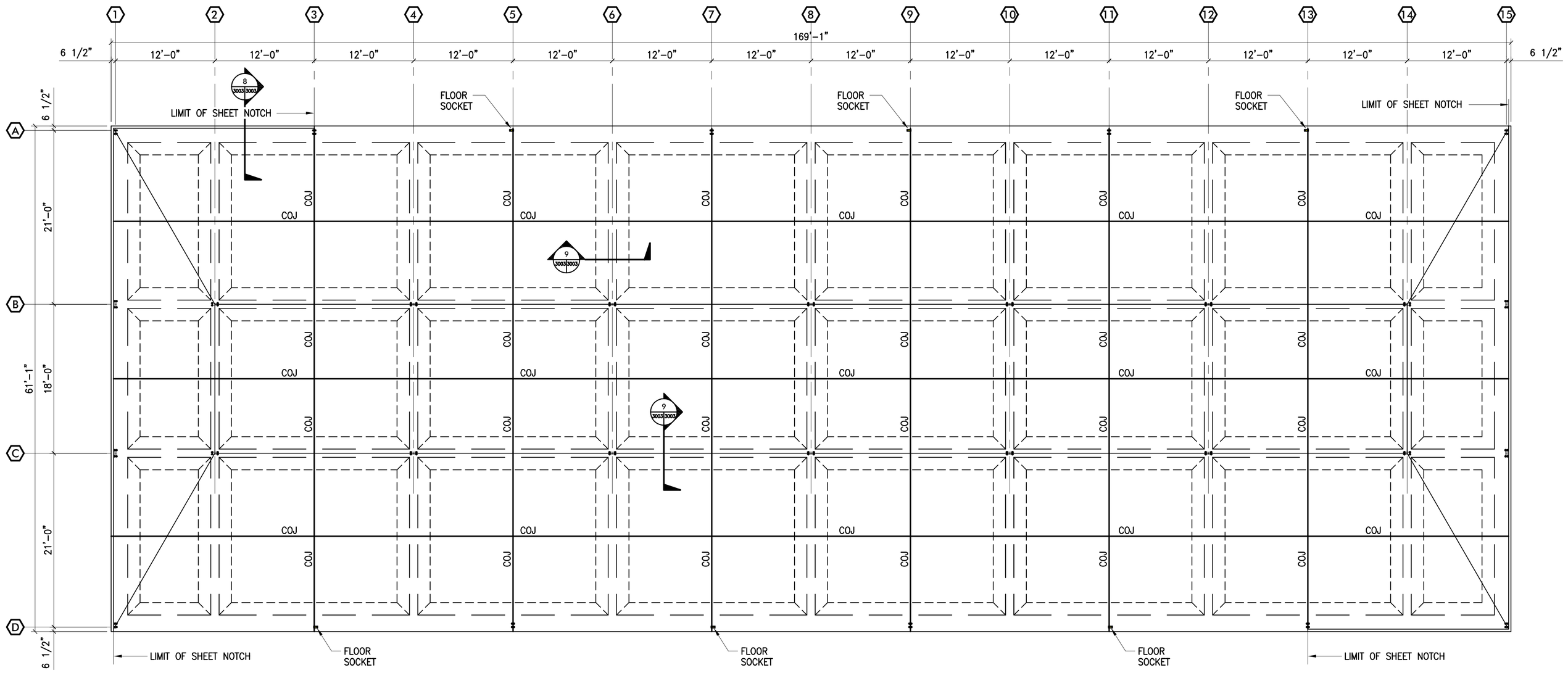
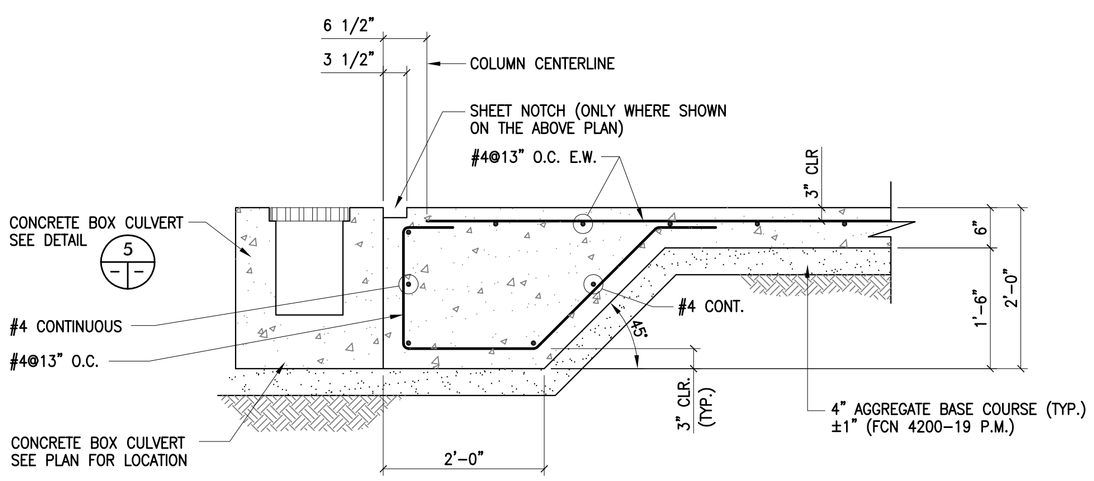
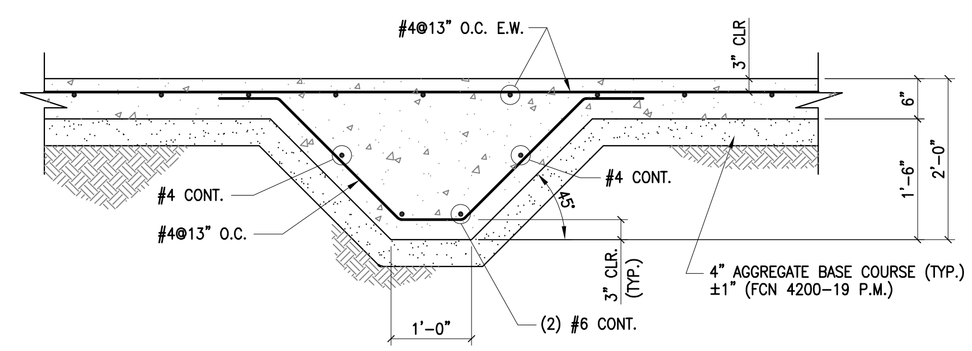




8 3003 3003 TYPICAL SECTION

SCALE: 3/4" = 1'-0"



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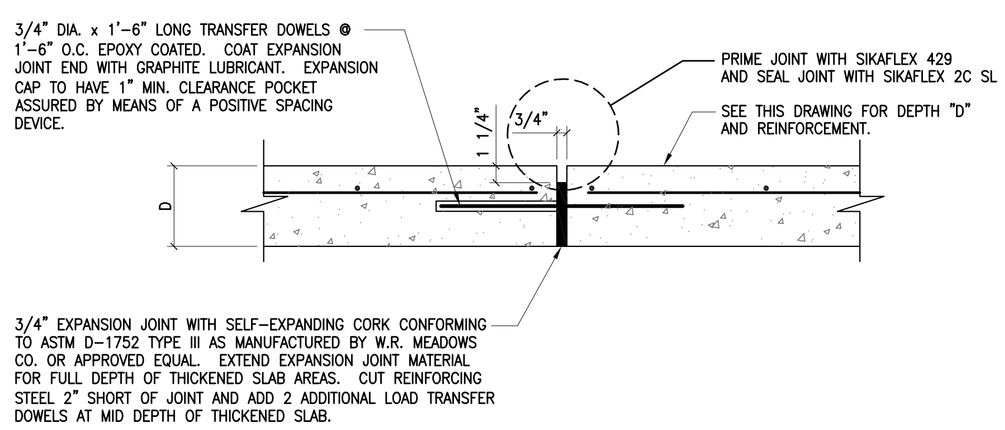
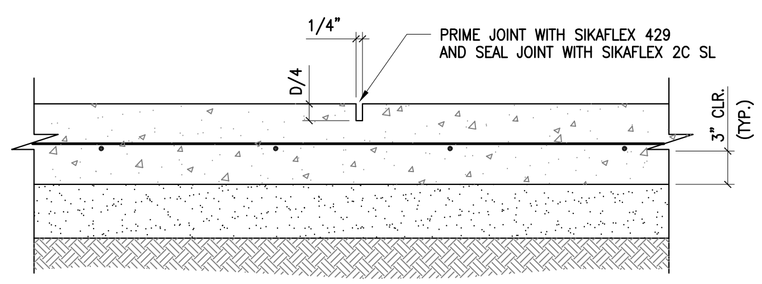


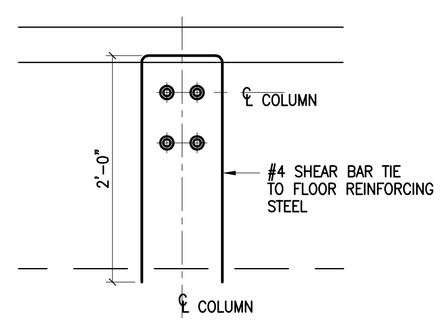
TYPICAL SLAB CONSTRUCTION/EXPANSION JOINT DETAIL (CJ)

SCALE: 1 1/2" = 1'-0"



TYPICAL SLAB CONTROL JOINT DETAIL (COJ)

SCALE: 1 1/2" = 1'-0"



NOTE:
USE 180° BEND AND PLACE DIAGONALLY AT THE FOUR OUTSIDE CORNERS.

TYPICAL ENLAGED PLAN AT EXTERIOR COLUMN AND AT FLOOR SOCKETS

NO SCALE

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO COMMENCING WORK. CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.
2. CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL RULES AND REGULATIONS GOVERNING PERFORMANCE OF WORK.
3. DIMENSIONS ARE BASED UPON PRELIMINARY METAL BUILDING VENDOR PRINTS. CONTRACTOR TO COORDINATE WITH METAL BUILDING VENDOR TO OBTAIN FINAL CERTIFIED VENDOR PRINTS. NOTIFY ENGINEER OF ANY CHANGES FROM DESIGN DRAWING. BASIS OF DESIGN IS 6 UNIT N60-48 HANGAR DESIGNED AND MANUFACTURED BY ERECT-A-TUBE, HARVARD, IL. (815) 943-4091.

EARTHWORK

1. ALL EXCAVATED MATERIAL SHALL BE DISPOSED OF PROPERLY. EXCESS MATERIAL SHALL BE REMOVED FROM SITE.
2. GRADE EXTERIOR PAVEMENT AWAY FROM BUILDING ON ALL SIDES WHERE BUILDING IS NOT PROTECTED BY TRENCH DRAIN.

CONCRETE

1. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH ACI 301 AND 318 LATEST EDITION.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
3. ALL CONCRETE TO CONTAIN 3% ENTRAINED AIR.
4. CONCRETE TO BE PLACED WITH MAXIMUM SLUMP OF 4 INCHES.
5. ALL REINFORCING BARS SHALL MEET THE REQUIREMENTS OF ASTM A-615 GRADE 60. DETAILING SHALL CONFORM TO ACI 315, LATEST EDITION.
6. ALL REINFORCING SPLICES SHALL BE IN ACCORDANCE WITH ACI 318. PLACE BARS AT CONSTRUCTION JOINTS AS DETAIOLED OR SPECIFICALLY APPROVED BY ENGINEER.
7. ALL EXPOSED CONCRETE PAD SURFACES SHALL BE CURED USING A VISQUEEN VAPOR BARRIER PLACED OVER CONCRETE FOR 5 DAYS. (FCN 4200-020 P.M.) AFTER CURING, APPLY CHEMICAL SEALER/HARDENER (SEALHARD MANUFACTURED BY L&M CONSTRUCTION CHEMICALS OR APPROVED EQUAL) TO PAD SURFACE. DO NOT APPLY TO AREAS WHICH RECEIVE COLUMN BASE PLATES.
8. PROVIDE 1/2 INCH TOOL EDGE ON ALL EXPOSED CORNERS.
9. CONTRACTOR SHALL SUBMIT REINFORCING STEEL SHOP DRAWINGS FOR REVIEW AT LEAST 10 WORKING DAYS PRIOR TO FABRICATION.
10. BAR CHAIRS, HIGH CHAIRS, SUPPORT BARS AND ALL OTHER ACCESSORIES SHALL BE PROVIDED IN ACCORDANCE WITH ACI AND CRSI STANDARDS.
11. ALL CONCRETE SHALL RECEIVE A STEEL TROWEL FINISH.
12. ANCHOR BOLTS SHALL BE IN ACCORDANCE WITH ASTM A-307.
13. NON-SHRINK GROUT SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 7,000 PSI.
14. AGGREGATE BASE COURSE SHALL CONFORM TO NEW MEXICO DOT SPECIFICATIONS SECTION 304.21 FOR CLASS I BASE COURSE.
15. BOTTOM OF BASE PLATES FOR ALL EXTERIOR COLUMNS SHALL BE AT SAME ELEVATION. BOTTOM OF BASE PLATES FOR ALL INTERIOR COLUMNS SHALL BE BASED ON SLAB SLOPE.
16. THE USE OF 1/4" THICK LEVELING PLATES WITH SAME DIMENSIONS AND HOLE PATTERN AS THE BASE PLATES IS RECOMMENDED TO SET ELEVATIONS AND PROVIDE TEMPLATE FOR ANCORS BOLTS.
17. FLOOR SOCKETS ARE EMBEDDED ITEMS SUPPLIED BY THE HANGAR VENDOR AT TIME OF HANGAR INSTALLATION.
18. ANCHOR BOLTS SHALL BE DRILLED AND EPOXY-INSTALLED AT A LATER DATE AS DIRECTED BY THE ENGINEER.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE
HANGAR PAD FOUNDATION PLAN

DRAWN	M.W.M.
DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

SUBMITTED

APPROVED FOR RELEASE

Dwyer Engineering, LLC
Environmental, Geotechnical, Civil, Structural Engineering

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DRAWING NO 3003

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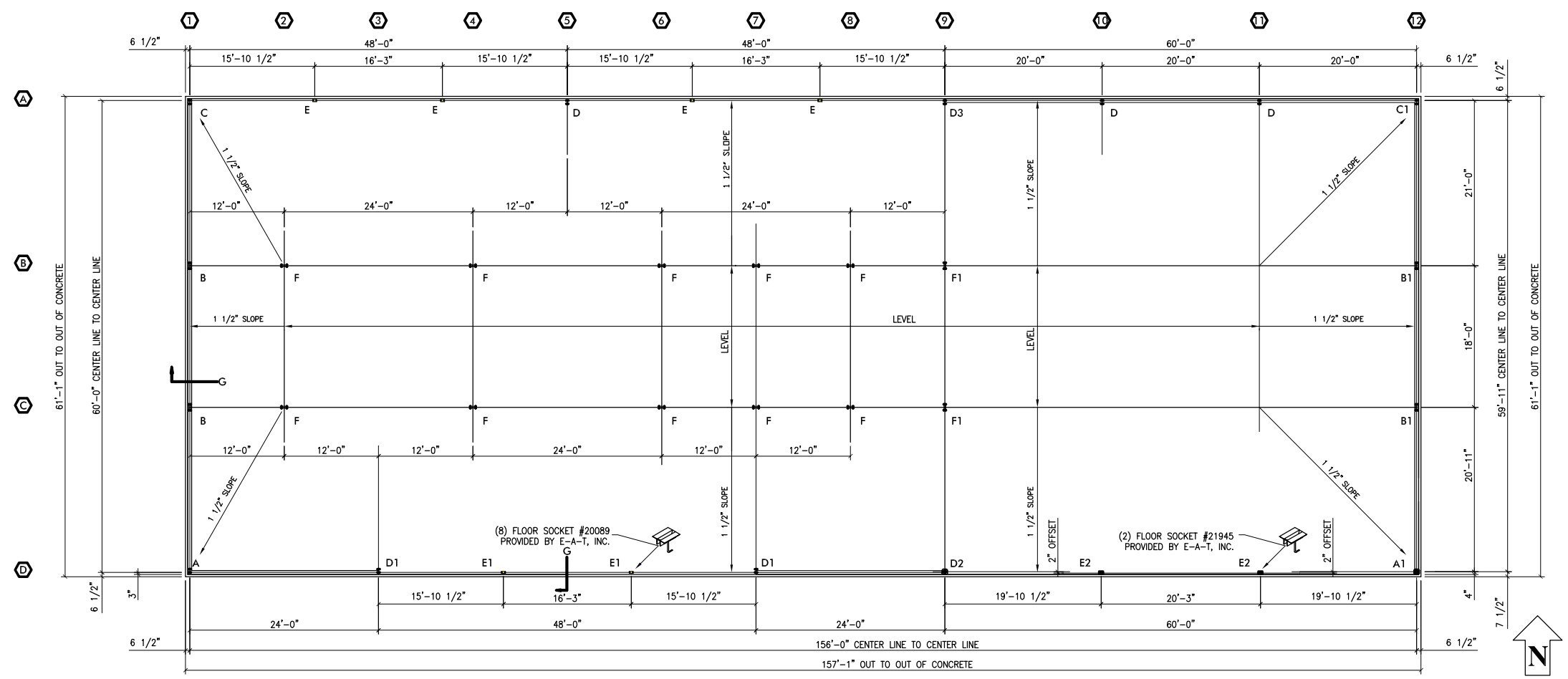
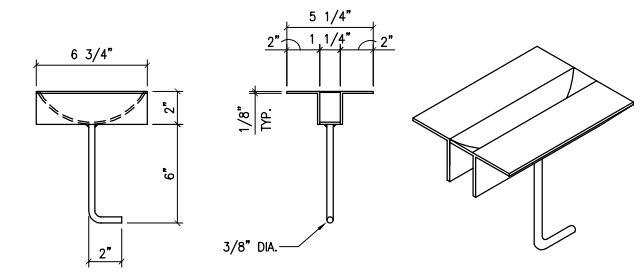


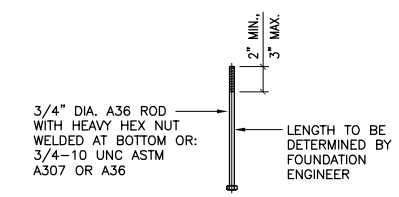
ANCHOR BOLT LAYOUT PLAN

GENERAL NOTES:

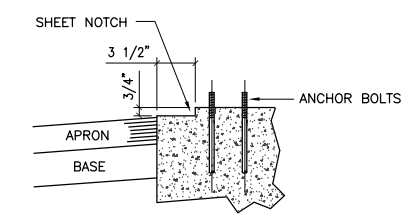
1. COLUMNMS AND BASE PLATES ARE TO BE PROVIDED AND INSTALLED BY OTHERS. SHOWN FOR INFORMATION ONLY.
2. FLOOR SOCKET TO BE INSTALLED BY CONTRACTOR. PARTS TO BE PURCHASED FROM ERECT-A-TUBE.
3. DRAWING AND DETAILS PROVIDED BY ERECT-A-TUBE, HARVARD, ILLINOIS (815) 943-4091. VERIFY ACCURACY OF DRAWING AND DIMENSIONS WITH ERECT-A-TUBE AND LOS ALAMOS COUNTY AIRPORT MANAGER PRIOR TO CONSTRUCTION.



FLOOR SOCKET



ANCHOR BOLT
(NOT PROVIDED BY ERECT-A-TUBE, INC.)



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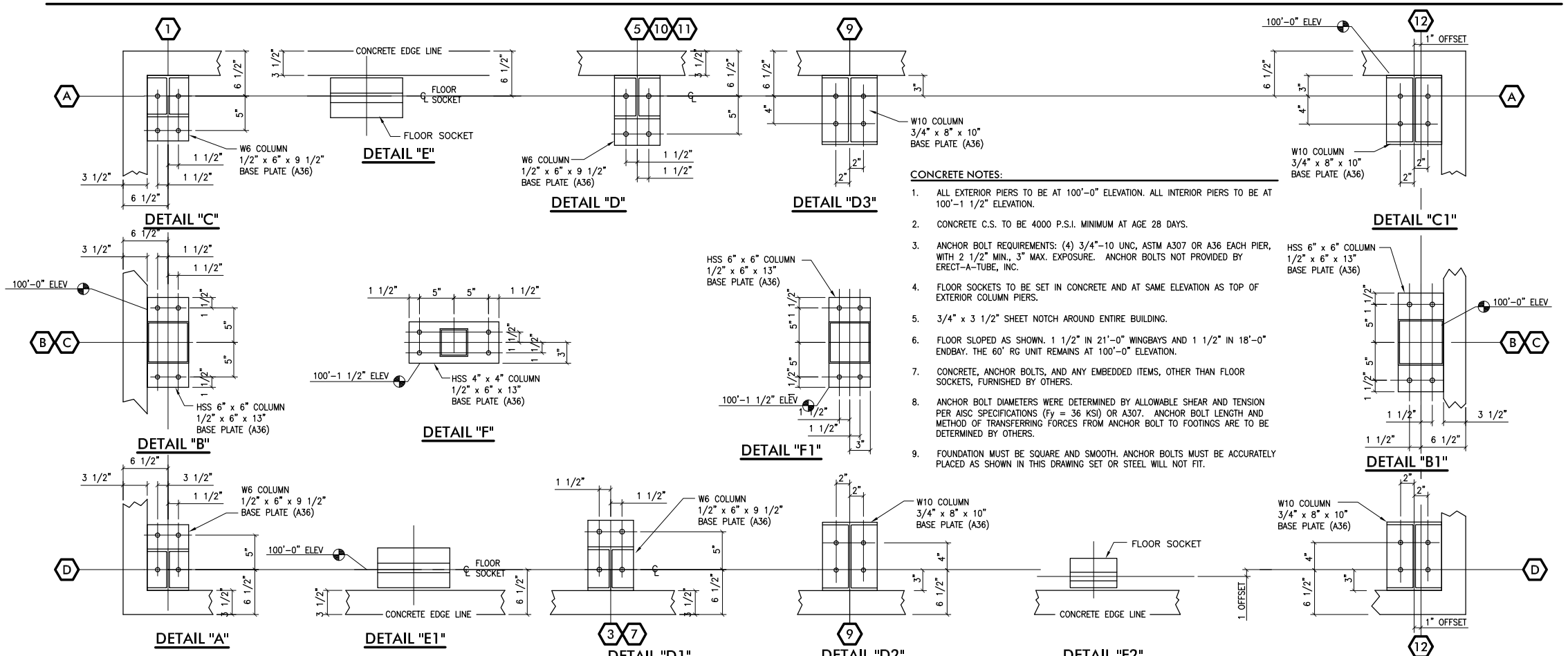

ANCHOR BOLT LAYOUT DETAILS

CONCRETE NOTES:

1. ALL EXTERIOR PIERS TO BE AT 100'-0" ELEVATION. ALL INTERIOR PIERS TO BE AT 100'-1 1/2" ELEVATION.
2. CONCRETE C.S. TO BE 4000 P.S.I. MINIMUM AT AGE 28 DAYS.
3. ANCHOR BOLT REQUIREMENTS: (4) 3/4"-10 UNC, ASTM A307 OR A36 EACH PIER, WITH 2 1/2" MIN., 3" MAX. EXPOSURE. ANCHOR BOLTS NOT PROVIDED BY ERECT-A-TUBE, INC.
4. FLOOR SOCKETS TO BE SET IN CONCRETE AND AT SAME ELEVATION AS TOP OF EXTERIOR COLUMN PIERS.
5. 3/4" x 3 1/2" SHEET NOTCH AROUND ENTIRE BUILDING.
6. FLOOR SLOPED AS SHOWN. 1 1/2" IN 21'-0" WINGBAYS AND 1 1/2" IN 18'-0" ENDBAY. THE 60' RG UNIT REMAINS AT 100'-0" ELEVATION.
7. CONCRETE, ANCHOR BOLTS, AND ANY EMBEDDED ITEMS, OTHER THAN FLOOR SOCKETS, FURNISHED BY OTHERS.
8. ANCHOR BOLT DIAMETERS WERE DETERMINED BY ALLOWABLE SHEAR AND TENSION PER AISC SPECIFICATIONS (Fy = 36 KSI) OR A307. ANCHOR BOLT LENGTH AND METHOD OF TRANSFERRING FORCES FROM ANCHOR BOLT TO FOOTINGS ARE TO BE DETERMINED BY OTHERS.
9. FOUNDATION MUST BE SQUARE AND SMOOTH. ANCHOR BOLTS MUST BE ACCURATELY PLACED AS SHOWN IN THIS DRAWING SET OR STEEL WILL NOT FIT.

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U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT LOS ALAMOS FIELD OFFICE
LOS ALAMOS AIRPORT LANDFILL COVER REPLACEMENT

TITLE
HANGAR PAD
ANCHOR BOLT LAYOUT

DRAWN	M.W.M.
DESIGN	S.F.D.
CHECKED	S.F.D.
DATE	3/15

SUBMITTED
APPROVED FOR RELEASE

Dwyer Engineering, LLC
Environmental, Geotechnical, Civil, Structural Engineering

SHEET — OF —

CONTRACT NO. DE-EM0002882
DRAWING NO 3004
REV

July 2015

ET COVER DESIGN REPORT

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505)270-0215

Revision 01

EXECUTIVE SUMMARY

This report provides a detailed summary of the design methodology, input parameters, unsaturated flow modeling, and applicable calculations justifying the cover profile for the Los Alamos County Airport Landfill. This cover system will replace a previously installed cover deemed to be inadequate (Dwyer 2012). The profile is comprised of a soil cover referred to as an Evapotranspiration (ET) cover with a gravel/soil surface admixture referred to as a 'desert pavement'. The cover system is designed to store infiltrated water until it can be removed via the combination of surface evaporation and transpiration through the vegetation collectively referred to as ET.

The new soil cover referred to as an Evapotranspiration (ET) Cover has been designed to meet applicable regulatory criteria and performance objectives. The cover is 3.0-ft thick that includes a surface layer composed of a 6-in thick rock/soil admixture (Figure 5). The overall profile provides adequate storage capacity to minimize flux from moving below the cover and attenuate radon gas from the covered mine spoils below established performance criteria. The surface rock/soil admixture was designed to minimize erosion while providing a rooting medium for native vegetation as well as storage capacity for infiltrated precipitation.

Table of Contents

1.0 INTRODUCTION 4

2.0 LOS ALAMOS COUNTY AIRPORT LANDFILL BACKGROUND 6

2.1 LAC AIRPORT LAND USE 9
2.2 LOS ALAMOS, NM CLIMATE 9
2.3 SITE GEOLOGY 9

3.0 PERFORMANCE OBJECTIVES & REGULATORY CRITERIA FOR COVER SYSTEM 10

4.0 COVER PROFILE DEVELOPMENT 12

4.1 UNSATURATED MODELING OF COVER SYSTEM 12
4.1.1 OVERVIEW OF UNSAT-H....13
4.1.2 UNSAT-H INPUT PARAMETERS....15
4.1.3 MODEL GEOMETRY....15
4.1.4 BOUNDARY CONDITIONS....15
4.1.5 VEGETATION DATA....18
4.1.6 SOIL PROPERTIES RELATED TO VEGETATION....20
4.1.7 SOIL PROPERTIES....21
4.1.8 MODEL OUTPUT....23

5.0 EROSION 25

5.1 DESIGN OF COVER SURFACE LAYER (ROCK/SOIL ADMIXTURE) 25
5.1.1 DESIGN RAINFALL EVENT....25
5.1.2 RUNOFF PREDICTION....25
5.1.3 CHANNEL GEOMETRY....27
5.1.4 INCIPIENT PARTICLE SIZE....28
5.1.5 DEPTH OF SCOUR AND ARMORING REQUIRED....29
5.1.6 ROCK/SOIL ADMIXTURE SUMMARY....29
5.2 LONG-TERM STABILITY OF ROCKY SOIL COVER 29
5.3 SOIL LOSS 30

6.0 MISCELLANEOUS CALCULATIONS 34

7.0 SUMMARY 35

7.0 REFERENCES 36

ATTACHMENT 39

FIGURES

Figure 1. Aerial View of Previously Installed MatCon Cover & Concrete Hangar Pads (to be removed) 4
Figure 2. Landfill Locations (LANL 1998) 8
Figure 3. Los Alamos, NM Typical Climate's Demand for Water (PET) vs. Supply of Water (Precipitation) 13
Figure 4. Schematic Representation of Water Balance Computation by UNSAT-H 14
Figure 5. Cover Profile 15
Figure 6. Climate Demand for Water vs. Supply of Water: Typical Weather (1942) 16
Figure 7. Climate Demand for Water vs. Supply of Water: Wettest Year on Record (1941) 17
Figure 8. Typical Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998) 18
Figure 9. Growing Degree Day for Typical Year, Los Alamos, NM 20
Figure 10. Computer Simulation Results 24
Figure 11. Contributory area for gully formation 27
Figure 12. Channel geometry 27
Figure 13. RUSLE K Factor, Ag Handbook 703 31
Figure 14. RUSLE R Factor, Ag Handbook 703 32
Figure 15. RUSLE LS Factor, Ag Handbook 703 33

TABLES

Table 1. Performance Objectives and Regulatory Criteria for Cover System 11
Table 2. Soil Input Parameters 22
Table 3. Computer Simulation Results 23
Table 4. Rock/Soil Admixture Summary 29

1.0 INTRODUCTION

This Design Report summarizes the design of a new cover system to replace the previously installed cover system that featured an asphaltic surface deemed to be inadequate (Dwyer 2012). The asphalt cover system was installed in early 2007 on the solid waste landfill located adjacent to the Los Alamos County (LAC) Airport. This cover system is composed of an asphalt surface (MatCon) in conjunction with five reinforced concrete slabs (Figure 1). A passive gas collection system was also incorporated into the cover system. The north and east perimeter side slopes of the LAC Airport Landfill are a prescriptive cover with a compacted soil and vegetated surface. The eastern slope is reinforced by retaining structures. The existing airport hangar facilities are located adjacent to the western edge of the landfill. A surface water drainage trench is located to the south.

The LAC airport landfill was closed as a hazardous waste landfill following guidelines set forth in the Resource Conservation and Recovery Act (RCRA), Subtitle C closures (40 CFR 264, Subpart N as incorporated by 20.4.1.600 NMAC). The intent of the asphalt cover system was to perform equivalent to a prescriptive cover for at least the duration of the 30-year post-closure care period (DOE/EA-1515 Final Environmental Assessment for Proposed Closure of the Airport Landfills within TA73). The reinforced concrete slabs were installed to provide a foundation for future airplane hangars. The surrounding asphalt surface was to provide access for the airplanes in and out of the hangars. The asphaltic surface was a specialty product produced by MatCon, Inc. marketed to be relatively impermeable.

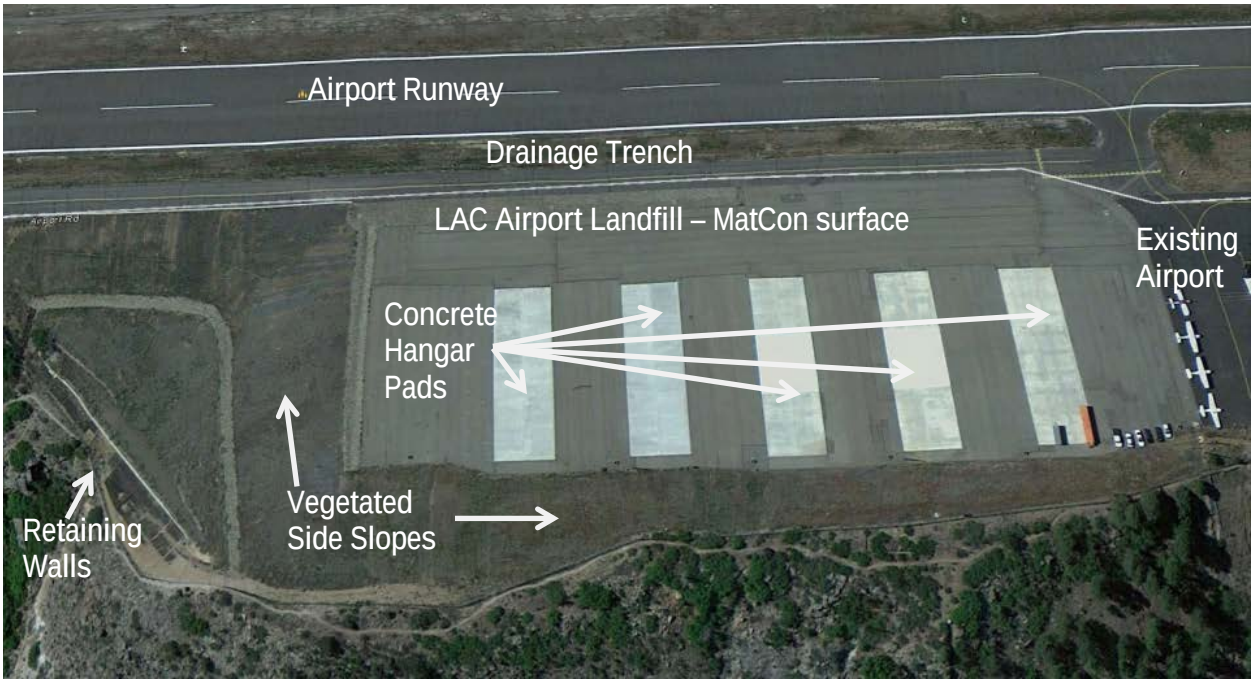

Figure 1. Aerial View of Previously Installed MatCon Cover & Concrete Hangar Pads (to be removed)

The US Department of Energy (DOE) began monitoring the LAC Airport Landfill in 2009. In December 2013, the DOE submitted to the New Mexico Environment Department (NMED) a *Formal Notification of Methane Levels at 100 Percent of the Lower Explosive Limit at Vent Risers along the North Edge of the Los Alamos Airport Landfill Cap and Request for a Waiver of the Implementation of an Active Gas Collection Using Blowers (Notification).* The NMED replied to this notification and waiver for active gas collection on July 25, 2014 (Pre-Design Work Plan, Dwyer Engineering 2014). The reply stated *"The Permittees must implement an active gas collection system or propose an alternative remedial measure to reduce infiltration of water into the landfill and to reduce methane levels below 100% LEL."* The reply further stated: *"The Permittees must submit a work plan for the implementation of an active gas collection system or an alternate remedial measure to NMED no later than September 30, 2014. Until the work plan is submitted to NMED, the Permittees must continue weekly monitoring at SWMU 73-001 (a) and continue to submit data to NMED on a monthly basis."*

In response to this NMED reply, the DOE submitted a Pre-Design Work Plan (Dwyer 2014) dated September 30, 2014, stating that the DOE will continue to monitor the landfill on the current schedule, but that the long-term solution will be to replace the cover system with a properly designed ET Cover. This Design Report summarizes the design of the cover profile to replace the existing asphalt cover.

2.0 LOS ALAMOS COUNTY AIRPORT LANDFILL BACKGROUND

The LAC airport is situated on one of the narrow mesas of the Pajarito Plateau that flank the eastern edge of the Jemez Mountains. The airport covers approximately 89 acres. Ground elevations range from approximately 7170 ft. above mean sea level (MSL) on the western end of the airport to approximately 7050 ft. on the eastern end. The runway grade is approximately 1.5 degrees toward the east. The airport is bounded on the north and east by steep slopes of the Pueblo Canyon. New Mexico State Road 502 trends along the south side of the property. Single unit housing is located west of the airport.

Two inactive solid waste disposal sites [the airport landfill, SWMU 73-001(a) and the debris disposal area (DDA), SWMU 73-001(d)] are located at the LAC Airport (Figure 2). This Design Report focuses only on the airport landfill, not the DDA. The DDA is mentioned for background information only. In late 2006 and early 2007, the Final Remedy landfill cover system was installed at the LAC airport landfill. The Final Remedy design and completion activities for the LAC airport landfill and the DDA were provided in the *Remedy Completion Report, DOE LASO TA-73 Airport Landfill SWMUs 73-001(a) and 73-001(d) April 2007 (North Wind and Weston 2007)*. As a condition of the remedy approval, NMED required post-closure care and monitoring of these two inactive solid waste disposal sites and submission of an annual report summarizing results from this activity.

The LAC airport landfill operated from 1943 to 1973 for the disposal of solid waste consisting of household trash from the Los Alamos town site and office trash from Los Alamos Scientific Laboratory. Prior to 1965, some of the waste was incinerated and subsequently buried in the airport landfill. Approximately 489,500 cubic yards of waste was disposed of in the landfill. The LAC airport landfill continued to receive waste until June 1973. From 1984 to 1986, wastes were excavated from the western portion of the LAC airport landfill and placed in the DDA (Figure 2). The excavations were backfilled in preparation for construction of airport hangars and tie-down areas (LANL, 1998).

From 1984 to 1986, approximately 126,000 cubic yards of burned debris were excavated from the western end of the airport landfill and reburied in a pair of parallel trenches at the DDA. In late 2006 and early 2007, the asphalt landfill cover system was installed on the airport landfill (Figure 1). The final remedy design and completion activities for the landfill and the DDA were provided in the "Remedy Completion Report, DOE LASO TA-73 Airport Landfill, SWMUs 73-001(a) and 73-001(d)" (North Wind and Weston 2007). Approximately 50,000 cubic yards of waste were relocated within the SWMU boundary during the 2006 remedy construction activities. With the exception of a single container of Freon-113, uncovered and subsequently managed off-site, no other hazardous or radioactive materials were discovered. After waste relocation, regrading and compaction were conducted; the following features were installed for the LAC airport landfill cover (Figure 1):

- Approximately six acres of MatCon (Modified Asphalt Technology for Waste Containment) asphalt pavement;
- Five concrete hangar pads within the MatCon pavement area;
- Landfill-gas collection system;
- Two rock retaining walls;
- Concrete retaining wall;
- Turf reinforcement matting (TRM);

- Revegetation of approximately four acres with native grasses; and
- A storm water collection system consisting of five trench drains, seven drain inlets, approximately 1950-ft of associated buried concrete storm-sewer lines, an 18 inch-diameter high-density polyethylene outfall pipe approximately 110 ft. in length, and three riprap drainage channels.
- Side slopes composed of a vegetated 2.5 ft. thick earthen cover with a composite drainage layer within its profile.

The first formal inspection of the airport landfill was conducted in July 2009. Inspection activities were conducted as part of post-closure and care and monitoring requirements required under 40 Code of Regulations 265.310 for Resource Conservation and Recovery Act (RCRA) Subtitle C landfill facilities. The inspection focused on the individual elements of the landfill cover including: the MatCon pavement area and hangar pads, vegetated areas, rip rap drainage channels, concrete and rock retaining walls, the storm water collection system and all temporary erosion control features. Inspection activities and findings were documented in annual inspection reports, generally submitted to NMED February 2010.

Several erosion control modifications and storm water enhancements were made in late 2009 and the spring of 2010; however, noticeable settlement directly impacting hangar pads was not addressed. Significant differential settlement (as much as 2-ft in areas) has been measured in the cover surface to date (Dwyer 2014).

Although the land and hangar pads have been under LAC ownership and management since the 2007 land transfer, the County has not built hangars on the pads to date. This is due to the noted degradation of the asphalt cover and concrete hangar pads.

In 2009 and 2010, erosion features (rills and small gullies) associated with storm water runoff from the paved areas above the vegetated slopes was repaired. In addition, the curb along the taxiway was repaired and extended to redirect storm water away from the main vegetated slope. These repairs and enhancements were detailed in the “Final Construction Report for Los Alamos Airport Landfill TA-73, SWMU 73-001(a) Cover Improvements, Los Alamos, New Mexico” (North Wind 2010).

The NMED’s approval with modifications for the remedy completion report required monitoring of the storm water runoff from the site.

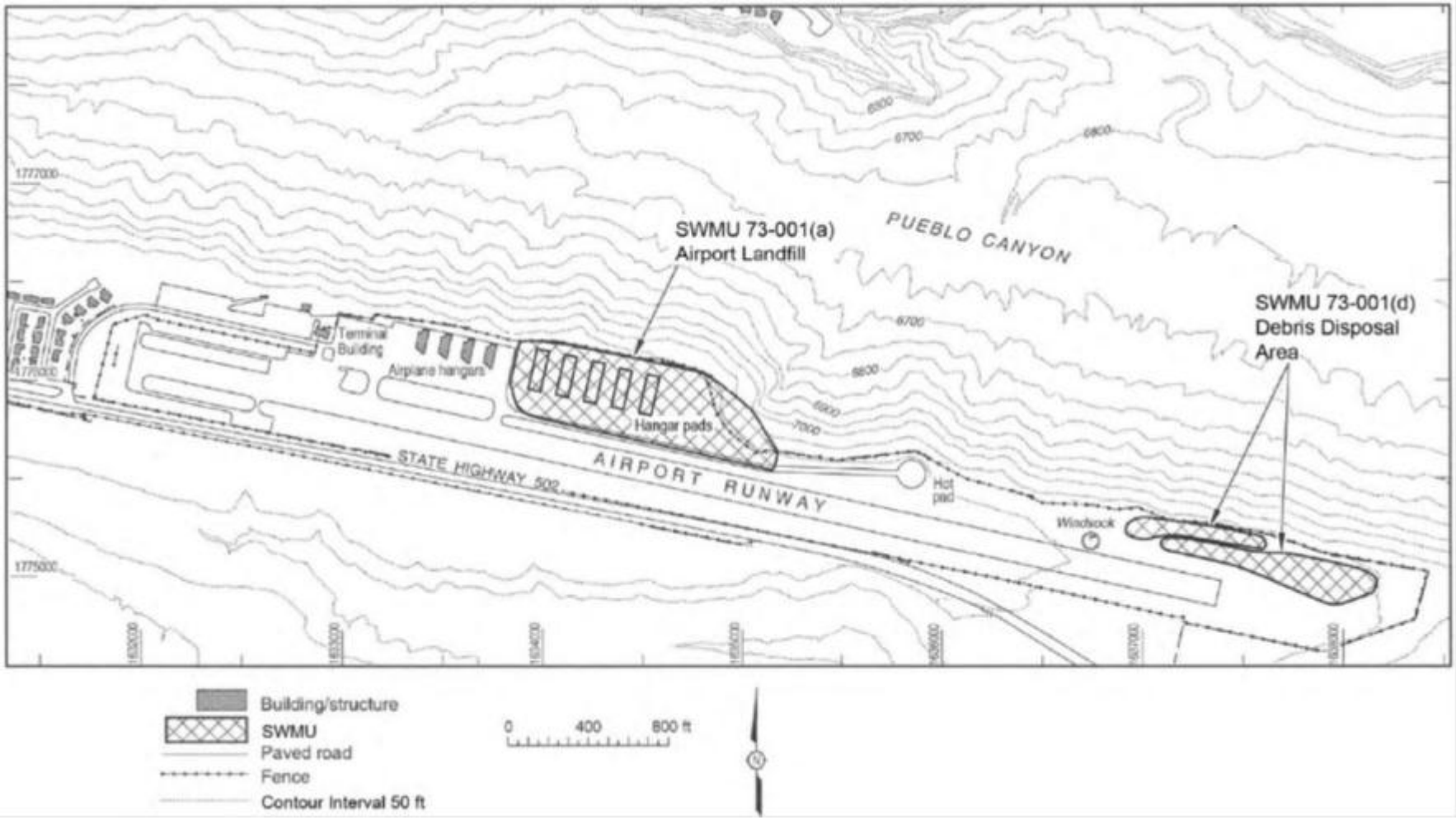

Figure 2. Landfill Locations (LANL 1998)

2.1 LAC AIRPORT LAND USE

The LAC Airport is situated on the eastern edge of the town site of Los Alamos, NM on a narrow mesa between State Road 502 and Pueblo Canyon (Figure 1). The LAC Airport was built in 1947 by the Atomic Energy Commission (predecessor to DOE) to serve the transportation needs of the Los Alamos Scientific Laboratory. The airport is currently owned and operated by the County of Los Alamos. The airport property was conveyed from DOE to the Los Alamos County in October 2008 and was formerly part of LANL Technical Area (TA) 73.

The airport is predominately used for general aviation purposes such as recreation and air taxi. An average of 30 operations (takeoffs and landings) occur daily (Ploeger 2009). The vast majority of operations involve single-engine propeller aircraft. Business jets and air-ambulance helicopters occasionally use the airport.

The single runway is 5,500 ft. long. The airport facilities consist of a terminal building, a two-story storage building (formerly the landfill incinerator building), four rows of T-hangars, various taxiways, two parking aprons, a self-service fueling station, the Hot Pad, and a strip of older hangars on the west end of the airport. Prior to 2000, the Hot Pad was used for loading and unloading LANL sensitive cargo. The Hot Pad is now used for aircraft parking and has six tie-down spots.

Pueblo Canyon extends along the north side of the airport and is undeveloped land. An unpaved road trends along the floor of the canyon. Road traffic typically consists of a few vehicles a day. The newer LAC waste-water treatment plant is located approximately 1.1 miles down the canyon from the Airport landfill.

The airport property and Pueblo Canyon are not located within the boundaries of the Santa Fe National Forest.

2.2 LOS ALAMOS, NM CLIMATE

Los Alamos, NM has a temperate mountain climate with four distinct seasons (LANL 1999). For the LANL meteorological station nearest the airport, the mean precipitation including snowmelt is approximately 18.7-in per year (LANL 2006). The peak months for precipitation are July and August (Figure 3) when afternoon thunderstorms can produce high intensity rainfall.

2.3 SITE GEOLOGY

The Bandelier Tuff (consolidated volcanic ash) forms the bedrock underlying the airport. The Hackroy series is developed from the tuff and is characterized as a well-drained sandy loam (NRCS 2008). The uppermost north-facing slope near the airport is steep and rocky with scattered scrub oak, chamisa, bunch grass, and juniper. Near the canyon floor, the slope lessens and the vegetation is dominated by ponderosa pine. The channel along the canyon floor is ephemeral and has stream flow only in response to heavy precipitation. The vertical relief from the airport paved area to the canyon floor is approximately 500-ft. The depth to groundwater beneath the airport is about 1200-ft (North Wind 2006). No water supply wells are located on the airport property or nearby in Pueblo Canyon.

3.0 PERFORMANCE OBJECTIVES & REGULATORY CRITERIA FOR COVER SYSTEM

Table 1 summarizes the performance objectives and regulatory criteria for the cover system. The specific design elements related to the cover and where it is described within this report are also contained in Table 1.

An important performance objective for the new cover system is the ability to accommodate subsidence or differential settlement. The existing cover is primarily being replaced due to problems encountered by differential settlement that has occurred since its installation. A fatal flaw in the previous asphalt cover system was the assumption that because of the age of the landfill there would be no significant settlement after installation of the cover and that the cover system would remain relatively impermeable. In fact, the cracking in the asphalt and concrete exaggerated ongoing settlement by allowing significant percolation into the underlying waste and accelerating the biodegradation of the waste that also leads to an increase in methane gas production. Exasperating the problem was the fact that all of the rain water that rain through the surface cracks into the underlying waste was trapped there because the existing cover system had a reverse capillary barrier with the base coarse/gravel layer below the asphalt and the underlying soil combined with the fact that there was no conductive layer that enabled water within the landfill to move upward in response to energy gradients created by the variance in the climate's demand for water or potential evapotranspiration as described in Section4.

The ET Cover does not relay on an impermeable layer to resist infiltration rather it relies on inflation moving into the cover and stored within the soil profile until evapotranspiration can remove it thus minimizing percolation into the underlying waste. Furthermore, the ET Cover is designed with a minimum 3.3% slope that encourages runoff form the site while providing an allowance for some differential settlement and still providing for a positive slope instead of ponding as was the case with the existing cover that was design relatively flat. An advantage of the ET Cover is that if significant differential settlement does occur, a simple fix is to add soil to depressed surface areas thus brings the surface back to its designed grade. Finally, the ET Cover is expected to minimize percolation into the underlying waste thus slowing the ongoing biodegradation of the waste. This will be monitoring via water balance of the cover system and methane gas monitoring as described in the Post-Closure Care and Monitoring Plan.

Table 1. Performance Objectives and Regulatory Criteria for Cover System

No.	Performance Objectives	Regulatory Criteria	Design element	Location summarized in Design Report
1	Minimize flux or deep percolation through cover system	40CFR264.310	Cover profile	Section 4
2	Minimal maintenance	40CFR264.310	ET Cover/Gravel /soil admix/veg	Section 4, Section 5
3	Minimize erosion	40CFR264.310	Gravel/soil admix	Section 5
4	Soil loss less than 2 tons/acre/year	EPA 1991	Gravel/soil admix	Section 5.3
5	Promote drainage off of cover	40CFR264.310 EPA 1991	Cover grades	3% minimum slope
6	Accommodate settlement/subsidence	40CFR264.310	ET Cover; Placement densities/moisture	Section 3
7	Cover permeability less than or equal to natural subsoils present	40CFR264.310	Cover material	Section 4

4.0 COVER PROFILE DEVELOPMENT

This report describes an Evapotranspiration (ET) Cover System that satisfies the stated performance objectives described in Section 3.0. The design methodology utilized is consistent with that recommended in ITRC (2003), EPA-909-R-11-007 (EPA 2012), and Dwyer et al (2006). Modeling was performed to evaluate an ET Cover profile (Section 4.1) utilizing an identified soil borrow source, native vegetation and site-specific climate data. The cover soil will be purchased and trucked to the site from an approved vendor. The soil laboratory testing data from these borrow sites is available in Borrow Study Report (Dwyer 2013). The computer simulations demonstrated that the recommended soil cover profile will minimize flux (Table 3 and Figure 10).

The final cover profile includes a rock/soil admixture surface layer designed to provide erosion resistance. The design of this layer is described in Section 5.1. The recommended cover soil profile will be installed over the prepared subgrade after removal of the asphalt cover and concrete hangar pads. The slope will have a minimum slope of 3%.

4.1 UNSATURATED MODELING OF COVER SYSTEM

This section summarizes the modeling performed in support of the design of the profile for the final cover system for the Los Alamos County Airport Landfill. The planned cover system is to be an earthen cover referred to as an Evapotranspiration (ET) Cover.

Los Alamos, NM has a temperate mountain climate with four distinct seasons (LANL 1999). For the LANL meteorological station nearest the airport, the mean precipitation including snowmelt is approximately 18.7-in per year (LANL 2006). The peak months for precipitation are July and August (Figure 3) when afternoon thunderstorms can produce high intensity rainfall. Figure 3 depicts the average monthly distribution of precipitation as well as the monthly climatic demand for water, referred to as potential evapotranspiration (PET). That is, figure 3 shows that for an average year the supply of water (precipitation) is far less than the climatic demand for water (potential evapotranspiration) for every month of the year. Thus a well-designed ET Cover that emphasizes storage of infiltrated meteoric water until it is removed via ET will work in this type of climate.

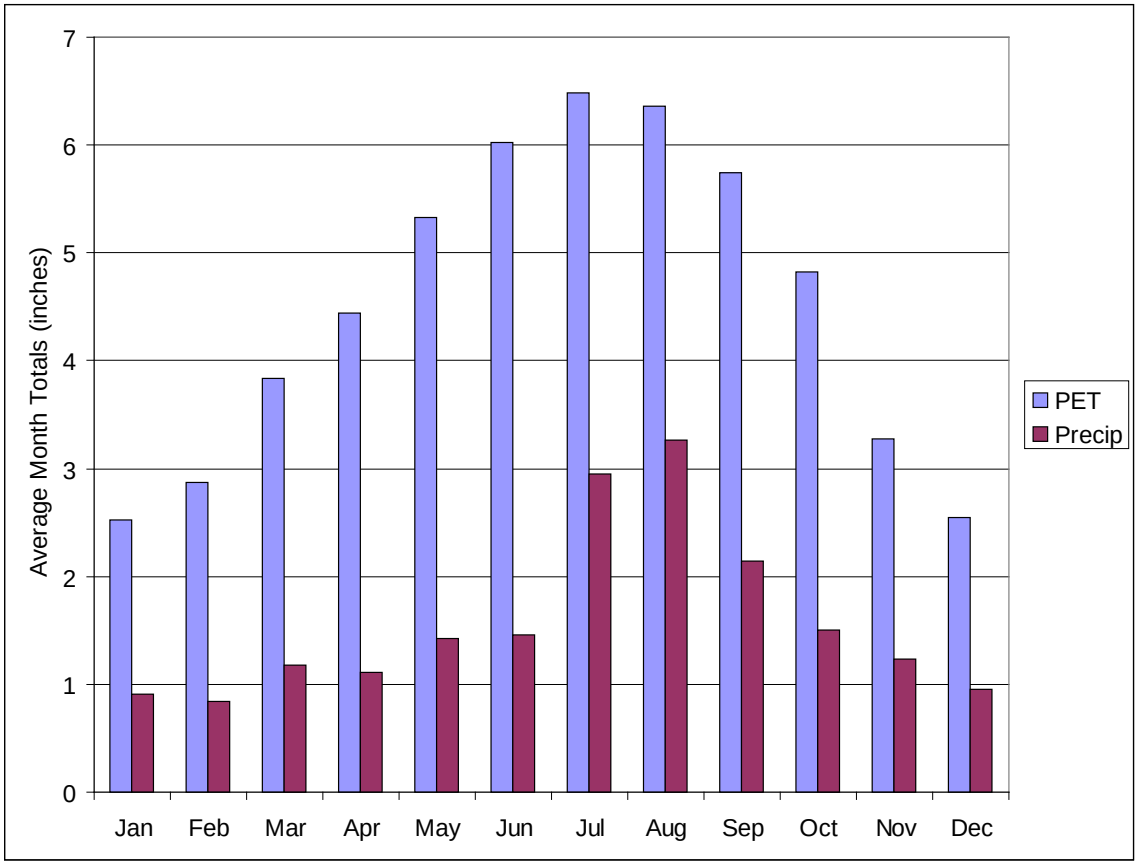

Figure 3. Los Alamos, NM Typical Climate's Demand for Water (PET) vs. Supply of Water (Precipitation)

Historically, HELP (Schroeder et al, 1994) has been the software utilized to predict water balance in landfill systems including the final cover. However, it is now recognized that this software has its limitations (ITRC 2003). Software more applicable for the analyses of water flow within an alternative earthen cover system is based on the Richard's Equation (ITRC 2003). One of the most common software (ITRC 2003) that is based on the Richard's equation used today is UNSAT-H (Fayer 2000). This unsaturated modeling software was designed specifically for earthen covers. It has been recommended for use on alternative earthen covers in design guidance documents including ITRC (2003), EPA-909-R-11-007 (EPA 2012), and Dwyer et al (2006). Consequently, UNSAT-H was used on this project.

4.1.1 OVERVIEW OF UNSAT-H

UNSAT-H has been used to design many recent alternative earthen cover designs (ITRC 2003, Dwyer 2003, EPA-909-R-11-007, Dwyer et al 2006). UNSAT-H is a one-dimensional, finite-difference computer program developed at the Pacific Northwest National Laboratory by Fayer and Jones (1990). UNSAT-H can be used to simulate the water balance of earthen covers as well as soil heat flow (Fayer 2000). UNSAT-H simulates water flow through soils by solving Richards' equation and simulates heat flow by solving Fourier's heat conduction equation.

A schematic illustration showing how UNSAT-H computes the water balance is shown in Figure 4. UNSAT-H separates precipitation falling on an earthen cover into infiltration and overland flow. The quantity of water that infiltrates depends on the infiltration capacity of the soil profile immediately prior to rainfall (e.g., total available porosity). Thus, the fraction of precipitation shed as overland flow depends on the saturated and unsaturated hydraulic conductivities of the soils characteristic of the final cover. If the rate of precipitation exceeds the soil's infiltration capacity, the extra water is shed as surface runoff. UNSAT-H does not consider absorption and interception of water by the plant canopy, or the effect of slope and slope-length when computing surface runoff. This allows for conservative infiltration and percolation estimates since landfill cover systems are generally sloped to encourage runoff.

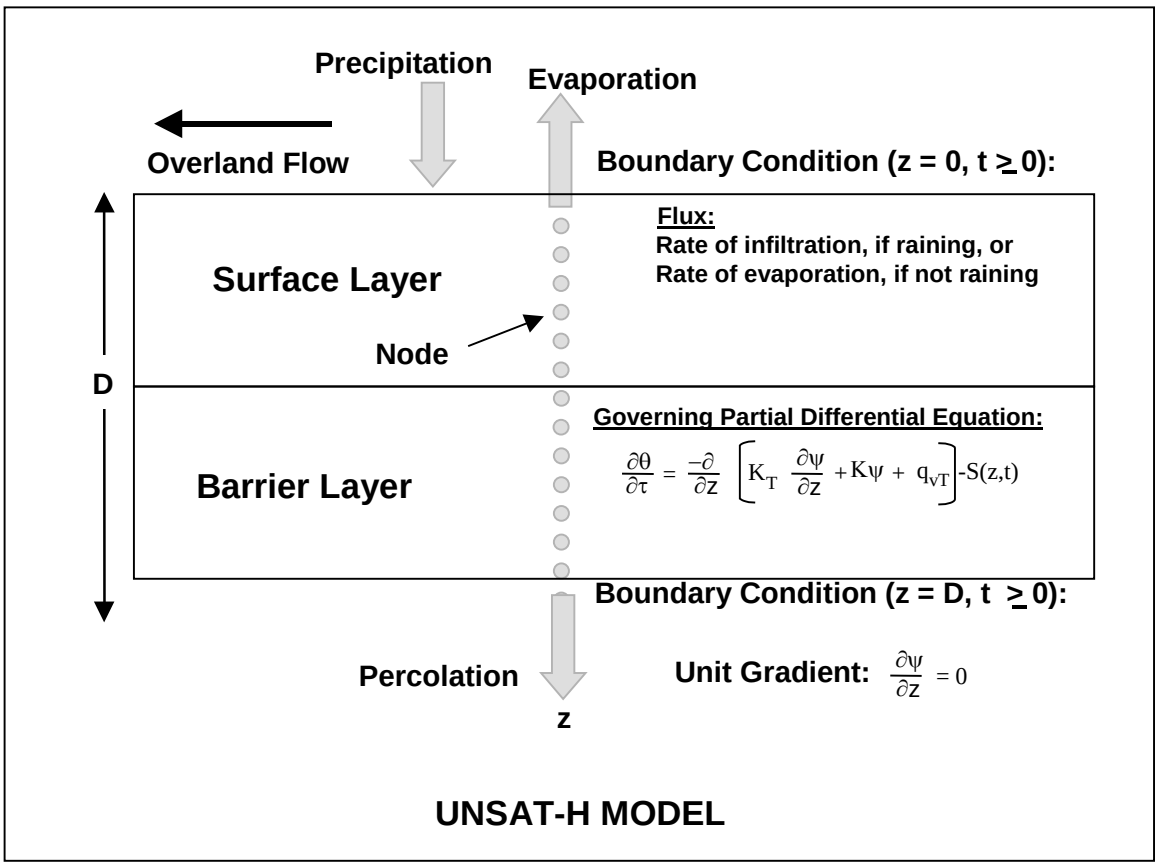

Figure 4. Schematic Representation of Water Balance Computation by UNSAT-H

Water that has infiltrated a soil profile during an UNSAT-H simulation moves upward or downward as a consequence of gravity and matric potential gradients. Evaporation from the cover surface is computed using Fick's law. Water removal by transpiration of plants is treated as a sink term in Richards' equation. Potential evapotranspiration (PET) is computed from the daily wind speed, relative humidity, net solar radiation, and daily minimum and maximum air temperatures using a modified form of Penman's equation given by Doorenbos and Pruitt (1977). Soil water storage is computed by integrating the water content profile. Flux from the lower

boundary is via percolation. UNSAT-H, being a one-dimensional program, does not compute lateral drainage.

4.1.2 UNSAT-H INPUT PARAMETERS

Input parameters were developed for simulations using UNSAT-H for the ET cover. These parameters were developed based on field and laboratory measurements, values from the literature, and expert opinion. These parameters are described in the following sections.

4.1.3 MODEL GEOMETRY

The model geometry was based on the expected depth of the cover system. The nodal spacing was set at a range narrow enough to accurately represent the modeled cover profile. A general summary of the profile model is included in Figure 5. The rock/soil admixture is 25% rock to 75% soil (by volume) based on the design presented in Section 4.1.

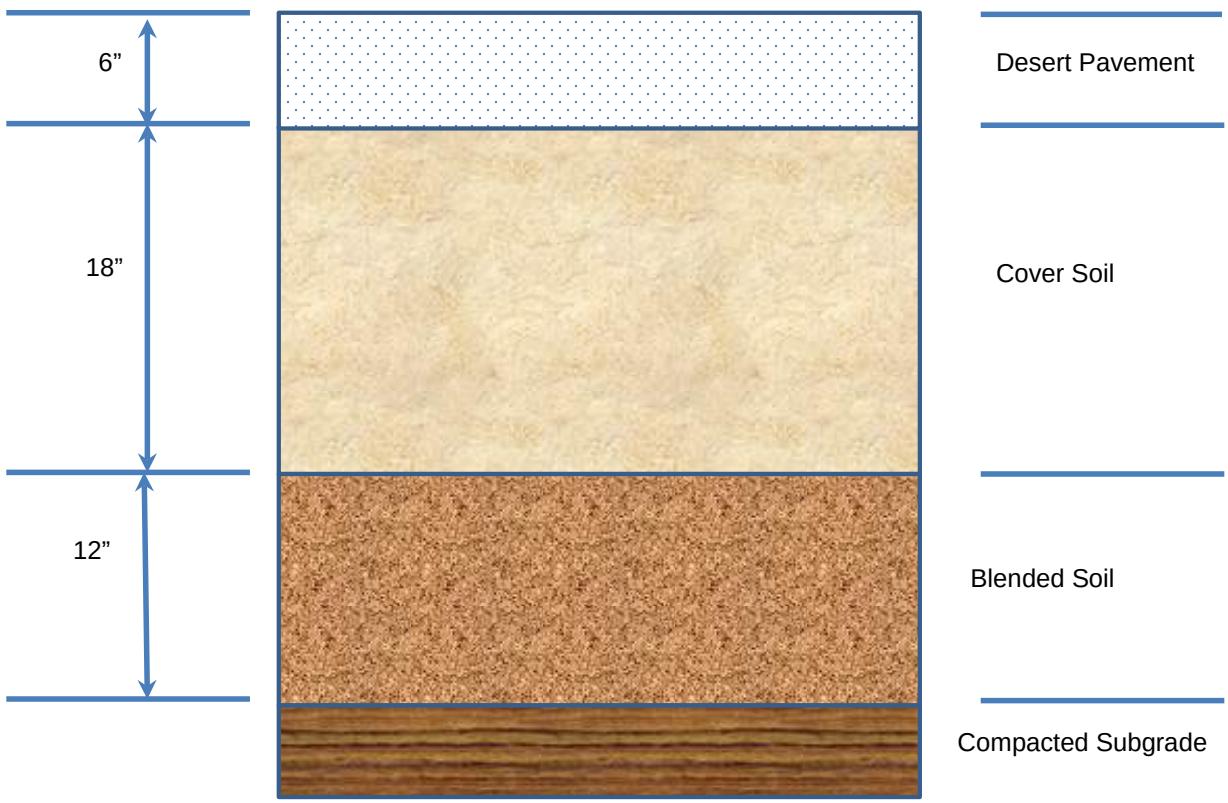

Figure 5. Cover Profile

4.1.4 BOUNDARY CONDITIONS

Weather from Los Alamos, NM was utilized as the upper boundary condition. All available historical weather data for Los Alamos was evaluated from 1910 to present. Typical climatic conditions as well as extreme conditions were evaluated to determine a minimum cover thickness. The specific year used to evaluate the profiles under typical conditions was 1942

(figure 6) with an annual precipitation of 18.45 in (46.86 cm). Extreme climatic conditions were also evaluated by evaluating the profile subject to the wettest year on record (figure 7). The year of 1941 was the wettest on record with an annual precipitation of 30.33 in (77.04 cm).

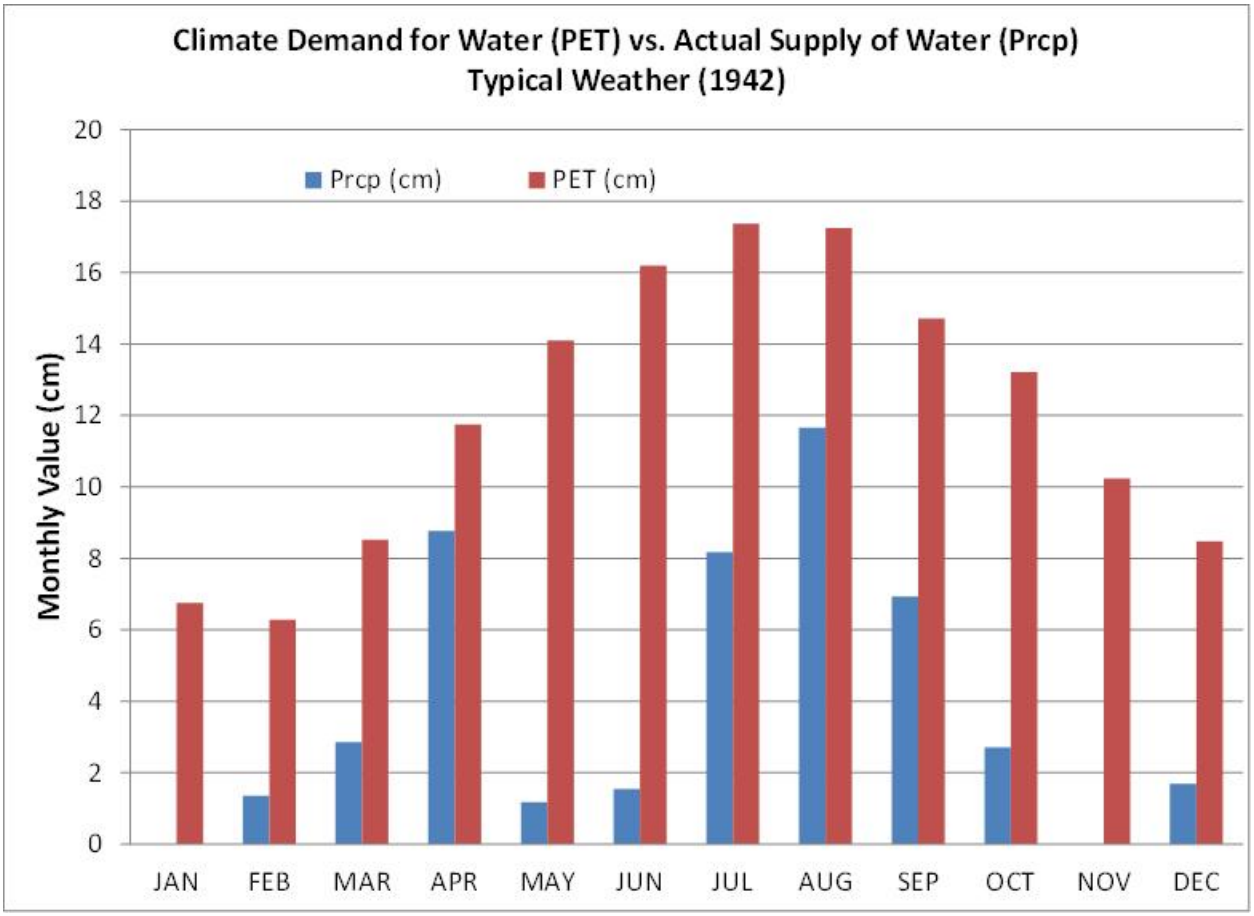

Figure 6. Climate Demand for Water vs. Supply of Water: Typical Weather (1942)

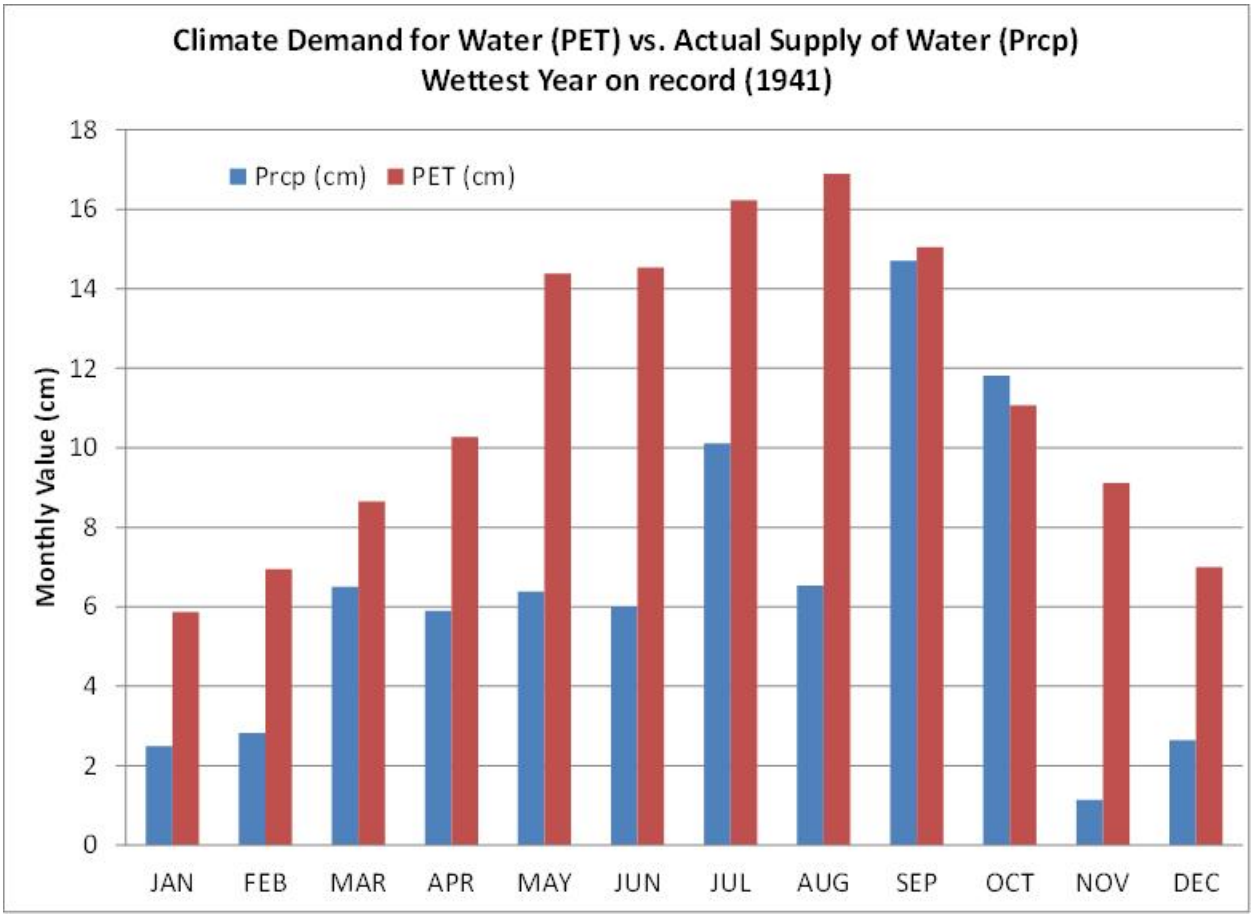

Figure 7. Climate Demand for Water vs. Supply of Water: Wettest Year on Record (1941)

The flow of water across the surface and lower boundary of the cover profile of interest is determined by boundary condition specifications. For infiltration events, the upper boundary was generally set to a maximum hourly flux for these computer simulations of 0.4 inches (1 cm) per hour that produced no runoff while maximizing infiltration. This is conservative because it is expected at the site given the designed slopes that a significant percentage of precipitation will runoff the site without infiltrating into the cover profile.

The UNSAT-H program partitions PET into potential evaporation (E_p) and potential transpiration (T_p). Potential evaporation is estimated or derived from daily weather parameters (Fayer 2000). Potential transpiration is calculated using a function (Equation 1) that is based on the value of the assigned leaf area index (LAI) and an equation developed by Ritchie and Burnett (1971) as follows:

$$T_p = PET\,[a + b(LAI)^c] \quad \text{where } d \le LAI \le e \qquad \textbf{Equation 1}$$

where:

a,b,c,d, and e are fitting parameters;

a = 0.0, b = 0.52, and c = 0.5, d = 0.1, and e = 2.7 (Fayer 2000)

The maximum and minimum daily temperatures, daily precipitation value and site latitude were input parameters used to calculate PET (Samani and Pessarkli, 1986). The Samani method used to calculate PET correlates very well with the Penman method utilized within UNSAT H (Samani and Pessarkli, 1986). The UNSAT-H program then partitioned the daily PET values into E_p and T_p. T_p was calculated using a function developed by Equation 1 above. The PET or climatic demand for water versus the amount of rain is graphically presented for a typical year above in Figure 6 and wettest year on record in Figure 7.

Two separate files were written for each year modeled: one file represented the daily PET values and the other file consisted of the daily precipitation values. The model run consisted of ten consecutive average years followed by the wettest year on record. This allowed for nine consecutive average years in front of the selected model years to establish appropriate antecedent conditions.

The lower boundary condition was a unit gradient. With the unit gradient, the calculated drainage flux depended upon the hydraulic conductivity of the lower boundary node. The unit gradient corresponded to gravity-induced drainage and was most appropriate when drainage was not impeded. The base of the modeled profile was well below transient activity and in steady state conditions to ensure that the unit gradient bottom boundary condition used did not affect the output.

4.1.5 VEGETATION DATA

Vegetation will generally increase ET from the cover because a plant's matric potential or suction can be orders of magnitude higher than that of the soil (Figure 8).

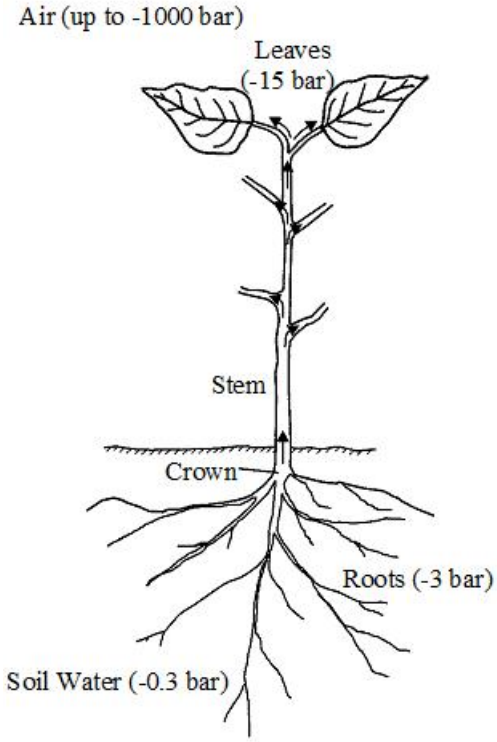

Figure 8. Typical Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998)

The input parameters representing vegetation include the LAI, rooting depth and density, root growth rate, the suction head values that corresponds to the soil's field capacity, wilting point, and water content above which plants do not transpire because of anaerobic conditions. The onset and termination of the growing season for the site are defined in terms of Julian days. The maximum rooting depth is based on expected vegetation characteristics. The root length density (RLD) is assumed to follow an exponential function such as that defined in Equation 2:

$$\mathbf{RLD = a\ exp(-bz) + c} \qquad \textbf{Equation 2}$$

where:

a,b, and c are fitting parameters

z = depth below surface

The cover profile (Figure 5) was modeled with vegetation on the surface. The parameters used for the RLD functions in Equation 2 were: a = 0.315, b=0.0073, and c = 0.076 (Fayer 2000). The time required for maximum rooting depth establishment was set at full depth beginning on day 1. The maximum rooting depth was conservatively set at 3 ft. (91 cm). This rooting depth is conservative because native grasses can reach depths up to 9 ft. (2.74 m) (Foxx et al 1984). A LAI of 1.1 was used that is consistent with a poor stand of grass (Simonton et al 1985). The growing degree day for the typical year of 1942 utilized is graphically presented in figure 9. The onset and termination of the growing season for the site were Julian days 83 and 335, respectively. The LAI was transitioned from 0 to 1.1 starting with Julian day 83 to 167. Day 167 through 211, the full LAI equal to 1.1 was utilized. The LAI was then transitioned down from 1.1 to 0 from Julian day 211 to 336. This was conservative since it is realistic that plants can transpire longer than indicated at this site. An average percent bare area of 37% was used (Simonton et al 1985). That is, vegetation coverage was only 63%. The assumed percent bare area of 37% essentially reduces the maximum LAI to 0.69 (63% of 1.1).

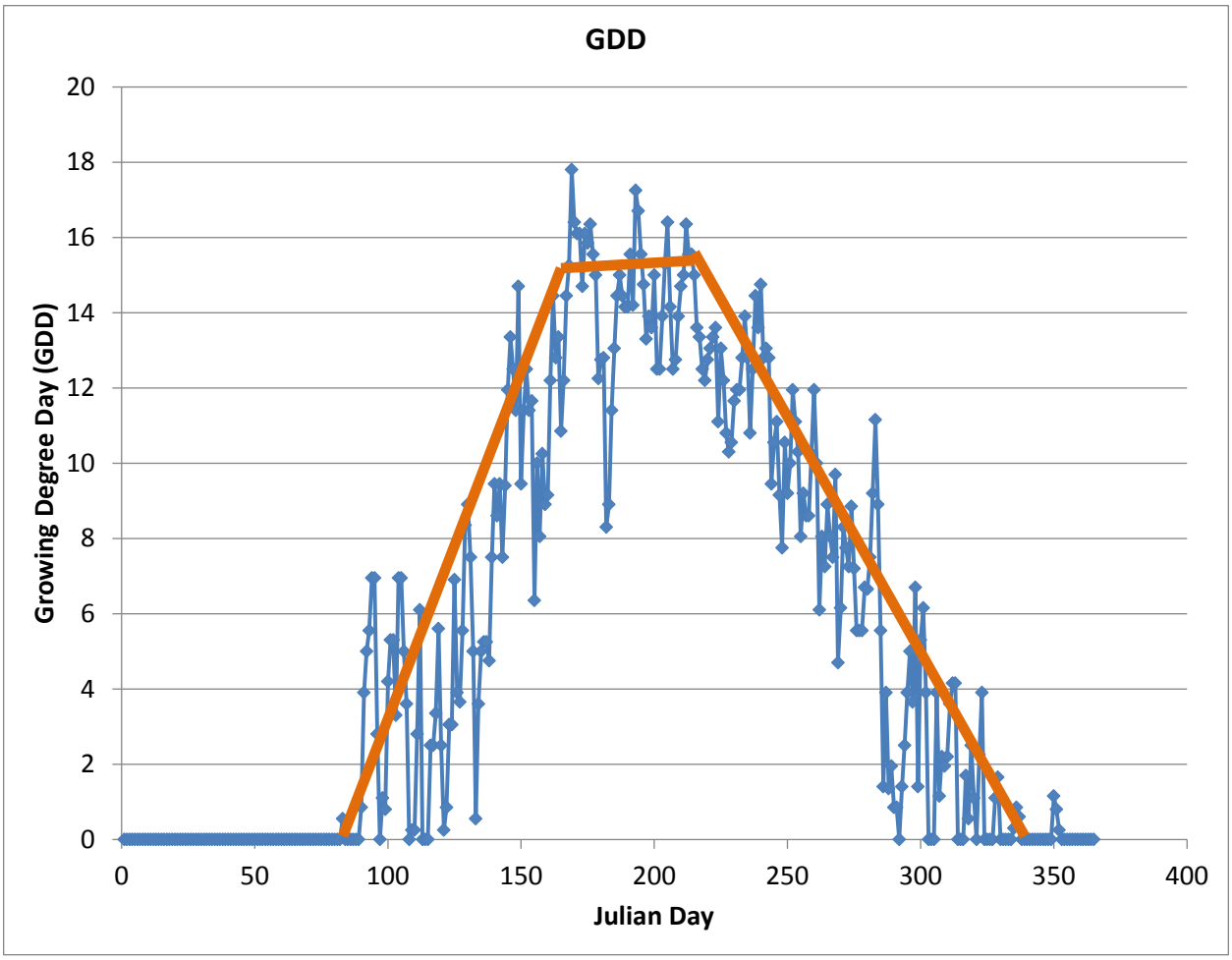

Figure 9. Growing Degree Day for Typical Year, Los Alamos, NM

4.1.6 SOIL PROPERTIES RELATED TO VEGETATION

Suction head values corresponding to the wilting point, field capacity, and a head value corresponding to the water content above which plants do not transpire because of anaerobic conditions were defined as input parameters in the model. Matric potential or suction heads are generally written as positive numbers, but in reality are negative values. Consequently, the higher the listed value - the greater the soil suction. The maximum water content a soil can hold after all downward drainage resulting from gravitational forces is referred to as its field capacity. Field capacity is often arbitrarily reported as the water content at about 330-cm of matric potential head (Jury et al. 1991). Below field capacity, the hydraulic conductivity is assumed to be so low that gravity drainage becomes negligible and the soil moisture is held in place by suction or matric potential.

Not all of the water stored in the soil can be removed via transpiration. Vegetation is generally assumed to reduce the soil moisture content to the permanent wilting point, which is typically defined as the water content at 656.2-ft (20,000 cm) of matric potential head for native grasses. This 656.2-ft (20,000 cm) value was conservatively used although some shrubs present near the

site could remove water from the soil to a suction of 3280.8-ft (100,000 cm) (Hillel 1998). Evaporation from the soil surface can further reduce the soil moisture below the wilting point toward the residual saturation, which is the water content at an infinite matric potential. The head corresponding to the water content below which plant transpiration starts to decrease was defined as 32.2-ft (1000 cm) (Fayer 2000). The head value corresponding to the water content above which plants do not transpire because of anaerobic conditions was defined at 4-in (10 cm) based on the assumed moisture characteristic curves for the utilized soil hydraulic properties.

4.1.7 SOIL PROPERTIES

Soil mechanical and hydraulic properties were obtained from laboratory testing of multiple soil samples collected at various potential borrow sources. There are multiple potential and approved borrow sources for cover soil as summarized in the Cover Soil Borrow Investigation and specified in the Technical Specifications Section 02200 (Earthwork).. The upper 6-in rock/soil admixture will be composed of the mixture of rock and borrow soil from an approved vendor. The cover soil specifications define the allowable soil characteristics and placement density and moisture content. Soil textures from approved equal borrow sites will be accepted only if they meet the specified criteria and are pre-approved by the Engineer.

The hydraulic properties of the borrow soils modeled were obtained from laboratory testing of the various soil textures at a prescribed density of 90% of the maximum dry density (ASTM D698). This density approximately equates to the natural density of the borrow soils in their undisturbed setting. Because the density of the soil will migrate towards this natural density setting, it is warranted to install it as close to this density as possible. Therefore, the construction specifications for installation of the cover soil will require the installed density of the cover soil to be 90% of its maximum dry density (MDD) with a small tolerance allowance (plus or minus 5 pcf of MDD).

The upper 6-in of the top deck cover profile will have rock mixed into it at a volumetric ratio of 25% rock to 75% soil. The rock size will have a D_{50} of 0.5-in. The mixture of rock into the soil effectively alters its hydraulic properties. Consequently, the hydraulic properties were altered for this upper 6-in layer (ASTM D4718). The following equation (Equation 3) was used to alter the saturated hydraulic conductivity based on the addition of rock (Peck and Watson 1979).

$$\boldsymbol{K_b = [K_s * 2(1 - V_r)]/(2 + V_r)} \qquad \text{Equation 3}$$

$$where: K_b = saturated\ hydraulic\ conductivty, bulk$$

$$K_s = saturated\ hydraulic\ conductivty, soil$$

$$V_r = volume\ of\ rock$$

The calculated bulk saturated hydraulic conductivity for the admixture layer was then increased an order to account for dynamic processes such as freeze/thaw cycles, wet/dry cycles, and biointrusion. This resulted in added conservatism in the modeling results. Additionally, the depth of soil cover from 6 to 12-in below ground surface (BGS) also had its saturated hydraulic concavity increased by an order of magnitude to account for the dynamic processes mentioned above. The cover soil from 1 to 2-ft BGS had its saturated hydraulic conductivity increased by half an order of magnitude for the similar dynamic processes. The upper foot generally has the highest percentage of roots while the next foot has a reduced volume of roots. This is represented by the RLD described above in section 4.1.5.

The moisture retention data for the cover soil was also altered to reflect the addition of the rock (Equation 4). Each respective volumetric moisture content (saturated and residual) was altered per ASTM D4718 and Bouwer & Rice (1984). The revised moisture characteristic curve with respective van Genuchten parameters for input into the UNSAT H computer simulations (Table 2).

$$\boldsymbol{\theta_b} = (\mathbf{1} - \boldsymbol{V_r}) * \boldsymbol{\theta_s} \qquad \text{Equation 4}$$

$$where: \theta_{b,s\ or\ r} = volumetric\ moisture\ content, bulk$$

$$\theta_{s\ or\ r} = volumetric\ (saturated\ or\ residual) moisture\ content\ for\ soil, respectively$$

The Mualem conductivity function was used to describe the unsaturated hydraulic conductivity of the soils (van Genuchten et al 1991). The van Genuchten 'm' parameter for this function is assumed to be'1-1/n'; 'n' being one of the established van Genuchten parameters. The initial soil conditions were expressed in terms of suction head values that correspond to the average moisture content between each soil layer's field capacity and permanent wilting point determined from each respective soil layer's moisture characteristic curve.

A summary of the soil input parameters for the UNSAT H computer simulation are summarized in Table 2. The layers correspond to the profile shown in Figure 5.

Table 2. Soil Input Parameters

Soil	Depth BGS[1]	K_{sat}	Van Genuchten Parameters			
			θ_s	θ_r	α (1/cm)	n
Rock/Soil Admixture	0 to 0.5-ft (0 to 16 cm)	1.89E-03 in/sec (4.80E-03 cm/sec)	0.2635	0.046	0.0076	1.8637
Cover Soil	0.5-ft to 1.0-ft (17 cm to 31 cm)	3.7E-03 in/sec (9.40E-03 cm/sec)	0.3513	0.0613	0.0076	1.8637
Cover Soil	1.0-ft to 2.0-ft (32 cm to 61 cm)	1.85E-03 in/sec (4.70 E-03 cm/sec)	0.3513	0.0613	0.0076	1.8637
Cover Soil	2.0-ft to 3.0-ft (62 cm to 91 cm)	9.45E-07 in/sec (2.4E-06 cm/sec)	0.3317	0.0	0.0055	1.2128
Subgrade Soil	Beneath 3.0-ft (92 cm to 300 cm)	3.39E-04 in/sec (8.6E-04 cm/sec)	0.3513	0.0613	0.0076	1.8637

1. [1] below ground surface (BGS)

4.1.8 MODEL OUTPUT

The computer simulations output is summarized in Table 3 and Figure 10. The computer simulations involved running 10 typical years consecutively to mitigate any biases from assumed initial soil conditions, followed by the wettest year on record. The table below contains the tenth year of the average consecutive modeled years and the wettest year on record. The following variables are summarized for each year: (1) applied precipitation; (2) applied potential evapotranspiration (PET); (3) calculated transpiration; (4) calculated evaporation; (5) calculated runoff; (6) calculated percolation; and (7) the remaining water storage capacity within the modeled soil profile.

Following the tables is a graphical summation (Figure 10) of the soil depth versus annual flux for the average climate year and wettest year on record, respectively. This depth of cover soil where flux is minimized is referred to as the Dwyer Point of Diminishing Returns Method (Dwyer et al 2007). The 'point of diminishing returns' is defined as the depth at which flux is effectively minimized; that is, the depth at which an additional increment of soil will no longer significantly reduce the flux. At this depth the governing regulations (40CFR264.310 and 20.3.13.1313 NMAC) are satisfied for percolation.

Table 3. Computer Simulation Results

Year	Precip.	PET	Transp.	Evap.	Runoff	Percolation[1]	Store
Average Year	45.2 cm (17.8 in)	145.2 cm (57.2 in)	15.2 cm (6.0 in)	30.0 cm (11.8 in)	0	0	23.3 cm (9.2 in)
Wettest Year on Record	77.0 cm (30.3 in)	136.3 cm (53.6 in)	18.4 cm (7.3 in)	56.1 cm (22.1 in)	0	0	25.8 cm (10.2 in)

[1] Percolation is zero at a depth of 89 cm (35 in) for average climatic conditions; percolation is zero at a cover depth of 89 cm (35 in) for the wettest year on record.

40 CFR 264.310 and 20.3.13.1313 NMAC require that flux through the cover be minimized. Under typical climatic conditions for the site, the flux minimization criterion is satisfied for the cover profile at a depth of 89 cm (35 in). Refer to Figure 10. Actually flux is reduced to zero at this depth. For the wettest year on record with an annual precipitation in excess of 30-inches, the flux was minimized (zero) within the cover profile at a depth of just over 89 cm (35 in). Therefore, no flux is estimated for the 3 ft. thick cover profile modeled. Figure 10 represents the computer simulation results of a 3-foot thick cover profile whereby the bottom foot of soil is a higher fines content soil resulting for a mixture of 50% overburden (soil with a minimum of 25% fines) and a higher clay content soil (minimum fines content of 60%). Fines content is defined as the soil that passes a #200 sieve that generally represents silt and clay. The 18-inches directly above this bottom foot of blended soil is simply overburden (soil with a minimum fines content of 25%). The top 6-inches of soil are 75% overburden soil mixed with 25% rock by volume.

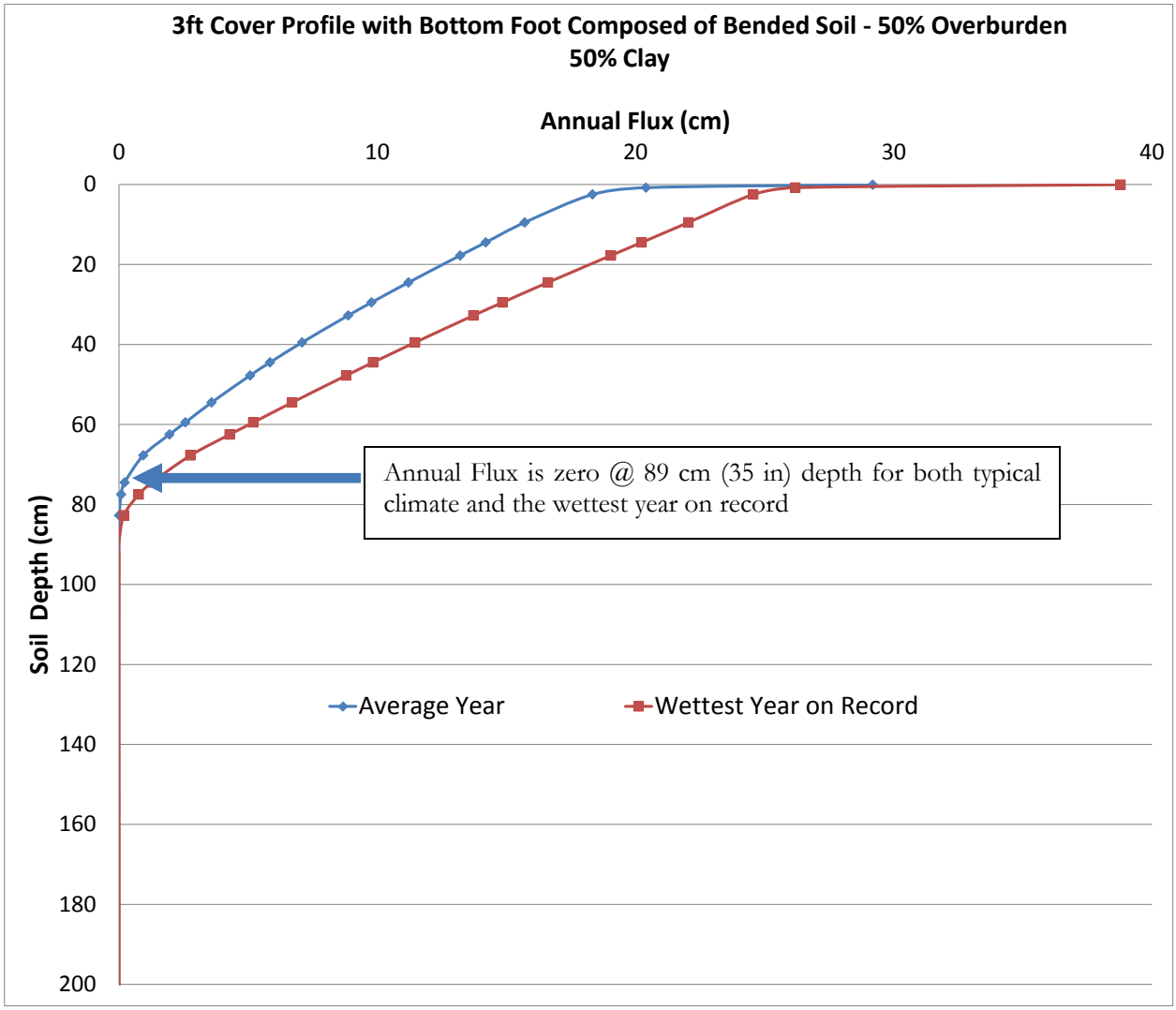

Figure 10. Computer Simulation Results

Conservatism was incorporated into the model in the form of limiting the precipitation rate to encourage 100% infiltration of precipitation into the cover profile. Furthermore, the modeling is one-dimensional and thus slope is not taken into account and thus there was no runoff due to slope. The upper 24 inches of the cover profile had its saturated hydraulic conductivity increased for the computer simulations to take into account potential changes to the soil hydraulic properties due to such things as freeze/thaw cycles, wet/dry cycles, biointrusion, and uncertainty in rock mixtures.

5.0 EROSION

The cover was designed to resist erosion. A top surface composed of a mixture of rock and cover soil was designed to mitigate the potential for rill or gully formation, as well as, reduce the potential for soil loss due to surface runoff. Research (Dwyer 2003) and monitoring of multiple projects within the southwestern United States has shown this surface admixture also promotes an effective establishment of native vegetation.

The following subsections summarize the design methodology and calculations performed to satisfy the performance objectives related to erosion. Section 5.1 summarizes the design of the rock/soil admixture. Section 5.2 summarizes the stability of the final slope as a rocky soil per NUREG 1623. Finally, section 5.3 summarizes the compliance of annual soil loss to less than two tons/acre/year as recommended by EPA (1991).

5.1 DESIGN OF COVER SURFACE LAYER (ROCK/SOIL ADMIXTURE)

Rock/soil admixtures provide excellent means to minimize erosion while allowing for vegetation establishment without a significant reduction in evaporation (Waugh et al 1994, Dwyer 2003, Dwyer et al 2007). Erosion (Ligotke 1994) and water balance studies (Waugh 1994) suggest that moderate amounts of gravel mixed into the cover topsoil will control both water and wind erosion. As wind and water pass over the landfill cover surface, some winnowing of fines from the admixture is expected, creating a vegetated erosion-resistant surface sometimes referred to as a ‘desert pavement’. The following rock/soil admixture design is for the cover surface or ‘desert pavement’.

5.1.1 DESIGN RAINFALL EVENT

The rainfall intensity value used to calculate the runoff volume from the cover was determined using data supplied by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Hydrometerological Design Studies Center. The data from NOAA Atlas 14, Volume 1 for Los Alamos, NM was used whereby the one hour precipitation frequency estimate for a 100 return period is 2.17 inches (5.51 cm). The one hour time of concentration is conservative for any contributory area less than 50 acres (20 hectares) (Lindeburg 1989).

5.1.2 RUNOFF PREDICTION

The “rational method” was used to estimate runoff volumes. This method is commonly used in civil engineering applications and is a method approved by DOE (1989) for design of cover systems for sites regulated by the Uranium Mill Tailings Radiation Control Act of 1978 (i.e., UMTRA sites). The rational method is based on the assumption that rainfall occurs uniformly over the watershed at a constant intensity for duration equal to the time of concentration.

Using the rational method (Equation 5), the peak rate of runoff, (Q), in cubic feet per second (cfs) [runoff is actually in acre-inches/hour but is rounded to cfs] is given by the following expression:

Q = C I A **Equation 5**

where:

C = Runoff coefficient (dimensionless) = 0.3 (Lindebrg 1989)

I = Rainfall intensity (in/hr)

A = Surface area that contributes to runoff (acres) = $L^2/4$

The time of concentration was calculated as recommended by the National Resources Conservation Service (NRCS) (Lindeburg 2012) [Equation 6].

$$\boldsymbol{t_c = \frac{0.007*(nL)^{0.8}}{\sqrt{P}S^{0.4}}}$$ **Equation 6**

where:

$t_c = time\ of\ concentration$

$n = Manning\ roughness\ coefficient$

$L = slope\ length$

$P = rainfall\ intensity\ per\ NOAA\ Atlas\ 14\ for\ designated\ storm$

$S = slope\ (\frac{ft}{ft})$

Using n= 0.03 (NUREG 1623 and Chow 1959), L -= 153.5 ft., S = 0.0332, and P= 100-yr, 1-hr storm intensity value of 2.17 in/hr (NOAA Atlas 14, Vol. 1, version 5); the resulting time of concentration (t_c) is 3.83 minutes. However, Los Alamos County Design and Construction Standards (2008) state the minimum time of concentration is 10 minutes. The NRCS recommends the use of a 2-yr, 24-hr storm event. For Los Alamos, 2-yr, 24-hr storm event is 1.72 inches ((NOAA Atlas 14, Vol. 1, version 5)). However, the design is intended to resist a more severe storm with a higher intensity and shorter duration. Therefore, the 100-yr, 1-hr storm event was conservatively used which is 2.17 inches ((NOAA Atlas 14, Vol. 1, version 5)). The shorter duration, higher intensity storm is also better suited for the Los Alamos area where this type of storm is common.

The Rainfall Intensity value to be utilized in the Rational Formula is then calculated using the Steel formula [Equation 7] as recommended by the NRCS (Lindeburg 2012):

$$\boldsymbol{I = \frac{K}{t_c + b}}$$ Equation 7

where:

$I = rainfall\ intesnity\ (\frac{in}{hr})$

$K = steel\ formula\ coefficient for\ Region\ 6\ for\ a\ 100yr, 1hr\ storm$
$= 210\ (Lindeburg\ 2012, Figure\ 20.5)$

$b = steel\ formula\ coefficient for\ Region\ 6\ for\ a\ 100yr, 1hr\ storm$
$= 26\ (Lindeburg\ 2012, Table\ 20.2)$

Therefore, the resulting rainfall intensity (I) is 5.83 in/hr.

The contributory surface area was calculated based on the assumed configuration shown in figure 11 where L is the critical slope length. Slopes (3.3%) and slope length (153.5-ft) are from proposed contoured plans of the conceptual cover. The slopes and slope lengths were estimated to match the area configuration described here.

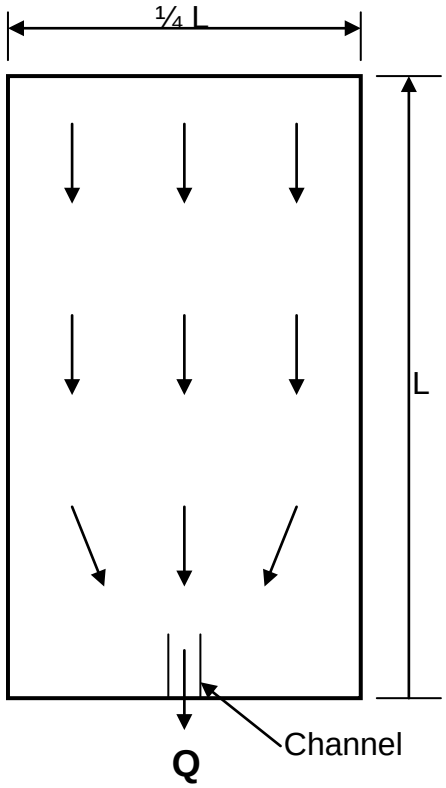

Figure 11. Contributory area for gully formation

5.1.3 CHANNEL GEOMETRY

The channel geometry shown in Figure 12 is that assumed for the gully formation.

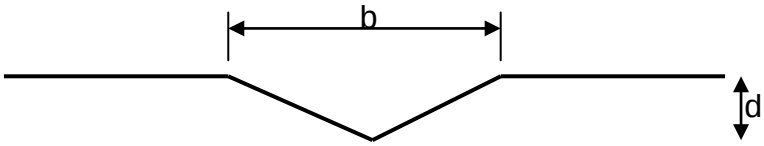

Figure 12. Channel geometry

The geometry of the channel that forms is based on regression equations [Equation 8 and 9] developed from analysis of a large number of channels (Simon, Li & Assoc. 1982). The channel width is given by:

$$b = 37\ (Q_m^{0.38} / M^{0.39})$$ **Equation 8**

where:

b = width of flow (ft.);

Q_m = mean annual flow (cfs);

M = percentage of silts and clays in soils (30.1% for applicable borrow soil, (Borrow Cover Soil Report, Dwyer Engineering 2015).

The mean annual flow (Q_m) is assumed to be between 10% and 20% of the peak rate of runoff (Q) (Dwyer et al. 2007). In this case 20% was used.

For the given discharge point of geometry, the hydraulic depth (d_h), defined as the flow cross-sectional area divided by the width of water surface, is half of the gully depth (d).

For flows at the critical slope:

$$b = 0.5\ F^{0.6}\ F_r^{-0.4} Q^{0.4}$$ **Equation 9**

where:

F = width to depth ratio = b/dh;

F_r = Froude Number ≈ 1.0.

5.1.4 INCIPIENT PARTICLE SIZE

The incipient particle size is the particle that is on the brink of movement at the assumed conditions. Any increase in the erosional forces acting on the particle, due to an increase in velocity or slope, for example, will cause its movement. This incipient particle size (D_c) was calculated using the Shield's Equation [Equation 10]:

$$D_c = \tau / F_s(\gamma_s - \gamma)$$ **Equation 10**

where:

τ = total average shear stress (psf);

F_s = Shield's dimensionless shear stress = 0.047;

γ_s = specific weight of soil (pcf) [measured, (Borrow Cover Soil Report, Dwyer Engineering 2015)];

γ = water density = 62.4 pcf.

The total average shear stress [Equation 11] is given by:

$$\tau = \gamma\ d_h\ S \qquad \textbf{Equation 11}$$

where:

S = slope (ft/ft).

d_h = hydraulic depth (ft)

5.1.5 DEPTH OF SCOUR AND ARMORING REQUIRED

The incipient particle size defines the maximum size of particle that will be eroded for a given set of conditions. The material larger than the incipient particle size will not be displaced or eroded, and can form an armoring that will protect the channel from further erosion from similar or lesser storm events.

The depth of scour (Y_s) to establish an armor layer is given by (Pemberton and Lara 1984):

$$Y_s = Y_a\ [(1/P_{c)}-1] \qquad \textbf{Equation 12}$$

where:

Y_s = scour depth;

Y_a = armor layer thickness;

P_c = decimal fraction of material coarser than the incipient particle size.

5.1.6 ROCK/SOIL ADMIXTURE SUMMARY

An excel spreadsheet was used to simultaneously solve the multiple equations described above. Table 4 presents the calculated results for the surface rock/soil admixture.

Table 4. Rock/Soil Admixture Summary

Q (cfs)	Qm (cfs)	b (in)	dH (in)	τ (psf)	Dc (in)	use D50 (in)	% rock	Ya (in)	Ys (in)	total depth (in)
0.24	0.05	36.9	0.68	0.11	0.28	0.5	25	1.5	4.5	6

5.2 LONG-TERM STABILITY OF ROCKY SOIL COVER

The long-term stability of the cover surface with the addition of the rock/soil admixture can be determined by Equation 13 (NUREG 1623):

$$S_s^{7/6} = [65*t^{5/3}]/[P*L*F*n] \quad \text{Equation 13}$$

where:

S_s = maximum stable slope (%);

t = 0.4*D75 = 0.2 in;

P = rainfall intensity = 8.06 in/hr;

L = slope length = 153.5 ft;

F= 3 (NUREG 1623);

n = 0.03.

solving, S_s = 8.35% (this represents the steepest stable slope under the given rock/soil admixture design and slope length for the site)

Therefore, since S_s = 8.35% is greater than the actual slope of 3.32%, the slope is stable.

5.3 SOIL LOSS

The Revised Universal Soil Loss Equation (RUSLE) represents a revision of the Universal Soil Loss Equation (USLE) technology in how the factor values in the equation are determined. RUSLE [Equation 14] is explained in the U.S. Department of Agriculture (USDA) Handbook 703, "Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE)." The RUSLE is expressed as:

$$A_s = R_e\, K\, (LS)\, C\, P_c \qquad \textbf{Equation 14}$$

Where:

A_s = average annual soil loss by sheet and rill erosion in tons per acre;

R_e = rainfall energy/erosivity factor (dimensionless) = 25 --- see figure 14;

K = soil erodibility factor (dimensionless) = 0.26 --- see figure 13;

LS = slope length and steepness factor (dimensionless) =0.4 --- see figure 15;

C = vegetative cover and management factor (dimensionless) = 0.21 (RUSLE2 software); and

P_c = conservation support practice factor (dimensionless) = 1 (no conservation support practice prescribed).

Solving:

A_s = 25*0.26*0.4*0.21*1 = 0.55 tons/acre/yr

The EPA (1991) recommends a maximum soil loss due to erosion of 2 tons/acre/year. Since the annual soil loss of 0.55 tons/acre/year is less than 2 tons/acre/year, the performance criteria for soil loss/erosion (EPA 1991) is satisfied.

The following figures are derived from Agriculture Handbook 703.

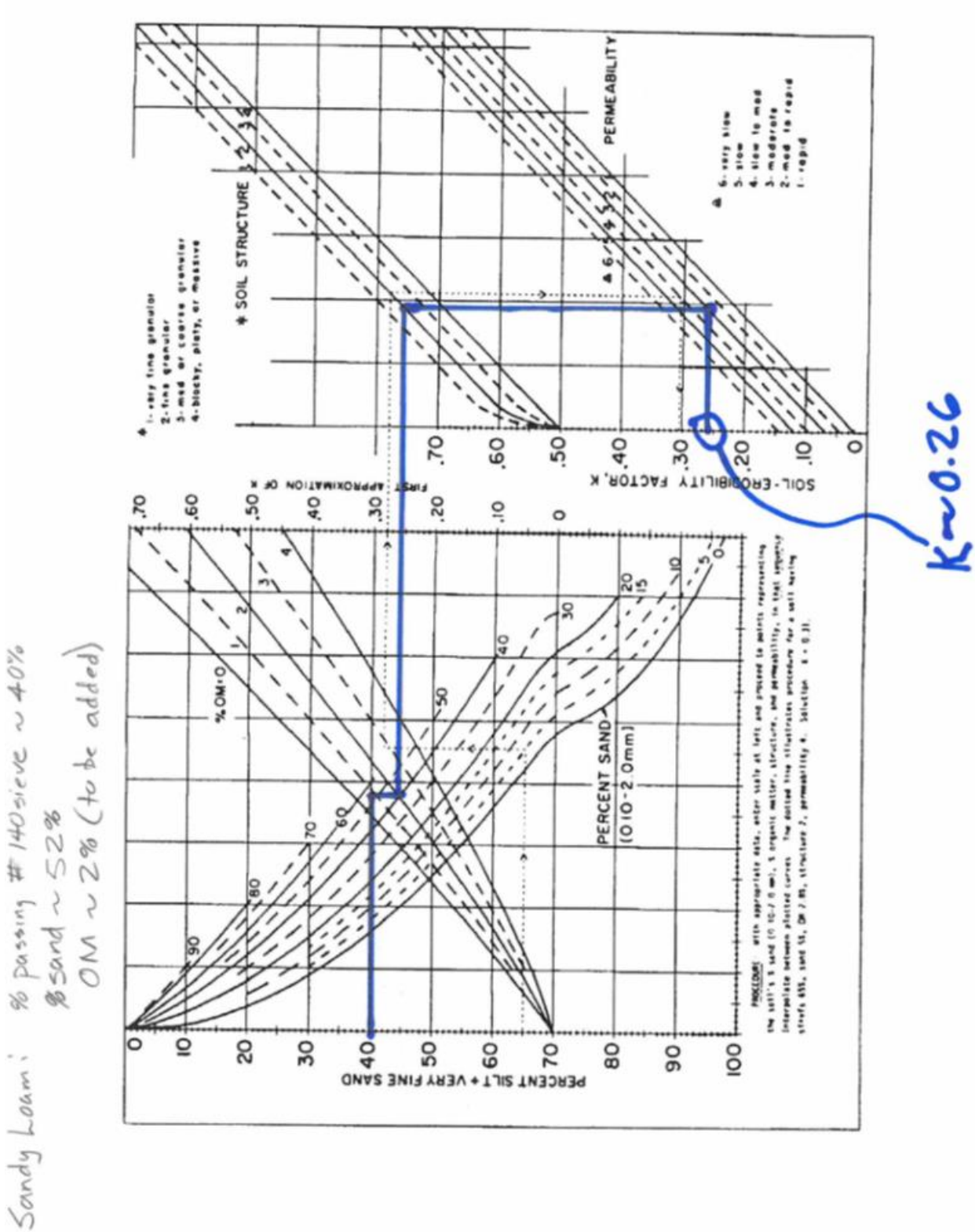

Figure 13. RUSLE K Factor, Ag Handbook 703

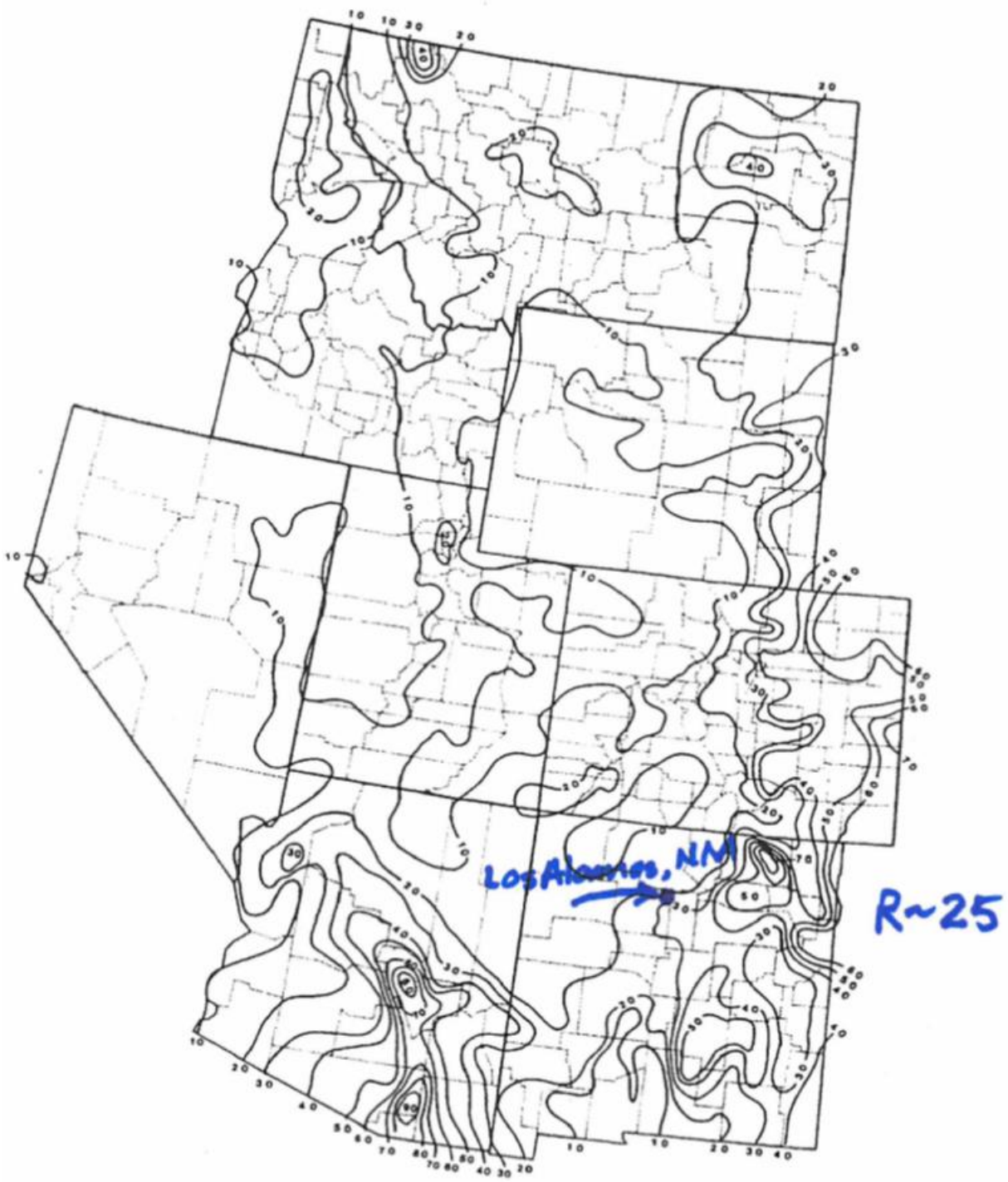

Figure 2-2. Isoerodent map of western United States. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

Figure 14. RUSLE R Factor, Ag Handbook 703

Table 4-1.
Values for topographic factor, LS, for low ratio of rill to interrill erosion.[1]

LS=0.4

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1.0	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.17
2.0	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34	0.35
3.0	0.26	0.26	0.26	0.26	0.26	0.28	0.33	0.36	0.38	0.40	0.43	0.44	0.46	0.48	0.52	0.55	0.57
4.0	0.33	0.33	0.33	0.33	0.33	0.36	0.43	0.46	0.50	0.54	0.58	0.61	0.63	0.67	0.74	0.78	0.82
5.0	0.38	0.38	0.38	0.38	0.38	0.44	0.52	0.57	0.62	0.68	0.73	0.78	0.81	0.87	0.97	1.04	1.10
6.0	0.44	0.44	0.44	0.44	0.44	0.50	0.61	0.68	0.74	0.83	0.90	0.95	1.00	1.08	1.21	1.31	1.40
8.0	0.54	0.54	0.54	0.54	0.54	0.64	0.79	0.90	0.99	1.12	1.23	1.32	1.40	1.53	1.74	1.91	2.05
10.0	0.60	0.63	0.65	0.66	0.68	0.81	1.03	1.19	1.31	1.51	1.67	1.80	1.92	2.13	2.45	2.71	2.93
12.0	0.61	0.70	0.75	0.80	0.83	1.01	1.31	1.52	1.69	1.97	2.20	2.39	2.56	2.85	3.32	3.70	4.02
14.0	0.63	0.76	0.85	0.92	0.98	1.20	1.58	1.85	2.08	2.44	2.73	2.99	3.21	3.60	4.23	4.74	5.18
16.0	0.65	0.82	0.94	1.04	1.12	1.38	1.85	2.18	2.46	2.91	3.28	3.60	3.88	4.37	5.17	5.82	6.39
20.0	0.68	0.93	1.11	1.26	1.39	1.74	2.37	2.84	3.22	3.85	4.38	4.83	5.24	5.95	7.13	8.10	8.94
25.0	0.73	1.05	1.30	1.51	1.70	2.17	3.00	3.63	4.16	5.03	5.76	6.39	6.96	7.97	9.65	11.04	12.26
30.0	0.77	1.16	1.48	1.75	2.00	2.57	3.60	4.40	5.06	6.18	7.11	7.94	8.68	9.99	12.19	14.04	15.66
40.0	0.85	1.36	1.79	2.17	2.53	3.30	4.73	5.84	6.78	8.37	9.71	10.91	11.99	13.92	17.19	19.96	22.41
50.0	0.91	1.52	2.06	2.54	3.00	3.95	5.74	7.14	8.33	10.37	12.11	13.65	15.06	17.59	21.88	25.55	28.82
60.0	0.97	1.67	2.29	2.86	3.41	4.52	6.63	8.29	9.72	12.16	14.26	16.13	17.84	20.92	26.17	30.68	34.71

[1]Such as for rangeland and other consolidated soil conditions with cover (applicable to thawing soil where both interrill and rill erosion are significant).

Figure 15. RUSLE LS Factor, Ag Handbook 703

6.0 MISCELLANEOUS CALCULATIONS

Miscellaneous calculations including volume approximations for waste removal and replacement, concrete removal, cover soil needed, hydrology, drainage channel sizing are included in the Attachment at the end of this report.

7.0 SUMMARY

An ET Cover was designed to replace the existing asphaltic cover over the Los Alamos County Airport Landfill. The cover was designed to satisfy all performance objectives and regulatory criteria cited in section 3 of the report for a RCRA Subtitle C facility.

Advantages of an ET Cover include: (1) it utilizes natural soils and materials; (2) its operation is less reliant on engineered systems than covers employing resistive barriers; (3) it does not appreciatively degrade over time; (4) it maintains integrity in the event of differential settlement; (5) it provides for better slope stability compared to covers employing a geomembrane; (6) it provides long-term oxidation of methane and NMOC emissions(all soil cover systems naturally regulate methane through both physical barrier and methane oxidation processes); (7) Improved vegetation (increased soil storage capacity & deeper rooting medium); (8) Improved erosion control and slope stability (increased vegetation density and increased rooting mass results in reduced runoff and less erosion); (9) Improved longevity due to it being a natural sustainable system resulting in better long-term performance; and (10) it requires minimal maintenance and is relatively easy to maintain and repair; and (11) its construction is easier and thus more reliable (Dwyer 2000).

In summary, an ET Cover is composed of natural soils and they are designed to mimic or assist natural processes, as opposed to trying to resist them (as is the case with engineered barrier systems). For this reason they are well suited to perform over the long term, which is a key goal of a final cover system.

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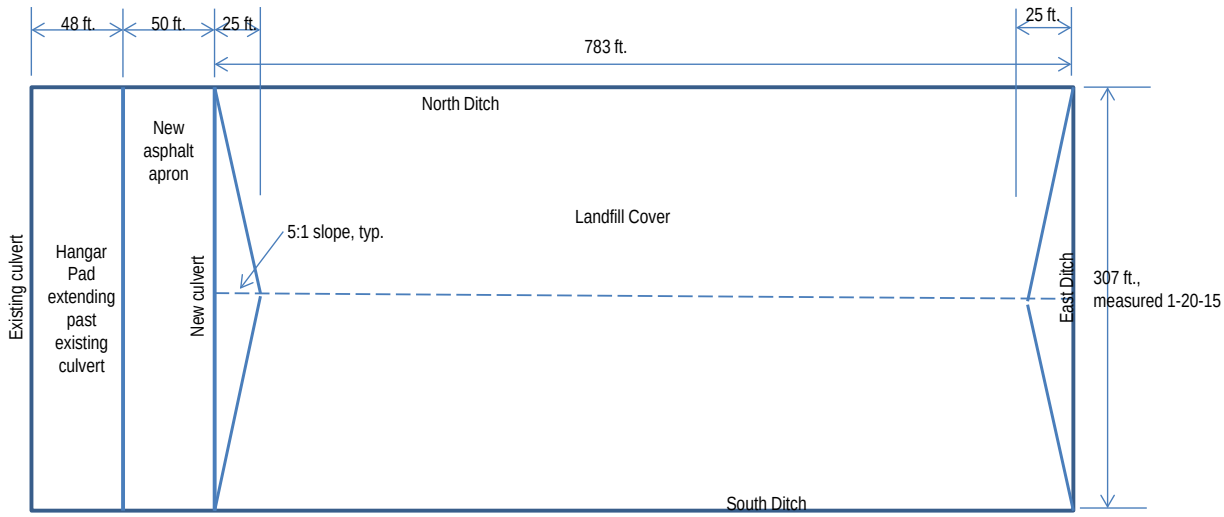
ATTACHMENT

Hydrology Calculations:



Los Alamos, NM (NOAA Atlas 14, Vol. 1):

Storm	Guidance
100 yr./1hr = 2.17 in	EPA Guidance (NOAA Atlas 14, Vol. 1, version 5))
10 yr./24 hr. = 2.48 in	NM DOT Design Event (NOAA Atlas 14, Vol. 1, version 5)
25 yr./ 24 hr. = 2.94 in	NM DOT Check Event (Extreme) (NOAA Atlas 14, Vol. 1, version 5)

Use Rational formula (per NM DOT for less than 150 acres):

$$Q = CIA$$

Where:

$$C = 0.3\ [ref.\ Lindeberg\ 1989]$$

$$I = Rainfall\ Intensity\ \left(\frac{in}{hr}\right)$$

$$A = contributory\ area - conservatively\ assume\ half\ of\ landfill$$

$$A = {}^{1}/_{2}\,(783\ ft)(307\ ft) = 120{,}190.5\ ft^2 = 2.76\ acres$$

- Look @ 100yr/1hr event per EPA & 25 yr./24 hr. event per NM DOT to determine worst case:

$$t_c = time\ of\ concentration = \frac{0.007 * (nL)^{0.8}}{\sqrt{P} * S^{0.4}}$$

Where:

$$n = Manning\ coef.(for\ cover - Ref.: Chow\ 1959) = 0.03$$

$$L = slope\ length = \frac{307}{2} = 153.5\ ft$$

$$P = storm\ intensity = 2.17\frac{in}{hr}\ [100\ \text{yr.} / 1\ \text{hr. storm}]$$

$$S = slope\ of\ cover = 0.0332\ ft/ft$$

$t_c = \frac{0.007*(0.0332*153.5)^{0.8}}{\sqrt{2.17}*0.0332S^{0.4}} = 0.0639\ hr = 3.83\ minutes$, use 10 minutes per minimum time of concentration allowed per Los Alamos County Design and Construction Standards (2008)

$$I = Intensity = \frac{K}{t_c + b}$$

Where:

$$K = 210\ [Ref.: Lindeburg\ 2012, Fig\ 20.5\ for\ 100\ yr\ frequency]$$

$$b = 26\ [Ref.: Lindeburg\ 2012, Table\ 20.2\ for\ 100\ yr\ frequency]$$

$$I = \frac{210}{10 + 26} = 5.83\ in/hr$$

- Look @ 25yr/24hr event per NM DOT:

$t_c = \frac{0.007*(0.0332*153.5)^{0.8}}{\sqrt{2.94}*0.0332S^{0.4}} = 0.055\ hr = 3.3\ minutes$, use 10 minutes per minimum time of concentration allowed per Los Alamos County Design and Construction Standards (2008)

$$I = \frac{155}{10 + 26} = 4.3\ in/hr$$

Where:

$$K = 155\ [Ref.: Lindeburg\ 2012, Fig\ 20.5\ for\ 25\ yr\ frequency]$$

$$b = 26\ [Ref.: Lindeburg\ 2012, Table\ 20.2\ for\ 25\ yr\ frequency]$$

Use 100 yr. / 1 hr. storm as worst case with I = 5.83 in/hr.

Therefore,

$$\underline{Q = 0.3 * 5.83 * 2.76 = \mathbf{4.8\ cfs}}$$

Size North Channel:

Slope of site West to East – keep slope with new channel = 1.3%

Q= 4.8cfs per Hydrology calculations

N= 0.023 for gravel lined channel

Calculations utilized open channel calculator software available on internet: http://www.eng.auburn.edu/~xzf0001/Handbook/Channels.html

V-shaped channel; with 2:1 side slopes:

Calculate minimum channel depth with above listed parameters:

Depth = 0.80 ft.

V = 3.7 ft. / sec

Possible slope variances in other channels: look @ 2% to 0.5%:

For slope = 2%.....Depth = 0.74ft with V = 4.3 fps

For slope 0.5%.....Depth = 0.97 ft with V = 2.6 fps

Therefore, minimum flow height of 1 ft. is good for all possible slopes within the channels around perimeter of landfill.

Size New Rip Rap:

Reference: Abt and Johnson (1988)

$$D_{50} = 5.23 * S^{0.43} * Q_d^{0.56} = rock\ size$$

Where:

$$S = slope = 1.3\% = 0.013 ft/ft$$

$$Q_d = design\ flow\ rate$$

$$Q_d = Q * C_R * C_m$$

$$Q = flow\ rate\ per\ rational\ Formula = 4.8\ cfs$$

$$C_R = rock\ coefficient = 1.0$$

C_m=coefficient of movement = 1.35

$$Q_d = 5.8 * 1.35 * 1 = 6.52\ cfs$$

$$D_{50} = 5.23 * 0.013^{0.43} * 6.52^{0.56} = 2.31\ (crushed\ rock)$$

For rounded rock use Factor of Safety of 40%, therefore:

$$D_{50} = 2.31 * 1.4 = 3.23\ in\ (rounded\ rock)$$

Use $D_{50} = 4\ in$

Depth = 2 x $D_{50} = 8\ in, minimum$

Waste Volume (approximate):

Average depth of waste per drilling = $8 + 3 + 17.5 + 11.5 + 3.5 + 7.5/_6 = 8.5\ ft$

Surface area = 100*150 = 15,000 ft^2

Volume of waste = 15,000 * 8.5 = 127,500 ft^3 **= 4722 cubic yards**

Waste to be spread of remaining landfill footprint – along crown/full length

Assume 3 ft. thick waste spread over length of 700 ft.,
Width of waste = 182/3= 61 ft. wide

Cover Soil Volume Required (approximate):

Horizontal slope length = 150 ft. @ slope 3.32% (rise of 5 ft.)

Effective slope length = $\sqrt{150^2 + 5^2} \approx 150ft$

Gravel Admixture: 25% gravel to 75% soil by volume for 6 in depth

Area = 770 ft. x 300 ft. = 231,000 ft2 = 5.3 acres

Depth = 3 ft. – 0.25(0.5) = 2.875 ft.

Compacted volume = 664,125 ft3 = **24,597.2 CY**

Convert to weight:

Assume density max = 130 PCF,

Placed @ 90% of MDD = 130*0.9 = 117 PCF

Weight = 664,125 * 117 * 1 ton/2000 lbs. = **38,851.3 tons**

Removal Volume of Concrete Hangar Pads:

2 East Pads: 195' x 63', 9" thick

Plus: 3' wide x 2' deep perimeter
Plus: 7' x 7' x 2' deep footings (4 each)
Plus: concrete drain trench : [5" x 16" x 2' + 8" x 10"] x 195 '

Volume:	195x63x9/12	= 9213.75 ft^3	slab
+	3(2-0.75)(195+195+63+63)	= 1935 ft^3	perimeter
+	7(7)(2-0.75)(4 each)	= 245 ft^3	footings
+	{[5"(16")(2) + 8(10)]/144 in^2/ft^2}{195}	= 325 ft^2	trench
	Subtotal	=11,718.75 ft^3	
	x 2 pads	=23437.5 ft^3 = 868 CY	

3 west Pads: 202.5' x 60', 6" thick

Plus: 2.75' wide x 1.5' deep perimeter perimeter
Plus: 2.5' x 1.5' x [202.5'*2 +60'*9 length] waffle
Plus: [5" x 16" x 2' + 8" x 10"] x 202.5 ' concrete drain trench

Volume:	202.5*60*6/12	= 6075 ft^3	slab
+	2.75*1.5*(202.5*2 + 60*2)	= 2165.6 ft^3	perimeter
+	2.5*1.5[202.5*2 + 60*9]	= 3543.8 ft^3	footings
+	{[5"(16")(2) + 8(10)]/144 in^2/ft^2}{202.5}	= 337.5 ft^2	trench
	Subtotal	=12,121.9 ft^3	
	x 3 pads	=36,365.6 ft^3 = 1347 CY	

Total = 2,215 CY

Available Borrow Soils Volume Estimates:

1. LANL Borrow Source #1 (2-10-15) 5133 CY
2. Alcalde, NM:
    a. Clay (2-10-15) = 1.5’ (2*43560.2) = 130,681 ft3 = 4840 CY
    b. Sandy Soil under clay = dependent on depth excavated
    c. Rocky Loam (2-10-15) = 5000 CY +
3. Espanola Transit (Jan 2015):
    a. Clay 6000 tons
    b. Silt 10,000 tons
    c. Overburden 25,000 CY +
4. LANL Borrow #2 - TA54 (Mar 2015) 10,000 CY
5. LANL Borrow Source #3 – Sigma Mesa (May 2015) 6,000+ CY

July 2015

CONSTRUCTION QUALITY ASSURANCE PLAN (CQAP)

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F. Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

Revision 01

Table of Contents

LIST OF ACRONYMS **6**

CHANGE SUMMARY PAGE **7**

1.0 INTRODUCTION **8**

1.1 Purpose and Scope 8
1.2 Definition of Terms 8
1.3 Involved Parties and Personnel 9
1.4 Personnel Qualifications 9
1.5 Site Owner/Responsible Party 10
1.6 Design Engineer 10
1.7 Construction Manager 10
1.8 CQA Manager 11
1.9 Contractor 11
1.10 Surveyor 12
1.11 CQC Consultant 12
1.11.1 CQC Project Manager 12
1.11.2 CQC Technicians 13
1.12 CQC Laboratory 13

2.0 PROJECT COMMUNICATION **15**

2.1 Flow of Information 15
2.2 Pre-Bid Meeting 15
2.3 Project Kick-Off Meeting 16
2.4 Pre-Construction Meeting 17
2.5 Progress Meetings 18
2.6 Problem or Work Deficiency Meetings 18
2.7 Sample Custody 18
2.8 Weather 18
2.9 Work Stoppages 19

3.0 PROJECT DOCUMENTATION **20**

3.1 Daily Summary Reports 20
3.2 Testing Reports 21
3.3 Field Change Reports 21
3.4 Design or Specification Changes 22
3.5 CQA Compliance Reports 22
3.6 Drawings Of Record 22
3.7 Document Control 22
3.8 Storage of Records 23
3.9 Final Documentation and Certification 23

4.0 CONSTRUCTION METHOD APPROVAL **24**

5.0 REMOVAL AND DISPOSAL OR RECYCLING OF EXISTING COVER MATERIALS ... **25**

5.1 Disposal of Reinforced Concrete 25
5.2 Disposal of Gas Risers 25
5.3 Recycling of Asphalt 25

6.0 WASTE RELOCATION **26**

6.1 Excavation 26
6.1.1 Hold Point 26
6.2 Vertical Liner Installation 26
6.3 Backfill of Excavated Area of Waste Removal 26
6.3.1 Hold Point 27
6.4 Waste Placement and Compaction 27
6.4.1 Hold Point 27

7.0 SITE REGRADING 28

7.1 Material Placement 28
7.2 Moisture and Density Control 28
7.3 Final Slope and Grades 29
7.4 Tolerances 29
7.5 Testing Methods 29
7.6 Nonconformance, Corrective Action and Stop Work 31
7.7 Documentation 31
7.7.1 Hold Point 31

8.0 COVER SYSTEM 32

8.1 Material Conformance Monitoring and Testing 33
8.2 Cover Soils 33
8.2.1 Bottom Soil Texture Mixed Layer 33
8.2.2 Middle Cover Layer 33
8.2.3 Surface Rock/Soil Admixture 33
8.2.4 Material Placement 34
8.2.5 Moisture and Density Control 35
8.2.6 Surface Slopes and Grades 36
8.3 Tolerances 36
8.4 Nonconformance, Corrective Action and Stop Work 36
8.5 Documentation 37
8.5.1 Hold Points 37

9.0 CHANNEL ROCK PROTECTION AND EROSION CONTROL 42

9.1 Material Conformance Monitoring and Testing 42
9.2 Drainage Channel Subgrade 42
9.3 Diversion Channel Riprap 42
9.4 Material Placement 43
9.5 Surface Slopes and Grades 43
9.6 Tolerances 43
9.7 Nonconformance, Corrective Action and Stop Work 43
9.8 Documentation 44
9.8.1 Hold Points 44

10.0 PROTECTION OF SOIL STOCKPILES 45

11.0 SEEDING QUALITY CONTROL 46

12.0 ASPHALT CONCRETE PAVEMENT 48

12.1 Subgrade Preparation 48
12.2 Base-Platform Construction 48
12.3 Tack Coat 48
12.4 Surface Course Construction 48

13.0 CONCRETE 50

13.1 Subgrade Preparation 50
13.2 Materials 50
13.2.1 Concrete 50
13.2.2 Steel Reinforcement and/or Welded Wire Reinforcement 50
13.2.3 Placement 50

APPENDIX 51

FIGURES

Figure 1. Project Organization 15

TABLES

Table 1. Subgrade Placement Requirements 30
Table 2. Summary of Cover Components Layer and Lift Thicknesses 35
Table 3. Testing and Performance Criteria for Borrow Source Areas 38
Table 4. Testing and Performance Criteria for Cover Soils 39
Table 5. Testing and Performance Criteria for Gravel Admixture 41
Table 6. Summary of Testing Frequency and Criteria for Channel Materials 44

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AMRL	AASHTO Materials Reference Laboratory
ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
CQA	Construction Quality Assurance
CQAP	Construction Quality Assurance Plan
CQC	Construction Quality Control
CY	Cubic yards
DOE	US Department of Energy
ET	Evapotranspiration
FPD	Federal Project Designate
FT	Foot or feet
MAX	Maximum
MDD	Maximum Dry Density
MIN	Minimum
NNSA	National Nuclear and Security Administration
IN	Inch(es)
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer
PLS	Pure Live Seed
QA	Quality Assurance
QC	Quality Control

CHANGE SUMMARY PAGE

Procedure/Plan No: CQAP - Los Alamos County Airport Cover Replacement

Change No.	Date	Affected Page(s)	Change Summary
REV. 0	06/2015	ALL	Original Issuance

1.0 Introduction

This document contains the Quality Assurance (QA) requirements for construction of the final cover system for the Los Alamos County Airport Landfill located in Los Alamos, NM. QA is a planned system of activities that provides the owner / operator and permitting agency documentation that the facility was constructed as specified in the design. The QA requirements summarized in this Plan shall be followed unless otherwise directed by the Department of Energy (DOE).

1.1 Purpose and Scope

The purpose of this CQA/QC Plan is to address the Construction Quality Assurance (CQA) and Construction Quality Control (CQC) procedures and requirements to be used during construction activities at the site in order to assure that the project is constructed in conformance with the Technical Specifications and Drawings submitted with the Work Plan, as well as applicable regulatory requirements and permit conditions. The CQA/QC Plan, herein referred to as the CQAP, is intended to: 1) define the individuals and organizations who will be involved in construction activities and their respective responsibilities and qualifications; 2) establish guidelines for the flow of information and project communication; 3) establish protocols for project documentation; and 4) establish specific CQA/QC procedures for the major components of the project.

This CQAP addresses construction of the following facilities:

- Removal and milling of asphalt landfill cover surface;
- Removal of existing concrete hangar pads within the landfill footprint;
- Removal of concrete culvert;
- Replacement of concrete culvert;
- Borrow areas and stockpiles (if any);
- Diversion channels;
- Construction of a new reinforced concrete hangar pad;
- Relocation of waste within the landfill footprint;
- Construction of an evapotranspiration (ET) soil cover for the landfill;
- Construction of runoff control and diversion channels as necessary;
- Repair/replacement of disturbed asphalt pavement areas on the airport site; and
- Seeding of cover system.

1.2 Definition of Terms

In the context of this CQAP, the following definitions apply:

Construction Quality Assurance (CQA): A planned and systematic pattern of means and actions designed to assure adequate confidence that the materials or services meet contractual and regulatory requirements and will perform satisfactorily in service. CQA refers to the means and actions employed by the involved parties to assure conformity of the project work with this CQAP, the Drawings, and the Technical Specifications. These actions are under the control of the owner and/or Design Engineer.

Construction Quality Control (CQC): Actions which provide a means to measure and regulate the characteristics of an item or service in relation to contractual and regulatory requirements. CQC refers to those actions taken by the Contractor, technicians, or other involved parties to verify that the materials and the workmanship meet the requirements of this CQAP, the Drawings, and the Technical Specifications. These activities are under the control of the Contractor performing the work activities.

Technical Specifications (submitted with Work Plan, Dwyer Engineering 2015b): The document that prescribes the requirements and standards for the specific elements of the design. The Technical Specifications will be prepared in final form prior to commencement of construction activities.

Drawings (submitted with Work Plan, Dwyer Engineering 2015a): The detailed project drawings to be used in conjunction with the Technical Specifications. These drawings will be prepared in final form as construction drawings prior to commencement of construction activities.

Construction Project: The total authorized/approved project that requires several construction segments to complete.

Construction Segment: A portion of the total construction project involving a specific area or type of work. Several construction segments will likely take place simultaneously during the project.

Construction Task: A basic construction feature of a construction segment involving a specific construction activity.

ASTM Standards: The latest versions of the American Society for Testing and Materials (ASTM) specifications, procedures and methods.

1.3 Involved Parties and Personnel

Each construction task within each segment of the overall project will consist of both a CQC and CQA component and compliance reporting that will be completed for each segment. Upon completion of all project segments, a Construction Completion Report will be prepared by the Design Engineer. Following is a listing of the parties (organizations and individuals) that will be involved in the implementation of the CQAP during work activities at the Site, including a discussion of each party's responsibility, authority and qualifications.

1.4 Personnel Qualifications

An important factor in assessing the quality of any cover system installation is the degree to which key personnel involved in the process are qualified to perform the required tasks. QA and QC personnel must be familiar with:

1. the project's design including plans and specifications;
2. project layout;
3. materials to be used;
4. drainage control features;

5. soil borrow materials;
6. construction procedures, complications, schedule, and equipment;
7. material placement techniques and requirements;
8. equipment to be used and its capabilities; and
9. site-specific complications/concerns.

A copy of the site-specific plans and specifications, CQAP, and QA and QC documentation reports shall be retained at the facility. The CQAP shall include a detailed description of all QA/QC activities to be used during materials inspection and construction to manage the installed quality of the covers and associated facilities.

Refer to Figure 1 for the communication and authority hierarchy for the following project personnel.

1.5 Site Owner/Responsible Party

The site owner is the Department of Energy (DOE), Environmental Management Los Alamos Field Office (EM-LA). The site responsible party/project manager referred to as the Federal Project Designate (FPD) is Ramoncita Massey, (505) 665-7771.

1.6 Design Engineer

Responsibility & Authority: The Design Engineer is responsible for the design of the various elements of the Reclamation Project and for preparing the Drawings and Technical Specifications. Throughout the project, the Design Engineers will interact as necessary with the FPD, CQA/QC staff, and Los Alamos County personnel. The Design Engineer (as approved by FPD) will approve all design changes that arise during the course of the Project. The responsible design engineer is Stephen F. Dwyer, PhD, PE (505) 270-0215.

Qualifications: The Design Engineer shall be a qualified Professional Engineer registered in the State of New Mexico. The Design Engineer shall have expertise which demonstrates significant familiarity with the design and construction of the various elements of landfill closure: including earthwork, cover design, and disposal. The Design Engineer shall have not less than ten years of expertise in alternative cover systems.

1.7 Construction Manager

Responsibility & Authority: The Construction Manager is responsible for the conduct, direction, and supervision of all landfill closure activities as detailed in the Drawings and Technical Specifications. The Construction Manager will be selected/appointed by the FPD. The Construction Manager is responsible for maintaining a detailed schedule for the various Construction Segments so that each is performed according to the schedule for the overall Reclamation Project. The Construction Manager will interact as required with all other parties involved in implementing the reclamation including the Contractor, the CQA/QC

personnel, and the DOE FPD. In the temporary absence of the Construction Manager, a designated representative will assume the duties of the Construction Manager. The Construction Manager will report directly to the FPD.

Qualifications: The Construction Manager shall have the design and construction experience necessary to manage a project of this scale.

1.8 CQA Manager

Responsibility & Authority: The CQA Manager will provide day-to-day, on-site oversight of the CQA/QC activities. The CQA Manager will report directly to the Design Engineer or the Construction Manager and the FPD, and will interact with the Contractor and others as project activities take place. The CQA Manager will maintain a thorough understanding of the Drawings, Technical Specifications, and this CQA/QC Plan. Specific responsibilities of the CQA Manager will include the following:

1. Attend all CQA-related meetings, including Project Kickoff and Pre-Construction Meetings;
2. Provide direct oversight of CQC activities;
3. Assign locations for testing and sampling;
4. Observe the collection of laboratory test samples;
5. Review results of field and laboratory testing and any test results provided by the Contractor and make appropriate recommendations;
6. Review the calibration and condition of on-site testing equipment, and Contractor's equipment documentation;
7. Report any deviations from the CQAP, Drawings, or Technical Specifications to the Construction Manager and arrange consultation with other parties as necessary to find solutions to unsolved problems; and
8. Prepare a daily field report for submittal to the Construction Manager.

Qualifications: The CQA Manager will be a qualified professional experienced in providing field CQA/QC oversight for landfill projects.

1.9 Contractor

Responsibility & Authority: The Contractor refers to an independent party or parties, contracted by the DOE, to perform the construction work in accordance with this CQAP, the Drawings, and the Technical Specifications. The Contractor will work under the direction of and report directly to the Site Owner and the Design Engineer.

Qualifications: Qualifications of the Contractor are specific to the construction contract. The Contractor shall have a demonstrated history of successful construction experience as appropriate for the project. The Contractor shall maintain current state and federal licenses and bonding as appropriate.

1.10 Surveyor

Responsibility & Authority: The Surveyor is responsible for surveying, documenting, and verifying the location of all significant components of the work. The Surveyor is responsible for issuing Record Drawings of the completed elements of the Construction Project. The Surveyor's work is coordinated with the Design Engineer, Contractor and CQA Manager. The Surveyor will report to the Contractor.

Qualifications: The Surveyor will be an established surveying company with at least three years of surveying experience in the State of New Mexico. All survey activities shall be performed under the direction of a Professional Land Surveyor, licensed as required by State of New Mexico regulations. The Surveyor shall be fully equipped and experienced in the use of total stations and the most recent version of AutoCAD.

1.11 CQC Consultant

Responsibility & Authority: The CQC Consultant is responsible for observing and documenting the various activities comprising the Project in accordance with this CQAP, the Technical Specifications, and the Drawings. Testing may include field and laboratory testing of various construction materials to be used on the project. The CQC Consultant will be responsible for issuing a report at the completion of the Project which will document construction and associated CQC activities. The CQC Consultant will work in coordination with the Contractor, Surveyor and other parties and will report directly to the Contractor.

Qualifications: The CQC Consultant shall be a well-established firm specializing in geotechnical and reclamation engineering that possesses the equipment, personnel, and licenses necessary to conduct the observation and testing required. The CQC Consultant will be experienced with earthwork, revegetation, and other reclamation activities. The CQC Consultant will be experienced in the preparation of CQC documentation including field documentation, field testing procedures, laboratory testing procedures, and CQC reports.

The Contractor will retain a CQC Consultant who will provide qualified staff for the project which will include the following individuals.

1. CQC Project Manager
2. CQC Technicians who will be responsible for performing QC testing under the observation of the CQA Manager

1.11.1 CQC Project Manager

Responsibility & Authority: The CQC Project Manager will be responsible for overall management of the CQC Plan for the Reclamation Project. The CQC Project Manager works from the office of the CQC Consultant and conducts periodic visits to the Site as required. The CQC Project Manager will oversee all CQC activities and will coordinate with

the Surveyor, the Contractor, and other staff. The CQC Project Manager will report directly to the Contractor.

The CQC Project Manager will be expected to maintain a thorough understanding of the existing Los Alamos Airport Landfill Cover Replacement project design documents including the Drawings, Technical Specifications, and this CQA/QC Plan. He/she will be responsible for notifying the Contractor immediately if controls, tests, or records are not conforming to the CQA/QC Plan, the Construction Plans, or the Technical Specifications. The approval of the CQC Project Manager is mandatory for all Test Result Reports required in this CQA/QC Plan. Specific responsibilities of the CQA Officer will include the following:

1. Administer the CQC testing program (i.e., provide supervision of and manage all CQC personnel and activities)
2. Provide and document all necessary training and certifications for CQC personnel
3. Review and approve the Contractor's CQC Plan(s), if applicable
4. Attend Project Kickoff and Pre-Construction Meetings, and make site visits as needed
5. Perform ongoing, timely review of all CQC documentation and provide signature on all CQC documentation

Qualifications: The CQC Project Manager will be a Professional Engineer registered in the State of New Mexico and will be experienced in providing CQC testing for large earthwork projects.

1.11.2 CQC Technicians

Responsibility & Authority: The CQC Technicians will perform and document specific QC tasks through the project to verify the adequacy of construction materials and procedures. The CQC Technicians will be retained by the Contractor and work under the direct supervision of the Contractor and the CQA Manager.

Qualifications: The CQC Consultant will identify areas of competency, review qualifications and approve technicians. The CQC Technicians will receive on-the-job training or off-site training as required under the direction of the CQC Consultant. The CQC Project Manager will determine the areas of expertise of the respective technician and maintain a file on each technician's training and certifications.

1.12 CQC Laboratory

Responsibility & Authority: The CQC Laboratory is a party, independent from the Site Owner and Contractor, responsible for conducting tests of soils and other project materials in accordance with ASTM and other applicable standards in either an on-site or off-site laboratory. More than one CQC Laboratory may be used to perform testing during work activities, depending upon the material being

tested. The CQC Laboratory will work in coordination with other personnel and will report results directly to the CQC Consultant.

Qualifications: The CQC Laboratory will be an American Association of State Highway and Transportation Officials (AASHTO) Materials Reference Library (AMRL) accredited laboratory in testing soils and rock using the ASTM standards outlined in the Technical Specifications and this plan. The CQC Laboratory will be capable of providing test results within a maximum of seven days of receipt of samples and will maintain that capability throughout the duration of the project.

2.0 Project Communication

2.1 Flow of Information

Effective communication is necessary to ensure a high degree of quality during the Los Alamos County Airport Landfill Closure Project. Specific meetings of key project personnel will take place, including a Pre-Bid Meeting, Resolution Meeting, Pre-Construction Meeting, weekly Progress Meetings, and Problem or Work Deficiency Meetings. In addition, informal communication and cooperation will take place between the various parties listed in Section 1. The organizational chart showing the proposed lines of communication between the various parties is shown in *Figure 1, Project Organization*. The planned project meetings are described in the following sections.

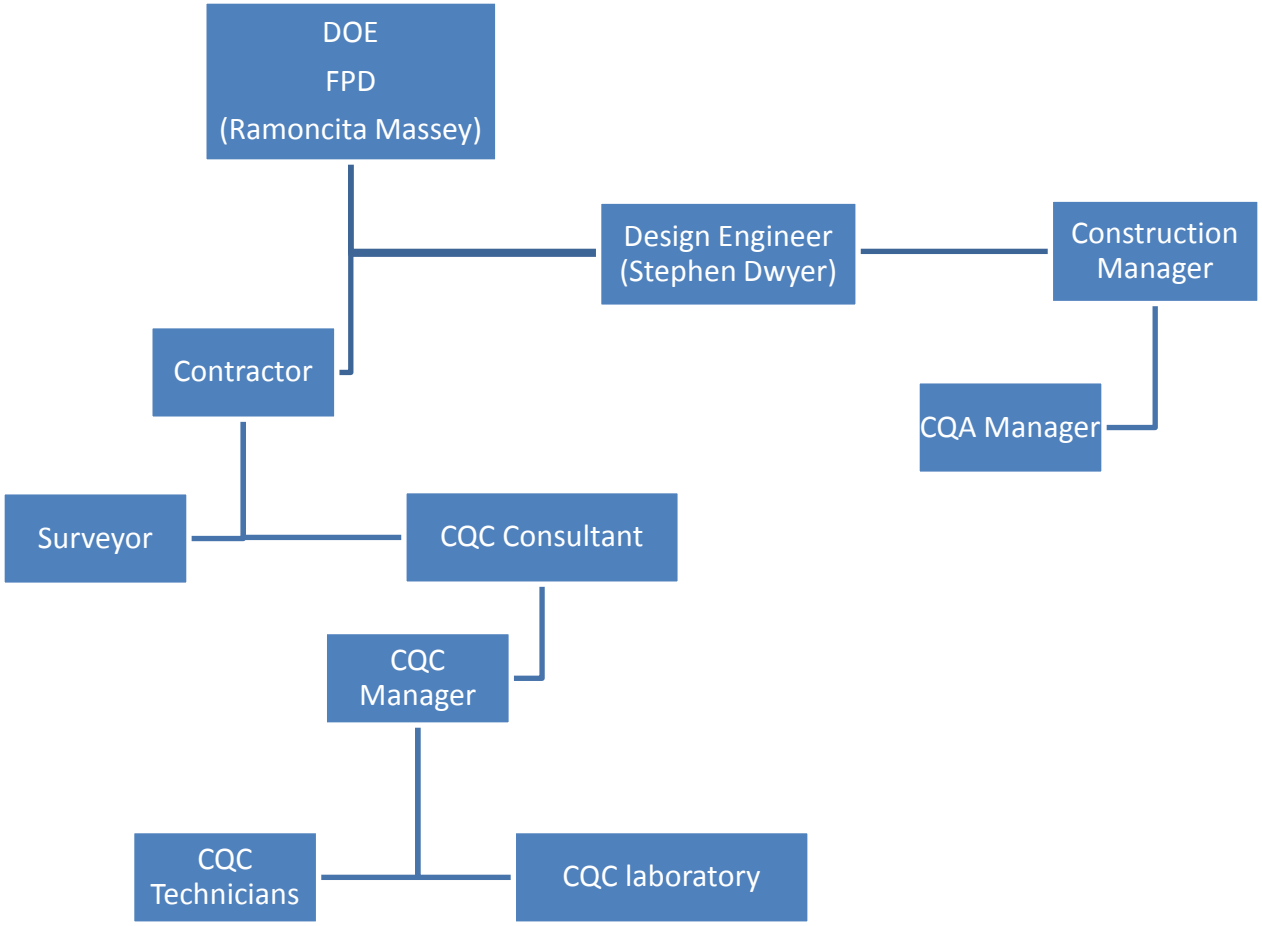


Figure 1. Project Organization

2.2 Pre-Bid Meeting

The intent of this meeting is to discuss the project, design, CQAP, and other key aspects of the project, as well as, to resolve differences of opinion among the various concerned parties before the project is let for bidding. Holding the pre-bid meeting before formal construction bids are prepared allows the companies bidding on the construction to better

understand the project and the level of QA required. Also, if the bidders identify problems with the CQAP or other design documents, DOE has the opportunity to correct those problems early on in the process.

2.3 Project Kick-Off Meeting

The objectives of the Kick-Off meeting are to establish lines of communication, review construction plans and specifications, emphasize the critical aspects of the project needed to achieve proper quality, begin planning and coordination of tasks, and identify potential factors that might cause difficulties or delays in construction. The meeting shall be attended by appropriate DOE personnel, the project's Design Engineer, Construction Manager, CQA Manager, representatives of the general contractor and major subcontractors, and the CQC Project Manager. Los Alamos County personnel shall be invited to the meeting as deemed appropriate by the FPD.

The meeting shall cover the following activities:

- An individual shall be assigned to take minutes.
- Individuals can be introduced to one another along with their project responsibilities (or potential responsibilities) can be identified.
- Copies of the project plans and specifications shall be made available for group discussion.
- The CQAP can be distributed.
- Copies of any special permit restrictions that are relevant to construction or QA shall be distributed.
- The plans and specifications shall be described, along with unique design features (so the contractors would understand the rationale behind the general design), potential construction problems, and allow for questions from any of the parties concerning the construction.
- The CQAP shall be reviewed and discussed, with the Design Engineer and CQA Manager outlining their expectations and identifying the most critical components of their project participation.
- Procedures for quality control proposed by installers and contractors shall be reviewed and discussed.
- Corrective actions to resolve potential construction problems shall be discussed.
- Procedures for documentation and distribution of documents shall be discussed.
- Each organization's responsibility, authority, and lines of communication shall be discussed.
- Suggested modifications to the CQAP that would improve quality management on the project shall be solicited.
- Climatic variables (e.g., precipitation, wind, temperature) that might affect the construction schedule shall be discussed.

Familiarizing all project participants with inspection and testing procedures and the criteria for pass/fail decisions (including the resolution of test data outliers) is a key objective of this meeting. Additionally, it is imperative that all parties understand the key problems QA personnel have identified and that each party fully understands their roles and responsibilities and the procedures regarding problem resolution.

2.4 Pre-Construction Meeting

The pre-construction meeting is recommended to be held in conjunction with the Kick-Off meeting. The meeting shall be scheduled after the general construction contracts have been awarded and the major subcontractors and material suppliers have been established. The purpose of the pre-construction meeting is to review the details of the CQAP, to ensure that the responsibility and authority of each individual is clearly understood, to reach agreement on the established procedures to resolve construction problems, and to establish a foundation of cooperation in quality management. The pre-construction meeting shall be attended by appropriate DOE personnel, the project's Design Engineer, Construction Manager, CQA Manager, representatives of the general contractor and major subcontractors, and the CQC Project Manager. Los Alamos County personnel shall be invited to the meeting as deemed appropriate by the FPD.

The pre-construction meeting shall include the following activities:

- Assignment of an individual to take meeting minutes.
- Site access/project restrictions.
- Discuss traffic and dust control plans.
- Introduce parties and identify their responsibilities and authority.
- Distribute the CQAP, identify any revisions made after the resolution meeting, and answer any questions about the CQAP, procedures, or related documentation.
- Discuss lines of project communication.
- Discuss reporting procedures, distribution of documents, the schedule for routine project meetings, and resolution of construction problems.
- Review site requirements and logistics, including safety procedures.
- Review the project design, discuss the most critical construction aspects, and discuss scheduling and sequencing issues.
- Discuss quality control procedures to be employed by suppliers and subcontractors contracted to the general contractor.
- Discuss quality control procedures to be employed by the installer or contractor.
- Compile a list of action items requiring resolution and assign responsibilities for these items.

2.5 Progress Meetings

Progress meetings will be held weekly at the site or by teleconference, between the DOE FPD, Design Engineer, CQA Manager, Contractor, the Construction Manager, and other concerned parties participating in project construction. This meeting will include discussions of the current project progress, planned activities for the next week, and revisions to the work plan or schedule. The Construction Manager will appoint an individual to document the meeting and send meeting minutes to all attendees for review and comment.

At times, additional progress meetings can be called at the discretion of the DOE representative, Design Engineer, Contractor and/or CQA engineer. Meeting attendees shall be those involved in the specific issues being discussed.

2.6 Problem or Work Deficiency Meetings

It is anticipated that most work deficiencies will be minor and can be resolved in the field by the CQC Technicians, the CQA Manager, and the Contractor. The deficiency and resolution will be recorded in the daily field reports and weekly summary reports prepared by the CQA Manager.

A special meeting will be held when and if a problem or deficiency is present, or likely to occur, that cannot be easily resolved in the field. The meeting will be attended by the Contractor, the Construction Manager, the CQA Manager, and other parties as appropriate. If the problem requires a design modification, the Design Engineer and/or DOE FPD should either be present at, consulted prior to, or notified immediately upon conclusion of this meeting. The Construction Manager will appoint an individual to record the meeting and send meeting minutes to all attendees for review and approval. The purpose of the work deficiency meeting is to define and resolve the problem or work deficiency as follows:

1. Define and discuss the problem or deficiency;
2. Identity cost and schedule issues;
3. Review alternative solutions;
4. Select a suitable solution agreeable to all parties; and
5. Implement an action plan to resolve the problem or deficiency

2.7 Sample Custody

All samples shall be identified and described in the CQAP. Whenever a sample is taken, a chain of custody record shall be made for that sample. If the sample is transferred to another individual or laboratory, records of the transfer shall be established so that a chain of custody can be traced. The purpose for the records of sample custody is to assist in tracing the cause of anomalous test results or other testing problems, and to minimize the potential for accidental sample loss.

2.8 Weather

Weather can play a significant factor on construction activities and material placement during cover installation. The contractor or installer is responsible for complying with the contract plans and specifications (along with the quality control for the various components of the cover system). Specifications shall include restrictions on weather

conditions for certain construction activities such as soil placement where dry soil placement is critical. The contractor or installer is responsible for insuring that these weather restrictions are served during construction.

2.9 Work Stoppages

Unexpected work stoppages can result from a variety of causes. The CQA Manager shall be careful during any work stoppages to determine: (1) whether in-place materials were covered and protected from damage, (2) whether partially covered materials were adequately protected, and (3) whether manufactured materials were properly stored and properly or adequately protected from the elements. In essence, the cessation of construction during work stoppages does not mean that QA inspection and documentation temporarily ceases.

3.0 Project Documentation

In addition to insuring the correct installation of the cover system, another major intent of the QA process is to provide documentation of the construction process. The CQA Manager will be responsible to prepare documentation that demonstrates that quality requirements have been addressed and satisfied. Documentation may include monitoring logs, testing data sheets, photo logs, equipment calibration forms, daily field reports, weekly summary reports, reports of design or specification changes, and a final CQA Report. All documentation will be maintained in the Los Alamos County Airport Landfill Project files and will be available to the DOE FPD, Design Engineers, and the Construction Manager at all times. The CQA Manager and Construction Manager will be responsible for preparing or approving all necessary forms that will be required throughout the Project. These forms will be used to document CQA activities.

Daily reporting and documentation procedures shall be required. The CQA Manager shall prepare daily written inspection reports that are to be included in the final QA documentation. The daily reports shall include information about the work accomplished, tests performed and observations made, along with descriptions of the adequacy of the work completed.

3.1 Daily Summary Reports

A daily written summary is to be prepared by the CQC Consultant. These reports provide a chronological framework for identifying and recording all other reports and aids in tracking what activities/tasks were completed and by whom. At a minimum, the daily summary reports shall include the following:

- Date, project name, location, construction observed, personnel involved in major activities, and other relevant identification information
- Description of weather conditions, including temperature, cloud cover, and precipitation.
- Summaries of any meetings held and actions recommended or taken.
- Specific work segments and locations of construction under way during that particular day.
- Equipment and personnel being utilized in each work task, including subcontractors.
- Identification of areas or units of work being inspected.
- Description of off-site materials received, including any quality control data provided by the supplier.
- Calibrations or recalibrations of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding approval (or disapproval) of units of material or of work and/or corrective actions to be taken in instances of substandard or suspect quality.
- Inspection data sheets and/or problem reporting and corrective measures used to substantiate any QA decisions described in the previous item.

- Signature of the CQC Consultant.
- Any other pertinent information.

3.2 Testing Reports

All observations, results of field tests, and results of laboratory tests performed on- or off-site shall be recorded on a data sheet. Recorded observations and test results can take the form of notes, charts, sketches, or photographs, or a combination of these.

At a minimum, the inspection data sheets shall include the following information:

- Project name and date of inspection.
- Description or title of the inspection activity.
- Applicable section(s) of Technical Specifications.
- Location of the inspection activity or location from which the sample was taken.
- Type of inspection activity and procedure used (reference to standard method when appropriate or specific method described in CQAP).
- Recorded observation or test data.
- Results of the inspection activity (pass/fail); comparison with specification requirements.
- In addition to the individual preparing the data sheet, identification of all personnel involved in the inspection.
- Signature of the CQC Technician and review signature by the CQC Manager.

3.3 Field Change Reports

A problem is defined as material or workmanship that does not meet the requirements of the plans, specifications, or CQAP for a project or any obvious defect in material or workmanship (even if there is conformance with plans, specifications, and the CQAP). Changes that do not alter the intent of the Construction Plans or *Technical Specifications*, or affect the cost or schedule of the project; may be made during construction in order to fit field conditions. Field changes require the approval of the Construction Manager and the CQA Manager. Field changes are to be reported on Form No. 2 (included in Appendix). At a minimum, problem identification and corrective measures reports shall contain the following information:

- Location of the problem.
- Description of the problem (in sufficient detail and with supporting sketches or photographic information where appropriate) to adequately describe the problem.
- Probable cause for the problem.
- How and when the problem was identified (reference to inspection data sheet or daily summary report by inspector).
- Where relevant, estimation of how long the problem existed.

- Any disagreement noted by the inspector between him/her-self and contractor about whether or not a problem existed or the cause of the problem.
- Suggested corrective measure(s).
- Documentation of correction, if corrective action was taken and completed prior to finalization of the problem, and completed corrective measures report (reference to inspection data sheet, where applicable).
- Where applicable, outline of suggested methods to prevent similar problems in the future.
- Signature of the CQC Technician and review signature by the CQC Manager

3.4 Design or Specification Changes

During construction, design or specification changes may be required. Design changes will require the written approval of the Design Engineer and will take the form of technical memorandum and/or an addendum to the Drawings or *Technical Specifications*. Design changes are to be reported on Form No. 3 (included in Appendix). Design changes must be approved in writing by the DOE.

3.5 CQA Compliance Reports

At the completion of each construction segment, the CQA Manager will prepare a CQA Compliance Report signed and sealed by a Professional Engineer licensed in the State of New Mexico. The CQA Report will acknowledge that the work has been performed in conformance with the Drawings and *Technical Specifications*. The CQA Report will include all supporting documentation including:

1. All daily field reports and weekly summary reports
2. Laboratory test reports
3. Field change reports
4. Construction problems and resolution data sheets
5. Documentation of design or specification changes

Compliance Reports are to be completed on Form No. 1 (included in Appendix).

3.6 Drawings Of Record

Drawings of record (also referred to as “as-built” drawings) shall be prepared to document the actual lines, grades, and conditions of each component of the covers/facilities. For the cover soil components, the record drawings shall include survey data that identifies lower and upper elevations of a particular component (layer), the plan dimensions of the component, and locations of all destructive and nondestructive test sampling sites.

3.7 Document Control

The QA documents shall be maintained under a document control procedure. Any modifications to the documents shall be reported to and agreed upon by all parties involved. An indexing procedure shall be developed for conveniently replacing pages in

the QA plan when modifications became necessary; the replacement pages detail the revision status.

3.8 Storage of Records

During construction, the CQA Manager shall be responsible for all QA documents including copies of the design criteria, specifications, plan revisions, and originals of all data sheets and reports. Duplicate records shall be kept at a separate location to prevent the loss of this valuable information if the originals were inadvertently destroyed.

3.9 Final Documentation and Certification

At the conclusion of Construction, the Design Engineer or a designated representative will prepare a Construction or Project Completion Report. This report will be submitted to the DOE within 90 calendar days after the Final Inspection and receipt of validated final laboratory analytical data. This report will be prepared under the direct supervision of and stamped by a Professional Engineer registered in the State of New Mexico. This report will include, at a minimum:

1. A description of the outstanding items identified in the pre-final inspection, and certification that any issues were corrected;
2. A summary of the work defined in the work plan, and a description of the final design and construction demonstrating that the work was conducted in accordance with the DOE direction and approval;
3. A summary and description of any changes made to the work defined in the work plan, and an explanation of why the changes were necessary and/or beneficial; and
4. Recommendations for the overall project.
5. Drawings of Record, as-built conditions

4.0 Construction Method Approval

Prior to construction, each Contractor will submit a summary of their proposed construction methods, equipment and testing protocols to the Design Engineer for approval. The Design Engineer will review the submittal and provide approval, in writing, of the Contractor's plans. The Contractor may be required to modify their proposed methods, equipment, or testing protocols prior to approval.

5.0 Removal and Disposal or Recycling of Existing Cover Materials

The Final Design documents provide identification of areas requiring removal. Materials to be removed include reinforced concrete hangar pad foundations (6 each), methane gas risers and spinners (6 each), utility poles (3 each) and asphaltic surface. The reinforced concrete and methane risers shall be disposed of in the Los Alamos County Landfill or approved equal. Disposal quantities are to be documented. Los Alamos County requirements are to be met for disposal of this material. The asphalt material is to be recycled. The asphaltic material will be milled on-site and stockpiled in designated locations.

5.1 Disposal of Reinforced Concrete

All reinforced concrete to be removed as described in the Final Design documents shall be transported to the Los Alamos County Landfill for recycling. All applicable State of New Mexico and Los Alamos County transportation and disposal requirements shall be met. Documentation of materials removed and disposed of shall be submitted to the CQA Manager.

5.2 Disposal of Gas Risers

All methane gas risers to be removed as described in the Final Design documents shall be transported to the Los Alamos County Landfill for recycling. All applicable State of New Mexico and Los Alamos County transportation and disposal requirements shall be met. Documentation of materials removed and disposed of shall be submitted to the CQA Manager.

5.3 Recycling of Asphalt

All asphalt removed as described in Final Design documents shall be milled (less than ¾” diameter) and stockpiled. The asphalt shall be removed to the base or top of subgrade. The asphalt shall be cold milled using approved equipment such an asphalt milling machine. The material shall be stockpiled in designated areas as designated by the CQA Manager.

6.0 Waste Relocation

Waste from the northwest area of the landfill generally located under the proposed placement of a new concrete hangar pad shall be excavated and relocated along the centerline of the landfill after the asphalt and any base coarse has been removed. Approximately 4,722 cubic yards of waste is estimated to be excavated and relocated. The existing depth of waste is generally a few feet below ground surface (BGS) to up to 22.5 ft. BGS.

All QC testing shall be made available to the CQA Manager for concurrence.

6.1 Excavation

Asphalt directly above the areas to be excavated shall be removed and milled as described in section 5.3. Areas adjacent to the designated area will also require asphalt removal as required to meet OSHA excavation slope or set back requirements depending on depth of excavation.

6.1.1 Hold Point

After excavation of the waste is complete, the excavated area shall be inspected by the CQA Manager for concurrence. A CQA Compliance Report will be completed by the CQA Manager after completion of the waste excavation is agreed to be complete.

6.2 Vertical Liner Installation

A vertical liner composed of 40 mil linear low density polyethylene membrane shall be installed after excavation of waste is complete. The liner will extend vertically from the base of the excavation to the ground surface along the eastern edge of the of the projected concrete hangar pad. The liner shall be installed as the excavated area is backfilled to ensure its vertical placement. Defects in the liner shall be repaired prior to covering it with backfilled material.

The liner will begin at the base of the excavation and be installed as the backfilling of the landfill and area beneath the hangar pad is backfilled. Care will be taken to compact backfilled soil using compaction equipment submitted by the contractor and approved by the engineer such as a hand operated jumping jack compactor. Continual quality assurance inspection will ensure the liner is constructed without defects. This will include ensuring any damage incurred to the liner during its placement or compaction of soil shall be properly repaired before continuing.

6.3 Backfill of Excavated Area of Waste Removal

Clean material removed from the excavated area shall be stockpiled in an area as designed by the Construction Manager. After the Compliance Report is issued for waste excavation, the excavated area can be backfilled with the stockpiled clean material and other materials as designated by the CQA Manager or Design Engineer. Material backfilled shall be placed in compacted lifts compacted per

the Technical Specifications. Materials shall be compacted generally as dry as possible while meeting requirements set for in the Technical Specifications. Material and moisture condition to be used as backfill shall be approved by the CQA Manager. Excessive moisture in the backfill material shall require drying prior to placement. If significant precipitation is received during backfilling where the backfilled material becomes too moist, material to a depth designated by the CQA Manager shall be excavated, dried and backfilled and compacted.

The CQC Technicians will monitor the weather and temperature conditions. No material will be placed when the fill material or the underlying material is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

6.3.1 Hold Point

After backfill and compaction of backfilled material is, the backfilled area shall be inspected by the CQA Manager for concurrence. A CQA Compliance Report will be completed by the CQA Manager after completion of the waste area backfill is agreed to be complete.

6.4 Waste Placement and Compaction

Waste shall be relocated from the excavated area to the centerline of the landfill after asphalt and any base coarse has been removed and the subgrade has been properly prepared per section 8.0. Concurrence of the waste relocation location shall be provided by the CQA Manager. The subgrade shall be compacted to a minimum of 95% of maximum dry density per ASTM D698. Waste will then be placed and compacted in lifts not to exceed 6 inches after compaction. Waste shall be compacted as dry as possible and with heavy compaction. The final density shall be as dense as practical.

6.4.1 Hold Point

After backfill and compaction of waste material, the final condition of the waste shall be inspected by the CQA Manager for concurrence. A CQA Compliance Report will be completed by the CQA Manager after completion of the waste area backfill is agreed to be complete.

7.0 Site Regrading

The CQC staff will provide monitoring and observation of the earthwork after removal and processing of excavated areas. This will include regrading the site to meet designated grades and elevations indicated on the Design Documents and compacting the material to meet density and moisture requirements designated in the Design Documents.

Regraded material shall be generally placed and compacted in lifts not to exceed 6 inches compacted per the applicable Technical Specifications. Material shall be compacted to meet a minimum of 95% of the maximum dry density per ASTM D698. Materials shall be compacted generally not wetter than 1% wet of the optimum moisture content per ASTM D698.

All QC testing will be made available to the CQA Manager for concurrence.

7.1 Material Placement

The CQC Technicians will observe the surface condition of the subgrade prior to fill placement. If the compacted surface of any layer of fill is too wet or smooth to bond properly with the layer of material to be placed thereon, it shall have its soil dried and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next succeeding layer of fill is placed.

The CQC Technicians will monitor the weather and temperature conditions. No material will be placed when the fill material or the underlying material is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

7.2 Moisture and Density Control

The CQC Technicians will monitor placement, moisture conditioning, and compaction of the backfill material as it is placed. Prior to the start of field compaction operations, appropriate laboratory compaction curves will be obtained for the range of materials to be placed. Laboratory compaction curves based on complete Proctor tests (ASTM D698) will be obtained.

The general site backfill material shall be compacted per the Technical Specifications.

Field density testing shall be conducted with the sand cone test (ASTM D1556) and/or a nuclear density gauge (ASTM D6938, or as modified by the CQA Manager). Correlation of nuclear density gauge results can be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Standard Proctor tests shall be conducted

for each material included in the subgrade or when material characteristics show significant variation.

Table 1 summarizes the testing criteria for the site grading fill materials. The CQA Manager may increase actual frequency of testing if variability of materials is noted at the Site, during adverse conditions, or to isolate failing areas of the construction.

7.3 Final Slope and Grades

The CQC Technicians and the Surveyor (if necessary) shall confirm that the regraded site areas of removal and backfilling are graded to establish positive drainage away from the repository.

7.4 Tolerances

The final surfaces shall be smoothed to avoid abrupt changes in surface grade or areas of runoff concentration. Tolerances are as described in the Technical Specifications and Drawings.

7.5 Testing Methods

Throughout the construction activities, various field and laboratory testing will be conducted to ensure that all materials meet the Technical Specifications (submitted with Work Plan, Dwyer Engineering 2015b). Where applicable, testing will be conducted in accordance with the current versions of the corresponding ASTM test procedures. Any revisions to the testing methods will be reviewed and approved by the Design Engineer and the CQA Manager prior to their usage. The required frequency of testing is described in the applicable sections that follow.

During earthwork operations and fill placement, testing will be conducted to ensure that the materials meet the gradation specifications (ASTM D422).

Moisture-density curves will be developed using the Standard Proctor test (ASTM D698). Rock corrections (ASTM D4718) for the Proctor tests may be required depending on the material being tested. Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the CQA Manager). Correlation of nuclear density gauge results can be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) or microwave on similar material. Correlations shall be as approved by the Engineer.

Table 1. Subgrade Placement Requirements

Component	Parameter	Test Method	Minimum Frequency	Max. Performance Criteria	Min. Performance Criteria	Response to Nonconformance
Backfill and Subgrade	Lift Thickness	Visual and/or measured	continual	6 inches after compaction	NA	rework
	Density	ASTM D6938	1 per 2,500 square feet	Greater than or equal to 95% of the maximum dry density as determined by ASTM D698	95% of the maximum dry density as determined by ASTM D698	rework
		ASTM D1556	As needed for calibration purposes. Minimum 1 for each component	Greater than or equal to 95% of the maximum dry density as determined by ASTM D698	95% of the maximum dry density as determined by ASTM D698	rework
	Moisture	ASTM D6938	1 per 2,500 square feet	1 % wet of Optimum moisture content as determined by ASTM D698	Dry of optimum moisture content (ASTM D698)	rework
		ASTM D2216 or D4643	Calibration only by ASTM D2216 as needed for calibration purposes. Minimum 1 for each component	1 % wet of Optimum moisture content as determined by ASTM D698	Dry of optimum moisture content (ASTM D698)	rework

ASTM = American Society for Testing and Materials

7.6 Nonconformance, Corrective Action and Stop Work

The CQA/QC staff, including the CQA Manager and CQC Technicians, will have the authority to reject material that has been placed. For a failed field moisture/density test, the CQC Technician will determine the extent and depth of the affected area and require the Contractor to re-work the material as described above. If persistent failed tests occur, indicating inadequate compaction methods, the CQA Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the moisture/density specifications can be met.

7.7 Documentation

All field and laboratory test results, observations of fill placement, and field compaction test results will be recorded using the Daily Field Reports and CQA Compliance Reports.

7.7.1 Hold Point

After regarding and compaction of the subgrade soils, the final condition of the material shall be inspected by the CQA Manager for concurrence. A CQA Compliance Report will be completed by the CQA Manager after completion of the waste area backfill is agreed to be complete.

8.0 Cover System

A multi-layered cover system will be placed over the prepared subgrade. The evapotranspiration (ET) cover system will include a top layer designed to provide protection against erosion and a lower layer designed to limit infiltration. The material specifications, layer configurations, layer thicknesses, borrow sources, placement methods, and compaction requirements are described in the *Technical Specifications*. The CQC Technicians will monitor placement, moisture conditioning, and compaction of the backfill material as it is placed.

All QC testing will be made available to the CQA Manager for concurrence.

The cover will be placed in three segments with a compacted lift thickness not to exceed 1ft. The bottom foot will be a soil mixture as described in the *Technical Specifications.* Two different soil textures from an approved borrow source/vendor will be uniformly mixed and compacted as the first lift. The next segment of the cover system will be an approved soil texture from an approved borrow source/vendor to form the next 18 in. of cover. The top 6 in. of cover will be composed of an approved cover soil from an approved borrow source/vendor uniformly mixed with gravel. All mixing methods must be approved prior to commencement of this activity. Uniformity of final soil composition for all soil layers is critical.

Quality Assurance of the cover soil shall accomplish these objectives:

1. Ensure layer material quality meets specifications;
2. Ensure rock/soil admixture and soil texture combination soil layers are uniformly mixed prior to placement;
3. Ensure each layer material is properly placed.

Uniformity of compaction for all soil layers is critical. That is, each lift of cover soil shall be placed and compacted within a tight density tolerance. This will allow for the storage capacity requirements for the cover soil while minimizing the potential for preferential flow. Compaction of soil shall be carried out dry of optimum moisture contents, yet still within the acceptable density range. An intended benefit of dry of optimum compaction is that the completed soil layers will have greater water storage capacity than if they were compacted under wetter soil conditions and drier soils can be easier to work with during construction. Furthermore, compaction of dry soil minimizes the potential for desiccation cracking and thus preferential flow.

During cover placement, it is crucial that each lift be bonded to the previous lift. This cuts down on the creation of inter-lift passageways (cracks) for the water to travel along as it passes from an overlying lift to a lower one. To minimize the creation of inter-lift passageways, if a smooth-rolled compactor is used, each lift shall be scarified to a depth of 1 to 2 in. prior to the placement of the next lift thus establishing continuity between the lifts.

8.1 Material Conformance Monitoring and Testing

The CQA Manager will oversee monitoring and verification testing to ensure that the fill materials meet the gradation and classifications specifications. The CQA Manager will monitor earthmoving operations to ensure that the fill material is taken from the proper borrow sources.

Prior to the placement of the next layer of the cover, the CQA Manager shall inspect the completed layer and document any of the following:

- Erosion of the layer surface
- Cracking or desiccation of the surface
- Fill areas that may contain excessive organics or other debris
- Depressions, or settlement of the layer
- Irregularities in the layer surface (e.g. grading errors)

Any documented items that constitute non-conformance with the Drawings and *Technical Specifications* should be corrected prior to placement of the subsequent layer of the cover.

8.2 Cover Soils

The cover soils shall be obtained from the approved borrow sources/vendors, and meet the gradation and placement requirements outlined in the *Technical Specifications*.

8.2.1 Bottom Soil Texture Mixed Layer

The first layer of the cover shall be composed of a mixture of high fines (silt and clay) content soil with a soil with less fines content (overburden). The soil shall be mixed by volume as designated in the *Technical Specifications.* The method for mixing the two soils shall be submitted and approved by the Design Engineer prior to commencement of this activity. This layer shall be a minimum of 1 ft. thick after compaction.

8.2.2 Middle Cover Layer

The middle layer of the cover profile shall be a minimum of 18 in. after compaction of a single uniform soil. This layer shall be placed in two approximate equal and uniform lifts.

8.2.3 Surface Rock/Soil Admixture

The surface layer shall consist of a soil with gravel uniformly mixed into it and loosely placed to a minimum thickness of 6 in. The method utilized to mix the soil and gravel shall be submitted and approved by the Design Engineer prior to commencement of this activity.

The rock portion of the gravel admixture will consist of granular materials from approved off-site sources. Rock shall meet approved size and durability requirements. Gravel admixture material shall be free from

roots, branches, rubbish, and debris. Submittal of rock sizing and durability shall be approved prior to shipment.

The mixtures of rock to soil shall be 25 percent rock (with a D_{50} = 0.5 inches) to 75 percent soil by volume. The method used to mix the rock and soil shall be submitted and approved prior to the start of these activities.

The gradation specifications for the rock used for gravel admixture material shall be confirmed by gradation testing prior to mixing with the soil, to determine the particle sizes.

Soils used in the cover soil shall come from approved borrow sources/vendors only and possess an adequate supply of plant nutrients while limiting the amount of salts. The gradation specifications for gravel admixture material (soil-gravel mixture) shall be confirmed by gradation testing, on samples collected from the point of placement (on the cover).

Gravel admixture thickness will be controlled through the establishment of grade stakes placed on a 200 x 200 foot grid on the top slope of the cover and by a 100 x 100 foot grid on the side slopes or other approved method. Physical checks of gravel admixture depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes.

8.2.4 Material Placement

The CQC Technicians will observe the surface condition prior to fill placement. If the compacted surface of any layer of fill is too smooth to bond properly with the layer of material to be placed thereon, it will be reworked with a harrow, scarifier, or other suitable equipment to a 1” to 2” depth to provide a satisfactory bonding surface before the next succeeding layer of fill is placed.

If the compacted surface of any layer of fill in-place is too wet (e.g. due to precipitation) for proper compaction of the fill material to be placed thereon, it will be reworked with harrow, scarifier or other suitable equipment to reduce the moisture content to the required level. It will then be recompacted to the fill requirements.

Nesting of oversized material will be controlled through selective excavation of stockpiled material, observation of placement by CQC Technicians with authority to stop work and reject material being placed, and by culling oversized material from the fill using a grader. Successive loads of material will be placed on the fill so as to produce the best practical distribution of material.

The CQC Technicians will monitor the weather and temperature conditions. No material will be placed when the fill material or the underlying material is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density without developing frost lenses in the fill.

The CQC Technicians will monitor and document the lift thicknesses frequently to ensure the specifications are met. The required layer and lift thicknesses are listed in Table 2.

Table 2. Summary of Cover Components Layer and Lift Thicknesses

Cover Component	Material Type	Layer Thickness	Placement Lift Thickness
Bottom Soil Layer	Clay or silt loam mixed with sandy loam or approved other soils.	12 in. (min.) compacted	Place in 1 lift
Middle Soil Layer	Sandy loam	18 in. (min.) compacted	Place in 2 lifts
Surface Admixture	Sandy loam or approved other soil and gravel	6 in. (min.)	Place in 1 lift

min. = minimum

8.2.5 Moisture and Density Control

The CQC Technicians will monitor placement, moisture conditioning, and compaction of each fill as it is placed. Prior to the start of field compaction operations, appropriate laboratory compaction curves will be obtained for the range of materials to be placed (ASTM D698). Laboratory compaction curves based on complete Proctor tests will be conducted at the frequencies outlined in Tables 3 through 5, depending on the variability of materials being placed.

Each layer of the fill will be conditioned so that the moisture content is uniform throughout the layer prior to and during compaction. As far as practicable, the materials will be brought to the proper moisture content before placement. If necessary, water will be added after lift placement to the material by sprinkling on the layer. Each lift will be compacted by a sufficient number of roller passes or other compaction equipment to achieve the required dry density. Material that is too dry or too wet or does not meet the required dry density will be rejected and will be reworked until the moisture content and dry density are within the specified limits. Reworking may include removal, re-harrowing, reconditioning, re-rolling, or combinations of these procedures.

The required testing frequencies are included in Tables 3 through 5. Field density testing may be conducted with the sand cone test (ASTM D1556) or a nuclear density gauge (ASTM D6938, or as modified by the CQA Manager). Correlation of nuclear density gauge results shall be by comparison with results from sand cone test(s) and laboratory testing for water content(s) using the oven drying method (ASTM D2216) on similar material.

Field density tests shall be compared with Standard Proctor tests (ASTM D698 Method A or C) on the same material. Rock corrections (ASTM D4718) for oversize particles may be required for the gravel admixture (or other materials) depending on the gradation of the gravel material selected.

The actual frequency of testing may be increased by the CQA Manager if variability of materials is noted at the site, during adverse conditions, or to isolate failing areas of the construction.

8.2.6 Surface Slopes and Grades

Each layer of the cover profile shall have the slope as designated in the *Drawings and Technical Specifications*. The slopes shall be free from abrupt changes in grade or areas of runoff concentration.

8.3 Tolerances

The layer thicknesses shall meet the required minimum thicknesses. Slopes shall be within '+' or '–' 0.2% for the bottom and middle soil layers and '+' or '–' 0.1% for the surface layer.

8.4 Nonconformance, Corrective Action and Stop Work

A problem is defined as material or workmanship that does not meet the requirements of the plans, *Technical Specifications*, or CQAP for the project of any obvious defect in material or workmanship (even if there is conformance with plans, *Technical Specifications*, and the CQAP). The CQA Manager and CQC Technicians will have the authority to reject material that is brought to the Site or material that has been placed.

For a failed field moisture/density test, the CQC Technician will determine the extent and depth of the affected area and require the Contractor to re-work the material as described above. If persistent failed tests occur, indicating inadequate compaction methods, the CQA Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the moisture/density specifications can be met. The CQA Manager shall be involved in determining the extent and depth of affected area.

At a minimum, problem identification and corrective measures reports shall contain the following information:

- Location of the problem
- Description of the problem (in sufficient detail and with supporting sketches or photographic information where appropriate) to adequately describe the problem
- Probable cause for the problem
- How and when the problem was identified (reference to inspection data sheet or daily summary report by inspector)

- Where relevant, estimation of how long the problem existed
- Any disagreement noted by the inspector between him/herself and contractor about whether or not a problem existed or the cause of the problem
- Suggested corrective measure(s)
- Documentation of correction, if corrective action was taken and completed prior to finalization of the problem, and completed corrective measures report (reference to inspection data sheet, where applicable)
- Where applicable, outline of suggested methods to prevent similar problems in the future
- Signature of the CQC Technician and review signature of CQC Project Manager

8.5 Documentation

All field and laboratory test results, observations of fill placement, and field compaction test results will be recorded using the Daily Field Reports and CQA Compliance Reports.

Tables 3 through 5 include a summary of the required materials testing and frequencies for the cover components.

8.5.1 Hold Points

There will be 3 hold points for placement of the cover profile: 1) after completion of the bottom mixed soil layer; 2) after completion of the middle soil layer; and 3) and completion of the surface rock/soil admixture layer.

After Mixing (for appropriate layer), placement, and compaction of each cover layer, the final condition of the material shall be inspected by the CQA Manager for concurrence. A CQA Compliance Report will be completed by the CQA Manager after completion of the waste area backfill is agreed to be complete.

Table 3. Testing and Performance Criteria for Borrow Source Areas
(Tested & Approved at Borrow Sources prior to delivery to site)

Component	Parameter	Test Method	Minimum Frequency	Performance Criteria Objective	Performance Criteria Tolerance	Response to Nonconformance
Surface Layer Cover Soil for gravel admixture	Particle Size Analysis (wet sieve)	ASTM D422 Standard sieves, hydrometer	1 per soil source. CQA Manager can request additional tests depending on consistency of soil.	28% fines (passing #200sieve), average over all tests with; no stone or clod larger than 4-in diameter, no large roots or foreign objects	25% min (allowed per test) to 100% by weight, average for all tests must be greater than or equal to 28% for soil prior to mixing with rock; remove all stones clods larger than 4-in diameter	Reject if fines criteria not met; Remove large objects, roots
Cover Soil for Middle Layer	Particle Size Analysis (wet sieve)	ASTM D422 Standard sieves, hydrometer	1 per soil source. CQA Manager can request additional tests depending on consistency of soil.	28% fines (passing #200sieve), average over all tests with; no stone or clod larger than 4-in diameter, no large roots or foreign objects	25% min (allowed per test) to 100% by weight, average for all tests must be greater than or equal to 28% for soil prior to mixing with rock; remove all stones clods larger than 4-in diameter	Reject if fines criteria not met; Remove large objects, roots
Bottom Soil Layer: High fines content soil	Particle Size Analysis (wet sieve)	ASTM D422 Standard sieves, hydrometer	1 per soil source. CQA Manager can request additional tests depending on consistency of soil.	40% fines (passing #200sieve), average over all tests with; no stone or clod larger than 4-in diameter, no large roots or foreign objects	35% min (allowed per test) to 100% by weight, average for all tests must be greater than or equal to 40% for soil prior to mixing with rock; remove all stones clods larger than 4-in diameter	Reject if fines criteria not met; Remove large objects, roots

ASTM = American Society for Testing and Materials, NA = not applicable

Table 4. Testing and Performance Criteria for Cover Soils

Component	Parameter	Test Method	Minimum Frequency	Performance Criteria Objective	Performance Criteria Tolerance	Response to Nonconformance
Bottom Mixed Soil Layer	Density	ASTM D6938	4 tests per acre	90% of the maximum dry density as determined by ASTM D698.	Tolerance 88 to 92% of maximum dry density	rework
		ASTM D1556	1 per 25 ASTM D6938 readings for calibration purposes	90% of the maximum dry density as determined by ASTM D698.	Tolerance 88 to 92% of maximum dry density	rework
	Moisture	ASTM D6938	4 tests per acre	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework
		ASTM D2216	1 per 25 ASTM D6938 readings for calibration purposes	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework
	Depth	Survey or Approved method	Complete coverage	Bottom layer of cover shall be a minimum of 1-ft after compaction	1-ft, min.	Add soil where depth is insufficient
Middle Soil Layer	Density	ASTM D6938	4 tests per acre	90% of the maximum dry density as determined by ASTM D698.	Tolerance 88 to 92% of maximum dry density	rework
		ASTM D1556	1 per 25 ASTM D6938 readings for calibration purposes	90% of the maximum dry density as determined by ASTM D698.	Tolerance 88 to 92% of maximum dry density	rework
	Moisture	ASTM D6938	4 tests per acre	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework
		ASTM D2216	1 per 25 ASTM D6938 readings for calibration purposes	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework

Component	Parameter	Test Method	Minimum Frequency	Performance Criteria Objective	Performance Criteria Tolerance	Response to Nonconformance
	Depth	Survey or Approved method	Complete coverage	Middle layer of cover shall be a minimum of 1.5-ft after compaction	1.5-ft, min.	Add soil where depth is insufficient
Surface Rock/Soil Admixture Layer	Density	Visual	NA	Loosely placed	NA	If topsoil layer is too dense due to traffic or other, scarify or rework prior to seeding
	Moisture	ASTM D6938	4 tests per acre	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework
		ASTM D2216	1 per 25 ASTM D6938 readings for calibration purposes	Dry of optimum moisture content as determined by ASTM D698	Dry of optimum moisture content as determined by ASTM D698	rework
	Depth	Survey or Approved method	Complete coverage	Bottom layer of cover shall be a minimum of 1-ft after compaction	6-inches, min.	Add soil/gravel mixture where depth is insufficient

ASTM = American Society for Testing and Materials, pcf = pounds per cubic foot, cy = cubic yards, min = minimum

Table 5. Testing and Performance Criteria for Gravel Admixture

Component	Parameter	Test Method	Minimum Frequency	Performance Criteria/Objective	Performance Criteria Tolerance	Response to Nonconformance
Rock (approved vendor, or approved equal)	Size	Vendor certification	1 per rock source	Vendor certification and submittal approved by Engineer. Rock to contain no more than 5% material passing #4 sieve as delivered to site.	D_{50} of 0.5 inches diameter	reject
	Durability	Must be durable rock (i.e. sandstone is not acceptable)	1 per rock source	Vendor certification of durability and approval by Engineer		reject
Rock/Soil Admixture	Volumetric mixture	ASTM C136 or approved equal	1 per 1,000 CY	Verify prior to placement on cover. 25% rock by volume (D_{50} = 0.5-in) to 75% by volume Soil	tolerance 23 to 27% rock by volume	reject
	Depth	Survey or Approved method	Complete coverage	Top layer of cover shall be the rock/soil admixture with a minimum of 0.5-ft depth after placement.	0.5-ft, min.	Add rock/soil admixture where depth is insufficient

ASTM = American Society for Testing and Materials, cy = cubic yards, min = minimum, D_{50} = mean size of rock

9.0 Channel Rock Protection and Erosion Control

The drainage channels will be lined with riprap. The size, thickness and gradation requirements for the rock protection are provided in the Drawings and Technical Specifications.

9.1 Material Conformance Monitoring and Testing

Riprap will be a screened product transported from an approved vendor or borrow source. The CQC Technicians will verify compaction characteristics of the subgrade, the placed and compacted sand filter material, and confirm that the riprap and sand meet the gradation specifications. The CQC Technicians will perform monitoring and will conduct the appropriate verification testing to ensure that the riprap meets the gradation and durability specifications. During active riprap placement, each load of material will be visually checked against standard piles for gradation prior to transport to the channel locations.

All QC testing will be made available to the CQA Manager for concurrence.

9.2 Drainage Channel Subgrade

The CQC Technicians shall monitor the shaping and compaction of the subgrade soil. All soils the drainage channels are to be built on are to be graded to meet elevations, shape, and slopes designated in the Drawings and *Technical Specifications*. The soil is to be compacted to a minimum of 95% of the maximum dry density per ASTM D698.

The CQC Technicians shall confirm that the upper 6 inches (minimum) of the channel subgrade is prepared and compacted in accordance with the Technical Specifications (minimum of 95 percent (ASTM D698) plus/minus 2 percent of optimum moisture content).

9.3 Diversion Channel Riprap

Material for the diversion channels will consist of granular materials from approved sources. The rock must be durable (certification from vendor is required to ensure and to be submitted to Design engineer for approval prior to transport of the material to the site).

Rock shall be a screened product, free from roots, branches, rubbish, and debris. Designated gradations and minimum thickness for the rock placement will be specified in the Drawings and Technical Specifications.

Material specifications for the rock shall be confirmed by gradation testing conducted by the CQC Laboratory. Testing shall consist of particle-size distribution testing (ASTM D422 or approved) at a frequency of at least one test per rock size designation, or when rock characteristics show a significant variation.

Rock layer thickness will be controlled through the establishment of grade stakes placed at no greater than 100 foot intervals along the channel, at varying locations on the cross-section (or approved method as submitted and approved by the

Design Engineer). Physical checks of riprap depth will be accomplished through the use of hand dug test pits at each stake in addition to monitoring the depth indicated on the grade stakes during placement.

9.4 Material Placement

The CQC Technicians will monitor riprap placement. Riprap material will be hauled to the channels and spread by an approved method and equipment. Riprap shall be spread in a manner to minimize segregation of the material. Depth of placement will be controlled through the establishment of grade stakes. Physical checks of riprap depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes. The Contractor will excavate the test pits, and the CQC Technicians will observe and document the excavation. Placement of the riprap will avoid accumulation of riprap sizes less than the minimum D_{50} size and nesting of the larger sized rock.

The CQA Manager will monitor riprap placement. The riprap layer shall be compacted by an approved method with approved equipment, in order to key the rock for stability.

The geotextile and/or geosynthetic material shall meet that designated in the Drawings and Technical Specifications. The material is to be placed to avoid any wrinkling that would hinder the flow of water as it drains in the channel. The material is to be secured prior to placement of riprap to ensure no significant movement occurs resulting from placement of riprap.

9.5 Surface Slopes and Grades

The final channel surfaces shall have a positive slope toward the drainage point with maximum side slopes as designated in the Drawings and Technical Specifications.

9.6 Tolerances

The completed riprap thickness shall meet the minimum requirements. The drainage slope and side slopes shall meet that designated in the Drawings and Technical Specifications.

9.7 Nonconformance, Corrective Action and Stop Work

The CQA Manager and CQC Technicians will have the authority to reject riprap or geotextile/geosynthetics that are brought to the site or has been placed. For rejected materials, the CQC Technicians will identify the extent and will require the Contractor to excavate the material and place additional materials. If persistent failed tests occur, indicating inadequate placement methods, the CQA Manager will have the authority to stop the work until the underlying cause is determined and the Contractor can demonstrate that the materials can be placed according to the specifications.

9.8 Documentation

All field and laboratory test results, observations of material placement, and field compaction test results will be recorded using the Daily Field Reports and CQA Compliance Reports. Table 6 includes a summary of the required materials testing and frequencies for the erosion protection materials.

Table 6. Summary of Testing Frequency and Criteria for Channel Materials

Component	Test	ASTM Standard	Frequency	Criteria
Riprap	Gradation with 200 Wash	D422	1 per rock size designation, minimum	D_{50} and Durability*

ASTM = American Society for Testing and Materials

9.8.1 Hold Points

There will be 3 hold points for placement of drainage channels: 1) subgrade soils are compacted and meet slope and size requirements; 2) geotextiles and/or geosynthetics have been properly installed; and 3) and completion of the riprap channel.

A CQA Compliance Report will be completed by the CQA Manager after completion of each of the three hold points is agreed to be complete.

10.0 Protection of Soil Stockpiles

The contractor shall maintain proper erosion control measures for stockpiles and may be required to cover piles in situations where precipitation is anticipated. The CQA Manager should document improper stockpile management in situations where the integrity of the material is being affected. The Construction Manager and/or the CQA Manager should determine corrective measures.

11.0 Seeding Quality Control

Vegetation improves the success of an ET Cover system. It provides for long-term stability of the cover surface; minimizes erosion; and reduces flux. Ensuring an adequate stand of vegetation begins with ensuring the quality of seed used. A variety of mechanisms can be used to control and ensure high-quality seeding operations. The seeding contractor shall be required to develop and submit a seeding plan detailing all seeding equipment to be used, fertilizer types, and mulch sources for inspection prior to initiation of work. Seed and fertilizer formulation certifications from the suppliers shall be submitted prior to material use.

Qualified seeding contractors and operators shall be employed. Seeding native seed mixes requires experience and familiarity with the various seed types to ensure proper planting. The proper equipment for seeding the specified native mix must be used. Not all seed drills are capable of proper planting of native grass/forb mixes in a rock/soil admixture.

Seed and seed mixtures shall be delivered in sealed containers. Wet, moldy, or otherwise damaged seed or packages shall be rejected and unacceptable materials removed from the job site. All labeling required by law shall be intact and legible. After delivery to the work site, seeds shall be stored in a cool, dry, weatherproof, and rodent proof place or container in a manner that protects the seed from deterioration and permits easy access for inspection.

All seed shall be subject to inspection and concurrence by the Engineer before the subcontractor is authorized to proceed with the seeding operation. Seed shall be tested according to the Association of Official Seed Analysts, International Seed Testing Association, and the Federal Seed Act standards. A certificate of analysis from a certified testing laboratory shall accompany seed. Certify the following individual seed tests:

- Purity and germination: Before seed is used, retest for germination all seed stored over six months from the date of the original acceptance test, and resubmit the results for inspection.
- Prohibited noxious weed seed: Seed shall not contain any federal- or state-listed prohibited noxious weed seed (an amount within the tolerance of 0%) as determined by a standard purity test.
- Restricted noxious weed seed: Seed shall contain no more than 40 seeds per pound of any single species, or 150 seeds per pound of all species combined, of restricted noxious weed seed.
- Weed seed: Seed shall contain no more than 1% by weight of weed seed of other crops and plant species as determined by standard purity tests.

  Certification from a certified seed-testing laboratory for seed testing within six months of date of delivery includes the following:

- name and address of laboratory,
- date of test,
- lot number of each seed type, and

- results of tests, including name, percentage of purity and germination, percentages of weed content for each kind of seed furnished, hard seed content, and in case of seed mixtures, pure live seed (PLS) proportions of each kind of seed as specified.

  The seed vendor on each standard sealed container label can provide information regarding the seed mixture. The labels shall include the following information:

- seed mixture name,
- lot number,
- total net weight and PLS weight of each seed type,
- percentages of purity and germination,
- seed coverage (in acres) on a PLS basis, and
- percentage of maximum weed seed content clearly marked for each seed type.

The vendor shall package seed such that the acre coverage of each container is equal for convenience of inventory. Prior to planting any seed, the seed labels and certification documentation shall be inspected by CQA personnel to ensure the seed provided meets the requirements specified.

Seeding is to be done by drill seeding unless otherwise approved by the Design Engineer. Equipment and methods are to be submitted prior to commencement of seeding. Equipment proposed for use and the methods of seeding shall be inspected for concurrence prior to the commencement of seeding operations. The equipment shall be checked for compliance to safety requirements (in the contractor's health and safety plan) prior to the commencement of seeding operations. Equipment calibration tests shall be conducted immediately prior to commencement of seeding operations and when the seed mix changes or different equipment is used.

Consider environmental conditions and perform seeding operations only during periods when successful results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, seeding operation shall be discontinued.

12.0 Asphalt Concrete Pavement

Pavement outside of the footprint of the new concrete hangar that was removed due to excavation of waste shall be repaved to meet the maximum of that contained in the Drawings and Technical Specifications or the existing pavement for profile thicknesses.

12.1 Subgrade Preparation

All vegetation (including root systems), rocks, debris, and topsoil shall be removed from the area to be paved. The subgrade shall be properly shaped to meet true lines and elevations as designated in the Drawings and Technical Specifications. The subgrade soil shall be compacted to not less than 95 percent of the maximum dry density per ASTM D698. Should a proctor of the subgrade soils not be available, compaction provisions can be modified in consultation with the CQA Manager and Design Engineer. The surface of the compacted subgrade must not deviate by more than 3/4 inch from the established grade. A minimum drainage slope shall be maintained (per Drawings and Technical Specifications) to provide adequate drainage of surface water from the finished pavement.

Areas that show pronounced deflection under construction traffic indicate instability in the subgrade. If reworking and additional rolling do not correct the situation, the area soil must be removed, replaced with suitable material, and compacted. The use of asphalt-treated base or coarse granular material shall be used as designated in the Drawings and Technical Specifications.

12.2 Base-Platform Construction

Asphalt Concrete Base Material shall be placed on the prepared subgrade. A base of 4 inches or less in depth should be placed in one lift. A base of a total thickness of more than 4 inches shall be placed in two or more lifts with the bottom lift being a minimum of 3 inches. The material shall be spread and compacted to the required thickness and density as designated in the Drawings and Technical Specifications and in the grades and dimensions shown on the Drawings. The surface of the base must not deviate more than 1/2 inch when measured with a 10- foot straight edge.

12.3 Tack Coat

Before placing successive pavement layers, the previous course should be cleaned and a tack coat of diluted emulsified asphalt should be applied if needed. The tack coat may be eliminated if the previous course is freshly placed and thoroughly clean.

12.4 Surface Course Construction

After the concrete hangar pad is complete, preparation for placement of the final surface course of Asphalt Concrete can begin. Should operations or winter weather delay placement of the final surface, the Asphalt Concrete base can serve traffic needs during the interim.

Preparation for the surface course requires thorough cleaning and sometimes washing of the asphalt base to remove tracked-on dirt and foreign particles. After cleaning, any cracked or broken areas in the base should be removed, replaced with bituminous mix, and thoroughly compacted. All manholes, valve boxes, and other pavement fixtures shall be brought to finished grade.

The hot mix asphalt surface course consists of one or more layers placed on the previously constructed Asphalt Concrete base course. The material must be spread and compacted to the required thickness and in the grades and dimensions shown on the plans.

The target density is a mean density of at least 93% of the theoretical maximum density. The finished surface must not deviate more than 1/4 inch when measured with a 10-foot straight edge.

13.0 Concrete

A new concrete hangar and concrete culvert shall be cast-in-place as designated in the Drawings and Technical Specifications. The culvert shall utilized salvaged metal grill form existing culverts and thus shall be sized to accept these grills.

13.1 Subgrade Preparation

All vegetation (including root systems), rocks, debris, and topsoil should be removed from the area to concrete is to be cast. The subgrade must be properly shaped to meet true lines and elevations as designated in the Drawings and Technical Specifications. The subgrade soil shall be compacted to not less than 95 percent of the maximum dry density per ASTM D698. Should a proctor of the subgrade soils not be available, compaction provisions can be modified in consultation with the CQA Manager and Design Engineer. The surface of the compacted subgrade must not deviate by more than 3/4 inch from the established grade when using a 10-ft. straight edge.

Areas that show pronounced deflection under construction traffic indicate instability in the subgrade. If reworking and additional rolling do not correct the situation, the area soil must be removed, replaced with suitable material, and compacted. The use of asphalt-treated base or coarse granular material shall be used as designated in the Drawings and Technical Specifications.

13.2 Materials

13.2.1 Concrete

Concrete shall meet strength and workability requirements designated in the Drawings and Technical Specifications. Concrete material shall adhere to guidance set forth by the American Concrete Institute. Provide certification from the supplier that it meets requirements set forth in the Drawings and Technical Specifications

13.2.2 Steel Reinforcement and/or Welded Wire Reinforcement

Reinforcing steel and/or welded wire reinforcement shall be accepted based on the certified mill analysis of the steel from the manufacturer and visual inspection of the materials. The CQC technicians or CQA personnel can reject material based on visual defects or improper sizing.

13.2.3 Placement

Placement of cast-in-place concrete shall be done when the weather is deemed appropriate to do so. Risk of freezing or significant precipitation should be avoided. After placement of the concrete, the material should be protected against potential weather issues

If pouring concrete during or before inclement weather cannot be avoided, appropriate measures shall be taken by the Contractor and agreed upon by both the CQA Manager and Design Engineer prior to placement of the material.

APPENDIX

Form No. 1

COMPLIANCE REPORT

Project No._____ Date:_____

Construction Segment:_____

_____

Drawing No.:_____

Specification No.:_____

Description of Completed Construction Segment:

_____

_____

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_____

By: CQA Manager _____

Approvals:

Design Engineer _____

Project or Construction Manager _____

Form No. 2

FIELD CHANGE ORDER

Project No._____ Date:_____

Drawing No.:_____

Specification No.:_____

Design Feature:

_____

_____

_____

_____

Modifications:

_____

_____

_____

_____

Reason:

_____

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_____

Initiated by:_____

Approved by:_____
CQA Manager

Form No. 3

DESIGN CHANGE ORDER

Project No._____ Date:_____

Drawing No.:_____

Specification No.:_____

Design Feature:

_____

_____

_____

Change in Design:

_____

_____

_____

Reason:

_____

_____

_____

Initiated by:_____

Approvals:

CQA Manager:_____

Project or Construction Manager:_____

Design Engineer:_____

July 2015

CONSTRUCTION IMPLEMENTATION PLAN

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505) 270-0215

Revision 01

EXECUTIVE SUMMARY

This Construction Implementation Plan addresses construction sequencing and methods to be utilized in the installation of the cover replacement for the U.S. Department of Energy (DOE) Los Alamos County Airport Landfill Cover Replacement project. This Construction Implementation Plan identifies a planned set of construction activities to complete the installation of the cover replacement.

Table of Contents

1.0 Scope of Document 4
1.1 Changes to Construction Implementation Plan 4
2.0 Construction Documents 5
2.1 Storm Water Pollution Prevention Plan (SWPPP) 5
2.2 Construction Traffic Control Plan 5
2.3 Health and Safety 5
2.4 Post-Closure Care and Monitoring Plan 6
3.0 Construction Schedule 7
4.0 Construction Cost Estimate 11
5.0 Project Construction Tasks and Sequencing 12
5.1 Landfill Cover Replacement Tasks and Associated Work 12
5.2 Submittals 12
5.3 Contractor Mobilization 12
5.4 Removal of Asphalt 13
5.5 Demolition and removal of concrete hangar pads and culvert 13
5.6 Remove drainage piping within landfill footprint 13
5.7 Relocate waste 13
5.8 Backfill waste removal area 14
5.9 Place vertical liner between landfill and backfilled waste removal area 14
5.10 Regrade landfill subgrade, prepare, compact 14
5.11 Regrade subgrade for drainage channels, prepare and compact 15
5.12 Haul cover soil 15
5.13 Mix, place, compact bottom foot of cover soil profile 15
5.14 Place, compact 2 lifts of middle cover soil profile 15
5.15 Haul rock for cover top layer 16
5.16 Mix, place top cover layer composed of soil/rock admixture 16
5.17 Prepare subgrade for new hangar pad and box culvert 16
5.18 Form, reinforcement, pour, finish concrete hangar pad and box culvert 16
5.19 Prepare subgrade for asphalt 17

5.20 Place new, repair existing asphalt surface 17
5.21 Seed cover 17
5.22 Place erosion matting 17
5.23 Final inspections / reporting 17
5.24 Demobilize 18
6.0 Project Communication 19
6.1 Issue Resolution 19
ATTACHMENT 20
CONSTRUCTION ESTIMATE 20

FIGURES

Figure 1. Estimated Construction Schedule, Part 1 8
Figure 2. Estimated Construction Schedule, Part 2 9

TABLES

Table 1. Estimated Construction Tasks Start/Finish 10

1.0 Scope of Document

This document includes (1) an outline of a conceptual construction schedule for the individual components of the Cover Replacement Project and (2) a description of the strategy and activities that will be implemented during the Cover Replacement Project, including specific construction activities, potential major scheduling problems or delays, lines of communication, and anticipated remedies to overcome any potential problems and delays.

1.1 Changes to Construction Implementation Plan

This document presents the construction sequencing, implementation of individual tasks, and facilitation of construction with the objective of meeting the construction schedule. This document should be considered a guide, and not a mandate for construction activities. Prior to construction, the Contractor shall review this plan and the associated construction schedule, and either accept it in its current form, or suggest changes to the information provided herein. Contractor acceptance or modifications to this document should be provided to Dwyer Engineering LLC and the Department of Energy in writing. Ultimately, adherence to the overall construction schedule is the Contractor's responsibility.

2.0 Construction Documents

Related construction documentation includes the following:

2.1 Storm Water Pollution Prevention Plan (SWPPP)

The *Storm Water Pollution Prevention Plan* (*SWPPP*) will be authored by the Contractor selected to perform the Cover Replacement Project to address storm water management and erosion control issues. The *SWPPP* shall include Best Management Practices (BMPs) to minimize on-site erosion and off-site discharge during construction and describes the continued use of BMPs after construction and prior to the establishment of vegetation.

2.2 Construction Traffic Control Plan

Primary access to the Site is through New Mexico State Route 502. The Project will involve having materials trucked in potentially from Espanola and Albuquerque, NM. Materials such as soil and gravel will require multiple truck loads that will require a traffic control plan for access to Los Alamos and The Airport area.

Prior to construction activities, the Contractor shall prepare a Traffic Control Plan that addresses maintaining access for all necessary haul trucks and construction vehicles safely to the Site while not interfering with traffic to/from the Airport. This plan shall also address construction traffic at the Site, including rights-of- way, traffic direction/patterns, and equipment operator communication. This plan may require improvements to the main access road, and may also require construction of temporary access roads. Haul trucks entering and exiting the main access road onto Route 502 must obey all standard traffic laws and regulations.

In addition, the Contractor must consider in the traffic plan the placement of the cover soils to prevent construction traffic from overcompacting the cover components and/or resulting in non-uniform compaction of the cover, during delivery and placement.

2.3 Health and Safety

A Design Site Health and Safety Plan (HASP) (Work Plan, Appendix K) has been prepared that ensures the personnel of Dwyer Engineering adhere to the requirements of: Occupational Safety and Health Administration standards, 29 CFR Part 1910 and 29 CFR Part 1926; United States Army Corps of Engineers “Safety and Health Requirements Manual” (EM 385-1-1; 15 Sep 2008 edition) and “Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities (ER 385-1-92, dated May 2007) requirements.

Prior to beginning any work on the Site, the Contractor shall prepare a HASP that covers their planned activities. Contractor’s staff shall be trained for site-specific activities, conditions, and radiation hazards under the Contractor’s Health and Safety Plan (HASP) for the project.

As with all construction projects, the weather can affect both site safety and the construction schedule. Each of the tasks described in this plan, have the potential to be affected by inclement

weather, and the Contractor will be expected to account for this possibility in budget, safety, and schedule planning.

2.4 Post-Closure Care and Monitoring Plan

A Post-Closure Care and Monitoring Plan (PCMP) has been prepared that addresses post-closure care and monitoring for the U.S. Department of Energy (DOE) Los Alamos County Airport Landfill closure (Work Plan, Appendix J). This PCMP identifies post-closure care and monitoring requirements and activities for the landfill that satisfy NMAC 20.4.1.600 and 40 CFR 265. A tentative inspection and reporting schedule is also identified.

3.0 Construction Schedule

The construction implementation schedule outlined in Figure 1, 2 and Table 1 describes estimated start dates, completion dates and durations for the tasks anticipated to complete the Project. This schedule expands upon the details included on the schedule prepared as part of the work plan. The schedule in Figure 1, 2 and Table 1 identifies timing for initiation and completion of critical path construction activities. The implementation schedule includes conferences and inspections as detailed in the SOW. The schedule shown in Figure 1, 2 and Table 1 is an estimate and the retained Contractor will be required to prepare and submit a detailed, proposed Construction Schedule for approval by the Engineer.

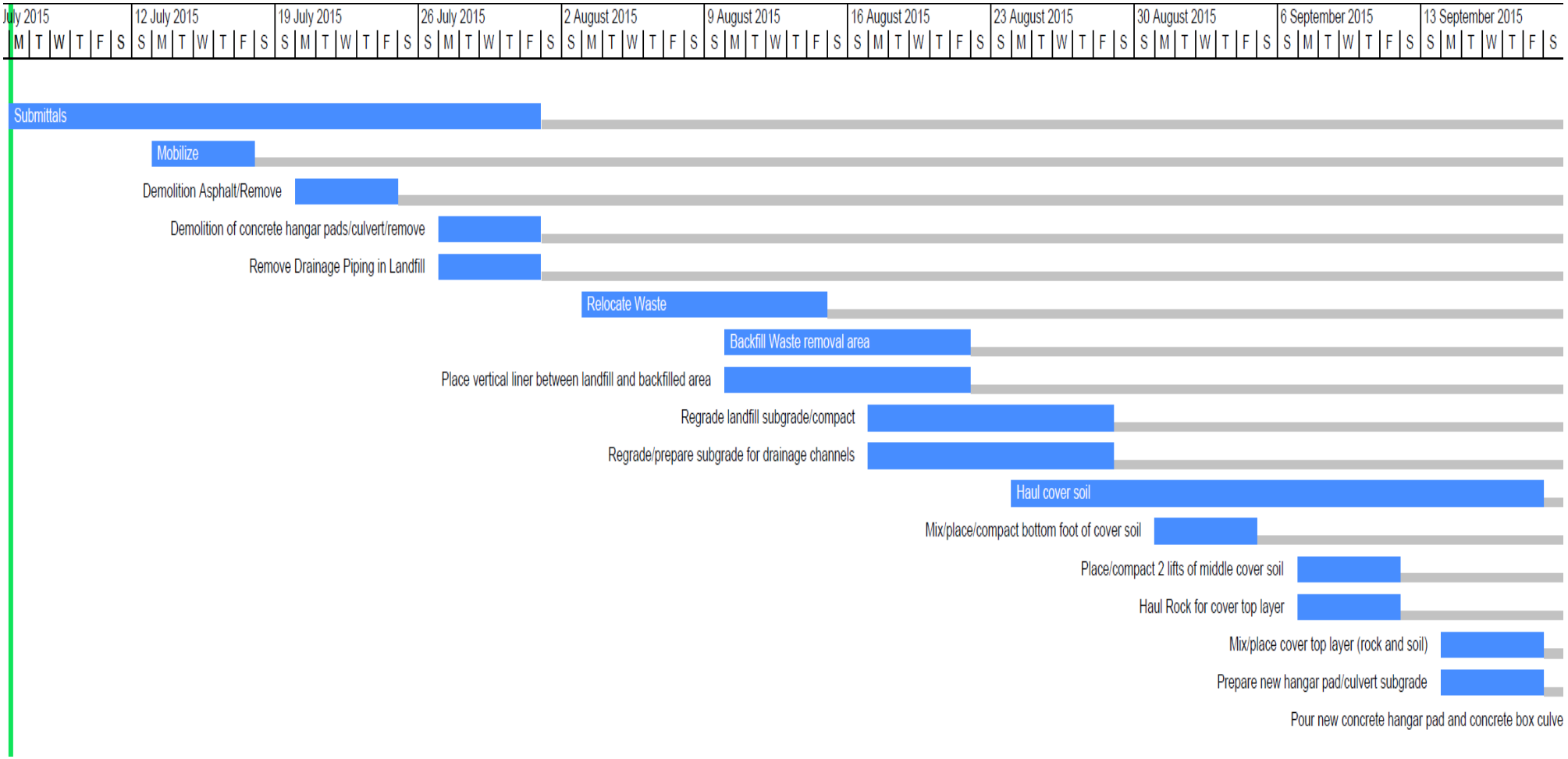


Figure 1. Estimated Construction Schedule, Part 1

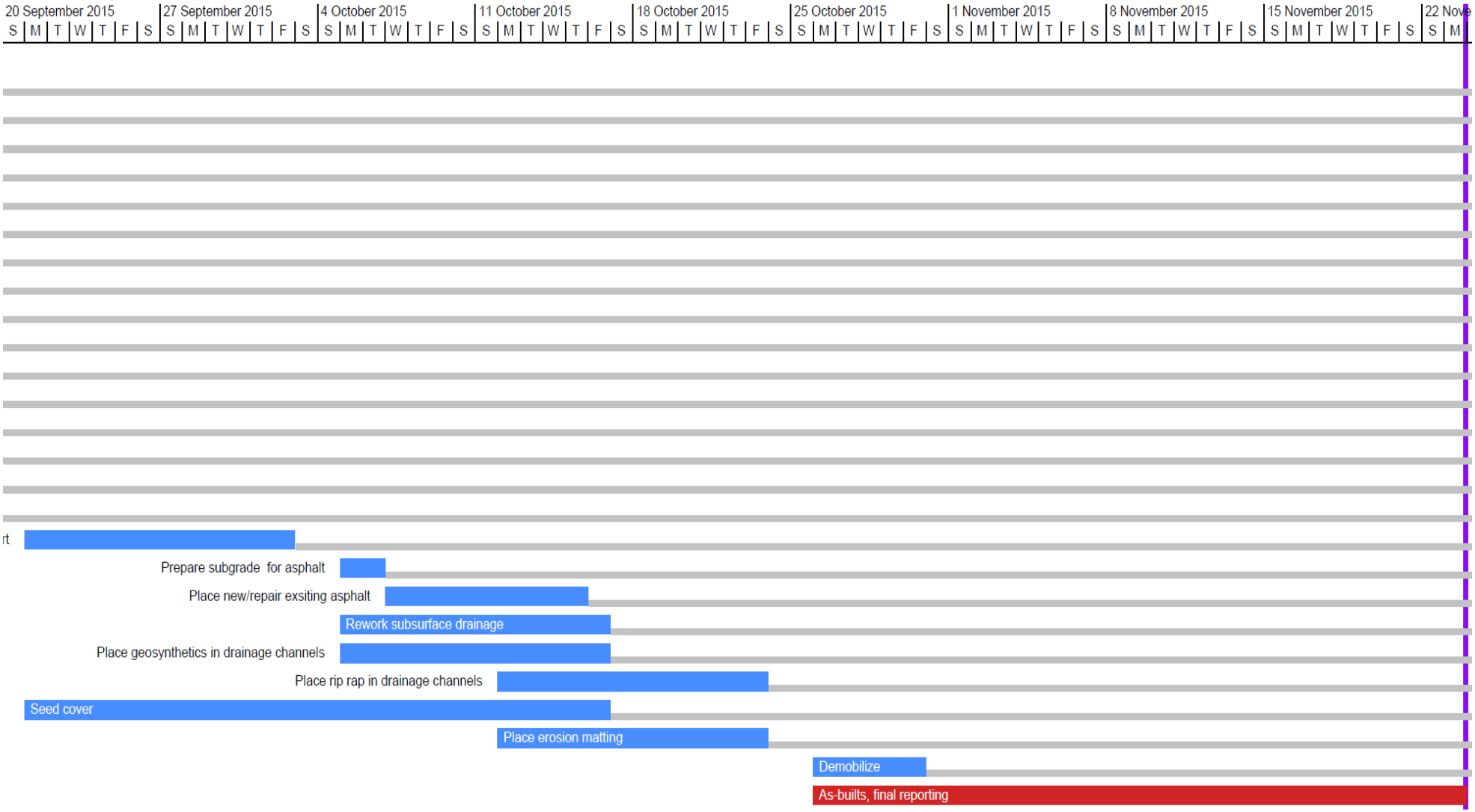


Figure 2. Estimated Construction Schedule, Part 2

Table 1. Estimated Construction Tasks Start/Finish

Name	Start	Finish
Submittals	6 July 2015	31 July 2015
Mobilize	13 July 2015	17 July 2015
Demolition Asphalt/Remove	20 July 2015	24 July 2015
Demolition of concrete hangar pads/culvert/remove	27 July 2015	31 July 2015
Remove Drainage Piping in Landfill	27 July 2015	31 July 2015
Relocate Waste	3 August 2015	14 August 2015
Backfill Waste removal area	10 August 2015	21 August 2015
Place vertical liner between landfill and backfilled area	10 August 2015	21 August 2015
Regrade landfill subgrade/compact	17 August 2015	28 August 2015
Regrade/prepare subgrade for drainage channels	17 August 2015	28 August 2015
Haul cover soil	24 August 2015	18 September 2015
Mix/place/compact bottom foot of cover soil	31 August 2015	4 September 2015
Place/compact 2 lifts of middle cover soil	7 September 2015	11 September 2015
Haul Rock for cover top layer	7 September 2015	11 September 2015
Mix/place cover top layer (rock and soil)	14 September 2015	18 September 2015
Prepare new hangar pad/culvert subgrade	14 September 2015	18 September 2015
Pour new concrete hangar pad and concrete box culvert	21 September 2015	2 October 2015
Prepare subgrade for asphalt	5 October 2015	6 October 2015
Place new/repair existing asphalt	7 October 2015	15 October 2015
Rework subsurface drainage	5 October 2015	16 October 2015
Place geosynthetics in drainage channels	5 October 2015	16 October 2015
Place rip rap in drainage channels	12 October 2015	23 October 2015
Seed cover	21 September 2015	16 October 2015
Place erosion matting	12 October 2015	23 October 2015
Demobilize	26 October 2015	30 October 2015
As-builts, final reporting	26 October 2015	23 November 2015

4.0 Construction Cost Estimate

The construction cost estimate performed by the Department of Energy is $3,930,000.

The breakdown of the estimate is as follows:

General Conditions	144,000	
ET Cover	1,950,000	
Demolition		520,000
Asphalt Demolition		265,000
Concrete Demolition		232,000
Storm Drainage System		15,000
Utility Poles		1,000
Methane Collection System		8,000
Site Construction	1,430,000	
Rockwork		85,000
Site Clearing & Earthwork		1,350,000
Hangar Pad	1,835,000	
Demolition		840,000
Waste Excavation		840,000
Hangar Pad Construction		997,000
Concrete		151,000
Asphalt/Paving		26,000
Site Clearing & Earthwork		820,000

Refer to the attachment at the end of this document for further details of the construction estimate.

5.0 Project Construction Tasks and Sequencing

5.1 Landfill Cover Replacement Tasks and Associated Work

The work outlined in this plan consists of execution of the following tasks associated with the Project. Many of these tasks can be performed simultaneously, therefore the list below should be used as a general construction sequencing guide.

1. Submittals
2. Mobilize
3. Demolition and removal of asphalt
4. Demolition and removal of concrete hangar pads and culvert
5. Remove drainage piping within landfill footprint
6. Relocate waste
7. Backfill waste removal area
8. Place vertical liner between landfill and backfilled waste removal area
9. Regrade landfill subgrade, prepare, compact
10. Regrade subgrade for drainage channels, prepare and compact
11. Haul cover soil
12. Mix, place, compact bottom foot of cover soil profile
13. Place, compact 2 lifts of middle cover soil profile
14. Haul rock for cover top layer
15. Mix, place top cover layer composed of soil/rock admixture
16. Prepare subgrade for new hangar pad and box culvert
17. Form, rebar, pour, finish concrete hangar pad and box culvert
18. Prepare subgrade for asphalt
19. Place new, repair existing asphalt surface
20. Seed cover
21. Place erosion matting
22. Final inspections / reporting
23. Demobilize

These tasks are described below along with activities necessary to implement each task, and how these tasks should be coordinated to facilitate construction in order to meet the construction schedule.

5.2 Submittals

Submittals of materials, construction methods, construction equipment will be required prior to commencing specific work elements. A pre-construction meeting will be held between key personnel to include the Contractor, Engineer, DOE representatives to discuss the Project and key elements, potential conflicts, lines of communications, as well as, potential modifications to submitted Project documents and design elements.

5.3 Contractor Mobilization

The Contractor will mobilize to the site and begin to install Best Management Practices (BPMs) temporary erosion controls such as install silt fence, sediment check-dams, and

straw bale check dams. The contractor shall submit a Project Storm Water Pollution Prevention Plan (SWPPP), a Health and Safety Plan (HASP) and associated training requirements, a Traffic Control Plan and set up temporary facilities. The Contractor shall also erect temporary fencing. During ***all*** earthwork activities, dust is to be strictly controlled and minimized. The Contractor is to submit a Dust Control Plan for approval prior to commencement of any earthwork activities.

All compaction equipment and methods are to be submitted by the Contractor and approved by the Engineer.

5.4 Removal of Asphalt

The Contractor shall remove the existing asphalt surface currently covering the landfill. This is clean material that shall be recycled. It is scheduled to be milled on-site and hauled off-site. Some of the milled asphalt may be used as base coarse for new asphaltic surface to be installed on the Project or possibly as structural fill. The remainder of the material will be removed from the site.

5.5 Demolition and removal of concrete hangar pads and culvert

The existing concrete hangar pads (6 each) shall be demolished and the materiel shall be hauled off-site for recycling. In addition, the existing concrete box culvert separating the landfill surface from the asphaltic surface of the airport taxiway shall be demolished and the materiel shall be hauled off-site for recycling. The existing plan is to truck the demolished reinforced concrete removed from the Site to the Los Alamos County Landfill where an on-site contractor has a crushing operation in place to crush the material and provide it for purchase to the community. The rebar from the concrete will be removed and sold as recycled steel by the same County contractor.

5.6 Remove drainage piping within landfill footprint

Subsurface piping within the footprint of the existing landfill poses a future differential settlement risk. Therefore, after removal of the asphalt and concrete from the landfill surface, subsurface drainage piping shall be excavated and removed. This material is metal corrugated culverts. It shall be crushed and recycled where practical. The end of the drainage lines on the south side of each drainage line shall be plugged where it interfaces with the remaining subsurface drainage system.

5.7 Relocate waste

A new airplane storage hangar is to be installed at the airport. The hangar installation is not part of this Project. However, preparation for installation of this hangar as well as a reinforced concrete foundation and asphaltic surface apron surrounding the concrete hangar pad shall be installed on this project. To minimize the potential for differential settlement and concentration of methane within the hangar or airplanes; the waste within the footprint of the new hangar and asphalt apron shall be removed and relocated within the footprint of the landfill as depicted on the Project Drawings. The solid waste shall be excavated and

relocated along the centerline of the landfill where it will be covered by the new Cover Replacement. The waste shall be placed in the designated areas and compacted in thin lifts not to exceed 6-inches. Placed and compacted waste shall have a minimum 6-inch thick lift of clean dry material placed over it at the conclusion of each day unless directed otherwise by the FPD. The waste shall be compacted as dry as possible to the highest density practical. All construction equipment and compaction methods hall be submitted for approval by the Engineer.

5.8 Backfill waste removal area

The area where the waste is relocated from shall be backfilled with acceptable fill and compacted in thin lifts. Only clean acceptable fill soils shall be permitted to be used to backfill this area. The soils shall be placed in lifts not to exceed 6-inches in thickness and be compacted to a minimum of 95% of the maximum dry density per ASTM D698 while controlling the soil moisture to disallow excessive water. Any soils than are found to be too wet shall be removed and dried.

5.9 Place vertical liner between landfill and backfilled waste removal area

As the waste removal area and adjacent areas are backfilled, a vertical liner composed of polyethylene shall be constructed separating the clean backfilled area below the new hangar facility from the landfill. The liner is intended to minimize the potential for migration of methane from the landfill laterally to the hangar area subsurface.

The liner will begin at the base of the excavation and be installed as the backfilling of the landfill and area beneath the hangar pad is backfilled. Care will be taken to compact backfilled soil using compaction equipment submitted by the contractor and approved by the engineer such as a hand operated jumping jack compactor. Continual quality assurance inspection will ensure the liner is constructed without defects. This will include ensuring any damage incurred to the liner during its placement or compaction of soil shall be properly repaired before continuing.

5.10 Regrade landfill subgrade, prepare, compact

The subgrade beneath the planned Final Cover shall be regraded to the slope and extent shown on the Drawings. Cut excavation shall be made at the northern and southern boundaries of the landfill and filled toward the center of the landfill thus raising the grade from near level to a grade of about 3.3% or that approved by the Engineer. Large objects greater than 4-inches in diameter shall be buried within the landfill and compacted. Compaction shall concentrate on maximizing the density of the subgrade while limiting the moisture content. All relocated materials shall be compacted to a minimum of 95% of the maximum dry density per ASTM D698, while limiting the moisture content to the optimum moisture content.

5.11 Regrade subgrade for drainage channels, prepare and compact

The subgrade for the perimeter drainage channels around the landfill shall be graded to meet slopes and elevations designated on the Drawings. Large objects greater than 1/2-inches in diameter shall not be allowed on the surface of the subgrade to avoid damage to the overlying geosynthetic materials. Slopes are to be uniform and maintain positive drainage throughout. Compaction shall concentrate on maximizing the density of the subgrade while limiting the moisture content. All relocated materials shall be compacted to a minimum of 95% of the maximum dry density per ASTM D698, while limiting the moisture content to the optimum moisture content.

5.12 Haul cover soil

Soils to be used for the replacement cover system shall be hauled to the site from off-site. Only approved soils shall be used. All materials to be used in the cover profile shall be submitted by the Contractor and approved by the Engineer. A Traffic Control Plan shall be prepared and submitted by the Contractor for approval prior to hauling any soils to the site. The protection and/or the improvement of exiting roadways shall be discussed in the Traffic Control Plan. Placement of the cover soil shall also be discussed in the Traffic Control Plan to ensure not over compacting placed cover soil. The cover soil shall be stockpiled in approved and designated areas only. The stockpiled material shall be protected against loss of soil due to erosion.

5.13 Mix, place, compact bottom foot of cover soil profile

After the subgrade for the landfill has been properly prepared and approved by the Construction Manager, placement of the cover soil can begin. The bottom layer of the cover shall be composed of a specified mixture of two borrow soils. The mixing method, equipment, and materials shall be submitted by the Contractor and approved by the Engineer prior to placement of cover soil. The soils shall be uniformly mixed and placed in one compacted lift not less than 12-inches deep. The layer shall be within the slope and elevations designated in the Technical Specifications and Drawings. The cover will extend over all areas of waste materials and landfill, as shown in the construction Drawings. Proper grade control, by survey methods or approved other, is necessary to assure that the cover layers are placed to the correct thickness, grades, and extents. The Contractor should use a Surveyor to assist his crew with placement of the cover materials, and should schedule the Surveyor in advance such that surveying does not impact the project schedule.

5.14 Place, compact 2 lifts of middle cover soil profile

After the bottom layer of the cover soil profile for the landfill has been properly placed, prepared and approved, placement of the middle cover soil layer can begin. The middle layer of the cover shall be composed of a single approved soil texture. The placing and compacting method, equipment, and materials shall be submitted by the Contractor and approved by the Engineer prior to placement of cover soil. The middle layer is to be not less than 18-inches thick. Therefore, this layer shall be completed in two equal lifts. The layer shall be within the slope and elevations designated in the Technical Specifications

and Drawings. The cover will extend over all areas of waste materials and landfill, as shown in the construction Drawings. Proper grade control, by survey methods or approved other, is necessary to assure that the cover layers are placed to the correct thickness, grades, and extents. The Contractor should use a Surveyor to assist his crew with placement of the cover materials, and should schedule the Surveyor in advance such that surveying does not impact the project schedule.

5.15 Haul rock for cover top layer

Rock to be used for the replacement cover system top layer shall be hauled to the site from off-site. Only approved rock shall be used. All materials to be used in the cover profile shall be submitted by the Contractor and approved by the Engineer. The protection and/or the improvement of exiting roadways shall be discussed in the Traffic Control Plan. The rock to be used in the top layer of the cover shall be stockpiled in approved and designated areas only. The stockpiled material shall be protected against loss of soil due to erosion.

5.16 Mix, place top cover layer composed of soil/rock admixture

After the initial lifts of the soil cover have been placed over the landfill and compacted, the Contractor will begin preparing the mixture of cover soil and gravel (gravel admixture) for the top surface of the landfill. Because the mixture will require testing of the materials before placement and after mixing, the Contractor will have to prepare a test section, so that the method of mixing the gravel and soil can be observed and approved by the Engineer.

5.17 Prepare subgrade for new hangar pad and box culvert

The subgrade designated for placement of the new concrete hangar pad and box culvert shall be graded to meet the extent and grades designated on the Drawings. The subgrade shall be compacted to a minimum of 95% of the maximum dry density meeting requirements set forth in the Technical Specifications. The finished area shall be free of objects that would impair the integrity of the structures to be placed on the area.

5.18 Form, reinforcement, pour, finish concrete hangar pad and box culvert

The reinforced concrete hangar pad and box culvert are to be formed, have their reinforcement steel placed and tied, and then concrete poured to meet the requirements set forth in the Drawings and Technical Specifications. The rebar and concrete are to meet strength requirements set forth in the Technical Specifications. The concrete is to be poured and finished only when predicted weather is favorable. It is preferred that the concrete not be poured when freezing temperatures are forecast.

5.19 Prepare subgrade for asphalt

After the concrete hangar pad has been poured and finished, the subgrade for the new and repaired areas for asphalt placement shall be graded and compacted to meet the requirements set forth in the Drawings and Technical specifications. The subgrade designated for placement of the asphalt shall be graded to meet the extent and grades designated on the Drawings. The subgrade shall be compacted to a minimum of 95% of the maximum dry density meeting requirements set forth in the Technical Specifications. The finished area shall be free of objects that would impair the integrity of the structures to be placed on the area.

5.20 Place new, repair existing asphalt surface

After the subgrade has been prepared and approved, base coarse shall be placed and compacted to meet the extent and depth designated in the Drawings. Compaction and material requirements are to meet requirements set forth in the Technical Specifications. Upon completion of the base coarse placement grading, and compaction, the new asphaltic surface shall be placed to meet the extent and depth designated in the Drawings and Technical Specifications.

5.21 Seed cover

The seed mix, seeding methodology, and equipment must be submitted by the Contractor and approved by the Engineer prior to any seeding activities taking place. Seeding must take place in favorable weather conditions. After the full cover profile has been placed and approved as well as adjacent areas have been completed including the drainage channels, hangar pad, concrete culvert, and asphaltic surfaces; the cover and disturbed areas can be seeded with an approved seed mix and seeding method.

5.22 Place erosion matting

After seeding operations have been completed and approved, erosion matting shall be placed around the base perimeter of the landfill and on the disturbed areas that were seeded north of the new asphalt hangar pad apron. The matting material and placement methodology shall be submitted by the Contractor and approved by the Engineer prior to delivery of the materials to the site. The material shall be placed and secured to the extent designated in the Drawings and Technical Specifications and as recommended by the manufacturer.

5.23 Final inspections / reporting

A Pre-Final Construction Conference shall be held at the Site to discuss the procedures and requirements for the construction completion and final inspection. The meeting shall include representation by the Contractor, DOE, and Dwyer Engineering as well as any other designated personnel. The topics at this conference may include (1) Site Cleanup; (2) Demobilization; (3) the pre-final and final inspection and schedule; and (4) final reporting and as-built requirements and responsibilities. The pre-final inspection will

consist of a walk-through of the entire Site to determine if the project is complete and consistent with the contract documents and approved Work Plan. A pre-final inspection report shall be submitted to the DOE within 7 days with all findings and remedies.

The Final Inspection shall be held at the Site and consists of a walk-through field inspection, focusing on the outcomes of the Pre-Final Inspection and any deficiencies and/or non-compliances with the design plans and specifications. Should any items reviewed during the Pre-Final Inspection remain unresolved, the inspection shall be considered another Pre-Final Inspection requiring the associated report and the scheduling of a Final Inspection. The DOE Project Manager shall lead the Final Inspection. The field meeting shall include representatives from all parties including all who attended the Pre-Final Inspection. A final Inspection report shall be completed to document the outcomes of the Final Inspection and shall be submitted to the DOE within seven days following the Final Inspection.

A Project Completion Report shall be submitted to the DOE within 60 days following the Final Inspection Report and the receipt of validated, final, laboratory analytical data. The Project Completion Report shall contain a brief description of all identified outstanding construction items and the resolution of the items, synopsis of work done, description of any changes and/or modifications to the work, and recommendations for the overall project. The DOE shall review the report and provide comments and/or deficiencies for a re-submittal. The revised report shall be submitted to the DOE within 30 days of receipt of the comments and/or deficiencies. The DOE shall review the revised report and inform the Contractor and Engineer, in writing, of approval or disapproval of the final Project Completion Report.

5.24 Demobilize

The contractor shall demobilize from the site after completion of the cover replacement project. The Contractor shall remove all equipment and temporary facilities including fencing.

6.0 Project Communication

6.1 Issue Resolution

The prescribed lines of project communication are detailed in the *Construction Quality Assurance Plan (CQAP)* for the Project (Work Plan, Appendix L). Project issues, including examples described in this plan, shall be resolved along the lines of communication described in the CQAP.

ATTACHMENT

CONSTRUCTION ESTIMATE

The main project is an estimate for site demolition and construction of new ET cover at Los Alamos airport.

This estimate also includes installing a replacement hangar pad for the 5 removed in the main project.

Assumptions:

- The construction area is located above a landfill with solid/hazardous waste. The waste, under the new hangar will be excavated and replaced with clean fill dirt.

- Depth sampling indicates an approximate depth of landfill waste at the location of the hangar at 22' deep. Waste excavation calculations are assumed at 11' deep on average and includes overexcavation.
- Estimate anticipates significant over-excavation to the east will be necessary to safely reach the 22' landfill depth. 33% grade needed to perform a sloped excavation to access the 22' depth.
- Installation of hangar pad will match the 9" slab design in the current as-built package.

- Assume hazardous waste crew and equipment necessary to excavate the waste.

- General Conditions markup: - Los Alamos, historically, is 20% higher than the national average for pricing purposes, especially RS Means' national average calculation (1.2 markup). Productivity markup 80% accordingly.
-2012 MII Cost Book Escalation 3.4% GC HOOH 10% Profit 5% Markup on Subs 2.5% Subs HOOH 10% Profit 5%.

- Class 3 Estimate: using expert judgment and unit pricing. Class 3 estimate accuracy range -20% to +30 % per AACEI). Using -20% and +20%.

- Draft schedule anticipates a 5 month schedule (1.5 month mobilization, 3 month construction, and 1 month project closeout).

- Permitting
- Assume job trailer for General Contractor only. Subs will be brought in for specific work.

- Available fill location is in Espanola NM, 25mi away one-way travel.

- Concrete batch plant in Los Alamos, NM. 10 Mi round trip.

- New Mexico has a tax called NMGRT. Current rate for Los Alamos is 7.135%. Applies to materials, services and equipment.

- Earthwork Conversion factors for Bank CY, Loose CY, and Compact CY are BCY=1.0 LCY=1.25 CCY =.9.

Exclusions:

-Risk analysis and contingency will be analyzed via a separate Risk Analysis Report.

- Asphalt demolition is included in the ET Cover section. No asphalt demolition is covered in the Hangar Pad section

- Drainage to the concrete trench.

- Design and Title III construction services.

- "right-sizing" the hangar pad to the local site constraints. The designed hangar is more conservative than a rough guess at this point. Hangar will likely be similar in foundation and thickness, but may have less area.
- Site contains access to all temporary utilities

- Hazardous waste will be distributed into remaining landfill area.

- No hazardous waste shipments necessary.

Estimated by	Adam Barras
Designed by	
Prepared by	Adam Barras
Preparation Date	3/31/2015
Effective Date of Pricing	3/31/2015
Estimated Construction Time	90 Days

	ProjectCost
Point Estimate	$3,930,000
Range ±20%	$3,144K to $4,716K
General Conditions	144,000
ET Cover	1,950,000
Demolition	520,000
Asphalt Demolition	*265,000*
Concrete Demolition	*232,000*
Storm Drainage System	*15,000*
Utility Poles	*1,000*
Methane Collection System	*8,000*
Site Construction	1,430,000
Rockwork	*85,000*
Site Clearing & Earthwork	*1,350,000*
Hangar Pad	1,835,000
Demolition	840,000
Waste Excavation	*840,000*
Hangar Pad Construction	997,000
Concrete	*151,000*
Asphalt/Paving	*26,000*
Site Clearing & Earthwork	*820,000*

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	ProjectCost
Direct Cost			**939,131.53**	**373,450.19**	**1,585,885.06**	**542,125.00**	**0.00**	**3,928,377.73**
1 General Conditions	**1.0000**	**LS**	**0.00**	**0.00**	**0.00**	**110,000.00**	**0.00**	**144,176.74**
1.1 site specific equipment mobilization	1.0000	LS	0.00	0.00	0.00	50,000.00	0.00	65,534.88
(Note: includes job site trailer, equipment mobilization, job fencing, etc.)								
1.2 Readiness Documentation and review	1.0000	LS	0.00	0.00	0.00	10,000.00	0.00	13,106.98
(Note: Assumed as a basic readiness document, primarily focusing on the Hangar SOW.)								
1.3 Support Personnel and Services	1.0000	LS	0.00	0.00	0.00	50,000.00	0.00	65,534.88
(Note: Includes ES&H, Security, and Waste Specialist services)								
			355,285.3844	*195,006.0099*	*923,191.8000*	*248,125.0000*		*1,949,210.8844*
2 ET Cover	**1.0000**	**EA**	**355,285.38**	**195,006.01**	**923,191.80**	**248,125.00**	**0.00**	**1,949,210.88**
			294,616.3178	*101,270.3452*	*0.0000*	*0.0000*		*518,887.7027*
2.1 Demolition	**1.0000**	**EA**	**294,616.32**	**101,270.35**	**0.00**	**0.00**	**0.00**	**518,887.70**
			147,679.0592	*53,328.8573*	*0.0000*	*0.0000*		*263,460.5957*
2.1.1 Asphalt Demolition	**1.0000**	**EA**	**147,679.06**	**53,328.86**	**0.00**	**0.00**	**0.00**	**263,460.60**
			6.3143	*2.2802*	*0.0000*	*0.0000*		*11.2648*
2.1.1.1 Demolish, remove pavement & curb, remove bituminous pavement, 4" to 6" thick, excludes hauling and disposal fees	23,388.0000	SY	147,679.06	53,328.86	0.00	0.00	0.00	263,460.60
			130,058.9799	*46,966.0141*	*0.0000*	*0.0000*		*232,026.2365*
2.1.2 Concrete Demolition	**1.0000**	**EA**	**130,058.98**	**46,966.01**	**0.00**	**0.00**	**0.00**	**232,026.24**
			110.5004	*39.9032*	*0.0000*	*0.0000*		*197.1336*
2.1.2.1 Demolish, remove pavement & curb, concrete, rod reinforced, 7" to 24" thick, remove with backhoe, excludes hauling	1,177.0000	CY	130,058.98	46,966.01	0.00	0.00	0.00	232,026.24
(Note: Assumed at 6" thick slab. 0)								
			10,425.5650	*917.7868*	*0.0000*	*0.0000*		*14,867.7041*
2.1.3 Storm Drainage System	**1.0000**	**EA**	**10,425.56**	**917.79**	**0.00**	**0.00**	**0.00**	**14,867.70**
			5.2034	*0.0000*	*0.0000*	*0.0000*		*6.8200*
2.1.3.1 Selective demolition, water & sewer piping & fittings, plastic Pipe, 10"-18", diameter, excludes excavation	475.0000	LF	2,471.60	0.00	0.00	0.00	0.00	3,239.52
			10.3919	*1.4296*	*0.0000*	*0.0000*		*15.4945*
2.1.3.2 Selective demolition, water & sewer piping & fittings, concrete pipe end pieces, 15", diameter, excludes excavation	346.0000	LF	3,595.61	494.65	0.00	0.00	0.00	5,361.09
			19.1156	*1.8559*	*0.0000*	*0.0000*		*27.4872*
2.1.3.3 Selective demolition, manholes & catch basins, manhole or catch basin, cast in place, 4'-8' deep, excludes excavation	228.0000	SF	4,358.35	423.14	0.00	0.00	0.00	6,267.09
(Note: 13ct at 5'Lx3.5'W 228SF)								
			569.9277	*57.6868*	*0.0000*	*0.0000*		*822.6129*
2.1.4 Utility Poles	**1.0000**	**EA**	**569.93**	**57.69**	**0.00**	**0.00**	**0.00**	**822.61**
			284.9639	*28.8434*	*0.0000*	*0.0000*		*411.3065*
2.1.4.1 Selective demolition, utility poles & cross arms, utility poles, wood, 20'-30' high	2.0000	EA	569.93	57.69	0.00	0.00	0.00	822.61
			5,882.7859	*0.0000*	*0.0000*	*0.0000*		*7,710.5535*
2.1.5 Methane Collection System	**1.0000**	**EA**	**5,882.79**	**0.00**	**0.00**	**0.00**	**0.00**	**7,710.55**

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	ProjectCost
			2.2300	*0.0000*	*0.0000*	*0.0000*		*2.9229*
2.1.5.1 Selective demolition, water & sewer piping & fittings, plastic Pipe, 3/4" - 4", diameter, excludes excavation	2,638.0000	LF	5,882.79	0.00	0.00	0.00	0.00	7,710.55
			60,669.0666	*93,735.6647*	*923,191.8000*	*248,125.0000*		*1,430,323.1817*
2.2 Site Construction	**1.0000**	**EA**	**60,669.07**	**93,735.66**	**923,191.80**	**248,125.00**	**0.00**	**1,430,323.18**
			16,027.4853	*18,233.5719*	*30,516.3000*	*0.0000*		*84,903.5272*
2.2.1 Rockwork	**1.0000**	**EA**	**16,027.49**	**18,233.57**	**30,516.30**	**0.00**	**0.00**	**84,903.53**
			16,027.4853	*18,233.5719*	*30,516.3000*	*0.0000*		*84,903.5272*
2.2.1.1 Rip Rap Drainage	**1.0000**	**EA**	**16,027.49**	**18,233.57**	**30,516.30**	**0.00**	**0.00**	**84,903.53**
			0.1801	*0.0769*	*0.0000*	*0.0000*		*0.3369*
2.2.1.1.1 Cut drainage ditch, common earth, 30' wide x 1' deep	1,274.0000	LF	229.51	97.92	0.00	0.00	0.00	429.16
			17.5312	*21.0635*	*31.5000*	*0.0000*		*91.8729*
2.2.1.1.2 Rip-rap and rock lining, random, broken stone, machine placed for slope protection	861.0000	LCY	15,094.36	18,135.65	27,121.50	0.00	0.00	79,102.59
(Note: line item used for all rip-rap installations. 10'W=335CY 26'w=354CY CY*1.25=LCY 689*1.25=861)								
			0.3399	*0.0000*	*1.6400*	*0.0000*		*2.5951*
2.2.1.1.3 Geotextile Subsurface Drainage Filtration, fabric, laid in trench, polypropylene, ideal conditions	2,070.0000	SY	703.61	0.00	3,394.80	0.00	0.00	5,371.78
(Note: line item used for all rip-rap installations. 10'W=9060SF 26'w=9568SF 18628/9=2070SY)								
			44,641.5814	*75,502.0928*	*892,675.5000*	*248,125.0000*		*1,345,419.6545*
2.2.2 Site Clearing & Earthwork	**1.0000**	**EA**	**44,641.58**	**75,502.09**	**892,675.50**	**248,125.00**	**0.00**	**1,345,419.65**
			44,641.5814	*75,502.0928*	*892,675.5000*	*248,125.0000*		*1,345,419.6545*
2.2.2.1 Fill Dirt and ET Cover	**1.0000**	**EA**	**44,641.58**	**75,502.09**	**892,675.50**	**248,125.00**	**0.00**	**1,345,419.65**
			0.0000	*0.0000*	*20.0000*	*0.0000*		*20.6800*
2.2.2.1.1 Soils for earthwork, common borrow, spread with 200 H.P. dozer, includes load at pit and haul, 2 miles round trip, excludes compaction	39,700.0000	CY	0.00	0.00	794,000.00	0.00	0.00	820,996.00
(Note: Using LCY calc 1.25 x BCY. current quote from transit mix company $20/cy 24472+4858+2429/27=31579*1.25=39698 DWYER Package = Surface area= 234231SF)								
			0.0000	*0.0000*	*0.0000*	*125.0000*		*129.2500*
2.2.2.1.2 Soil Delivery 20Cy per truck 20000 ecy/20 (Note: 39700/20=1985 truckfulls quoted $125 per delivery)	1,985.0000	EA	0.00	0.00	0.00	248,125.00	0.00	256,561.25
			1.0222	*1.7289*	*0.0000*	*0.0000*		*3.3678*
2.2.2.1.3 Backfill, bulk, 6" to 12" lifts, dozer backfilling, compaction with vibrating roller	43,670.0000	ECY	44,641.58	75,502.09	0.00	0.00	0.00	147,071.09
(Note: ECCY=CCY 39700*.9=35730 43670)								
			0.0000	*0.0000*	*19.2500*	*0.0000*		*23.5644*
2.2.2.1.4 Aggregate, stone, 3/4" to 1-1/2", prices per ton, includes material only	5,126.0000	TON	0.00	0.00	98,675.50	0.00	0.00	120,791.32
(Note: 4859 CY total coverage for ET Cover. 50/50 mix soil and aggregate. 2430CY aggregate 2.11 multiplication factor to tons 2430*2.11)								
			583,846.1445	*178,444.1851*	*662,693.2600*	*184,000.0000*		*1,834,990.1133*
3 Hangar	**1.0000**	**EA**	**583,846.14**	**178,444.19**	**662,693.26**	**184,000.00**	**0.00**	**1,834,990.11**
			27.0437	*6.9617*	*2.3828*	*0.0000*		*44.5438*
3.1 Demolition	**18,843.0000**	**BCY**	**509,584.25**	**131,178.43**	**44,900.00**	**0.00**	**0.00**	**839,338.04**

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	ProjectCost
			509,584.2542	*131,178.4317*	*44,900.0000*	*0.0000*		*839,338.0353*
3.1.1 Waste Excavation	**1.0000**	**EA**	**509,584.25**	**131,178.43**	**44,900.00**	**0.00**	**0.00**	**839,338.04**
			20.7553	*8.2886*	*1.6700*	*0.0000*		*37.5976*
3.1.1.1 Containment of hazardous waste,secure burial cell, excavation of contaminated soil & waste, 3/4 C. Y. excavator, to 10 feet deep, incl. 4 suits & resp./day/worker	10,000.0000	BCY	207,552.54	82,885.94	16,700.00	0.00	0.00	375,976.42
(Note: Includes Slope and main area excavation. Assume 5% hand digging 23696CY total excavation. 23969*.95=22511CY Hand Excav - 23969*.05=1198CY)								
			196.7335	*0.0000*	*17.7500*	*0.0000*		*262.5550*
3.1.1.2 Containment of hazardous waste,secure burial cell, excavation of contaminated soil & waste, by hand, 6 - 12 feet deep, incl. 4 suits & resp./day/worker	1,200.0000	BCY	236,080.22	0.00	21,300.00	0.00	0.00	315,066.01
(Note: Includes Slope and main area excavation. Assume 5% hand digging 23696CY total excavation. 23969*.95=22511CY Hand Excav - 23969*.05=1198CY)								
			4.3968	*3.2195*	*0.4600*	*0.0000*		*9.8864*
3.1.1.3 Containment of hazardous waste,secure burial cell, move contaminated soil & waste on-site, 2.5 C.Y. loader, 300 feet, incl. 4 suits & resp./day/worker	15,000.0000	LCY	65,951.50	48,292.49	6,900.00	0.00	0.00	148,295.61
(Note: spread waste in landfill to the east of excavation. (22511CY + 1198CY for hand and excavator) 24894*1.25=31117)								
			74,261.8902	*47,265.7534*	*617,793.2600*	*184,000.0000*		*995,652.0780*
3.2 Hangar Construction	**1.0000**	**EA**	**74,261.89**	**47,265.75**	**617,793.26**	**184,000.00**	**0.00**	**995,652.08**
			3.6182	*0.0957*	*6.1807*	*0.0000*		*12.1123*
3.2.1 Concrete	**12,427.0000**	**SF**	**44,963.59**	**1,189.66**	**76,807.76**	**0.00**	**0.00**	**150,519.86**
			831.1458	*87.4580*	*620.0000*	*0.0000*		*1,883.4461*
3.2.1.1 Structural concrete, in place, column (4000 psi), square, max reinforcing, 36" x 36", includes forms(4 uses), reinforcing steel, concrete, placing and finishing	11.0000	CY	9,142.60	962.04	6,820.00	0.00	0.00	20,717.91
(Note: design calls for 6'x6' spread footings.)								
			1.8285	*0.0135*	*3.8800*	*0.0000*		*7.0044*
3.2.1.2 Structural concrete, in place, slab on grade (3500 psi), over 10000 S.F., 12" thick, includes concrete, placing and finishing, excludes forms and reinforcing	12,427.0000	SF	22,722.87	167.27	48,216.76	0.00	0.00	87,043.86
			106.4887	*0.4907*	*177.0000*	*0.0000*		*347.6267*
3.2.1.3 Structural concrete, in place, spread footing (3000 psi), over 5 C.Y., includes forms, reinforcing steel, concrete, placing and finishing	94.0000	CY	10,009.94	46.12	16,638.00	0.00	0.00	32,676.91
(Note: turndown slab design. 508LF -)								
			106.4887	*0.4907*	*177.0000*	*0.0000*		*347.6267*
3.2.1.4 Drainage trench	29.0000	CY	3,088.17	14.23	5,133.00	0.00	0.00	10,081.17
(Note: use 0330534003850 for drainage trench detail.)								
			2,808.7855	*1,274.4976*	*16,985.5000*	*0.0000*		*25,790.8609*
3.2.2 Asphalt/Paving	**1.0000**	**EA**	**2,808.79**	**1,274.50**	**16,985.50**	**0.00**	**0.00**	**25,790.86**
			0.3489	*0.1583*	*2.1100*	*0.0000*		*3.2038*
3.2.2.1 Asphaltic concrete, parking lots & driveways, 6" stone base, 2" binder course, 2" topping, no asphalt hauling included	8,050.0000	SF	2,808.79	1,274.50	16,985.50	0.00	0.00	25,790.86
(Note: 50'Wx161'L asphalt vehicle access)								

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	ProjectCost
			1.2652	*2.1398*	*25.0275*	*8.7883*		*39.1337*
3.2.3 Site Clearing & Earthwork	**20,937.0000**	**ECY**	**26,489.52**	**44,801.60**	**524,000.00**	**184,000.00**	**0.00**	**819,341.36**
			26,489.5191	*44,801.5968*	*524,000.0000*	*184,000.0000*		*819,341.3619*
3.2.3.1 Fill Dirt	**1.0000**	**EA**	**26,489.52**	**44,801.60**	**524,000.00**	**184,000.00**	**0.00**	**819,341.36**
			1.0222	*1.7289*	*0.0000*	*0.0000*		*3.3678*
3.2.3.1.1 Backfill, bulk, 6" to 12" lifts, dozer backfilling, compaction with vibrating roller	25,913.0000	ECY	26,489.52	44,801.60	0.00	0.00	0.00	87,269.36
(Note: ECY = CCY ratio BCY=1.0 CCy = .9)								
			0.0000	*0.0000*	*20.0000*	*0.0000*		*20.6800*
3.2.3.1.2 Soils for earthwork, common borrow, spread with 200 H.P. dozer, includes load at pit and haul, 2 miles round trip, excludes compaction	26,200.0000	CY	0.00	0.00	524,000.00	0.00	0.00	541,816.00
(Note: 23557CY deduct -2606 worth of dirt from ET Cover Scope for installation of Hangar area. 20951CY*1.25=26188LCY)								
			0.0000	*0.0000*	*0.0000*	*125.0000*		*129.2500*
3.2.3.1.3 Soil Delivery 20Cy per truck 20000 ecy/20	1,472.0000	EA	0.00	0.00	0.00	184,000.00	0.00	190,256.00

July 2015

COVER SOIL BORROW INVESTIGATION

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
Stephen F Dwyer, PhD, PE
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505)270-0215

Revision 01

EXECUTIVE SUMMARY

This Cover Soil Borrow Investigation was performed to ensure an adequate quality and quantity of soil was available to construct the Evapotranspiration (ET) Cover at the Los Alamos County Airport Landfill. Multiple borrow sources were investigated including soil from two sources in Espanola, NM (Espanola Transit and DDT), a private land owner in Alcalde, NM just north of Espanola, and two federally owned borrow sources in Los Alamos, NM.

Background information for the Airport Landfill project is provided in the ET Cover Design Report, Los Alamos County Airport Landfill (Dwyer Engineering 2015) and Pre-Design Work Plan for the Los Alamos County Airport Landfill (Dwyer Engineering 2014).

TABLE OF CONTENTS

1.0 Scope of Document 3
1.1 Soil Testing 3
1.3 Soil Test Results 4
2.0 References 8
APPENDIX 9

TABLES

Table 1. SOIL PHYSICAL PROPERTY TESTS 3
Table 2. Soil Testing Results 5
Table 3. Soil Hydraulic Property Testing Results 7

1.0 Scope of Document

Multiple soil borrow sources were investigated to determine the quality of soil for use as a cover soil and the available quantity of soil. The sources investigated include:

1. Espanola Transit, Española, NM
2. DDT, Espanola, NM
3. Private land owner, Alcalde, NM
4. Borrow Source @ LANS, Los Alamos, NM
5. Borrow Source near TA54, Los Alamos, NM

Within the Espanola Transit source; there were three soil textures investigated, as well as, a number of soil blend combinations. There was also multiple soil textures investigated at the Alcalde, NM site.

1.1 Soil Testing

The soils were tested by a soil laboratory in Albuquerque, NM. The soils were initially investigated for the grain size distribution including clay content. Soils that were found to be a good match as a cover soil were then tested for their hydraulic properties. Table 1 presents testing standards applied.

Table 1. SOIL PHYSICAL PROPERTY TESTS

SOIL PHYSICAL PROPERTY TESTS	
Property	**Test Method**
Dry bulk density	ASTM D7263
Particle size analysis (wet)	ASTM D422 Standard sieves, wash, hydrometer
Saturated hydraulic property	ASTM D2434M or ASTM D5084
Moisture characteristic curve	ASTM D6836/ ASTM D6836M/ MOSA[1] Chp.26
Standard Proctor	ASTM D698
Calculated total porosity	ASTM D7263
Calculated unsaturated hydraulic conductivity	ASTM D6836; van Genuchten 1980[2]/ van Genuchten, et. al. 1991[3]
Soil classification	ASTM D2487
Laboratory Compaction Characteristics of Soil Using Standard Effort	ASTM D698

[1] Methods of Soil Analysis, Part 1. 1986. A. Klute, ed. American Society of Agronomy, Madison, WI

[2] van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898

[3] van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

1.3 Soil Test Results

Table 2 presents a summary of the grain size distribution testing performed, as well as, any proctor results. Table 3 presents a summary of hydraulic properties from sources that served as potential cover soil material. All hydraulic property testing was performed by an EPA certified laboratory in Albuquerque, NM.

Table 3 also presents a summary of the unsaturated flow modeling performed utilizing the listed soil as the bottom foot of soil in a three foot thick soil profile.

The appendix contains the available soil tests results for the applicable laboratories performing the testing.

Table 2. Soil Testing Results

Sample	Date	Available Volume of Soil	Company Testing	Proctor		Grain Size Distribution				
				Maximum Dry Density (pcf)	Optimum Moisture Content (%)	gravel	sand	silt	clay	% fines
Espanola Transit overburden fill	6/12/2013	Greater than 25,000 cy	Espanola Transit	128	9	27	49.3			23.7
DDT fill	11/13/2014	Greater than 25,000 cy	DBS&A	131.04	7.9	33.6	43	17.8	5.6	23.4
Espanola Transit overburden fill	11/13/2014	Greater than 25,000 cy	DBS&A	121.68	10.6	8.5	61.4	24.1	6	30.1
Espanola Transit Clay fill	1/8/2015	6000 tons	Espanola Transit			7	31.5			61.5
Espanola Transit Silt Processed	1/8/2015	10,000 tons	Espanola Transit			1	43.2			55.8
Espanola Transit overburden fill	1/29/2015	Greater than 25,000 cy	DBS&A			12	57.3	23.2	7.5	30.7
Espanola Transit Clay fill	1/29/2015	6000 tons	DBS&A			11.4	24	30.2	34.3	64.5
Espanola Transit Silt Processed	1/29/2015	10,000 tons	DBS&A			0.5	48.4	41.9	9.2	51.1
Alcalde Clay	2/25/2015	4840 cy	DBS&A			0.5	55.9	23.7	19.8	43.5
Alcalde Clay Loam	2/25/2015	Greater than 25,000 cy	DBS&A			26.3	43.7	16.6	13.4	30
Alcalde Rocky Loam	2/25/2015	5000 cy	DBS&A			44.6	39.2	12.2	4	16.2
Los Alamos Borrow	2/25/2015	5133 cy	DBS&A			17.8	38.9	35.1	8.3	43.4
Espanola Transit overburden fill	3/19/2015	Greater than 25,000 cy	DBS&A			12	57.3	23.2	7.5	30.7
Espanola Transit Clay fill	3/19/2015	6000 tons	DBS&A			11.4	24	30.2	34.3	64.5
Espanola Transit Silt Processed	3/19/2015	10,000	DBS&A			0.5	48.4	41.9	9.2	51.1

Sample	Date	Available Volume of Soil	Company Testing	Proctor		Grain Size Distribution				
				Maximum Dry Density (pcf)	Optimum Moisture Content (%)	gravel	sand	silt	clay	% fines
		tons								
Española Transit: Mix 50% Overburden 50% Clay	3/19/2015	See above	DBS&A	120.432	11.1	11.3	48.2	26.4	14.1	40.5
Española Transit: Mix 70% Overburden 30% Clay	3/19/2015	See above	DBS&A	124.176	10.8	11	53	25.5	10.4	35.9
Española Transit: Mix 50% Overburden 50% Silt	3/19/2015	See above	DBS&A	121.056	10.4	5.6	59.5	28.9	6	34.9
Los Alamos Borrow TA 54 (RANT)	4/8/15	10,000 cy	DBS&A			22.5	45.1	27.8	4.6	32.4
Los Alamos - Sigma Mesa 3 piles	2/10/15		Kleinfelder							
TW-052	2/10/15	2,000 cy	Kleinfelder			6	35.6			58.4
TW-053	2/10/15	2,000 cy	Kleinfelder			3	27.8			69.2
TW-054	2/10/15	2,000 cy	Kleinfelder			11	30.8			58.2

Table 3. Soil Hydraulic Property Testing Results

Sample	Classification	Ksat (cm/sec)	oversize corrected	van Genuchten				oversize corrected		Modeling Summary: Annual Flux @ 3ft depth (cm/yr)	
			Ksat (cm/sec)	Theta S	Theta R	alpha	n	Theta S	Theta R	Average Year	Wettest Year
DDT fill	Sandy Loam	1.20E-03	9.30E-04	35.13%	2.71%	0.0351	1.2752	28.80%	2.22%	0	4.1
Espanola Transit overburden fill	Loamy Sand	9.40E-04	8.60E-04	37.23%	6.50%	0.0076	1.8637	35.13%	6.13%	0.3	6.4
Española Transit: Mix 50% Overburden 50% Clay	Sandy Loam	2.70E-06	2.40E-06	35.85%	0.00%	0.0055	1.2128	33.17%	0.00%	0	0
Española Transit: Mix 70% Overburden 30% Clay	Sandy Loam	9.40E-06	8.30E-06	34.88%	0.00%	0.0077	1.2147	32.26%	0.00%	0	0.05
Española Transit: Mix 50% Overburden 50% Silt	Sandy Loam	4.90E-04	4.60E-04	36.67%	3.53%	0.0171	1.3946	35.32%	34.00%	0.01	4

2.0 References

1. Dwyer Engineering. 2014. Pre-Design Work Plan Los Alamos County Airport Landfill. DOE document no. COR-EPO-9, 18, 214-5941000, dated September 2014.
2. Dwyer Engineering. 2015. ET Cover Design Report. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.

APPENDIX

ESPANOLA TRANSIT MIX, LLC

READY-MIX CONCRETE - SAND - GRAVEL

P.O. BOX 38 ESPANOLA, NEW MEXICO 87532
PHONE (505) 753-2176 FAX (505) 753-2490
E-MAIL espanolatransit@rpcceo.com

Date of Report **6-13-13**

Project
Contractor
Type / Use of Material **OVERBURDEN**
Sample Source / Location

Location
Arch. / Engr.

Sampled/Submitted By **John R Peabody** Date **6-12-13**
TTCP#227817

Reference:
Special Instructions:

PHYSICAL PROPERTIES OF AGGREGATES

TEST RESULTS

SIEVE ANALYSIS ☐ ASTM C136 ☒ AASHTO T27		
SIEVE SIZE	ACCUMULATIVE % PASSING	SPECIFICATION
4 IN.		
2	**100**	
1 1/2	**95**	
1 1/8		
1	**88**	
3/4	**86**	
1/2	**80**	
3/8	**78**	
NO. 4	**73**	
8	**70**	
10	**69**	
16	**67**	
30	**63**	
40	**58**	
50	**52**	
100	**36**	
200	**23.7**	
FINER THAN NO 200 ☐ ASTM C117 ☐ AASHTO T11		
FINENESS MODULUS, ASTM C125 →		

LIQUID & PLASTIC PROPERTIES ☐ ASTM D4318 ☐ AASHTO T89 & T90		
METHOD ☐ A ☐ B	RESULT	SPECIFICATION
LIQUID LIMIT		
PLASTIC LIMIT		
PLASTICITY INDEX		
SAMPLE AIR DRIED: ☐ YES ☐ NO		
CLEANNESS VALUE C A227 →		
ORGANIC IMPURITIES ☐ ASTM C40 ☐ AASHTO T21		
ORGANIC PLANT NO. →	3 MAX	

PHYSICAL PROPERTIES			TEST RESULTS	SPECIFICATION
UNIT WEIGHT & VOIDS ☐ ASTM C29 ☐ AASHTO T19 ☐ RODDING ☐ JIGGING ☐ LOOSE	FINE AGGREGATE	UNIT WEIGHT, PCF → VOIDS, % →		
	COARSE AGGREGATE	UNIT WEIGHT, PCF → VOIDS % →		
SPECIFIC GRAVITY & ABSORPTION	FINE AGGREGATE ☐ ASTM C128 ☐ AASHTO T84 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
	COARSE AGGREGATE ☐ ASTM C127 ☐ AASHTO T85 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
SAND EQUIVALENT VALUE ☐ ASTM D2419 ☐ AASHTO T176		% →		
RESISTANCE TO DEGRADATION	SMALL COARSE AGGREGATE ☐ ASTM C131 ☐ AASHTO T96 GRADING	100 REV., % LOSS → 500 REV., % LOSS →		
	LARGE COARSE AGGREGATE ☐ ASTM C535 GRADING	200 REV., % LOSS → 1000 REV., % LOSS →		
LIGHTWEIGHT PIECES ☐ ASTM C123 ☐ AASHTO T113		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES ☐ ASTM C142 ☐ AASHTO T112		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
FRACTURED FACES COARSE AGGREGATE BY WEIGHT ☐ NMDOT FF-1 ☐ FLH T507 ☐ FAA		ONE OR MORE FACES, % → TWO OR MORE FACES, % →		
DURABILITY INDEX ☐ ASTM D3744 ☐ AASHTO T210		D_c →		
PROCEDURE: A ☐ COARSE B ☐ FINE C ☐ COARSE & FINE		D_f →		
UNCOMPACTED VOID CONTENT ☐ AZ 247 ☐ ASTM C1252 METHOD		% →		

Comments:

Copies To:

ESPANOLA TRANSIT MIX LLC

6-12-13 OVERBURDEN

SIEVE	Wt. Ret.	% Ret.	% Pass	Specs.		
4"		0.0000	100			
3"		0	100		WBW-W	
2 1/2"		0	100		WBW-D	3056.8
2"	0	0	100		WAW	
1 1/2"	138	4.5	95			
1"	353.4	11.6	88		% Moist.	#DIV/0!
3/4"	422.4	13.8	86			
1/2"	598.9	19.6	80			
3/8"	674.4	22.1	78			
#4	829.2	27.1	73			
#8	928	30.4	70			
#10	949.2	31.1	69			
#16	1013.8	33.2	67			
#30	1129.6	37.0	63			
#40	1270.2	41.6	58			
#50	1476.8	48.3	52			
#100	1951.2	63.8	36			
#200	2332.5	76.3	23.7			
Pass	2452.2	#DIV/0!				

MOISTURE-DENSITY RELATIONS OF SOIL

AASHTO T-99-10 METHOD C

ESPANOLA TRASIT MIX LLC

DATE 6/12/2013 MATERIAL OVERBURDEN

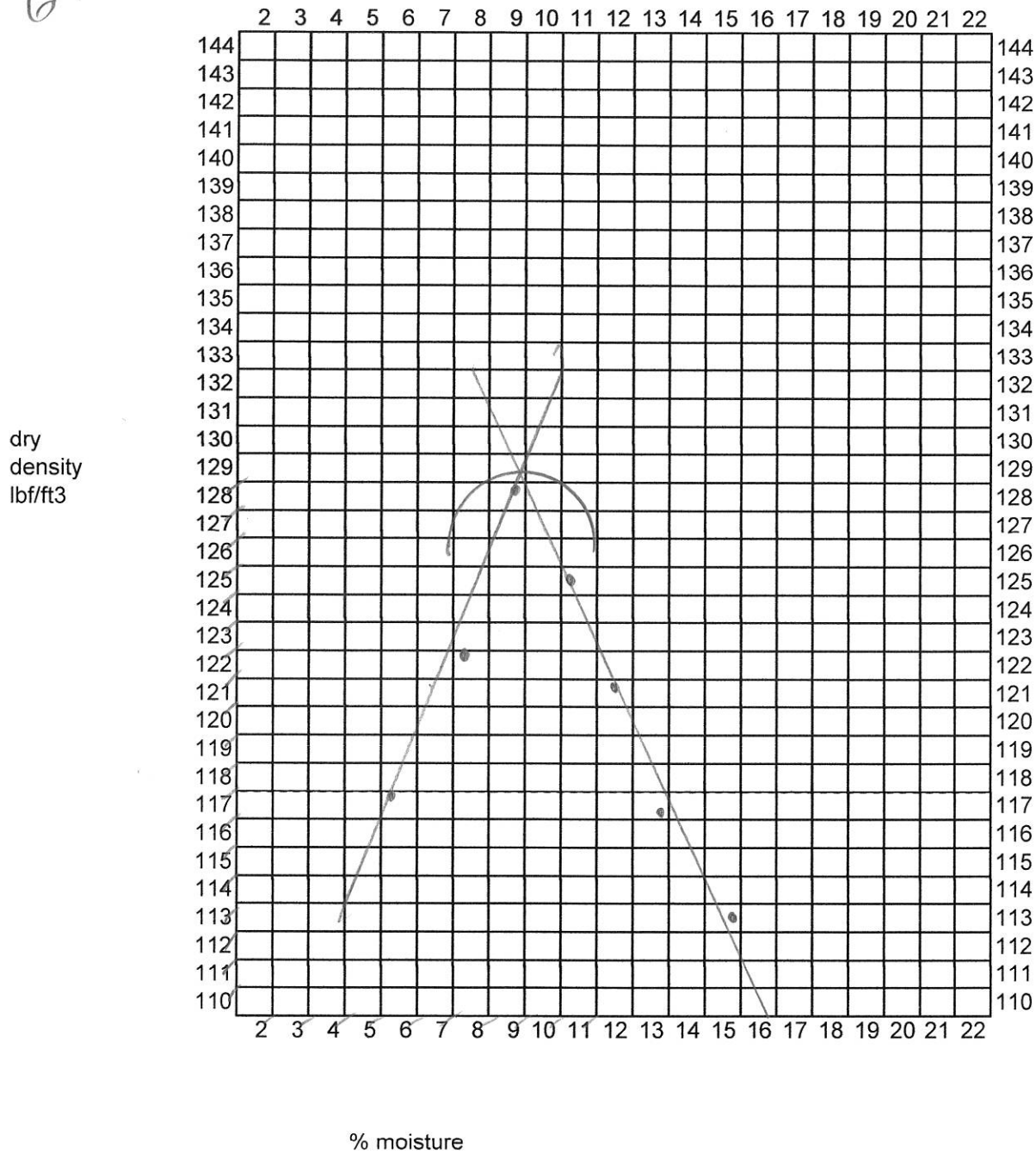
MOLD WEIGHT: 4218.6

	1	2	3	4	5	6	7
WATER IN CC	50	100	150	200	250	300	350
A:SAMPLE+MOLD G.	6083.8	6197.8	6323.3	6310.9	6259.7	6207.3	6178.8
B: WET SAMPLE G.	1865.2	1979.2	2104.7	2092.3	2041.1	1988.7	1960.2
C:WET SAMPLE LBS	4.103	4.354	4.630	4.603	4.490	4.375	4.31244
D: WET DENSITY LBS/FT3	123.1	130.6	138.9	138.1	134.7	131.3	129.4
E: MOISTURE SAMPLE WET G.	537.2	647.7	698.3	564.7	586.3	686.2	521.8
F: MOISTURE SAMPLE DRY G.	508.7	600.6	637.4	507.7	519	598.1	443.9
G: WEIGHT OF WATER	28.5	47.1	60.9	57	67.3	88.1	77.9
H: MOIST URE %	5.3	7.3	8.7	10.1	11.5	12.8	14.9
I: DRY DENSITY LBF/FT3	116.9	121.8	127.8	125.4	120.8	116.3	112.6

MAXIMUM DENSITY LBF/FT3	128
OPTIMUM MOISTER CONTENT	9

B= A-MOLD
C= Bx.0022
D= Cx30
G= E-F
H= G/Ex100
I= D/(H+100)x100

6'12 - overburden



128 @ 9%

ESPANOLA TRANSIT MIX, LLC

READY-MIX CONCRETE - SAND - GRAVEL

P.O. BOX 38 ESPANOLA, NEW MEXICO 87532
PHONE (505) 753-2176 FAX (505) 753-2490
E-MAIL espanolatransit@rpcceo.com

Date of Report **1-8-15**

Project
Contractor
Type / Use of Material **CLAY**
Sample Source / Location

Location
Arch. / Engr.

Sampled/Submitted By **John R Peabody** Date **1-6-15**
TTCP#227817

Reference:
Special Instructions:

PHYSICAL PROPERTIES OF AGGREGATES

TEST RESULTS

SIEVE ANALYSIS
☒ ASTM C136 ☐ AASHTO T27

SIEVE SIZE	ACCUMULATIVE % PASSING	SPECIFICATION
4 IN.		
2		
1 1/2		
1 1/8		
1	**100**	
3/4	**100**	
1/2	**98**	
3/8	**97**	
NO. 4	**93**	
8	**91**	
10	**90**	
16	**88**	
30	**85**	
40	**83**	
50	**79**	
100	**71**	
200	**61.5**	
FINER THAN NO 200 ☐ ASTM C117 ☐ AASHTO T11		

FINENESS MODULUS, ASTM C125 →

LIQUID & PLASTIC PROPERTIES
☒ ASTM D4318 ☐ AASHTO T89 & T90

METHOD ☒ A ☐ B	RESULT	SPECIFICATION
LIQUID LIMIT	**14**	
PLASTIC LIMIT	**4**	
PLASTICITY INDEX	**10**	

SAMPLE AIR DRIED: ☐ YES ☒ NO

CLEANNESS VALUE C A227 →

ORGANIC IMPURITIES ☐ ASTM C40 ☐ AASHTO T21
ORGANIC PLANT NO. → 3 MAX

PHYSICAL PROPERTIES			TEST RESULTS	SPECIFICATION
UNIT WEIGHT & VOIDS ☐ ASTM C29 ☐ AASHTO T19 ☐ RODDING ☐ JIGGING ☐ LOOSE	FINE AGGREGATE COARSE AGGREGATE	UNIT WEIGHT, PCF → VOIDS, % → UNIT WEIGHT, PCF → VOIDS % →		
SPECIFIC GRAVITY & ABSORPTION	FINE AGGREGATE ☐ ASTM C128 ☐ AASHTO T84 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
	COARSE AGGREGATE ☐ ASTM C127 ☐ AASHTO T85 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
SAND EQUIVALENT VALUE ☐ ASTM D2419 ☐ AASHTO T176		% →		
RESISTANCE TO DEGRADATION	SMALL COARSE AGGREGATE ☐ ASTM C131 ☐ AASHTO T96 GRADING	100 REV., % LOSS → 500 REV., % LOSS →		
	LARGE COARSE AGGREGATE ☐ ASTM C535 GRADING	200 REV., % LOSS → 1000 REV., % LOSS →		
LIGHTWEIGHT PIECES ☐ ASTM C123 ☐ AASHTO T113		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES ☐ ASTM C142 ☐ AASHTO T112		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
FRACTURED FACES COARSE AGGREGATE BY WEIGHT ☐ NMDOT FF-1 ☐ FLH T507 ☐ FAA		ONE OR MORE FACES, % → TWO OR MORE FACES, % →		
DURABILITY INDEX ☐ ASTM D3744 ☐ AASHTO T210 PROCEDURE: A ☐ COARSE B ☐ FINE C ☐ COARSE & FINE		D_c → D_f →		
UNCOMPACTED VOID CONTENT ☐ AZ 247 ☐ ASTM C1252 METHOD		% →		

Comments:

Copies To:

ESPANOLA TRANSIT MIX LLC

1-7-15 CLAY STOCK PILE

SIEVE	Wt. Ret.	% Ret.	% Pass	Specs.		
4"		0.0000	100			
3"		0	100		WBW-W	
2 1/2"		0	100		WBW-D	3450.1
2"		0	100		WAW	
1 1/2"		0	100			
1"	0	0	100		% Moist.	#DIV/0!
3/4"	0	0.0	100			
1/2"	80.2	2.3	98			
3/8"	109.3	3.2	97			
#4	229.5	6.7	93			
#8	314.5	9.1	91			
#10	334.5	9.7	90			
#16	399.4	11.6	88			
#30	500.9	14.5	85			
#40	601.9	17.4	83			
#50	715.6	20.7	79			
#100	994.2	28.8	71			
#200	1330	38.5	61.5			
Pass	1365.6	#DIV/0!				

LL- 14
PL- 4
PI- 10

ESPANOLA TRANSIT MIX, LLC

READY-MIX CONCRETE - SAND - GRAVEL

P.O. BOX 38 ESPANOLA, NEW MEXICO 87532
PHONE (505) 753-2176 FAX (505) 753-2490
E-MAIL espanolatransit@rpcceo.com

Date of Report **1-8-15**

Project
Contractor
Type / Use of Material **SILT**
Sample Source / Location

Location
Arch. / Engr.

Sampled/Submitted By **John R Peabody** Date **1-7-14**
TTCP#227817

Reference:
Special Instructions:

PHYSICAL PROPERTIES OF AGGREGATES

TEST RESULTS

SIEVE ANALYSIS
☒ ASTM C136 ☐ AASHTO T27

SIEVE SIZE	ACCUMULATIVE % PASSING	SPECIFICATION
4 IN.		
2		
1 1/2		
1 1/8		
1	**100**	
3/4	**99**	
1/2	**99**	
3/8	**99**	
NO. 4	**98**	
8	**98**	
10	**98**	
16	**97**	
30	**97**	
40	**96**	
50	**95**	
100	**85**	
200	**55.8**	
FINER THAN NO 200 ☐ASTM C117 ☐AASHTO T11		

FINENESS MODULUS, ASTM C125 →

LIQUID & PLASTIC PROPERTIES
☒ ASTM D4318 ☐ AASHTO T89 & T90

METHOD ☐A ☒B	RESULT	SPECIFICATION
LIQUID LIMIT	**9**	
PLASTIC LIMIT	**5**	
PLASTICITY INDEX	**4**	

SAMPLE AIR DRIED: ☐ YES ☒ NO

CLEANNESS VALUE C A227 →

ORGANIC IMPURITIES ☐ ASTM C40 ☐ AASHTO T21
ORGANIC PLANT NO. → 3 MAX

PHYSICAL PROPERTIES			TEST RESULTS	SPECIFICATION
UNIT WEIGHT & VOIDS ☐ ASTM C29 ☐ AASHTO T19 ☐ RODDING ☐ JIGGING ☐ LOOSE	FINE AGGREGATE COARSE AGGREGATE	UNIT WEIGHT, PCF → VOIDS, % → UNIT WEIGHT, PCF → VOIDS % →		
SPECIFIC GRAVITY & ABSORPTION	FINE AGGREGATE ☐ ASTM C128 ☐ AASHTO T84 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
	COARSE AGGREGATE ☐ ASTM C127 ☐ AASHTO T85 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
SAND EQUIVALENT VALUE ☐ ASTM D2419 ☐ AASHTO T176		% →		
RESISTANCE TO DEGRADATION	SMALL COARSE AGGREGATE ☐ ASTM C131 ☐ AASHTO T96 GRADING	100 REV., % LOSS → 500 REV., % LOSS →		
	LARGE COARSE AGGREGATE ☐ ASTM C535 GRADING	200 REV., % LOSS → 1000 REV., % LOSS →		
LIGHTWEIGHT PIECES ☐ ASTM C123 ☐ AASHTO T113		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES ☐ ASTM C142 ☐ AASHTO T112		FINE AGGREGATE, % → COARSE AGGREGATE, % →		
FRACTURED FACES COARSE AGGREGATE BY WEIGHT ☐ NMDOT FF-1 ☐ FLH T507 ☐ FAA		ONE OR MORE FACES, % → TWO OR MORE FACES, % →		
DURABILITY INDEX ☐ ASTM D3744 ☐ AASHTO T210 PROCEDURE: A ☐ COARSE B ☐ FINE C ☐ COARSE & FINE		D_c → D_f →		
UNCOMPACTED VOID CONTENT ☐ AZ 247 ☐ ASTM C1252 METHOD		% →		

Comments:

Copies To:

ESPANOLA TRANSIT MIX LLC

1-7-14 SILT

SIEVE	Wt. Ret.	% Ret.	% Pass	Specs.		
4"		0.0000	100			
3"		0	100		**WBW-W**	
2 1/2"		0	100		**WBW-D**	1922.5
2"		0	100		**WAW**	
1 1/2"		0	100			
1"	0	0	100		**% Moist.**	#DIV/0!
3/4"	19.1	1.0	99			
1/2"	22.6	1.2	99			
3/8"	25	1.3	99			
#4	32.5	1.7	98			
#8	44.2	2.3	98			
#10	46.3	2.4	98			
#16	52.5	2.7	97			
#30	63	3.3	97			
#40	73.8	3.8	96			
#50	91.4	4.8	95			
#100	284.3	14.8	85			
#200	849.2	44.2	55.8			
Pass	1051.2	#DIV/0!				

LL- 9
PL- 5
PI -4

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
LA54																X	X					

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
LA54	0.0098	0.51	1.0	102	0.42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
LA54	22.5	45.1	27.8	4.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
LA54	0.0098	0.51	1.0	102	0.42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
LA54	22.5	45.1	27.8	4.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA54
Ring Number: NA
Depth: NA

Test Date: 8-Apr-15

Initial Dry Weight of Sample (g): 19348.27
Weight Passing #4 (g): 14997.34
Weight Retained #4 (g): 4350.93
Weight of Hydrometer Sample (g): 88.63
Calculated Weight of Sieve Sample (g): 114.34

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	19348.27	100.00
	2"	50	151.31	151.31	19196.96	99.22
	1.5"	38.1	147.28	298.59	19049.68	98.46
	1"	25	288.42	587.01	18761.26	96.97
	3/4"	19.0	569.04	1156.05	18192.22	94.03
	3/8"	9.5	1988.86	3144.91	16203.36	83.75
	4	4.75	1206.02	4350.93	14997.34	77.51
-4			(Based on calculated sieve wt.)			
	10	2.00	8.86	34.57	79.77	69.76
	20	0.85	14.07	48.64	65.70	57.46
	40	0.425	11.52	60.16	54.18	47.38
	60	0.250	6.55	66.71	47.63	41.66
	140	0.106	8.04	74.75	39.59	34.62
	200	0.075	2.57	77.32	37.02	32.38
	dry pan		0.21	77.53	36.81	
	wet pan			36.81	0.00	

d_{10} (mm): 0.0098 d_{50} (mm): 0.51
d_{16} (mm): 0.019 d_{60} (mm): 1.0
d_{30} (mm): 0.064 d_{84} (mm): 9.7

Median Particle Diameter --d_{50} (mm): 0.51
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 102
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.42
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 3.4

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA54
Ring Number: NA
Depth: NA

Test Date: 6-Apr-15
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

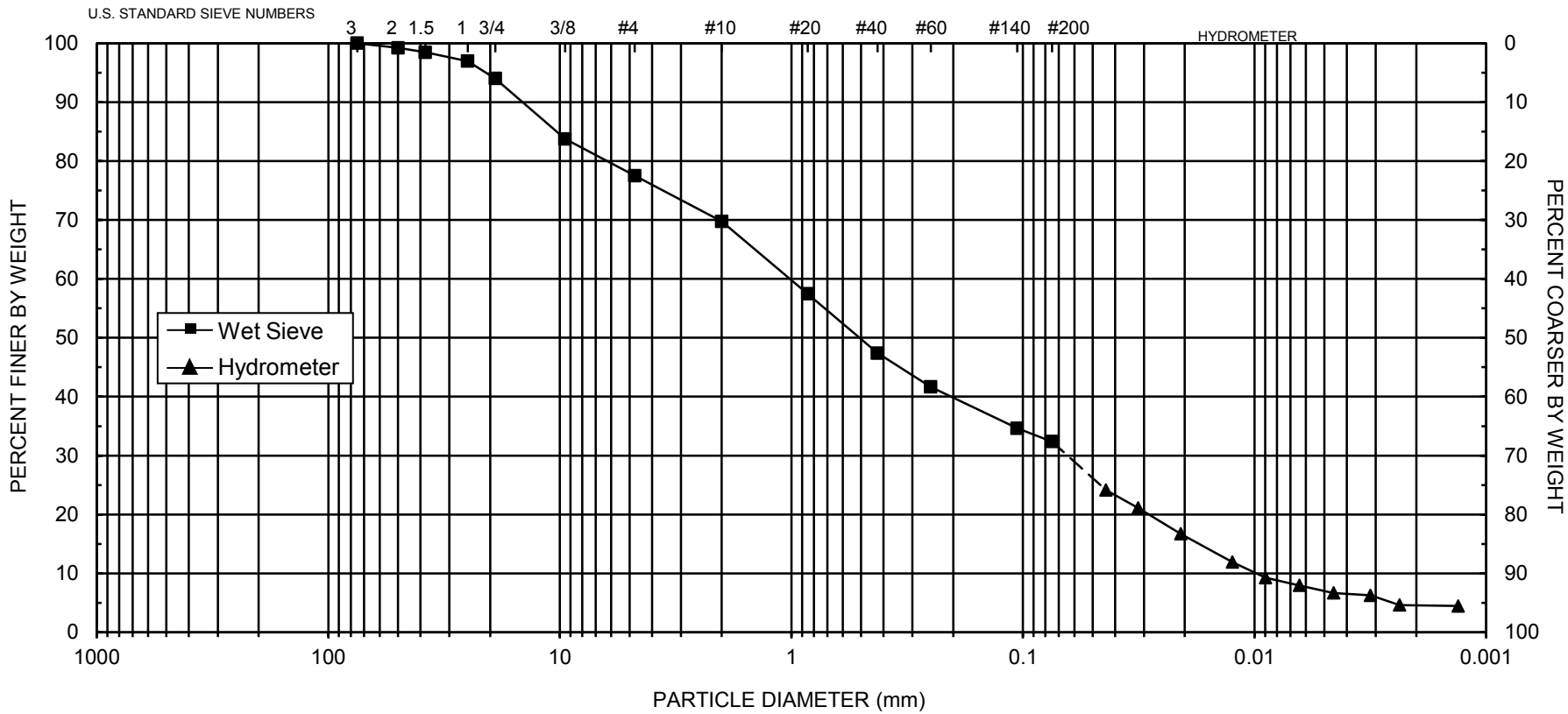
Initial Wt. (g)*:* 88.63
Total Sample Wt. (g)*:* 19348.27
Wt. Passing #4 (g): 14997.34

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
6-Apr-15	1	21.9	33.5	5.9	27.6	10.8	0.04377	31.1	24.1
	2	21.9	30.0	5.9	24.1	11.4	0.03176	27.2	21.1
	5	21.9	25.0	5.9	19.1	12.2	0.02080	21.6	16.7
	15	21.9	19.5	5.9	13.6	13.1	0.01244	15.3	11.9
	30	21.9	16.5	5.9	10.6	13.6	0.00896	12.0	9.3
	60	21.9	15.0	5.9	9.1	13.8	0.00639	10.3	8.0
	120	22.1	13.5	5.9	7.6	14.1	0.00455	8.6	6.7
	250	22.3	13.0	5.8	7.2	14.2	0.00315	8.1	6.3
	449	22.9	11.0	5.7	5.3	14.5	0.00236	5.9	4.6
7-Apr-15	1480	21.9	11.0	5.9	5.1	14.5	0.00132	5.8	4.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0098**	d_{30} = **0.064**	d_{50} = **0.51**	d_{60} = **1.0**	C_u = **102**	C_c = **0.42**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
LA54	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Laboratory Report for

Dwyer Engineering

County Airport Landfill Samples

March 19, 2015

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

March 19, 2015

Steve Dwyer
Dwyer Engineering
1813 Stagecoach Rd. SE
Albuquerque, NM 87123
(505) 844-0595

Re: DBS&A Laboratory Report for the Dwyer Engineering County Airport Landfill Samples

Dear Mr. Dwyer:

Enclosed is the report for the Dwyer Engineering County Airport Landfill samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Dwyer Engineering and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
Clay																X	X					
Silt																X	X					
Overburden																X	X					
Mix 1: Clay 50% Overburden 50%																X	X					X
Mix 1: Clay 50% Overburden 50% (90%)	X	X			X		X	X		X	X			X								
Mix 2: Clay 30% Overburden 70%																X	X					X
Mix 2: Clay 30% Overburden 70% (90%)	X	X			X		X	X		X	X			X								
Mix 3: Silt 50% Overburden 50%																X	X					X
Mix 3: Silt 50% Overburden 50% (90%)	X	X		X			X	X		X	X			X								

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Three samples were hand delivered, each in a full 5-gallon bucket, on January 21, 2015.

Sample Preparation and Testing Notes:
Each sample (Clay, Silt, and Overburden) was subjected to particle size analysis.

Three composite samples were then created: Mix 1: Clay 50% Overburden 50%, Mix 2: Clay 30% Overburden 70%, and Mix 3: Silt 50% Overburden 50%. Each composite sample was created using the specified percentages, on a volume basis. In order to ensure sufficient quantity of each composite sample, additional Overburden material was obtained from a previously received sample (formerly referred to as ET Fill).

Each composite sample was subjected to particle size analysis and standard proctor compaction testing. A portion of each sample was remolded into a testing ring to target 90% of the respective maximum dry bulk density at 2% below the respective optimum moisture content, based on the proctor compaction test results. The actual percent of maximum dry bulk density achieved was added to each sample ID. These remolded sub-samples were subjected to initial properties analysis, saturated hydraulic conductivity testing, and the hanging column and pressure chamber portions of the moisture retention testing.

Based on the proctor compaction method, material larger than 4.75mm was removed from the sample material prior to compaction and remolding. Oversize correction calculations are presented if the fraction removed was greater than 5% of the bulk sample mass.

Separate sub-samples were obtained for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the use of an assumed specific gravity value of 2.65.

Volumetric water contents were adjusted for changes in volume, where applicable. Due to the irregularities formed on the sample surfaces during swelling, volume measurements obtained after the initial reading should be considered estimates.

Summary of Sample Preparation/Volume Changes

Sample Number	Proctor Data		Target Remold Parameters[1]			Actual Remold Data			Volume Change Post Saturation[2]			Volume Change Post Drying Curve[3]		
	Opt. Moist. Cont. (%, g/g)	Max. Dry Density (g/cm^3)	Moist. Cont. (%, g/g)	Dry Bulk Density (g/cm^3)	% of Max. Density (%)	Moist. Cont. (%, g/g)	Dry Bulk Density (g/cm^3)	% of Max. Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Max. Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Max. Density (%)
Mix 1: Clay 50% Overburden 50% (90%)	12.5	1.87	10.5	1.68	90%	10.7	1.68	90.1%	1.68	---	90.1%	1.65	+1.7%	88.6%
Mix 2: Clay 30% Overburden 70% (90%)	12.1	1.94	10.1	1.74	90%	10.3	1.74	89.8%	1.74	---	89.8%	1.71	+1.7%	88.3%
Mix 3: Silt 50% Overburden 50% (90%)	11.0	1.91	9.0	1.72	90%	9.2	1.72	90.1%	1.72	---	90.1%	1.72	---	90.1%

[1]Target Remold Parameters: Provided by the client: 90% of maximum dry density at 2 percent below the optimum moisture content.

[2]Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

[3]Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
Mix 1: Clay 50% Overburden 50% (90%)	NA	NA	10.7	18.0	1.68	1.86	36.5
Mix 2: Clay 30% Overburden 70% (90%)	NA	NA	10.3	17.8	1.74	1.92	34.4
Mix 3: Silt 50% Overburden 50% (90%)	NA	NA	9.2	15.8	1.72	1.88	35.1

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
Mix 1: Clay 50% Overburden 50% (90%)	2.7E-06	2.4E-06		X
Mix 2: Clay 30% Overburden 70% (90%)	9.4E-06	8.3E-06		X
Mix 3: Silt 50% Overburden 50% (90%)	4.9E-04	4.6E-04	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
Mix 1: Clay 50% Overburden 50% (90%)	0	35.8
	22	35.2 ‡‡
	74	35.0 ‡‡
	160	31.7 ‡‡
	337	28.8 ‡‡
	8260	17.1 ‡‡
	45687	11.0 ‡‡
	486139	6.6 ‡‡
	839828	5.0 ‡‡
Mix 2: Clay 30% Overburden 70% (90%)	0	34.0
	20	34.6 ‡‡
	55	34.4 ‡‡
	140	30.2 ‡‡
	337	26.5 ‡‡
	8974	14.8 ‡‡
	33755	10.9 ‡‡
	181320	6.9 ‡‡
	839828	4.9 ‡‡
Mix 3: Silt 50% Overburden 50% (90%)	0	35.6
	13	35.5
	31	35.5
	101	27.4
	337	18.2
	7445	10.2
	42424	6.3
	179587	4.8
	839828	3.2

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
Mix 1: Clay 50% Overburden 50% (90%)	0.0055	1.2128	0.00	35.85	0.00	33.17
Mix 2: Clay 30% Overburden 70% (90%)	0.0077	1.2147	0.00	34.88	0.00	32.26
Mix 3: Silt 50% Overburden 50% (90%)	0.0171	1.3946	3.53	36.67	3.40	35.32

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
Clay	7.4E-05	0.014	0.056	757	0.29	WS/H	Classification by ASTM 2487 requires Atterberg test	Clay Loam †	(Est)
Silt	0.0033	0.073	0.096	29	4.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
Overburden	0.0056	0.15	0.20	36	4.8	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	
Mix 1: Clay 50% Overburden 50%	0.00074	0.12	0.18	243	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	(Est)
Mix 2: Clay 30% Overburden 70%	0.0014	0.14	0.20	143	13	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	
Mix 3: Silt 50% Overburden 50%	0.0067	0.13	0.16	24	3.8	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
Clay	11.4	24.0	30.2	34.3
Silt	0.5	48.4	41.9	9.2
Overburden	12.0	57.3	23.2	7.5
Mix 1: Clay 50% Overburden 50%	11.3	48.2	26.4	14.1
Mix 2: Clay 30% Overburden 70%	11.0	53.0	25.5	10.4
Mix 3: Silt 50% Overburden 50%	5.6	59.5	28.9	6.0

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm^3)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm^3)
Mix 1: Clay 50% Overburden 50%	12.5	1.87	11.1	1.93
Mix 2: Clay 30% Overburden 70%	12.1	1.94	10.8	1.99
Mix 3: Silt 50% Overburden 50%	11.0	1.91	10.4	1.94

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
Mix 1: Clay 50% Overburden 50% (90%)	NA	NA	10.7	18.0	1.68	1.86	36.5
Mix 2: Clay 30% Overburden 70% (90%)	NA	NA	10.3	17.8	1.74	1.92	34.4
Mix 3: Silt 50% Overburden 50% (90%)	NA	NA	9.2	15.8	1.72	1.88	35.1

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

	As Received	Remolded
Test Date:	NA	11-Feb-15
Field weight of sample* (g):		549.10
Tare weight, ring (g):		126.82
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		381.54
Sample volume (cm^3):		226.86
Assumed particle density (g/cm^3):		2.65
Gravimetric Moisture Content (% g/g):		10.7
Volumetric Moisture Content (% vol):		18.0
Dry bulk density (g/cm^3):		1.68
Wet bulk density (g/cm^3):		1.86
Calculated Porosity (% vol):		36.5
Percent Saturation:		49.2

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70% (90%)
Ring Number: NA
Depth: NA

	As Received	Remolded
Test Date:	NA	11-Feb-15
Field weight of sample* (g):		562.11
Tare weight, ring (g):		126.47
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		395.12
Sample volume (cm^3):		227.42
Assumed particle density (g/cm^3):		2.65
Gravimetric Moisture Content (% g/g):		10.3
Volumetric Moisture Content (% vol):		17.8
Dry bulk density (g/cm^3):		1.74
Wet bulk density (g/cm^3):		1.92
Calculated Porosity (% vol):		34.4
Percent Saturation:		51.7

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

	As Received	Remolded
Test Date:	NA	11-Feb-15
Field weight of sample* (g):		564.65
Tare weight, ring (g):		143.99
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		385.22
Sample volume (cm^3):		224.12
Assumed particle density (g/cm^3):		2.65
Gravimetric Moisture Content (% g/g):		9.2
Volumetric Moisture Content (% vol):		15.8
Dry bulk density (g/cm^3):		1.72
Wet bulk density (g/cm^3):		1.88
Calculated Porosity (% vol):		35.1
Percent Saturation:		45.0

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
Mix 1: Clay 50% Overburden 50% (90%)	2.7E-06	2.4E-06		X
Mix 2: Clay 30% Overburden 70% (90%)	9.4E-06	8.3E-06		X
Mix 3: Silt 50% Overburden 50% (90%)	4.9E-04	4.6E-04	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Falling Head Method

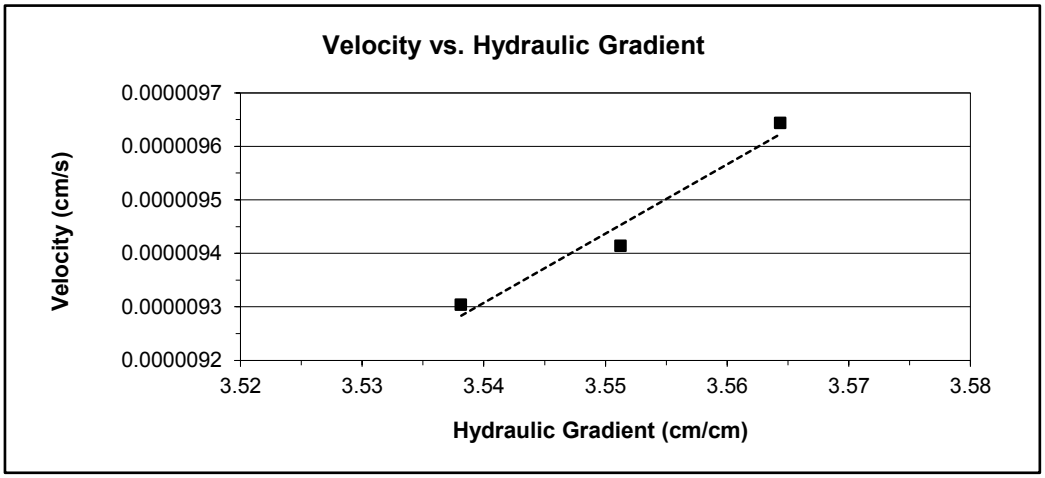
Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Type of water used: TAP
Backpressure (psi)*:* 0.0
Offset (cm)*:* 0.1
Sample length (cm)*:* 7.62
Sample x-sectional area (cm^2)*:* 29.78
Reservoir x-sectional area (cm^2)*:* 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
13-Feb-15	12:48:20	19.5	27.3	27.2	245	2.7E-06	2.7E-06
13-Feb-15	12:52:25	19.5	27.2	27.1			
Test # 2:							
13-Feb-15	12:52:25	19.5	27.2	27.1	251	2.6E-06	2.7E-06
13-Feb-15	12:56:36	19.5	27.1	27.0			
Test # 3:							
13-Feb-15	12:56:36	19.5	27.1	27.0	254	2.6E-06	2.7E-06
13-Feb-15	13:00:50	19.5	27	26.9			

Average Ksat* (cm/sec)*: **2.7E-06**
Oversize Corrected Ksat* (cm/sec)*: **2.4E-06**

Comments:
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4
Calculated Porosity of Fines (% vol)*:* 36.5

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	1893.24	14874.20	16767.44
Bulk Density (g/cm^3)*:*	2.65	1.68	1.75
Volume of Solids (cm^3)*:*	714.43	5612.90	6327.34
Volume of Voids (cm^3)*:*	0.00	3231.05	3231.05
Total Volume (cm^3)*:*	714.43	8843.96	9558.39
Volumetric Fraction (%)*:*	7.47	92.53	100.00
Mass Fraction (%)*:*	11.29	88.71	100.00
Ksat (cm/sec)*:*	NM	2.7E-06	2.4E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70% (90%)
Ring Number: NA
Depth: NA

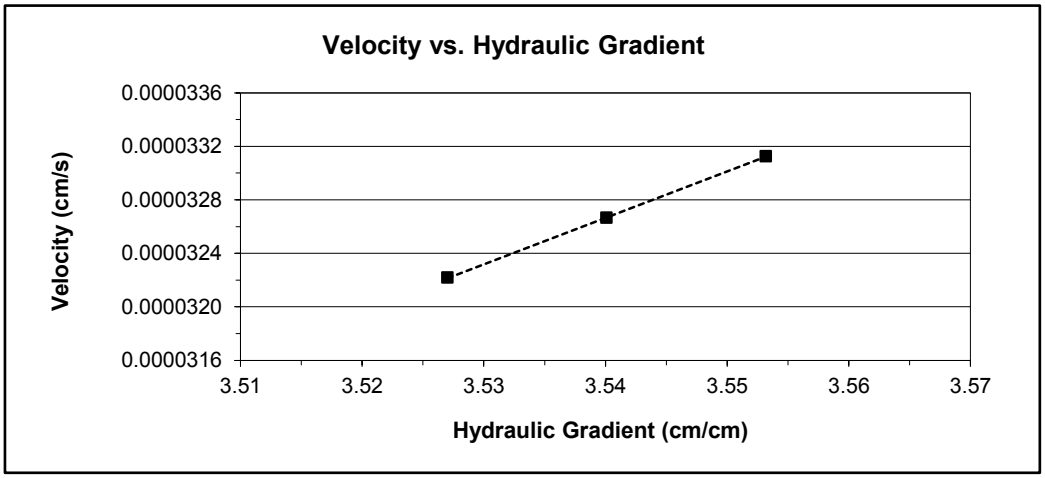
Type of water used: TAP
Backpressure (psi)*:* 0.0
Offset (cm)*:* 0.0
Sample length (cm)*:* 7.64
Sample x-sectional area (cm^2)*:* 29.76
Reservoir x-sectional area (cm^2)*:* 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
13-Feb-15	12:45:50	19.5	27.2	27.2	71	9.3E-06	9.5E-06
13-Feb-15	12:47:01	19.5	27.1	27.1			
Test # 2:							
13-Feb-15	12:47:01	19.5	27.1	27.1	72	9.2E-06	9.4E-06
13-Feb-15	12:48:13	19.5	27	27.0			
Test # 3:							
13-Feb-15	12:48:13	19.5	27	27.0	73	9.1E-06	9.3E-06
13-Feb-15	12:49:26	19.5	26.9	26.9			

Average Ksat* (cm/sec)*: **9.4E-06**
Oversize Corrected Ksat* (cm/sec)*: **8.3E-06**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4
Calculated Porosity of Fines (% vol)*:* 34.4

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	1904.13	15344.87	17249.00
Bulk Density (g/cm^3)*:*	2.65	1.74	1.81
Volume of Solids (cm^3)*:*	718.54	5790.52	6509.06
Volume of Voids (cm^3)*:*	0.00	3041.74	3041.74
Total Volume (cm^3)*:*	718.54	8832.25	9550.79
Volumetric Fraction (%)*:*	7.52	92.48	100.00
Mass Fraction (%)*:*	11.04	88.96	100.00
Ksat (cm/sec)*:*	NM	9.4E-06	8.3E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

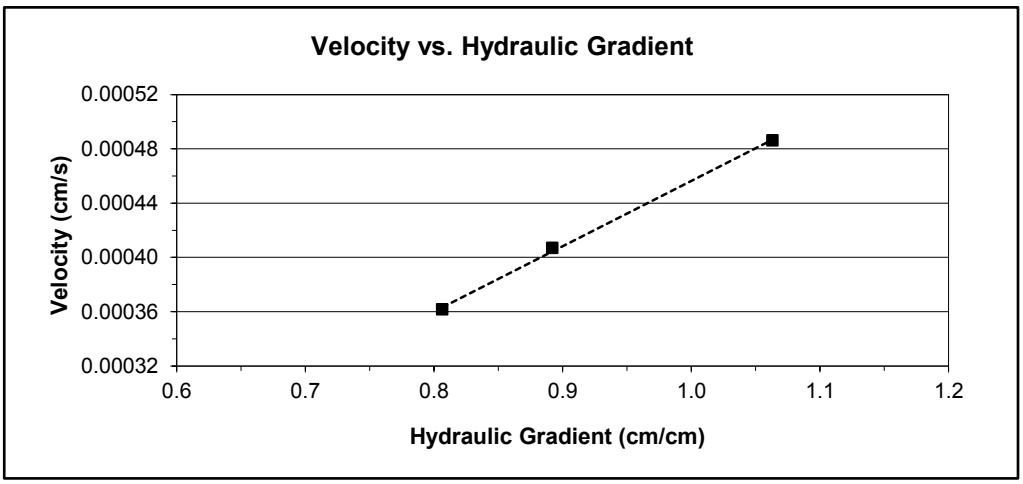
Type of water used: TAP
Collection vessel tare (g)*:* 11.06
Sample length (cm)*:* 7.60
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.49

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
13-Dec-15	13:01:06	19.5	7.7	12.78	1.7	120	4.8E-04	4.9E-04
13-Dec-15	13:03:06							
Test # 2:								
13-Feb-15	13:13:06	19.5	6.4	12.50	1.4	120	4.8E-04	4.9E-04
13-Feb-15	13:15:06							
Test # 3:								
13-Feb-15	13:25:18	19.5	5.75	12.34	1.3	120	4.8E-04	4.8E-04
13-Feb-15	13:27:18							

Average Ksat* (cm/sec)*: **4.9E-04**
Oversize Corrected Ksat* (cm/sec)*: **4.6E-04**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4
Calculated Porosity of Fines (% vol)*:* 35.1

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	894.88	15144.82	16039.70
Bulk Density (g/cm^3)*:*	2.65	1.72	1.75
Volume of Solids (cm^3)*:*	337.69	5715.03	6052.72
Volume of Voids (cm^3)*:*	0.00	3096.26	3096.26
Total Volume (cm^3)*:*	337.69	8811.28	9148.97
Volumetric Fraction (%)*:*	3.69	96.31	100.00
Mass Fraction (%)*:*	5.58	94.42	100.00
Ksat (cm/sec)*:*	NM	4.9E-04	4.6E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Moisture Retention Characteristics

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
Mix 1: Clay 50% Overburden 50% (90%)	0	35.8
	22	35.2 ‡‡
	74	35.0 ‡‡
	160	31.7 ‡‡
	337	28.8 ‡‡
	8260	17.1 ‡‡
	45687	11.0 ‡‡
	486139	6.6 ‡‡
	839828	5.0 ‡‡
Mix 2: Clay 30% Overburden 70% (90%)	0	34.0
	20	34.6 ‡‡
	55	34.4 ‡‡
	140	30.2 ‡‡
	337	26.5 ‡‡
	8974	14.8 ‡‡
	33755	10.9 ‡‡
	181320	6.9 ‡‡
	839828	4.9 ‡‡
Mix 3: Silt 50% Overburden 50% (90%)	0	35.6
	13	35.5
	31	35.5
	101	27.4
	337	18.2
	7445	10.2
	42424	6.3
	179587	4.8
	839828	3.2

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
Mix 1: Clay 50% Overburden 50% (90%)	0.0055	1.2128	0.00	35.85	0.00	33.17
Mix 2: Clay 30% Overburden 70% (90%)	0.0077	1.2147	0.00	34.88	0.00	32.26
Mix 3: Silt 50% Overburden 50% (90%)	0.0171	1.3946	3.53	36.67	3.40	35.32

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 381.54
Tare wt., ring (g): 126.82
Tare wt., screen & clamp (g): 26.64
Initial sample volume (cm^3): 226.86
Initial dry bulk density (g/cm^3): 1.68
Assumed particle density (g/cm^3): 2.65
Initial calculated total porosity (%): 36.53

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	13-Feb-15	14:00	616.20	0	35.79	
	20-Feb-15	14:25	616.70	22.0	35.16	‡‡
	27-Feb-15	13:40	616.10	74.0	35.04	‡‡
	6-Mar-15	14:40	608.10	160.0	31.69	‡‡
Pressure plate:	16-Mar-15	14:50	601.50	337	28.83	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	22.0	232.40	+2.44%	1.64	38.05
	74.0	231.47	+2.03%	1.65	37.80
	160.0	230.70	+1.69%	1.65	37.59
Pressure plate:	337	230.70	+1.69%	1.65	37.59

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)

Initial sample bulk density (g/cm^3)*:* 1.68

Fraction of test sample used (<2.00mm fraction) (%): 97.47

Dry weight of dew point potentiometer sample* (g)*:* 168.22

Tare weight, jar (g)*:* 116.39

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	16-Mar-15	15:45	173.72	8260	17.11	‡‡
	16-Mar-15	13:55	171.76	45687	11.01	‡‡
	16-Mar-15	12:45	170.35	486139	6.62	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8260	230.70	+1.69%	1.65	37.59
	45687	230.70	+1.69%	1.65	37.59
	486139	230.70	+1.69%	1.65	37.59

Dry weight of relative humidity box sample* (g)*:* 76.36

Tare weight (g)*:* 36.82

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	27-Feb-15	13:45	77.60	839828	5.04	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	839828	230.70	+1.69%	1.65	37.59

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

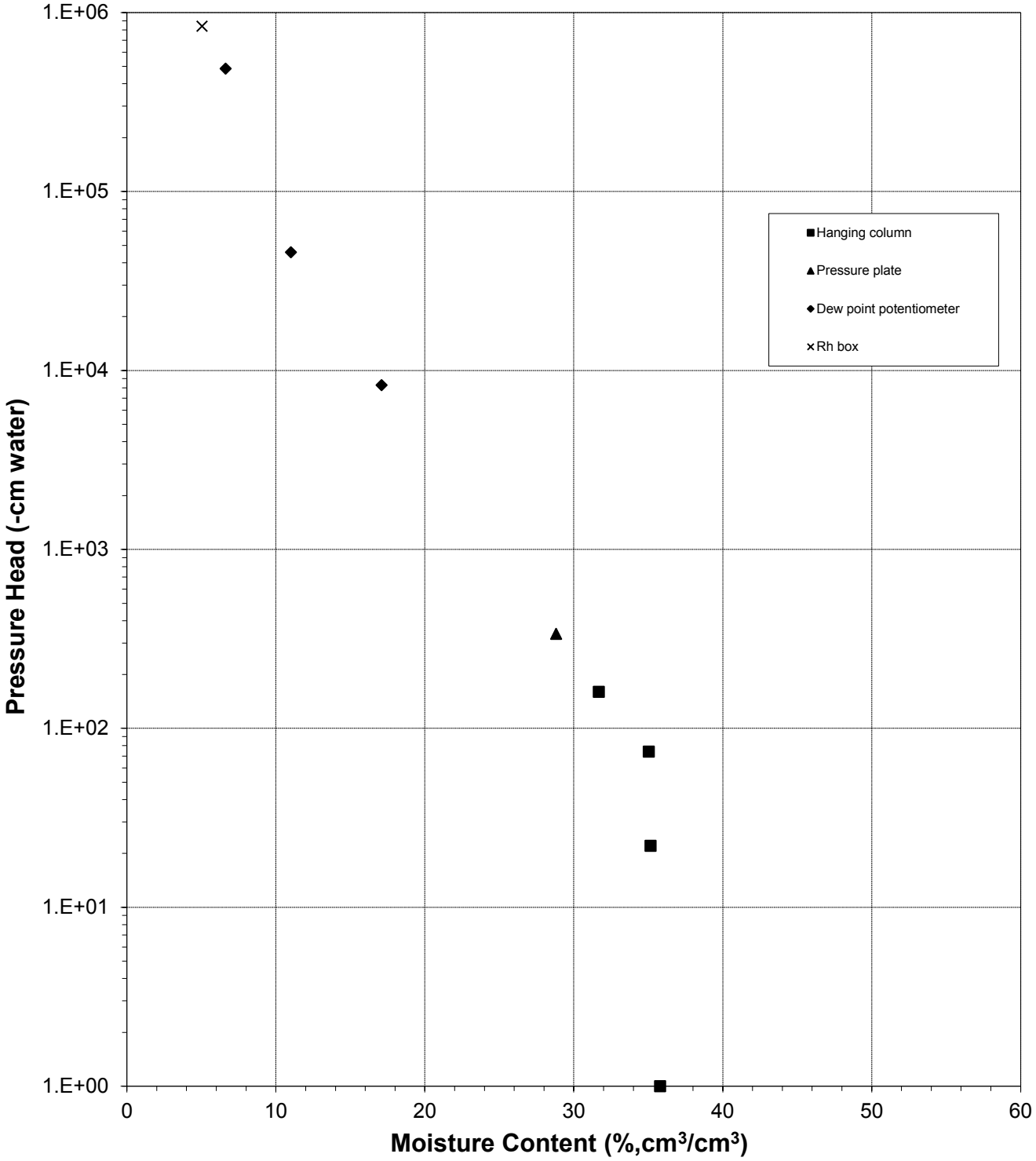
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

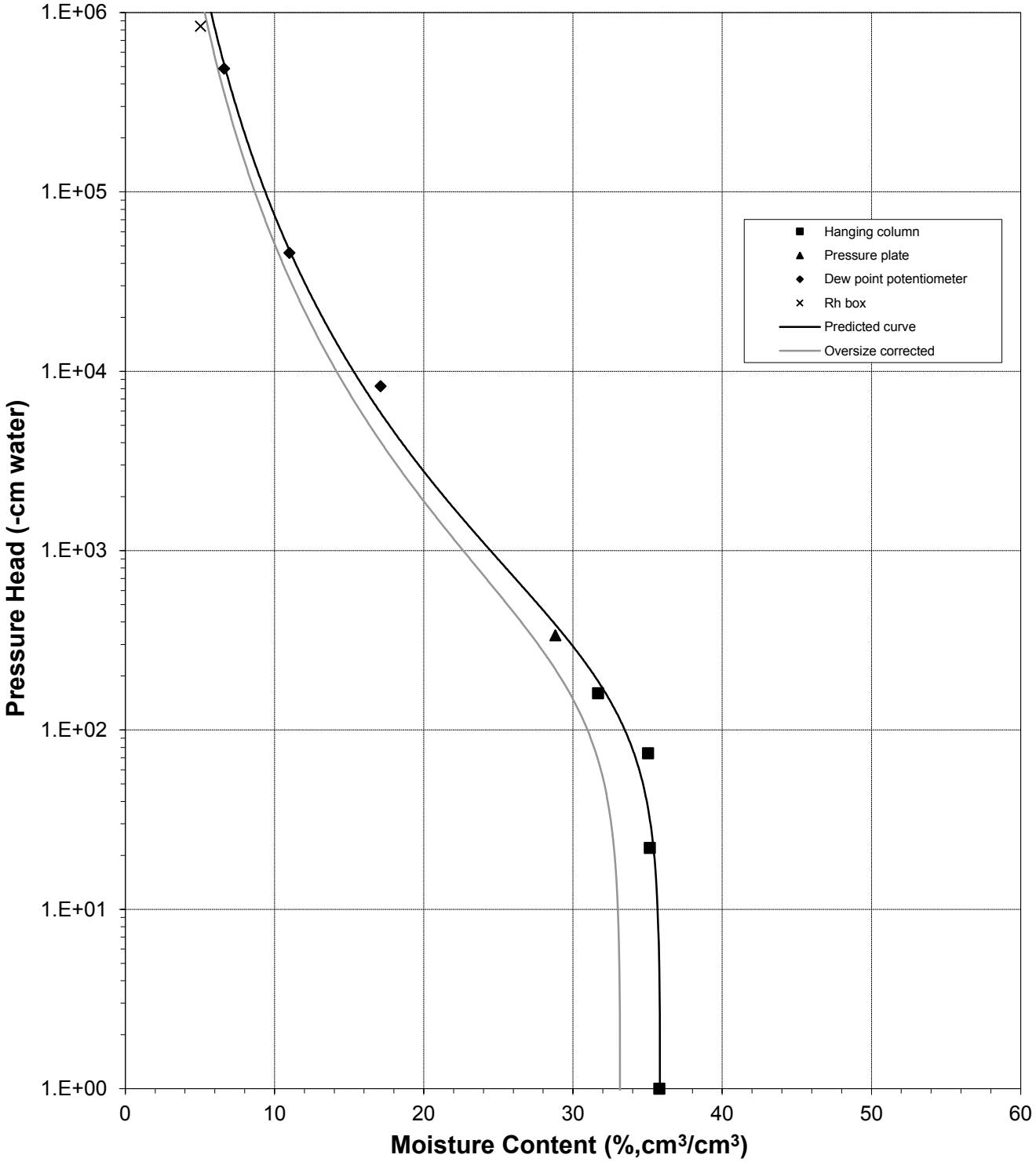
Water Retention Data Points

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



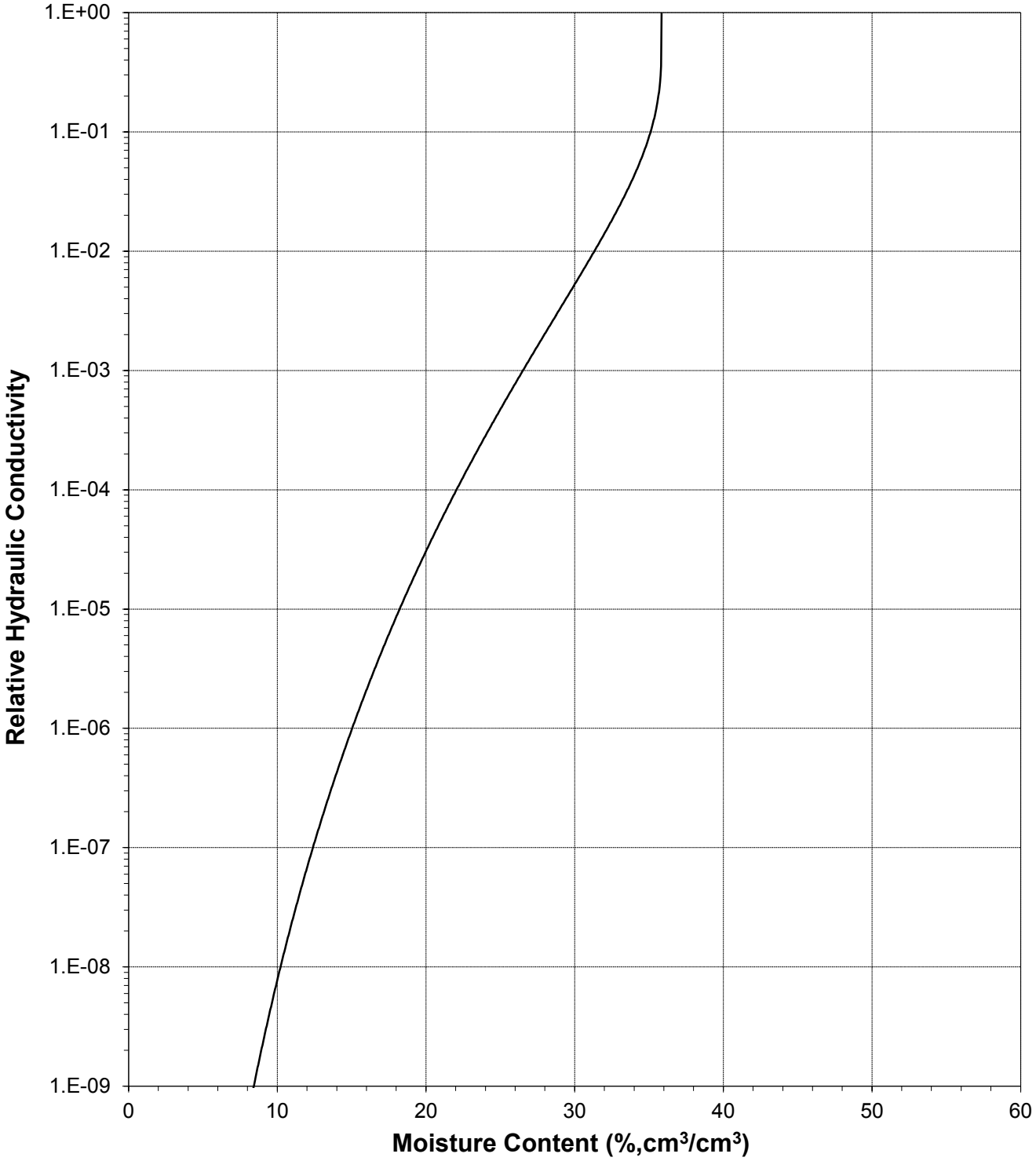
Predicted Water Retention Curve and Data Points

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



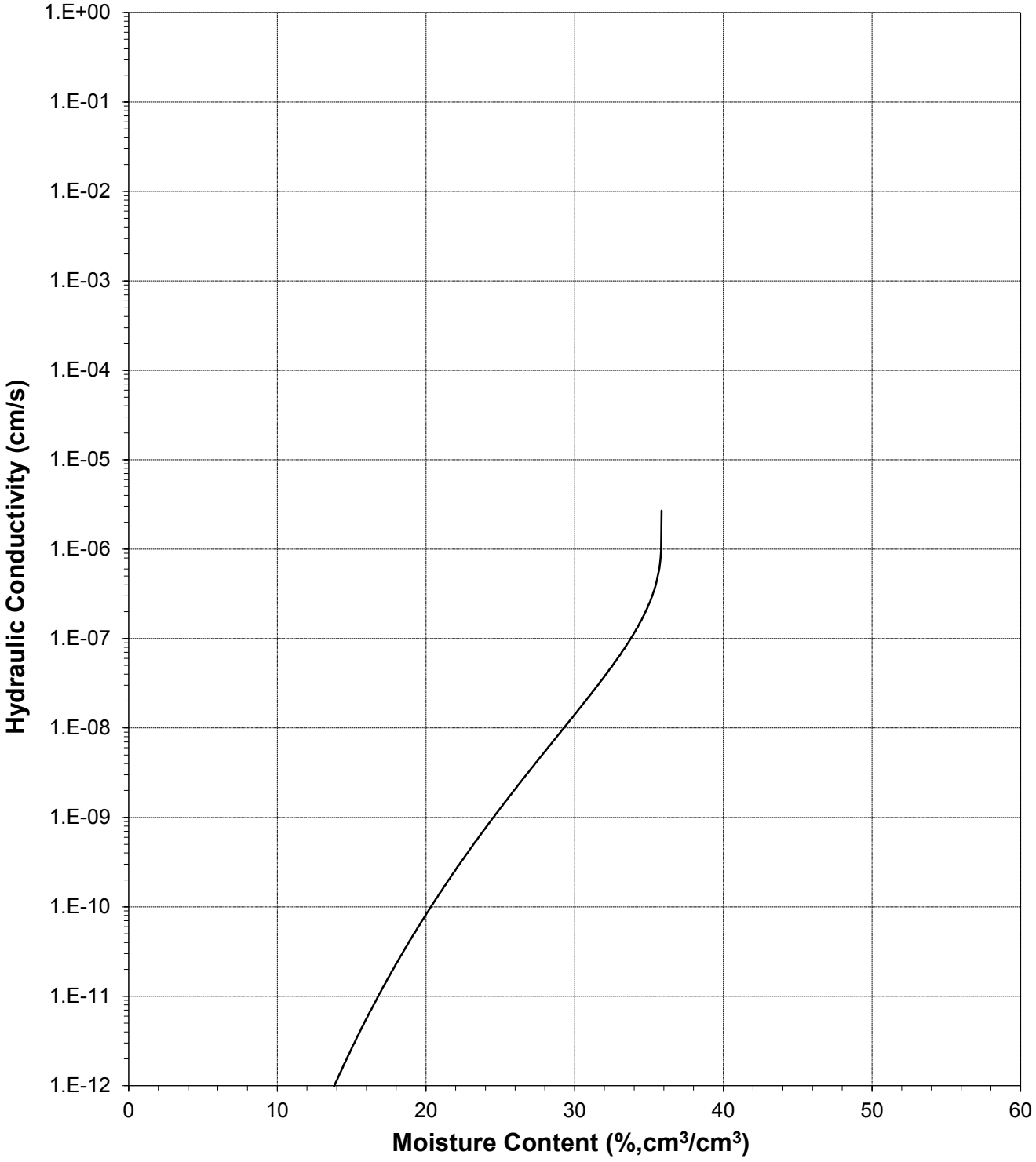
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



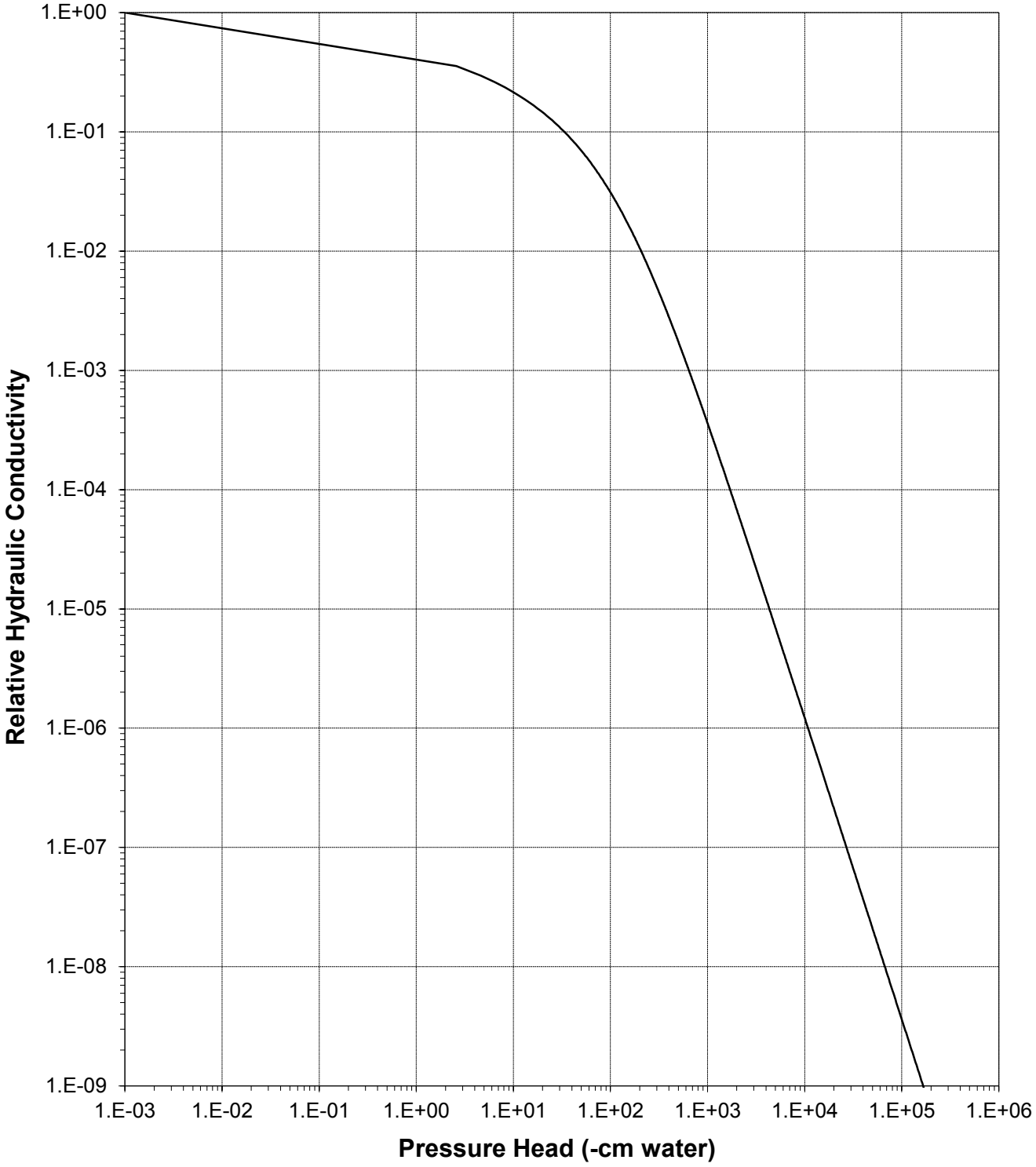
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



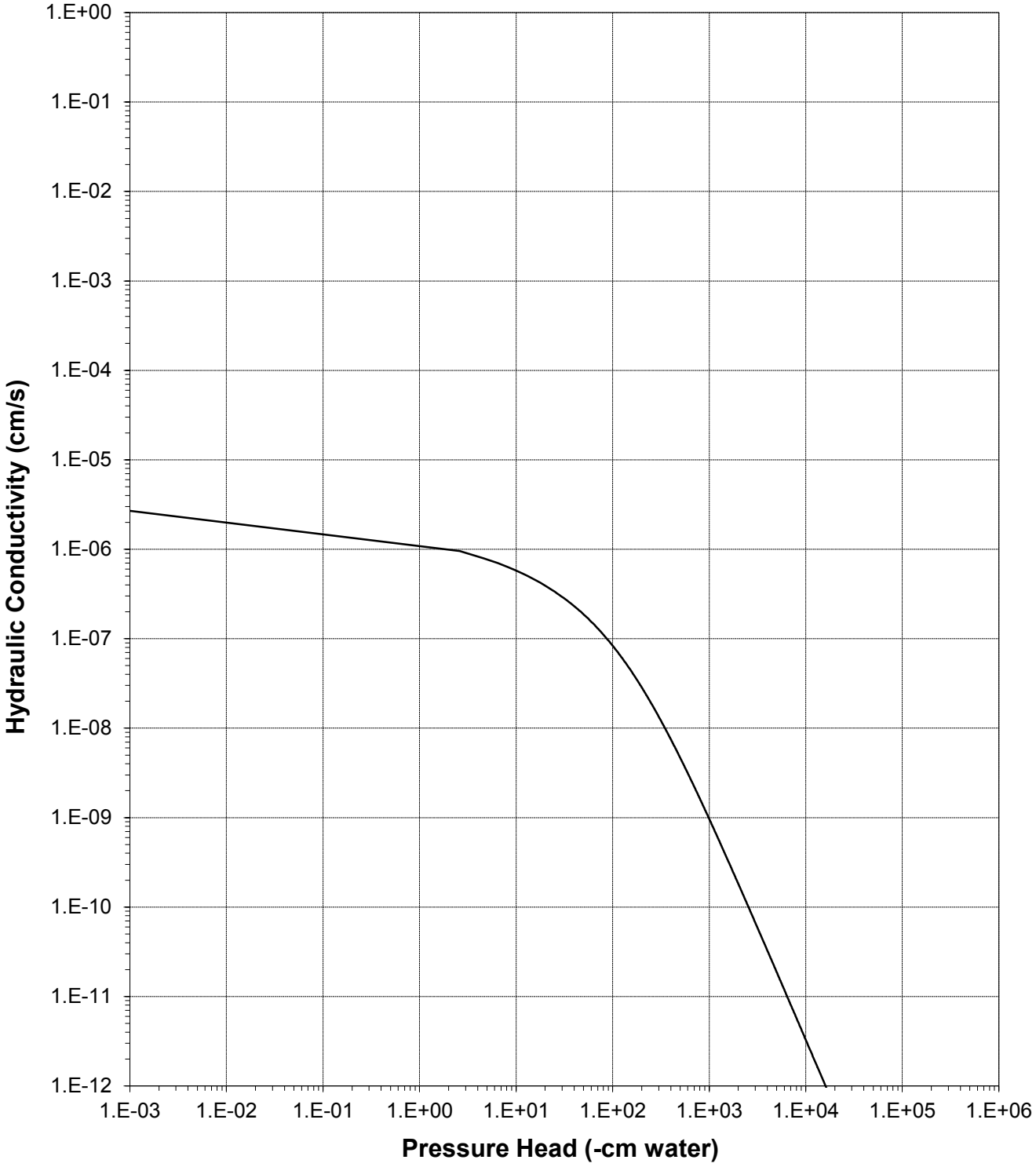
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 1: Clay 50% Overburden 50% (90%)



Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	1893.24	14874.20	16767.44
Mass Fraction (%):	11.29	88.71	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.68	1.75
Calculated Porosity (% vol):	0.00	36.53	33.80
Volume of Solids (cm^3):	714.43	5612.90	6327.34
Volume of Voids (cm^3):	0.00	3231.05	3231.05
Total Volume (cm^3):	714.43	8843.96	9558.39
Volumetric Fraction (%):	7.47	92.53	100.00
Initial Moisture Content (% vol):	0.00	17.96	16.62
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.68	1.75
Calculated Porosity (% vol):	0.00	36.53	33.80
Volume of Solids (cm^3):	714.43	5612.90	6327.34
Volume of Voids (cm^3):	0.00	3231.05	3231.05
Total Volume (cm^3):	714.43	8843.96	9558.39
Volumetric Fraction (%):	7.47	92.53	100.00
Saturated Moisture Content (% vol):	0.00	35.85	33.17
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.65	1.73
Calculated Porosity (% vol):	0.00	37.59	34.82
Volume of Solids (cm^3):	714.43	5612.90	6327.34
Volume of Voids (cm^3):	0.00	3380.83	3380.83
Total Volume (cm^3):	714.43	8993.74	9708.17
Volumetric Fraction (%):	7.36	92.64	100.00
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NM	2.7E-06	2.4E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70% (90%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 395.12
Tare wt., ring (g): 126.47
Tare wt., screen & clamp (g): 26.49
Initial sample volume (cm^3): 227.42
Initial dry bulk density (g/cm^3): 1.74
Assumed particle density (g/cm^3): 2.65
Initial calculated total porosity (%): 34.44

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	13-Feb-15	14:00	625.39	0	33.99	
	20-Feb-15	14:20	628.51	20.0	34.61	‡‡
	27-Feb-15	13:40	627.95	55.0	34.38	‡‡
	6-Mar-15	14:30	618.10	140.0	30.16	‡‡
Pressure plate:	16-Mar-15	14:50	609.40	337	26.51	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	20.0	232.40	+2.19%	1.70	35.84
	55.0	232.34	+2.16%	1.70	35.82
	140.0	232.16	+2.08%	1.70	35.78
Pressure plate:	337	231.29	+1.70%	1.71	35.54

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)

Initial sample bulk density (g/cm^3)*:* 1.74

Fraction of test sample used (<2.00mm fraction) (%): 97.44

Dry weight of dew point potentiometer sample* (g)*:* 182.61

Tare weight, jar (g)*:* 116.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	16-Mar-15	16:22	188.49	8974	14.79	‡‡
	16-Mar-15	15:25	186.94	33755	10.89	‡‡
	16-Mar-15	13:40	185.35	181320	6.89	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8974	231.29	+1.70%	1.71	35.54
	33755	231.29	+1.70%	1.71	35.54
	181320	231.29	+1.70%	1.71	35.54

Dry weight of relative humidity box sample* (g)*:* 72.82

Tare weight (g)*:* 40.00

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	27-Feb-15	13:45	73.80	839828	4.94	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	839828	231.29	+1.70%	1.71	35.54

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

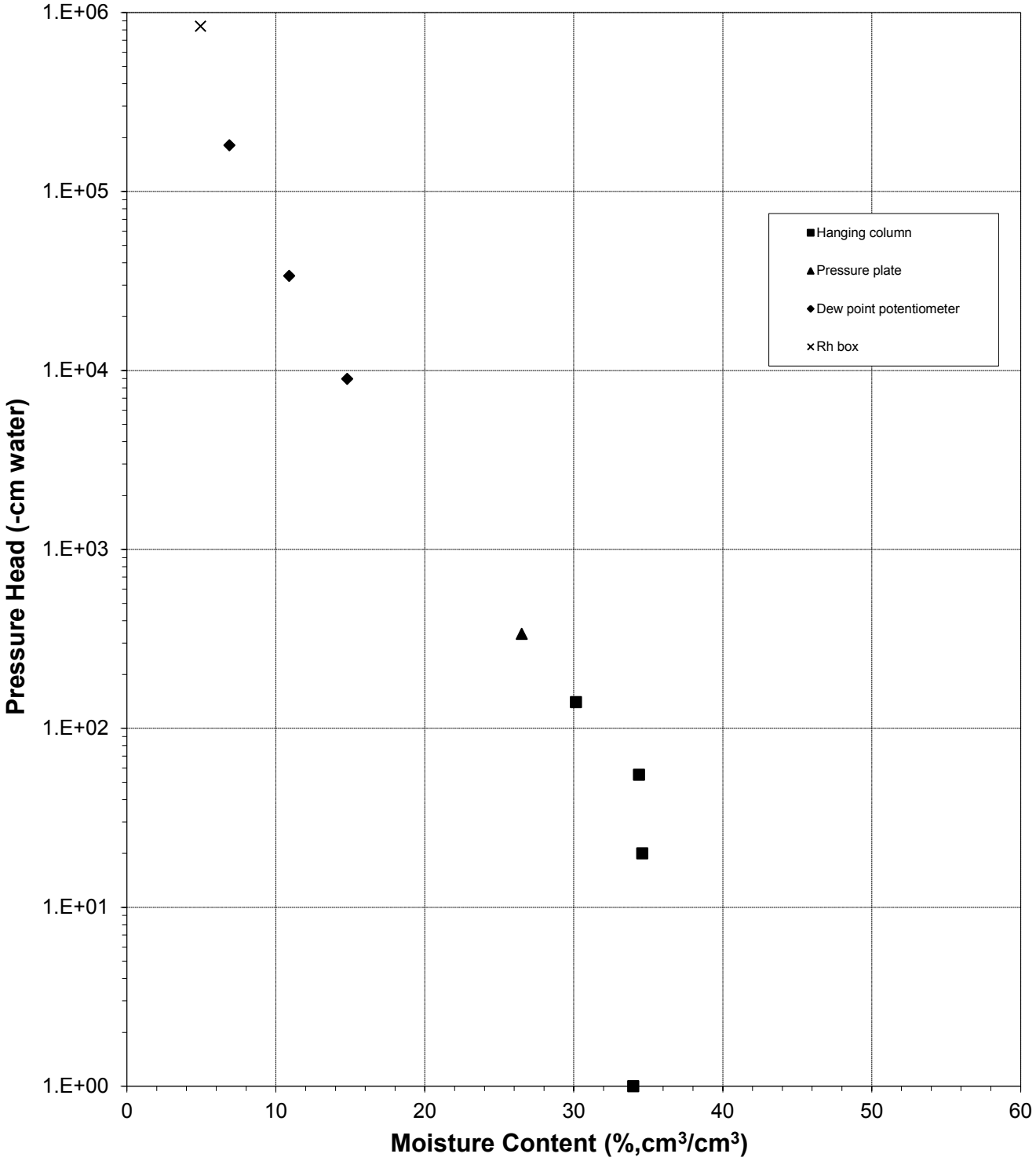
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

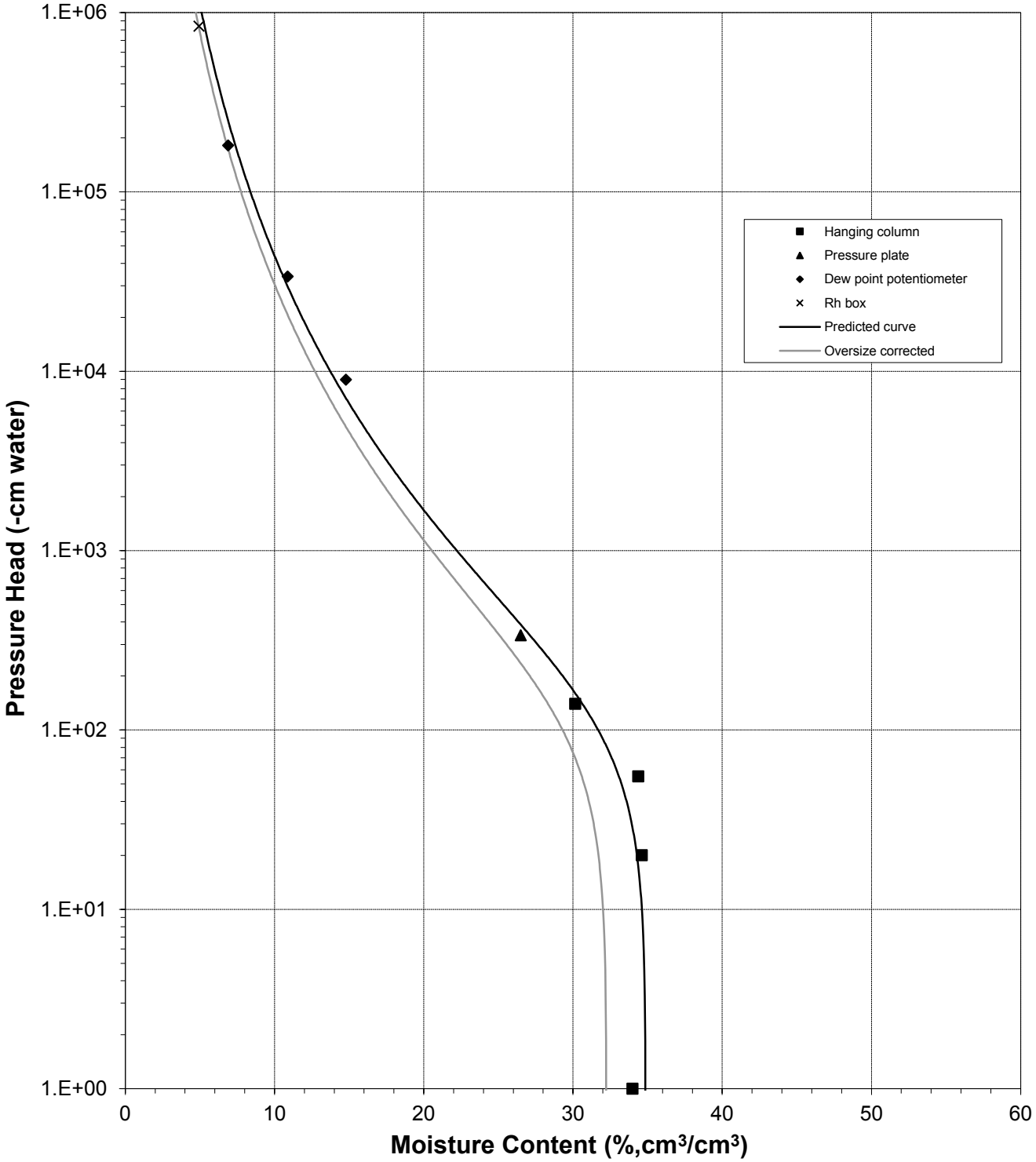
Water Retention Data Points

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



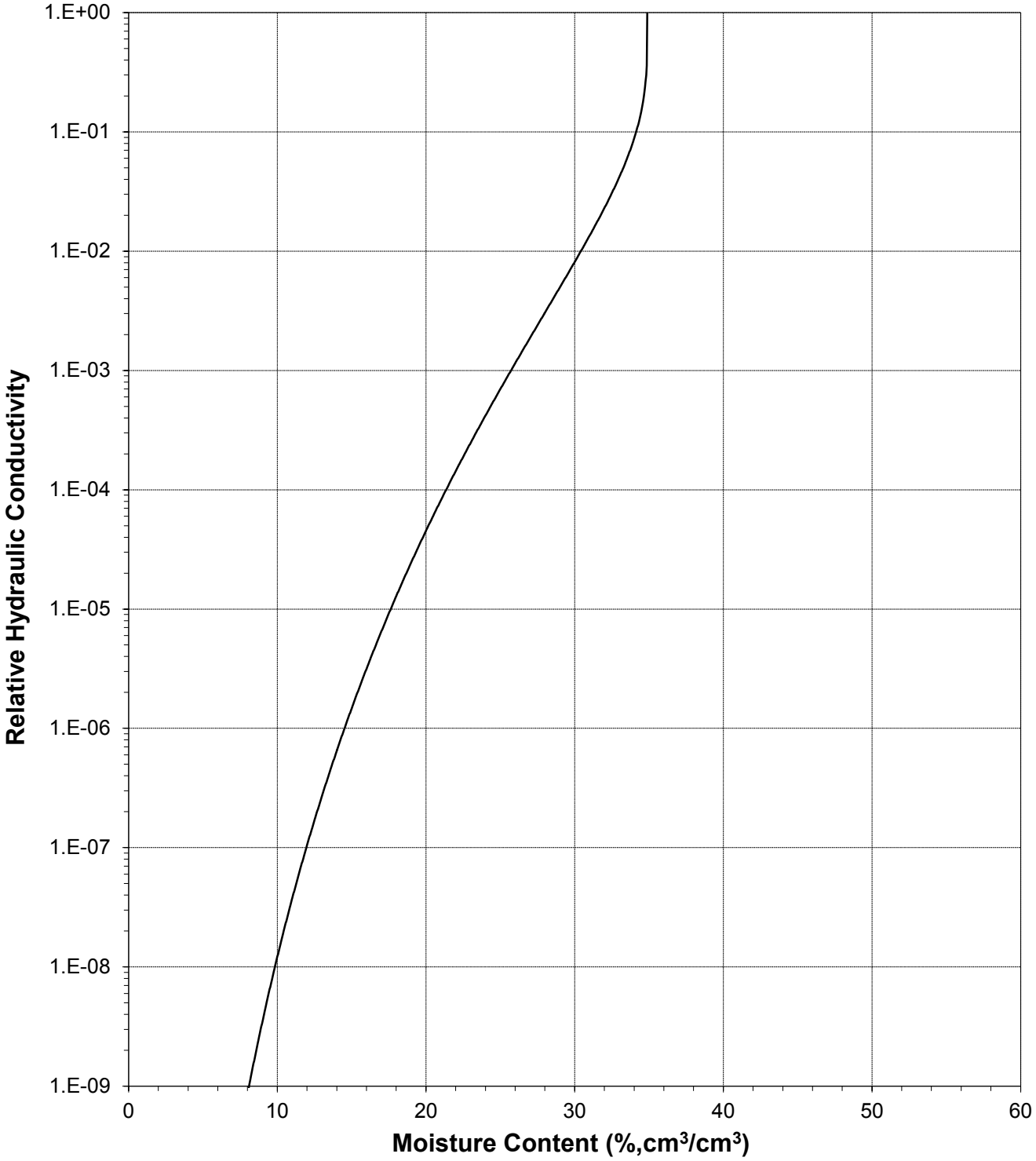
Predicted Water Retention Curve and Data Points

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



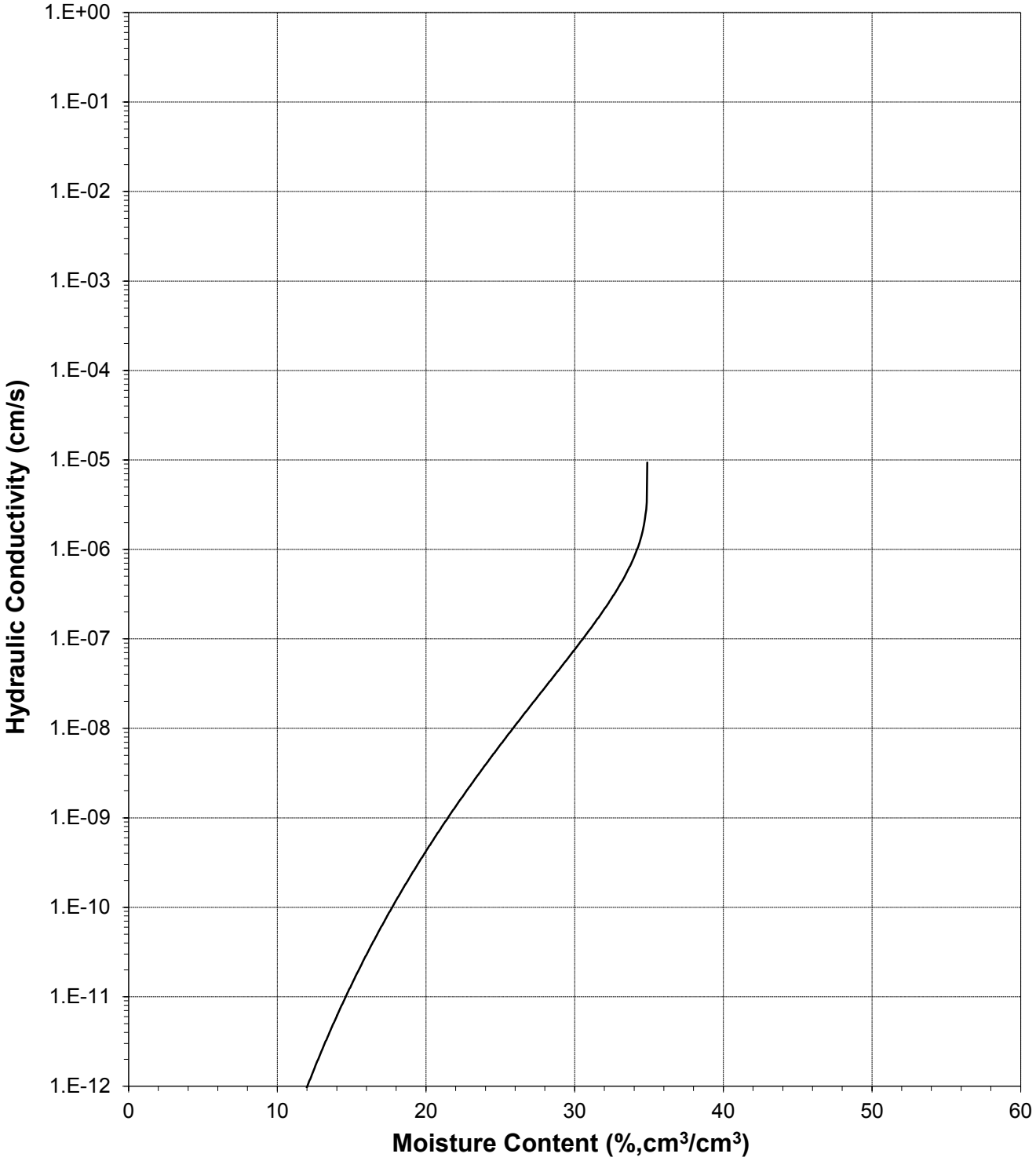
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



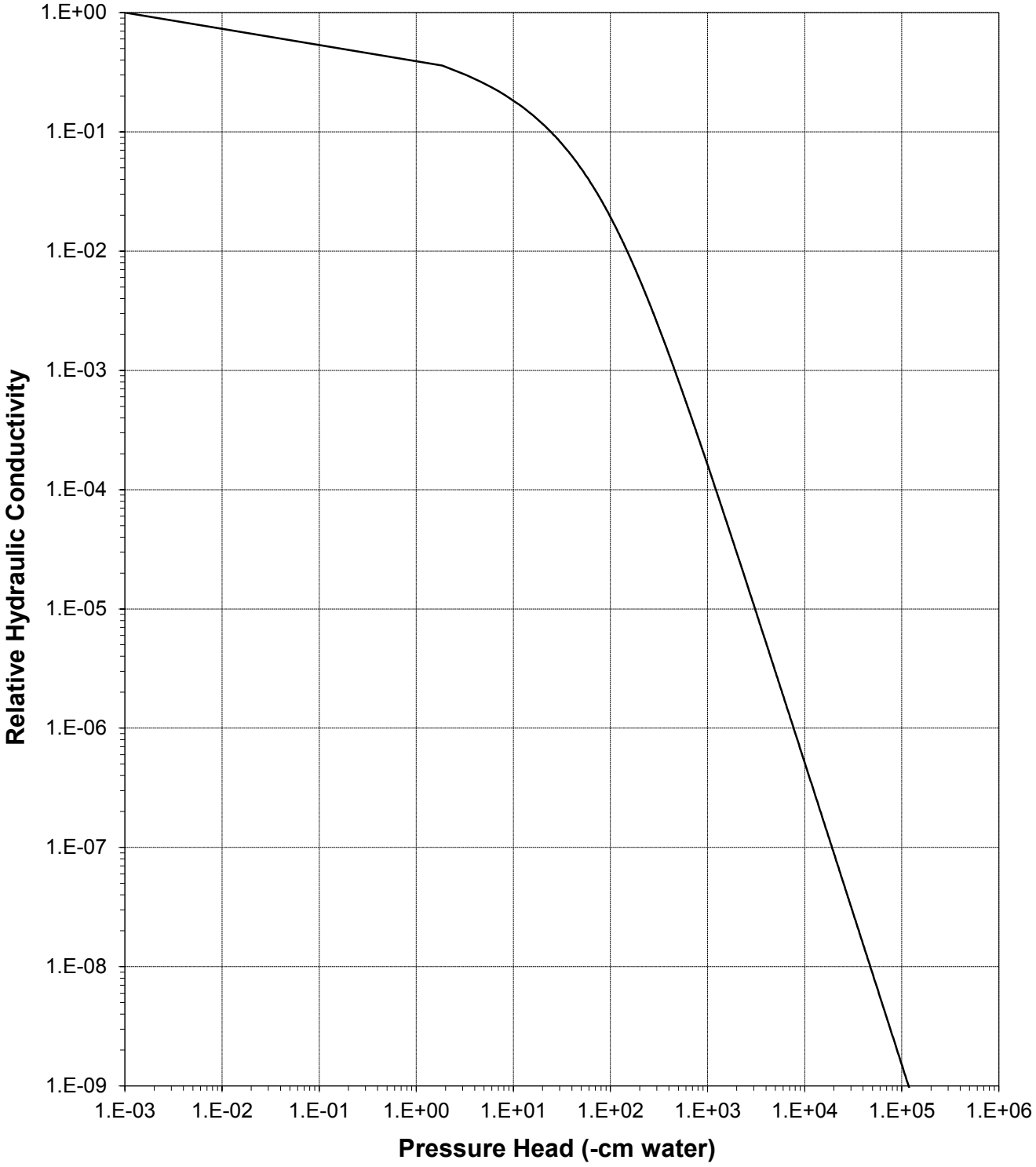
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



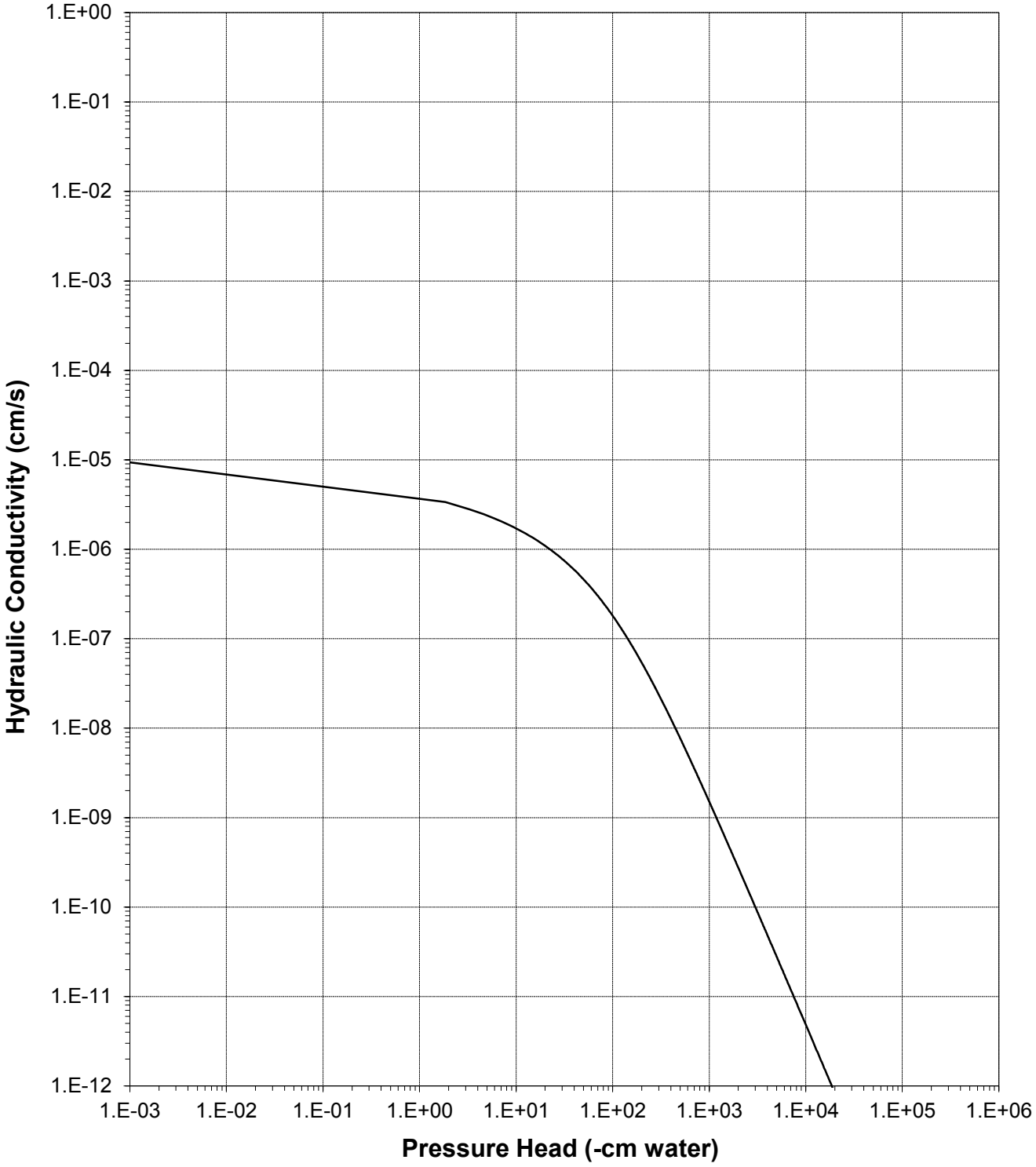
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 2: Clay 30% Overburden 70% (90%)



Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	1904.13	15344.87	17249.00
Mass Fraction (%):	11.04	88.96	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.74	1.81
Calculated Porosity (% vol):	0.00	34.44	31.85
Volume of Solids (cm^3):	718.54	5790.52	6509.06
Volume of Voids (cm^3):	0.00	3041.74	3041.74
Total Volume (cm^3):	718.54	8832.25	9550.79
Volumetric Fraction (%):	7.52	92.48	100.00
Initial Moisture Content (% vol):	0.00	17.82	16.48
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.74	1.81
Calculated Porosity (% vol):	0.00	34.44	31.85
Volume of Solids (cm^3):	718.54	5790.52	6509.06
Volume of Voids (cm^3):	0.00	3041.74	3041.74
Total Volume (cm^3):	718.54	8832.25	9550.79
Volumetric Fraction (%):	7.52	92.48	100.00
Saturated Moisture Content (% vol):	0.00	34.88	32.26
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.71	1.78
Calculated Porosity (% vol):	0.00	35.54	32.90
Volume of Solids (cm^3):	718.54	5790.52	6509.06
Volume of Voids (cm^3):	0.00	3192.00	3192.00
Total Volume (cm^3):	718.54	8982.52	9701.06
Volumetric Fraction (%):	7.41	92.59	100.00
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NM	9.4E-06	8.3E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 385.22
Tare wt., ring (g): 143.99
Tare wt., screen & clamp (g): 27.80
Initial sample volume (cm^3): 224.12
Initial dry bulk density (g/cm^3): 1.72
Assumed particle density (g/cm^3): 2.65
Initial calculated total porosity (%): 35.14

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	13-Feb-15	13:30	636.86	0	35.63
	20-Feb-15	14:20	636.60	13.0	35.51
	27-Feb-15	13:30	636.50	31.0	35.47
	6-Mar-15	14:30	618.40	101.0	27.39
Pressure plate:	16-Mar-15	14:50	597.90	337	18.24

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	13.0	---	---	---	---
	31.0	---	---	---	---
	101.0	---	---	---	---
Pressure plate:	337	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)

Initial sample bulk density (g/cm^3)*:* 1.72
Fraction of test sample used (<2.00mm fraction) (%): 98.52

Dry weight of dew point potentiometer sample* (g)*:* 162.77
Tare weight, jar (g)*:* 116.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	16-Mar-15	15:33	165.57	7445	10.23
	16-Mar-15	13:43	164.50	42424	6.32
	16-Mar-15	13:07	164.08	179587	4.79

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	7445	---	---	---	---
	42424	---	---	---	---
	179587	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 69.36
Tare weight (g)*:* 40.70

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	27-Feb-15	13:45	69.90	839828	3.21

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	839828	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

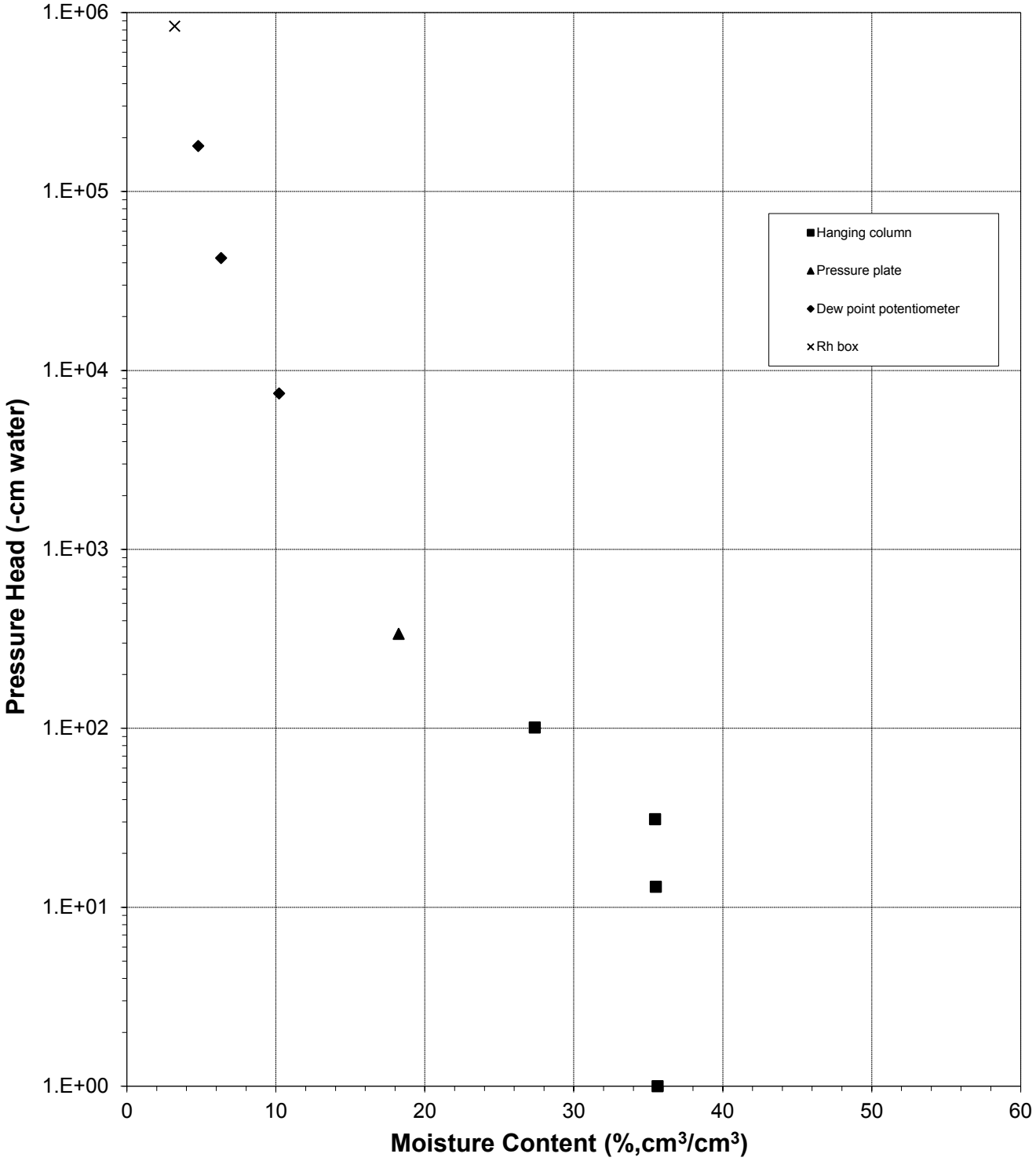
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

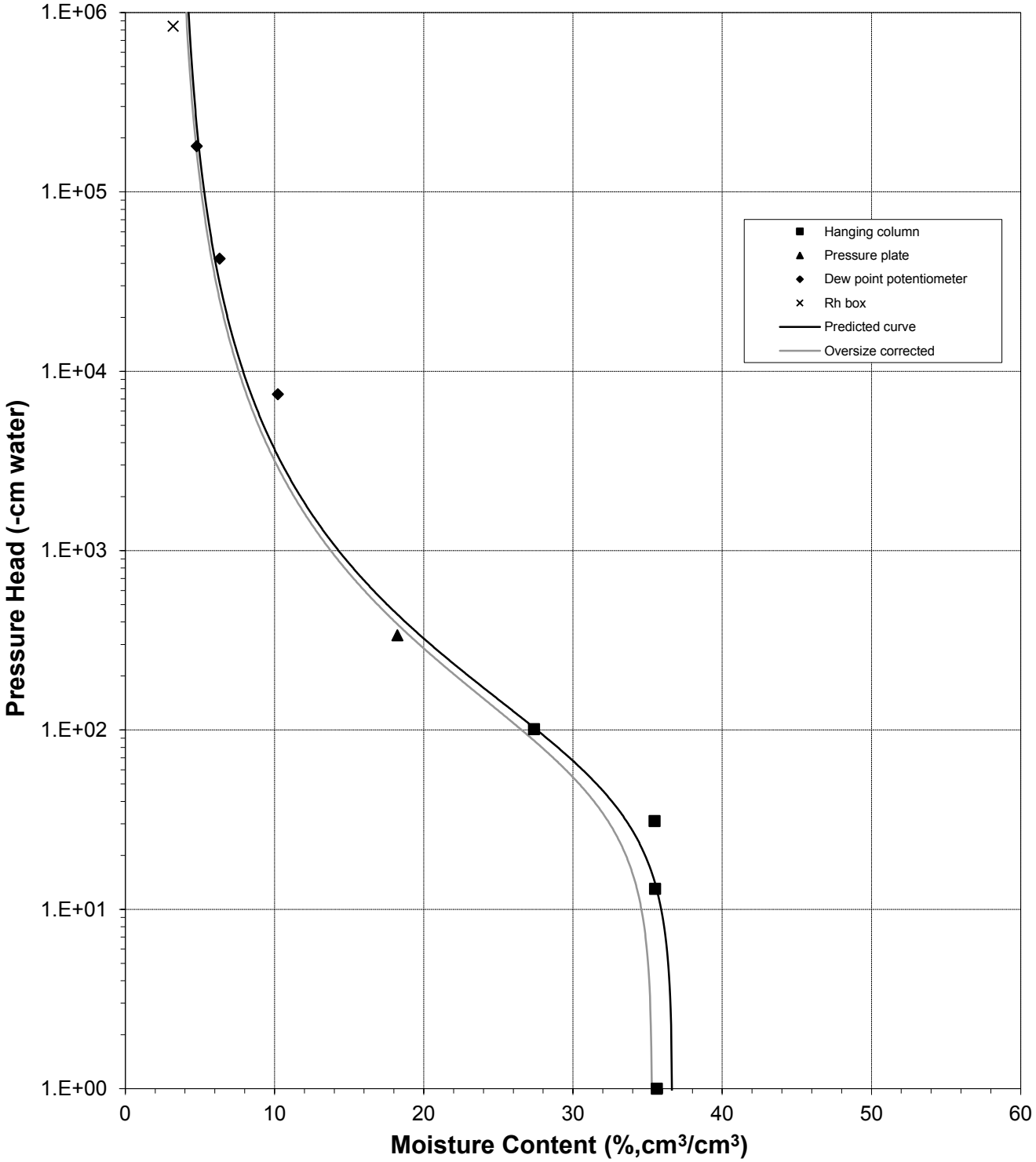
Water Retention Data Points

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



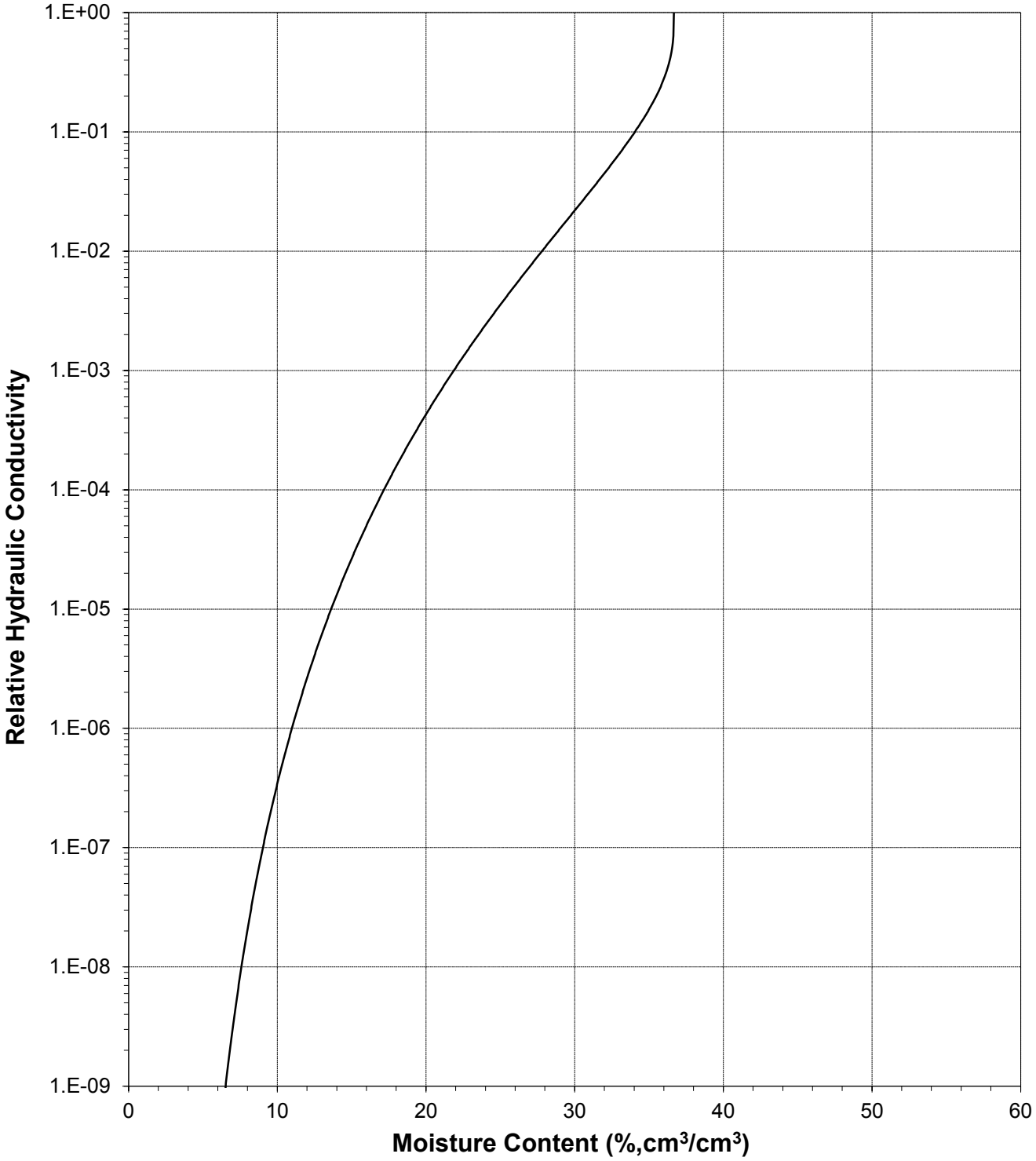
Predicted Water Retention Curve and Data Points

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



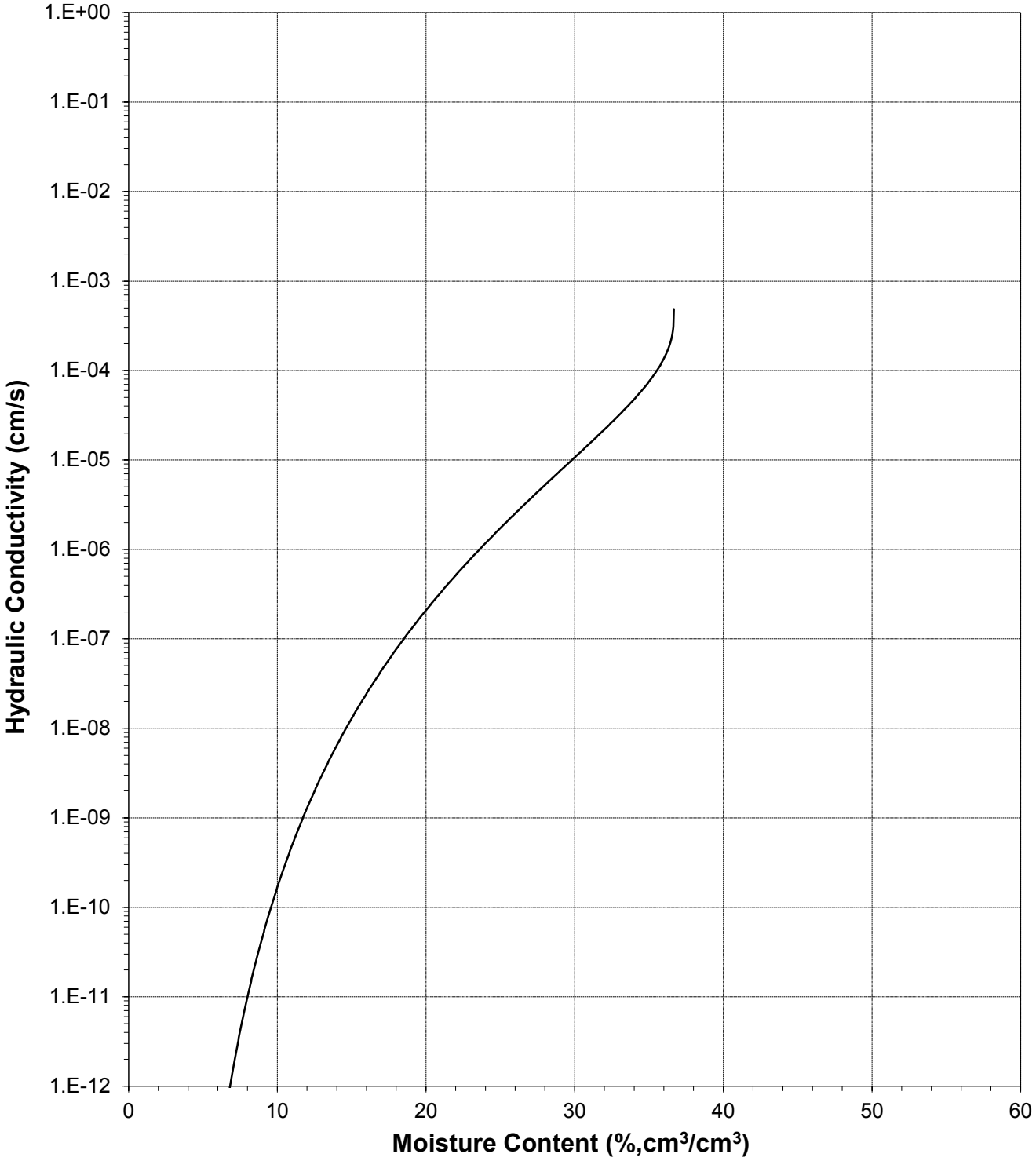
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



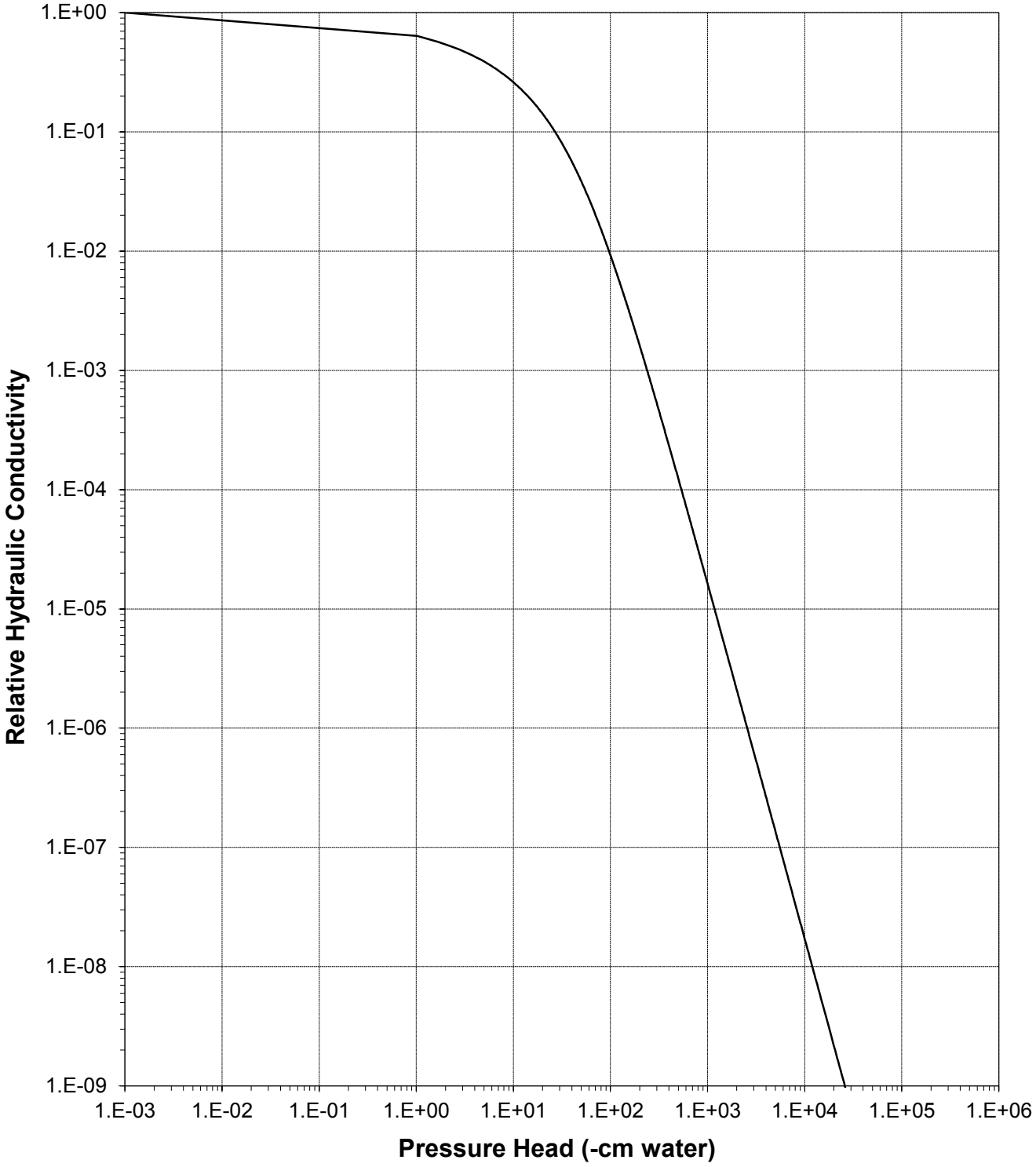
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



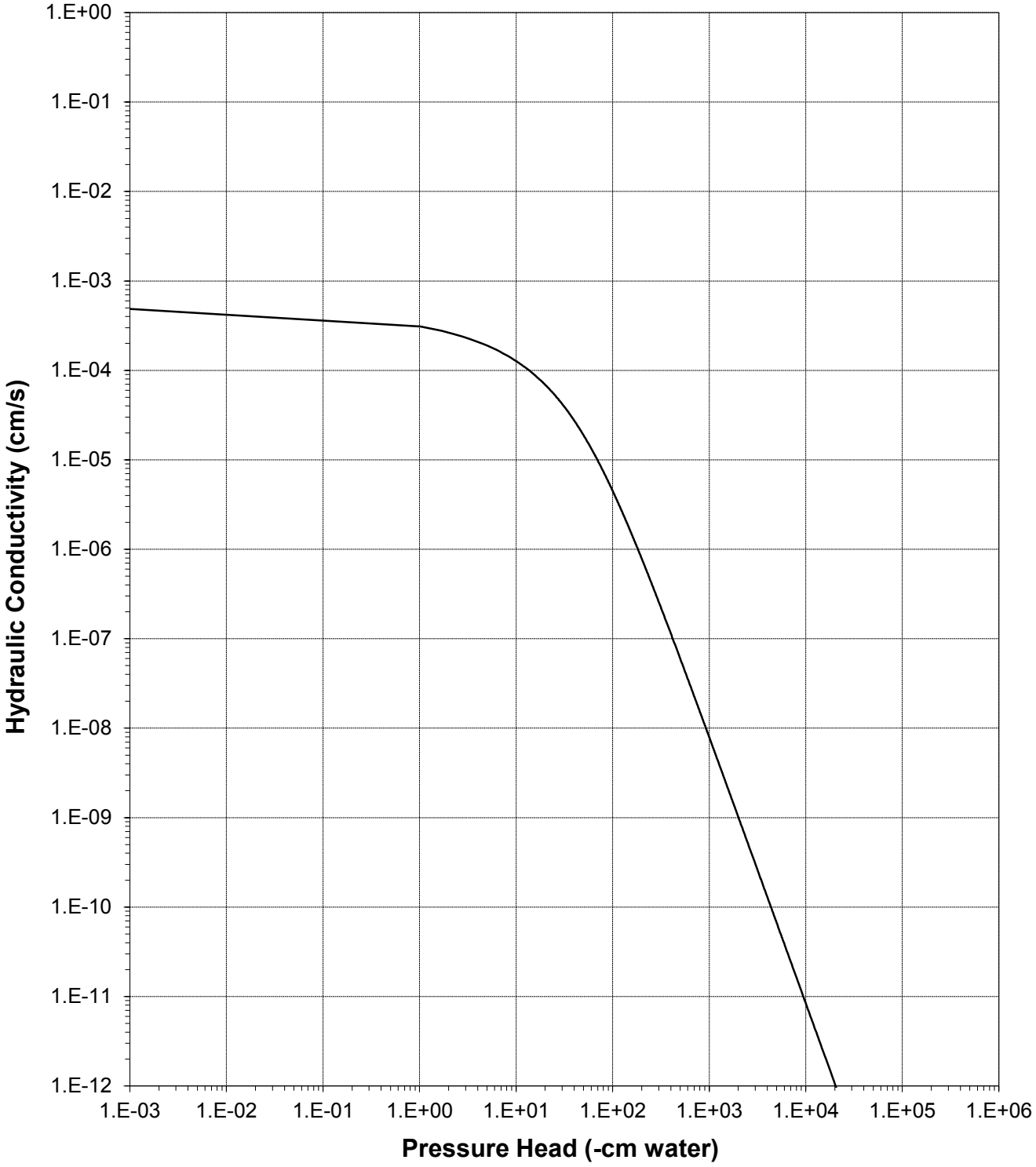
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Mix 3: Silt 50% Overburden 50% (90%)



Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50% (90%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	894.88	15144.82	16039.70
Mass Fraction (%):	5.58	94.42	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.72	1.75
Calculated Porosity (% vol):	0.00	35.14	33.84
Volume of Solids (cm^3):	337.69	5715.03	6052.72
Volume of Voids (cm^3):	0.00	3096.26	3096.26
Total Volume (cm^3):	337.69	8811.28	9148.97
Volumetric Fraction (%):	3.69	96.31	100.00
Initial Moisture Content (% vol):	0.00	15.81	15.23
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.72	1.75
Calculated Porosity (% vol):	0.00	35.14	33.84
Volume of Solids (cm^3):	337.69	5715.03	6052.72
Volume of Voids (cm^3):	0.00	3096.26	3096.26
Total Volume (cm^3):	337.69	8811.28	9148.97
Volumetric Fraction (%):	3.69	96.31	100.00
Saturated Moisture Content (% vol):	0.00	36.67	35.32
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.72	1.75
Calculated Porosity (% vol):	0.00	35.14	33.84
Volume of Solids (cm^3):	337.69	5715.03	6052.72
Volume of Voids (cm^3):	0.00	3096.26	3096.26
Total Volume (cm^3):	337.69	8811.28	9148.97
Volumetric Fraction (%):	3.69	96.31	100.00
Residual Moisture Content (% vol):	0.00	3.53	3.40
Ksat (cm/sec):	NM	4.9E-04	4.6E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
Clay	7.4E-05	0.014	0.056	757	0.29	WS/H	Classification by ASTM 2487 requires Atterberg test	Clay Loam †	(Est)
Silt	0.0033	0.073	0.096	29	4.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
Overburden	0.0056	0.15	0.20	36	4.8	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	
Mix 1: Clay 50% Overburden 50%	0.00074	0.12	0.18	243	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	(Est)
Mix 2: Clay 30% Overburden 70%	0.0014	0.14	0.20	143	13	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †	
Mix 3: Silt 50% Overburden 50%	0.0067	0.13	0.16	24	3.8	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
Clay	11.4	24.0	30.2	34.3
Silt	0.5	48.4	41.9	9.2
Overburden	12.0	57.3	23.2	7.5
Mix 1: Clay 50% Overburden 50%	11.3	48.2	26.4	14.1
Mix 2: Clay 30% Overburden 70%	11.0	53.0	25.5	10.4
Mix 3: Silt 50% Overburden 50%	5.6	59.5	28.9	6.0

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA
Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 1145.18
Weight Passing #4 (g): 1014.28
Weight Retained #4 (g): 130.90
Weight of Hydrometer Sample (g): 78.59
Calculated Weight of Sieve Sample (g): 88.73

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1145.18	100.00
	2"	50	0.00	0.00	1145.18	100.00
	1.5"	38.1	0.00	0.00	1145.18	100.00
	1"	25	0.00	0.00	1145.18	100.00
	3/4"	19.0	46.82	46.82	1098.36	95.91
	3/8"	9.5	41.26	88.08	1057.10	92.31
	4	4.75	42.82	130.90	1014.28	88.57
-4			(Based on calculated sieve wt.)			
	10	2.00	2.06	12.20	76.53	86.25
	20	0.85	2.40	14.60	74.13	83.54
	40	0.425	2.90	17.50	71.23	80.27
	60	0.250	3.19	20.69	68.04	76.68
	140	0.106	7.30	27.99	60.74	68.45
	200	0.075	3.47	31.46	57.27	64.54
	dry pan		0.85	32.31	56.42	
	wet pan			56.42	0.00	

d_{10} (mm): 7.4E-05 d_{50} (mm): 0.014
d_{16} (mm): 0.00017 d_{60} (mm): 0.056
d_{30} (mm): 0.0011 d_{84} (mm): 0.98

Median Particle Diameter --d_{50} (mm): 0.014
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 757
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.29
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.33

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Clay Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

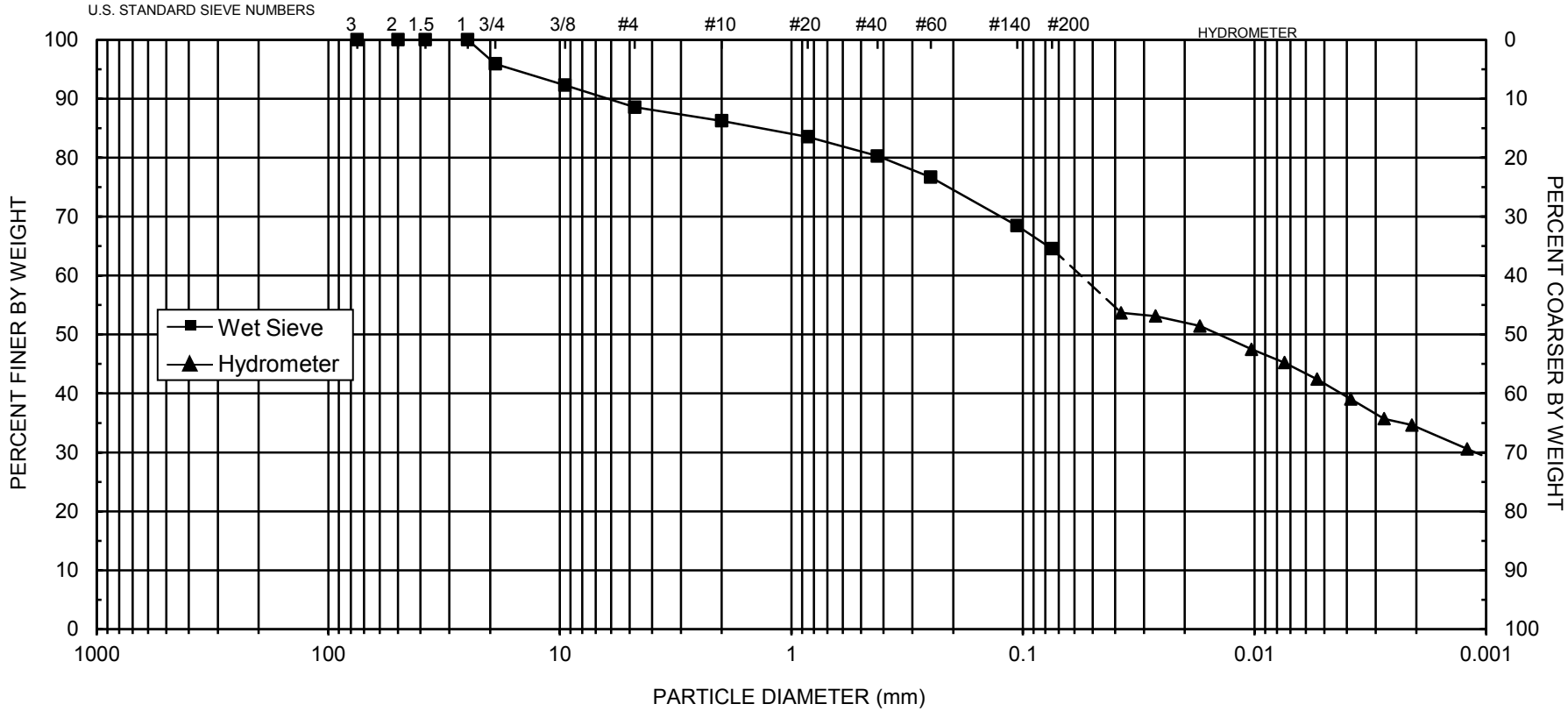
Initial Wt. (g)*:* 78.59
Total Sample Wt. (g)*:* 1145.18
Wt. Passing #4 (g): 1014.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	54.0	6.4	47.6	7.4	0.03763	60.6	53.7
	2	19.1	53.5	6.4	47.1	7.5	0.02675	60.0	53.1
	5	19.1	52.0	6.4	45.6	7.8	0.01719	58.1	51.4
	15	19.1	48.5	6.4	42.1	8.3	0.01029	53.6	47.5
	30	19.1	46.5	6.4	40.1	8.7	0.00741	51.1	45.2
	60	19.1	44.0	6.4	37.6	9.1	0.00537	47.9	42.4
	124	19.1	41.0	6.4	34.6	9.6	0.00383	44.1	39.0
	250	19.5	38.0	6.3	31.7	10.1	0.00276	40.3	35.7
	438	19.7	37.0	6.3	30.7	10.2	0.00209	39.1	34.6
28-Jan-15	1410	19.1	33.5	6.4	27.1	10.8	0.00121	34.5	30.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **7.4E-05**	d_{30} = **0.0011**	d_{50} = **0.014**	d_{60} = **0.056**	C_u = **757**	C_c = **0.29**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Clay	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Clay Loam †**

† Greater than 10% of sample is coarse material

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Silt
Ring Number: NA
Depth: NA
Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 957.59
Weight Passing #4 (g): 952.59
Weight Retained #4 (g): 5.00
Weight of Hydrometer Sample (g): 79.14
Calculated Weight of Sieve Sample (g): 79.56
Shape: Angular
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	957.59	100.00
	2"	50	0.00	0.00	957.59	100.00
	1.5"	38.1	0.00	0.00	957.59	100.00
	1"	25	0.00	0.00	957.59	100.00
	3/4"	19.0	0.00	0.00	957.59	100.00
	3/8"	9.5	4.80	4.80	952.79	99.50
	4	4.75	0.20	5.00	952.59	99.48
-4			(Based on calculated sieve wt.)			
	10	2.00	0.77	1.19	78.37	98.51
	20	0.85	0.31	1.50	78.06	98.12
	40	0.425	0.47	1.97	77.59	97.53
	60	0.250	1.83	3.80	75.76	95.23
	140	0.106	25.12	28.92	50.64	63.65
	200	0.075	9.97	38.89	40.67	51.12
	dry pan		4.64	43.53	36.03	
	wet pan			36.03	0.00	

d_{10} (mm): 0.0033 d_{50} (mm): 0.073
d_{16} (mm): 0.0086 d_{60} (mm): 0.096
d_{30} (mm): 0.038 d_{84} (mm): 0.18

Median Particle Diameter --d_{50} (mm): 0.073
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 29
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.087

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Silt
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

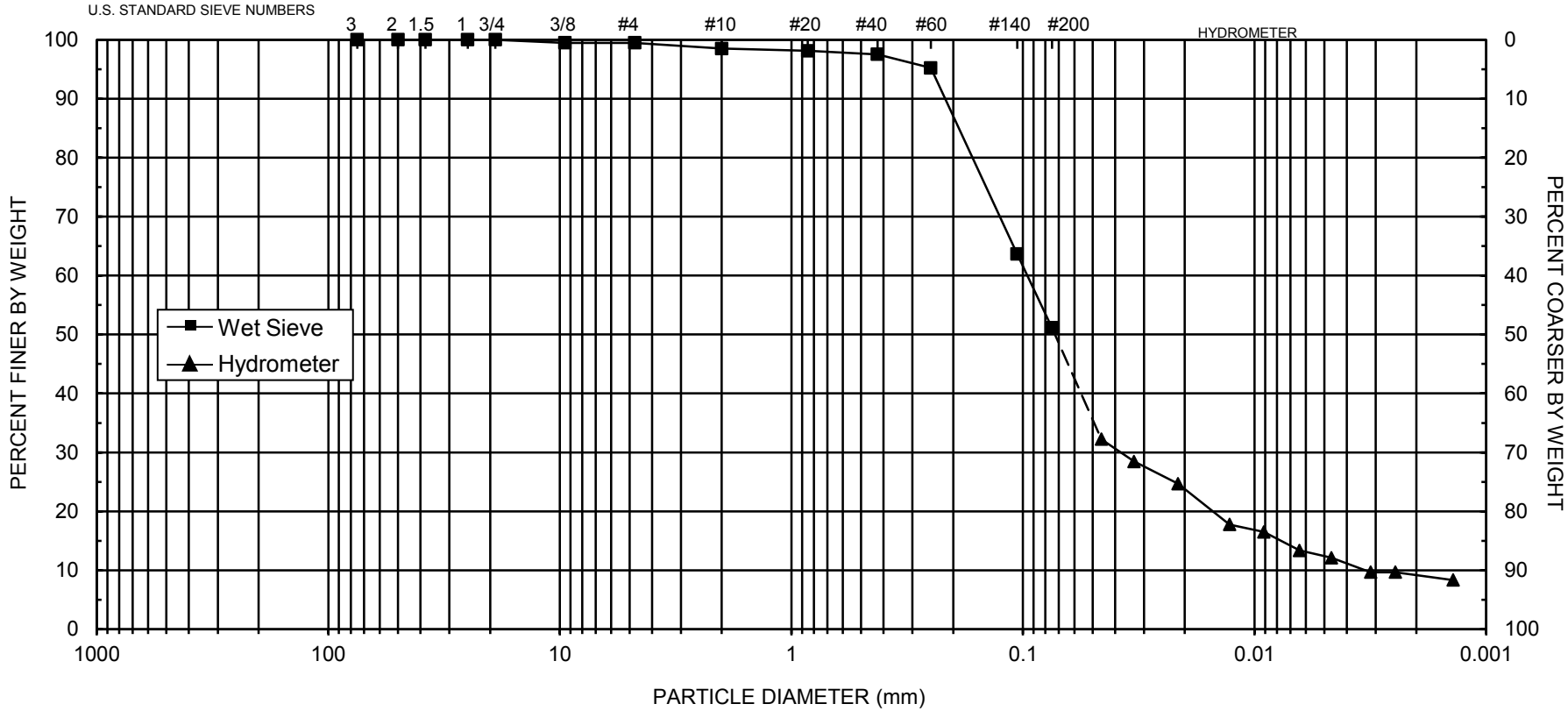
Initial Wt. (g)*:* 79.14
Total Sample Wt. (g)*:* 957.59
Wt. Passing #4 (g): 952.59

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	32.0	6.4	25.6	11.1	0.04584	32.4	32.2
	2	19.1	29.0	6.4	22.6	11.5	0.03313	28.6	28.4
	5	19.1	26.0	6.4	19.6	12.0	0.02139	24.8	24.7
	15	19.1	20.5	6.4	14.1	12.9	0.01281	17.9	17.8
	30	19.1	19.5	6.4	13.1	13.1	0.00911	16.6	16.5
	63	19.1	17.0	6.4	10.6	13.5	0.00639	13.4	13.4
	120	19.1	16.0	6.4	9.6	13.7	0.00465	12.2	12.1
	266	19.5	14.0	6.3	7.7	14.0	0.00315	9.7	9.7
	433	19.7	14.0	6.3	7.7	14.0	0.00246	9.7	9.7
28-Jan-15	1405	19.1	13.0	6.4	6.6	14.2	0.00138	8.4	8.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT			CLAY
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0033**	d_{30} = **0.038**	d_{50} = **0.073**	d_{60} = **0.096**	C_u = **29**	C_c = **4.6**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Silt	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam**

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Overburden
Ring Number: NA
Depth: NA
Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 1361.49
Weight Passing #4 (g): 1197.72
Weight Retained #4 (g): 163.77
Weight of Hydrometer Sample (g): 78.65
Calculated Weight of Sieve Sample (g): 89.40

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1361.49	100.00
	2"	50	0.00	0.00	1361.49	100.00
	1.5"	38.1	0.00	0.00	1361.49	100.00
	1"	25	73.27	73.27	1288.22	94.62
	3/4"	19.0	41.40	114.67	1246.82	91.58
	3/8"	9.5	25.57	140.24	1221.25	89.70
	4	4.75	23.53	163.77	1197.72	87.97
-4			(Based on calculated sieve wt.)			
	10	2.00	1.70	12.45	76.95	86.07
	20	0.85	2.19	14.64	74.76	83.62
	40	0.425	5.03	19.67	69.73	77.99
	60	0.250	10.25	29.92	59.48	66.53
	140	0.106	24.68	54.60	34.80	38.92
	200	0.075	7.38	61.98	27.42	30.67
	dry pan		1.89	63.87	25.53	
	wet pan			25.53	0.00	

d_{10} (mm): 0.0056 d_{50} (mm): 0.15
d_{16} (mm): 0.027 d_{60} (mm): 0.20
d_{30} (mm): 0.073 d_{84} (mm): 0.97

Median Particle Diameter --d_{50} (mm): 0.15
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 36
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.8
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.38

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Overburden
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

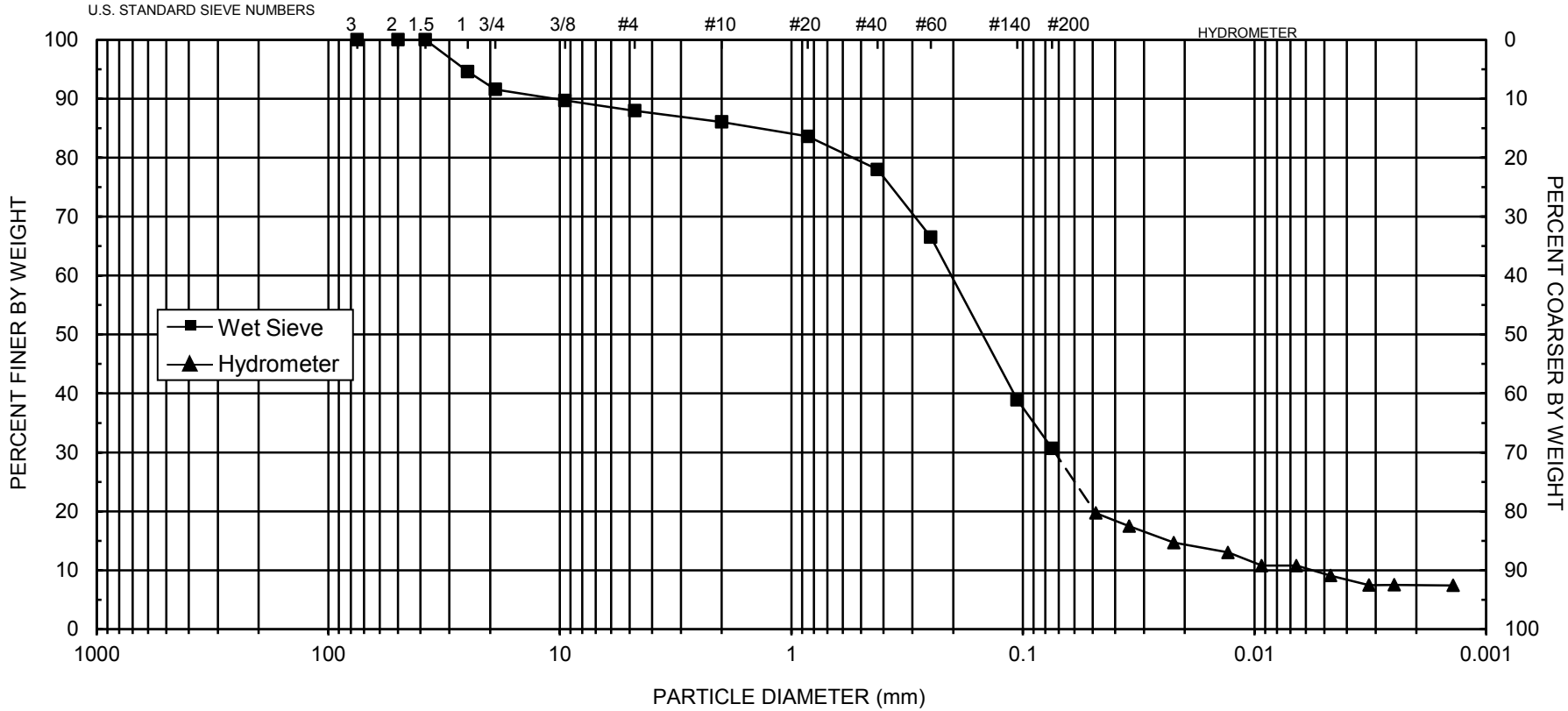
Initial Wt. (g)*:* 78.65
Total Sample Wt. (g)*:* 1361.49
Wt. Passing #4 (g): 1197.72

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	24.0	6.4	17.6	12.4	0.04848	22.4	19.7
	2	19.1	22.0	6.4	15.6	12.7	0.03473	19.9	17.5
	5	19.1	19.5	6.4	13.1	13.1	0.02232	16.7	14.7
	15	19.1	18.0	6.4	11.6	13.3	0.01301	14.8	13.0
	30	19.1	16.0	6.4	9.6	13.7	0.00931	12.2	10.8
	60	19.1	16.0	6.4	9.6	13.7	0.00658	12.2	10.8
	120	19.1	14.5	6.4	8.1	13.9	0.00470	10.3	9.1
	261	19.5	13.0	6.3	6.7	14.2	0.00320	8.5	7.5
	428	19.7	13.0	6.3	6.7	14.2	0.00249	8.6	7.5
28-Jan-15	1400	19.1	13.0	6.4	6.6	14.2	0.00139	8.4	7.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0056**	d_{30} = **0.073**	d_{50} = **0.15**	d_{60} = **0.20**	C_u = **36**	C_c = **4.8**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Overburden	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50%
Ring Number: NA
Depth: NA
Test Date: 17-Mar-15

Initial Dry Weight of Sample (g): 16767.44
Weight Passing #10 (g): 14497.87
Weight Retained #10 (g): 2269.57
Weight of Hydrometer Sample (g): 69.62
Calculated Weight of Sieve Sample (g): 80.52

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	16767.44	100.00
	2"	50	0.00	0.00	16767.44	100.00
	1.5"	38.1	21.19	21.19	16746.25	99.87
	1"	25	321.85	343.04	16424.40	97.95
	3/4"	19.0	565.10	908.14	15859.30	94.58
	3/8"	9.5	499.78	1407.92	15359.52	91.60
	4	4.75	485.32	1893.24	14874.20	88.71
	10	2.00	376.32	2269.57	14497.87	86.46
-10			(Based on calculated sieve wt.)			
	20	0.85	2.31	13.21	67.31	83.60
	40	0.425	4.40	17.61	62.91	78.13
	60	0.250	7.88	25.49	55.03	68.34
	140	0.106	18.04	43.53	36.99	45.94
	200	0.075	4.38	47.91	32.61	40.50
	dry pan		0.15	48.06	32.46	
	wet pan			32.46	0.00	

d_{10} (mm): 0.00074 d_{50} (mm): 0.12
d_{16} (mm): 0.0028 d_{60} (mm): 0.18
d_{30} (mm): 0.048 d_{84} (mm): 0.96

Median Particle Diameter --d_{50} (mm): 0.12
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 243
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 17
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.36

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50%
Ring Number: NA
Depth: NA

Test Date: 16-Mar-15
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

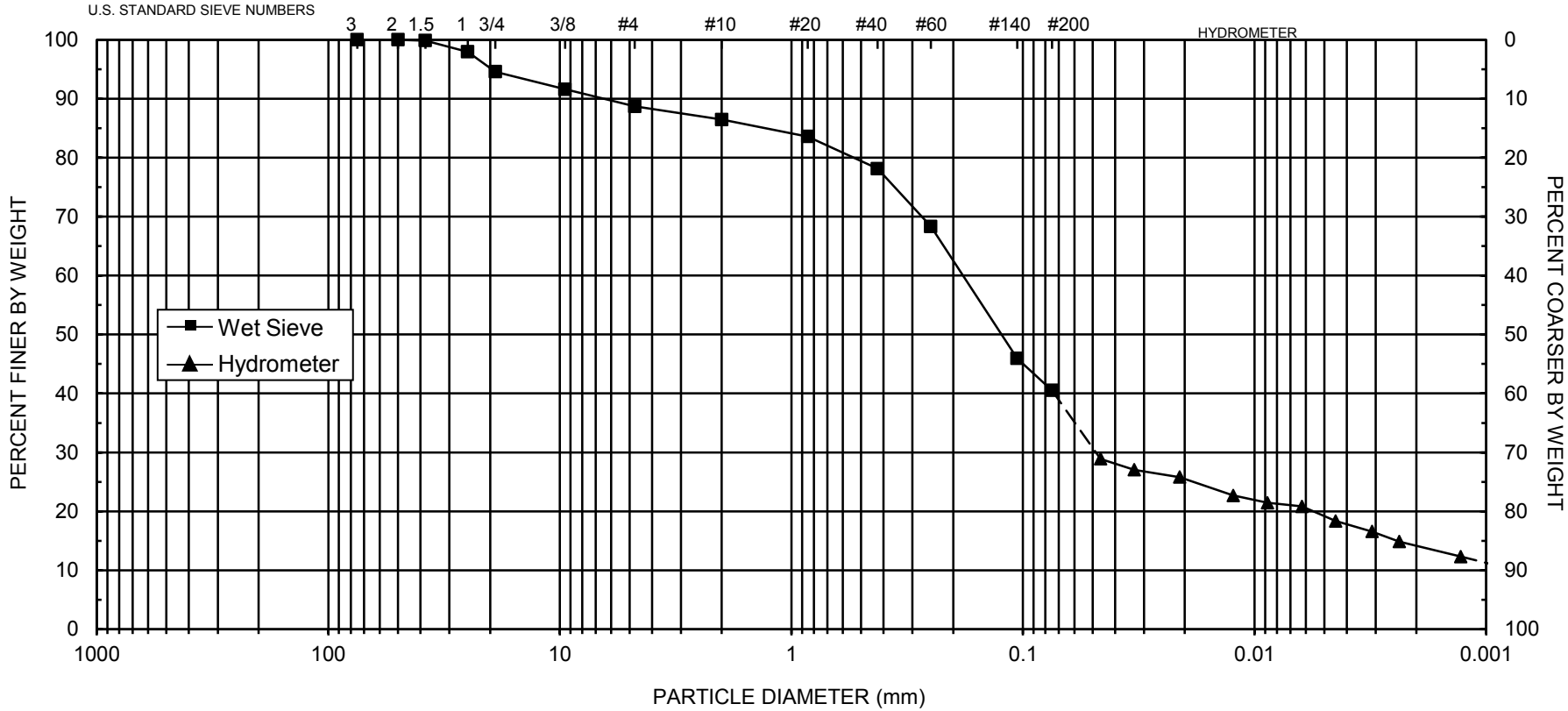
Initial Wt. (g)*:* 69.62
Total Sample Wt. (g)*:* 16767.44
Wt. Passing #10 (g): 14497.87

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-Mar-15	1	19.9	29.5	6.2	23.3	11.5	0.04622	33.4	28.9
	2	19.9	28.0	6.2	21.8	11.7	0.03303	31.3	27.0
	5	19.9	27.0	6.2	20.8	11.9	0.02104	29.8	25.8
	15	19.9	24.5	6.2	18.3	12.3	0.01235	26.2	22.7
	30	19.9	23.5	6.2	17.3	12.4	0.00879	24.8	21.4
	60	19.9	23.0	6.2	16.8	12.5	0.00624	24.1	20.8
	120	20.0	21.0	6.2	14.8	12.9	0.00446	21.2	18.4
	250	20.3	19.5	6.2	13.3	13.1	0.00311	19.1	16.6
	432	21.0	18.0	6.1	12.0	13.3	0.00237	17.2	14.8
17-Mar-15	1511	20.7	16.0	6.1	9.9	13.7	0.00128	14.2	12.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.00074**	d_{30} = **0.048**	d_{50} = **0.12**	d_{60} = **0.18**	C_u = **243**	C_c = **17**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Mix 1: Clay 50% Overburden 50%	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

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Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70%
Ring Number: NA
Depth: NA
Test Date: 17-Mar-15

Initial Dry Weight of Sample (g): 17249.00
Weight Passing #10 (g): 14951.64
Weight Retained #10 (g): 2297.36
Weight of Hydrometer Sample (g): 64.82
Calculated Weight of Sieve Sample (g): 74.78

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	17249.00	100.00
	2"	50	0.00	0.00	17249.00	100.00
	1.5"	38.1	30.40	30.40	17218.60	99.82
	1"	25	461.61	492.01	16756.99	97.15
	3/4"	19.0	520.32	1012.34	16236.66	94.13
	3/8"	9.5	461.10	1473.44	15775.56	91.46
	4	4.75	430.70	1904.13	15344.87	88.96
	10	2.00	393.22	2297.36	14951.64	86.68
-10			(Based on calculated sieve wt.)			
	20	0.85	2.14	12.10	62.68	83.82
	40	0.425	4.33	16.43	58.35	78.03
	60	0.250	7.98	24.41	50.37	67.36
	140	0.106	19.12	43.53	31.25	41.79
	200	0.075	4.39	47.92	26.86	35.92
	dry pan		0.40	48.32	26.46	
	wet pan			26.46	0.00	

d_{10} (mm): 0.0014 d_{50} (mm): 0.14
d_{16} (mm): 0.0076 d_{60} (mm): 0.20
d_{30} (mm): 0.060 d_{84} (mm): 0.90

Median Particle Diameter --d_{50} (mm): 0.14
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 143
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 13
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.35

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70%
Ring Number: NA
Depth: NA

Test Date: 16-Mar-15
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

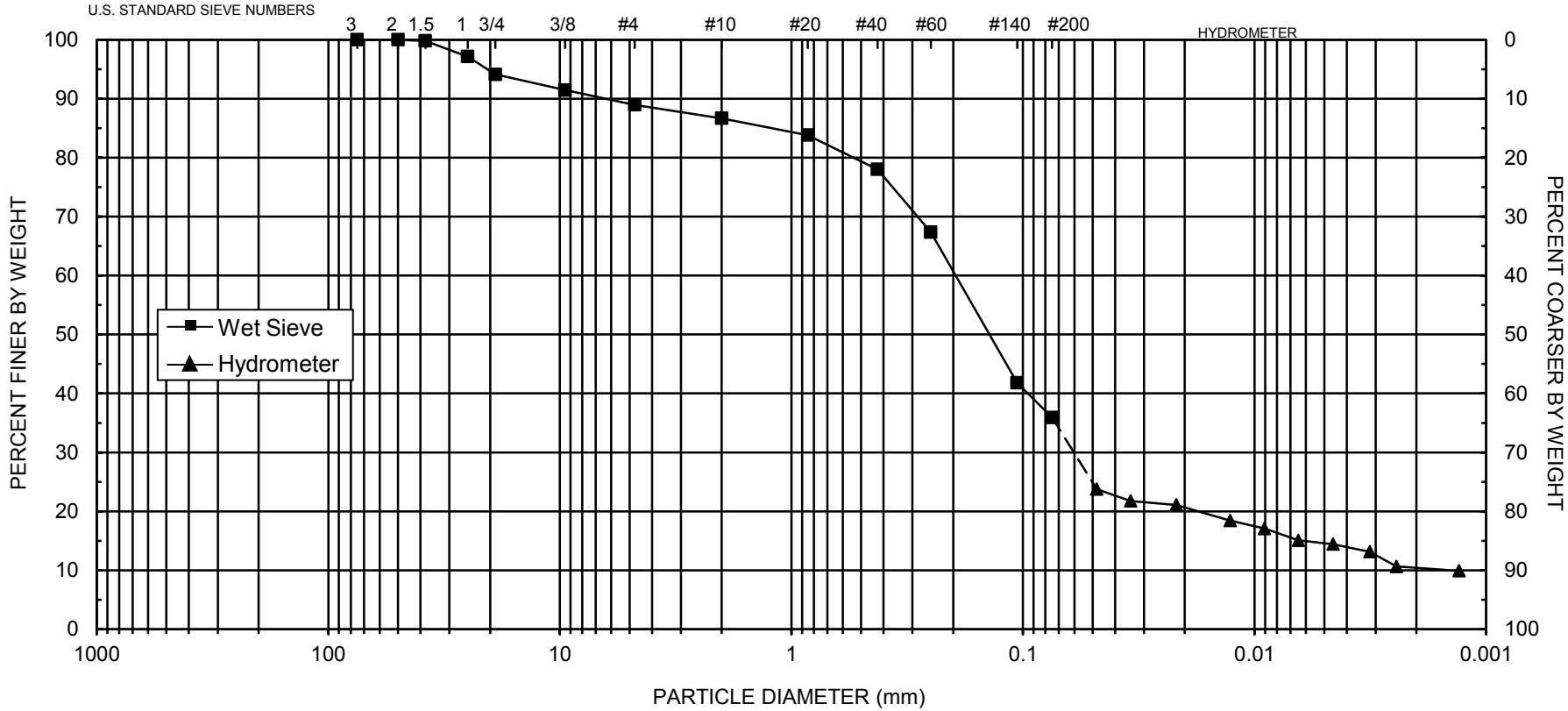
Initial Wt. (g)*:* 64.82
Total Sample Wt. (g)*:* 17249.00
Wt. Passing #10 (g): 14951.64

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-Mar-15	1	19.9	24.0	6.2	17.8	12.4	0.04800	27.4	23.8
	2	19.9	22.5	6.2	16.3	12.6	0.03428	25.1	21.8
	5	19.9	22.0	6.2	15.8	12.7	0.02175	24.3	21.1
	15	19.9	20.0	6.2	13.8	13.0	0.01272	21.2	18.4
	30	19.9	19.0	6.2	12.8	13.2	0.00905	19.7	17.1
	60	19.9	17.5	6.2	11.3	13.4	0.00646	17.4	15.1
	120	20.0	17.0	6.2	10.8	13.5	0.00458	16.6	14.4
	250	20.3	16.0	6.2	9.8	13.7	0.00317	15.2	13.1
	427	21.0	14.0	6.1	8.0	14.0	0.00244	12.3	10.6
17-Mar-15	1506	20.7	13.5	6.1	7.4	14.1	0.00131	11.4	9.9

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0014**	d_{30} = **0.060**	d_{50} = **0.14**	d_{60} = **0.20**	C_u = **143**	C_c = **13**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Mix 2: Clay 30% Overburden 70%	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50%
Ring Number: NA
Depth: NA
Test Date: 17-Mar-15

Initial Dry Weight of Sample (g): 16039.70
Weight Passing #10 (g): 14921.05
Weight Retained #10 (g): 1118.65
Weight of Hydrometer Sample (g): 68.17
Calculated Weight of Sieve Sample (g): 73.28

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	16039.70	100.00
	2"	50	0.00	0.00	16039.70	100.00
	1.5"	38.1	19.99	19.99	16019.71	99.88
	1"	25	303.62	323.62	15716.08	97.98
	3/4"	19.0	199.09	522.71	15516.99	96.74
	3/8"	9.5	218.09	740.80	15298.90	95.38
	4	4.75	154.08	894.88	15144.82	94.42
	10	2.00	223.77	1118.65	14921.05	93.03
-10			(Based on calculated sieve wt.)			
	20	0.85	1.15	6.26	67.02	91.46
	40	0.425	2.69	8.95	64.33	87.79
	60	0.250	6.86	15.81	57.47	78.42
	140	0.106	26.27	42.08	31.20	42.58
	200	0.075	5.63	47.71	25.57	34.89
	dry pan		0.26	47.97	25.31	
	wet pan			25.31	0.00	

d_{10} (mm): 0.0067 d_{50} (mm): 0.13
d_{16} (mm): 0.032 d_{60} (mm): 0.16
d_{30} (mm): 0.064 d_{84} (mm): 0.34

Median Particle Diameter --d_{50} (mm): 0.13
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 24
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.8
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.17

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50%
Ring Number: NA
Depth: NA

Test Date: 16-Mar-15
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

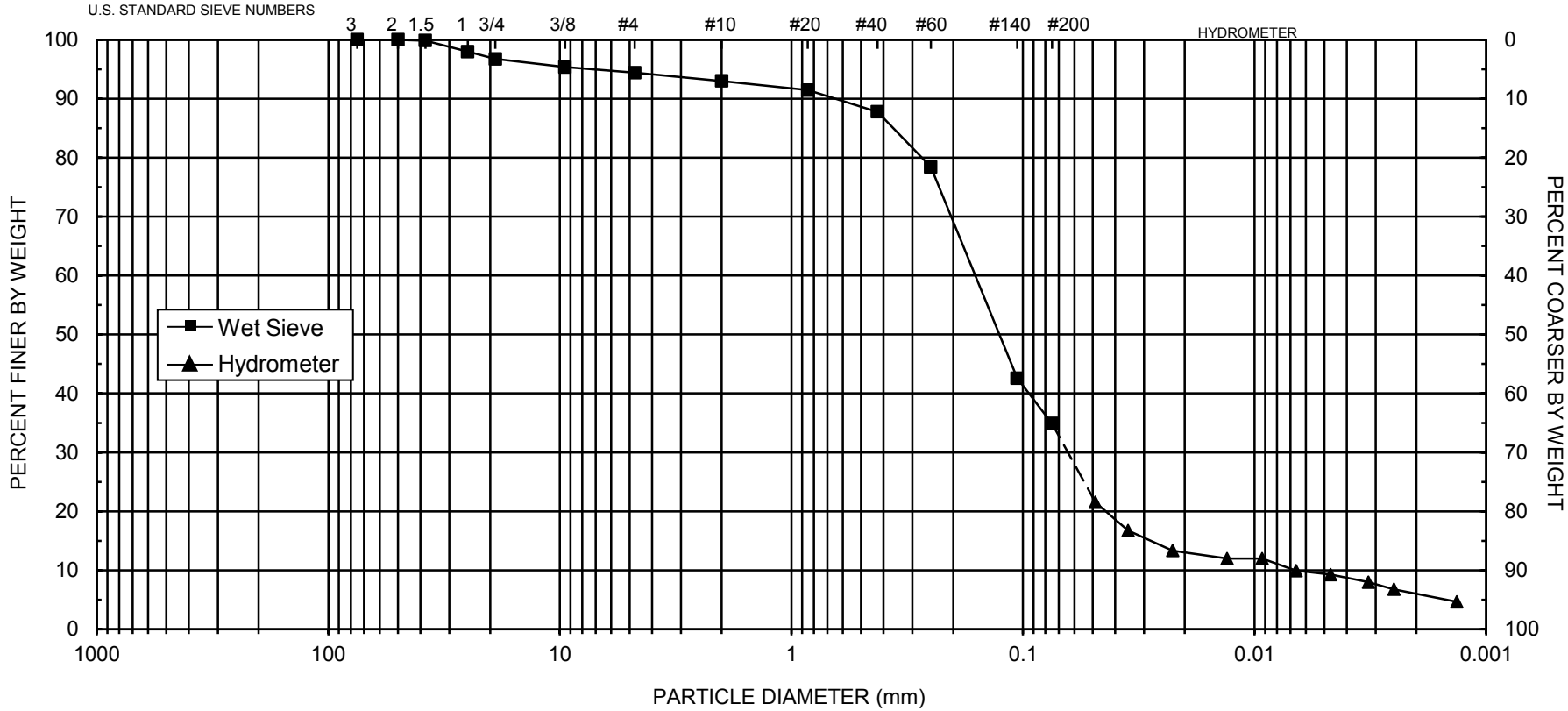
Initial Wt. (g)*:* 68.17
Total Sample Wt. (g)*:* 16039.70
Wt. Passing #10 (g): 14921.05

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-Mar-15	1	19.9	22.0	6.2	15.8	12.7	0.04864	23.1	21.5
	2	19.9	18.5	6.2	12.3	13.3	0.03516	18.0	16.7
	5	19.9	16.0	6.2	9.8	13.7	0.02258	14.3	13.3
	15	19.9	15.0	6.2	8.8	13.8	0.01311	12.9	12.0
	30	19.9	15.0	6.2	8.8	13.8	0.00927	12.9	12.0
	60	19.9	13.5	6.2	7.3	14.1	0.00661	10.7	9.9
	120	20.0	13.0	6.2	6.8	14.2	0.00468	9.9	9.3
	254	20.4	12.0	6.2	5.9	14.3	0.00322	8.6	8.0
	422	21.0	11.0	6.1	5.0	14.5	0.00249	7.3	6.8
17-Mar-15	1501	20.7	9.5	6.1	3.4	14.7	0.00134	5.0	4.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0067**	d_{30} = **0.064**	d_{50} = **0.13**	d_{60} = **0.16**	C_u = **24**	C_c = **3.8**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Mix 3: Silt 50% Overburden 50%	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam**

Daniel B. Stephens & Associates, Inc.

Proctor Compaction

Summary of Proctor Compaction Tests

Sample Number	Measured Optimum Moisture Content (% g/g)	Measured Maximum Dry Bulk Density (g/cm^3)	Oversize Corrected Optimum Moisture Content (% g/g)	Oversize Corrected Maximum Dry Bulk Density (g/cm^3)
Mix 1: Clay 50% Overburden 50%	12.5	1.87	11.1	1.93
Mix 2: Clay 30% Overburden 70%	12.1	1.94	10.8	1.99
Mix 3: Silt 50% Overburden 50%	11.0	1.91	10.4	1.94

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Proctor Compaction Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 1: Clay 50% Overburden 50%
Ring Number: NA
Depth: NA
Test Date: 5-Feb-15
As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4
Mass of coarse material (g)*:* 1893.24
Mass of fines material (g)*:* 14874.20
Mold weight (g): 4374.9
Mold volume (cm^3)*:* 944.44
Compaction Method: Standard A
Preparation Method: Dry
Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm^3)	Moisture Content (% g/g)
1	6157	408.23	400.17	292.89	1.76	7.51
2	6247	386.51	377.83	283.58	1.82	9.21
3	6332	376.93	365.70	266.46	1.86	11.32
4	6375	398.47	384.71	284.77	1.86	13.77
5	6320	556.46	511.04	269.15	1.73	18.78

Soil Fractions
Coarse Fraction (% g/g): 11.3
Fines Fraction (% g/g): 88.7

Properties of Coarse Material
Assumed particle density (g/cm^3)*:* 2.65
Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm^3)	Moisture Content of Composite (% g/g)
1	1.82	6.66
2	1.88	8.17
3	1.93	10.04
4	1.93	12.21
5	1.80	16.66

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

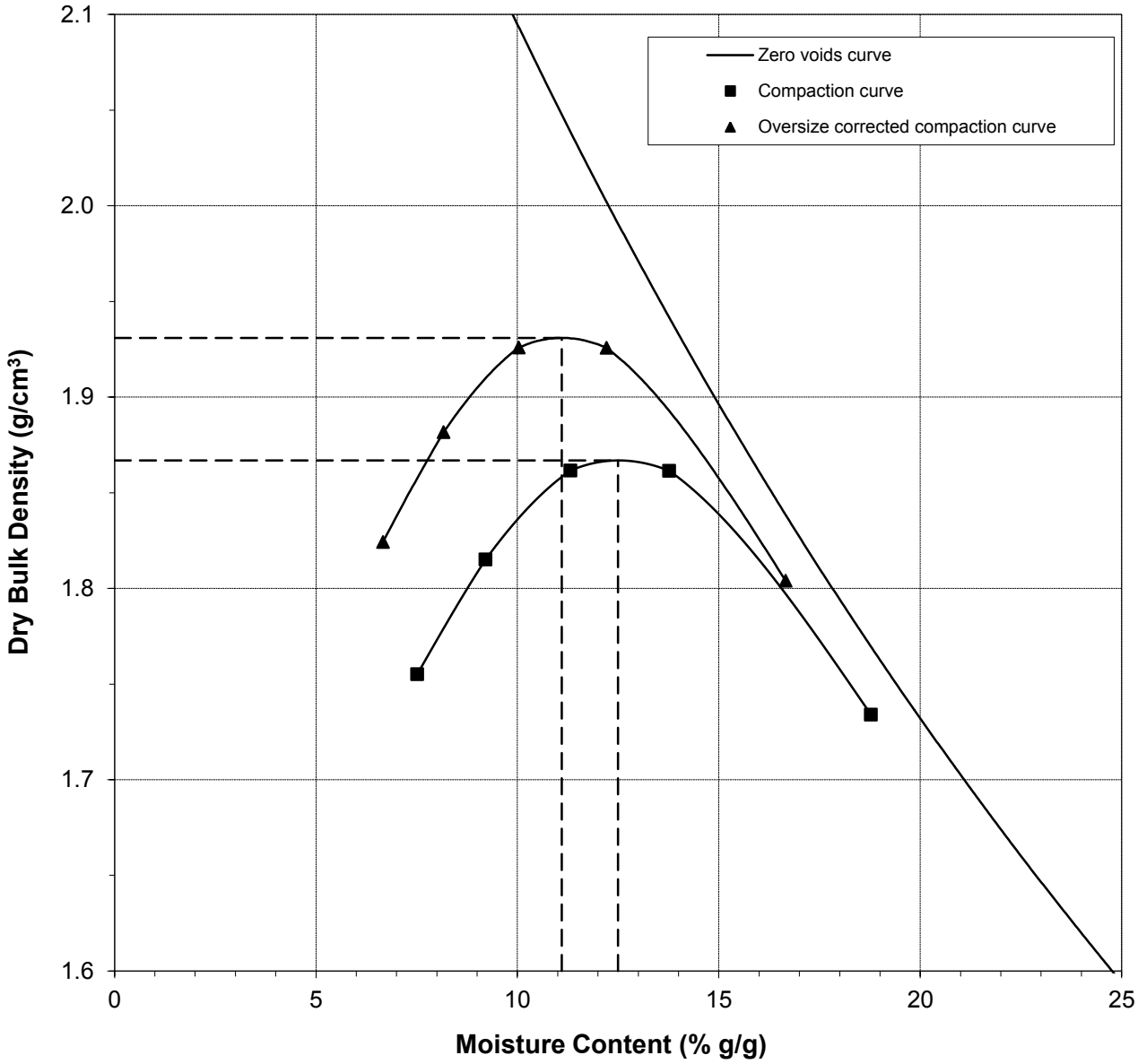
Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Proctor Compaction Data Points with Fitted Curve

Sample Number: Mix 1: Clay 50% Overburden 50%

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.5	11.1
Maximum Dry Bulk Density (g/cm^3):	1.87	1.93

Test Date: 5-Feb-15



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Proctor Compaction Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 2: Clay 30% Overburden 70%
Ring Number: NA
Depth: NA
Test Date: 5-Feb-15
As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4
Mass of coarse material (g)*:* 1904.13
Mass of fines material (g)*:* 15344.87
Mold weight (g): 4374.9
Mold volume (cm^3)*:* 944.44
Compaction Method: Standard A
Preparation Method: Dry
Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm^3)	Moisture Content (% g/g)
1	6271	429.30	418.12	296.93	1.84	9.23
2	6393	402.05	388.68	267.30	1.92	11.01
3	6432	459.02	439.79	298.44	1.92	13.60
4	6388	460.41	438.91	300.30	1.85	15.51
5	6322	552.86	510.64	268.16	1.76	17.41

Soil Fractions
Coarse Fraction (% g/g): 11.0
Fines Fraction (% g/g): 89.0

Properties of Coarse Material
Assumed particle density (g/cm^3)*:* 2.65
Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm^3)	Moisture Content of Composite (% g/g)
1	1.90	8.21
2	1.98	9.80
3	1.98	12.10
4	1.91	13.80
5	1.82	15.49

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

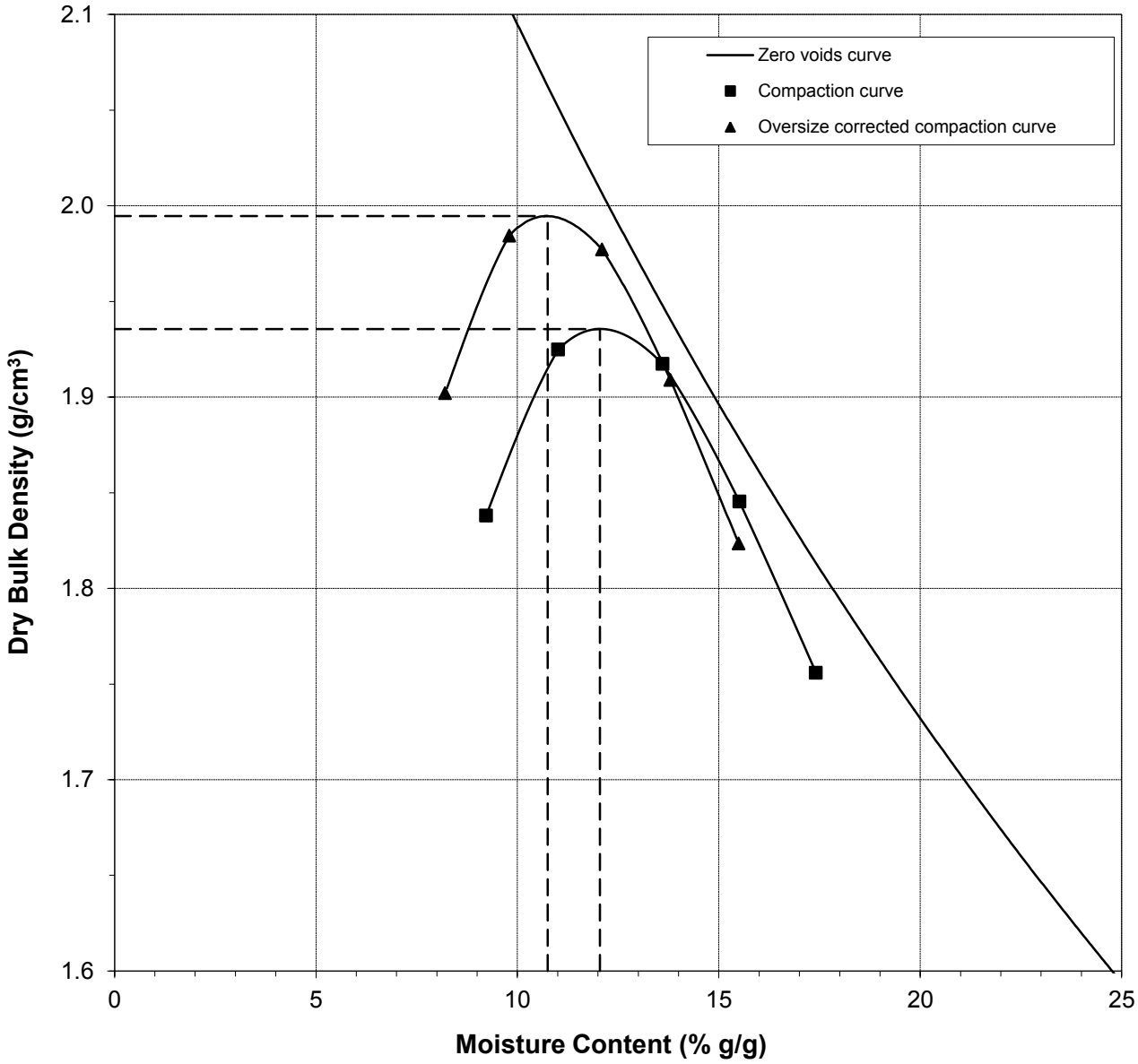
Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Proctor Compaction Data Points with Fitted Curve

Sample Number: Mix 2: Clay 30% Overburden 70%

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.1	10.8
Maximum Dry Bulk Density (g/cm^3):	1.94	1.99

Test Date: 5-Feb-15



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Proctor Compaction Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Mix 3: Silt 50% Overburden 50%
Ring Number: NA
Depth: NA
Test Date: 5-Feb-15
As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4
Mass of coarse material (g)*:* 894.88
Mass of fines material (g)*:* 15144.82
Mold weight (g): 4374.9
Mold volume (cm^3)*:* 944.44
Compaction Method: Standard A
Preparation Method: Dry
Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm^3)	Moisture Content (% g/g)
1	6173	374.60	369.34	284.53	1.79	6.20
2	6271	399.84	389.95	269.71	1.86	8.23
3	6353	428.98	415.73	284.32	1.90	10.08
4	6391	416.85	400.92	270.27	1.90	12.19
5	6394	471.02	449.64	297.83	1.87	14.08
6	6321	544.96	509.72	296.97	1.77	16.56

Soil Fractions
Coarse Fraction (% g/g): 5.6
Fines Fraction (% g/g): 94.4

Properties of Coarse Material
Assumed particle density (g/cm^3)*:* 2.65
Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm^3)	Moisture Content of Composite (% g/g)
1	1.83	5.86
2	1.89	7.77
3	1.93	9.52
4	1.93	11.51
5	1.90	13.30
6	1.80	15.64

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

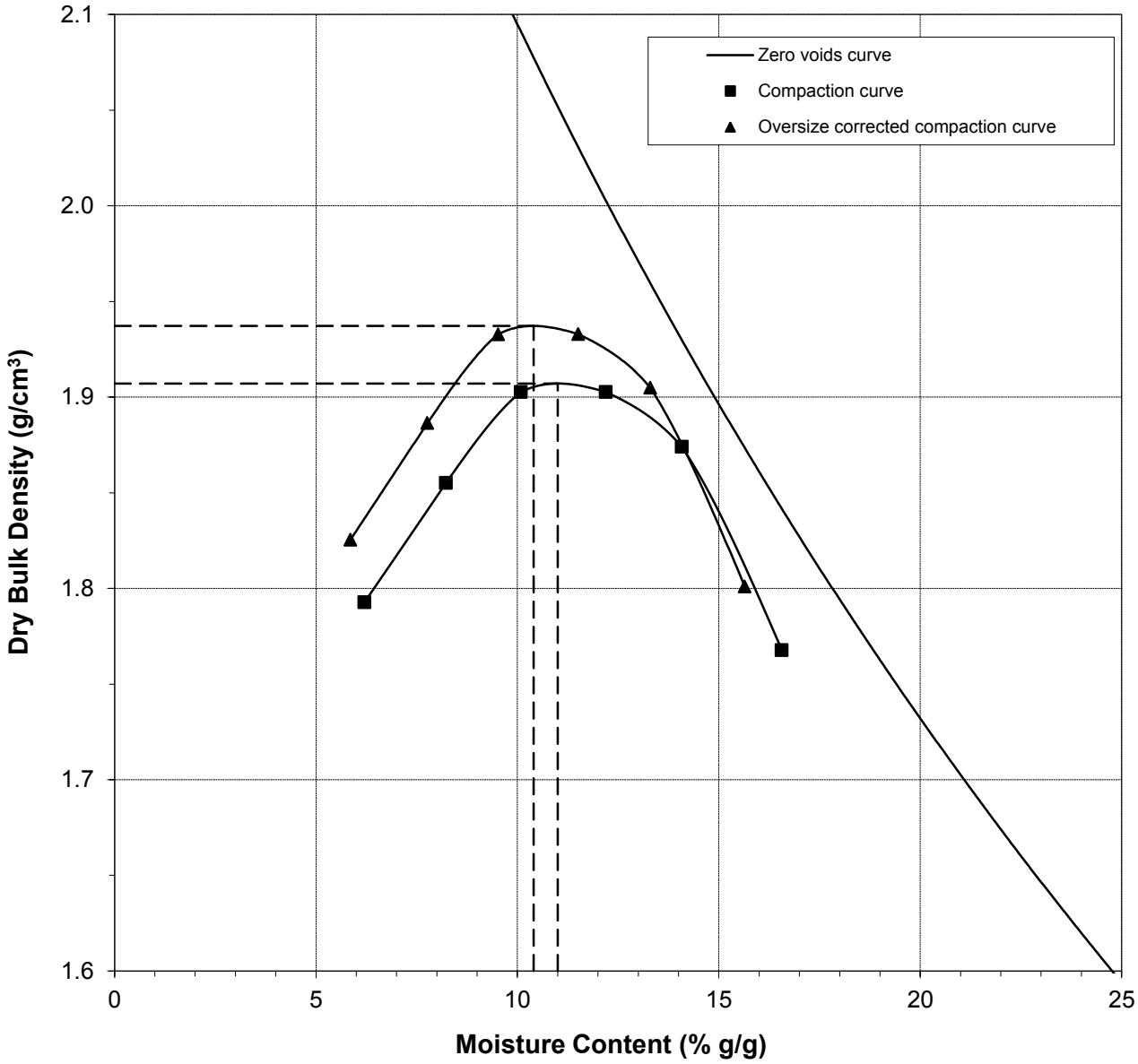
Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Proctor Compaction Data Points with Fitted Curve

Sample Number: Mix 3: Silt 50% Overburden 50%

	Measured	Corrected
Optimum Moisture Content (% g/g):	11.0	10.4
Maximum Dry Bulk Density (g/cm^3):	1.91	1.94

Test Date: 5-Feb-15



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: N. Candelaria
Data entered by: N. Candelaria
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Falling Head: (Rigid Wall)	Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 700-703, in A. Klute (ed.), Methods of Soil Analysis, Part 1, American Society of Agronomy, Madison, WI
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Particle Size Analysis:	ASTM D422
USDA Classification:	ASTM D422, USDA Soil Textural Triangle
Standard Proctor Compaction:	ASTM D698
Coarse Fraction (Gravel) Correction (calc):	ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6

Laboratory Report for

Dwyer Engineering

County Airport Landfill Samples

December 31, 2014

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

December 31, 2014

Steve Dwyer
Dwyer Engineering
1813 Stagecoach Rd. SE
Albuquerque, NM 87123
(505) 844-0595

Re: DBS&A Laboratory Report for the Dwyer Engineering County Airport Landfill Samples

Dear Mr. Dwyer:

Enclosed is the report for the Dwyer Engineering County Airport Landfill samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Dwyer Engineering and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
DDT Fill																X	X	X				X
DDT Fill (90.2%)	X	X		X			X	X		X	X			X								
ET Fill																X	X	X				X
ET Fill (89.6%)	X	X		X			X	X		X	X			X								

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Two samples were hand delivered, each in a 2/3 full to 3/4 full 5-gallon bucket, on November 7, 2014.

Sample Preparation and Testing Notes:
Both samples were subjected to standard proctor compaction. Each sample was remolded into testing rings to target 90% of the respective maximum dry bulk density at 2% below the respective optimum moisture content. The actual percentage of maximum density was added to each remolded sample ID. The remolded samples were subjected to initial properties testing, saturated hydraulic conductivity, and the hanging column and pressure chamber portions of the moisture retention testing. Based on the proctor compaction method, material larger than either 4.75mm or 3/8" (as appropriate) was removed from the sample material prior to compaction and remolding. Oversize correction calculations are presented if the fraction removed was greater than 5% of the bulk sample mass.

Separate sub-samples were prepared for particle size analysis, specific gravity testing, and the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the use of the measured specific.

Summary of Sample Preparation/Volume Changes

	Proctor Data		Target Remold Parameters[1]			Actual Remold Data			Volume Change Post Saturation[2]			Volume Change Post Drying Curve[3]		
Sample Number	Opt. Moist. Cont. (%, g/g)	Max. Dry Density (g/cm^3)	Moist. Cont. (%, g/g)	Dry Bulk Density (g/cm^3)	% of Max. Density (%)	Moist. Cont. (%, g/g)	Dry Bulk Density (g/cm^3)	% of Max. Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Max. Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Max. Density (%)
DDT Fill	10.5	1.97	8.5	1.78	90%	8.7	1.78	90.2%	1.78	---	90.2%	1.78	---	90.2%
ET Fill	11.7	1.90	9.7	1.71	90%	9.8	1.71	89.6%	1.71	---	89.6%	1.71	---	89.6%

[1]Target Remold Parameters: Provided by the client: 90% of maximum dry density at 2% dry of optimum moisture content.

[2]Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

[3]Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
DDT Fill (90.2%)	NA	NA	8.7	15.5	1.78	1.93	33.5
ET Fill (89.6%)	NA	NA	9.8	16.8	1.71	1.87	36.5

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
DDT Fill (90.2%)	1.2E-03	9.3E-04	X	
ET Fill (89.6%)	9.4E-04	8.6E-04	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
DDT Fill (90.2%)	0	34.4
	6	34.1
	22	33.6
	74	24.6
	337	19.2
	29574	8.2
	99838	6.4
	199677	5.2
	839828	4.1
ET Fill (89.6%)	0	37.1
	6	36.9
	22	36.7
	74	33.9
	337	18.7
	16113	9.3
	79544	7.2
	150930	5.9
	839828	4.5

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
DDT Fill (90.2%)	0.0351	1.2752	2.71	35.13	2.22	28.80
ET Fill (89.6%)	0.0076	1.8637	6.50	37.23	6.13	35.13

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
DDT Fill	0.010	0.49	1.2	120	1.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †
ET Fill	0.011	0.14	0.19	17	2.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
DDT Fill	33.6	43.0	17.8	5.6
ET Fill	8.5	61.4	24.1	6.0

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Summary of Specific Gravity Tests

	Test Sample			Oversize Material			Bulk Sample
Sample Number	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity[1]
DDT Fill	2.68	<4.75mm	66.4%	NR	>4.75mm	33.6%	2.68
ET Fill	2.69	<4.75mm	91.5%	NR	>4.75mm	8.5%	2.69

[1]Based on the <4.75mm material

--- = Unnecessary since specified fraction < 5% of composite mass

NA = Not analyzed

NR = Not requested

Summary of Proctor Compaction Tests

Sample Number	Measured: Optimum Moisture Content (% g/g)	Measured: Maximum Dry Bulk Density (g/cm^3)	Oversize Corrected: Optimum Moisture Content (% g/g)	Oversize Corrected: Maximum Dry Bulk Density (g/cm^3)
DDT Fill	10.5	1.97	7.9	2.10
ET Fill	11.7	1.90	10.6	1.95

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
DDT Fill (90.2%)	NA	NA	8.7	15.5	1.78	1.93	33.5
ET Fill (89.6%)	NA	NA	9.8	16.8	1.71	1.87	36.5

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill (90.2%)
Ring Number: NA
Depth: NA

	As Received	Remolded
Test Date:	NA	18-Nov-14
Field weight of sample* (g):		836.12
Tare weight, ring (g):		220.70
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		566.02
Sample volume (cm^3):		318.22
Measured particle density (g/cm^3):		2.67
Gravimetric Moisture Content (% g/g):		8.7
Volumetric Moisture Content (% vol):		15.5
Dry bulk density (g/cm^3):		1.78
Wet bulk density (g/cm^3):		1.93
Calculated Porosity (% vol):		33.5
Percent Saturation:		46.4

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill (89.6%)
Ring Number: NA
Depth: NA

	As Received	Remolded
Test Date:	NA	18-Nov-14
Field weight of sample* (g):		552.45
Tare weight, ring (g):		132.85
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		382.00
Sample volume (cm^3):		223.85
Measured particle density (g/cm^3):		2.69
Gravimetric Moisture Content (% g/g):		9.8
Volumetric Moisture Content (% vol):		16.8
Dry bulk density (g/cm^3):		1.71
Wet bulk density (g/cm^3):		1.87
Calculated Porosity (% vol):		36.5
Percent Saturation:		46.1

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
DDT Fill (90.2%)	1.2E-03	9.3E-04	X	
ET Fill (89.6%)	9.4E-04	8.6E-04	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill (90.2%)
Ring Number: NA
Depth: NA

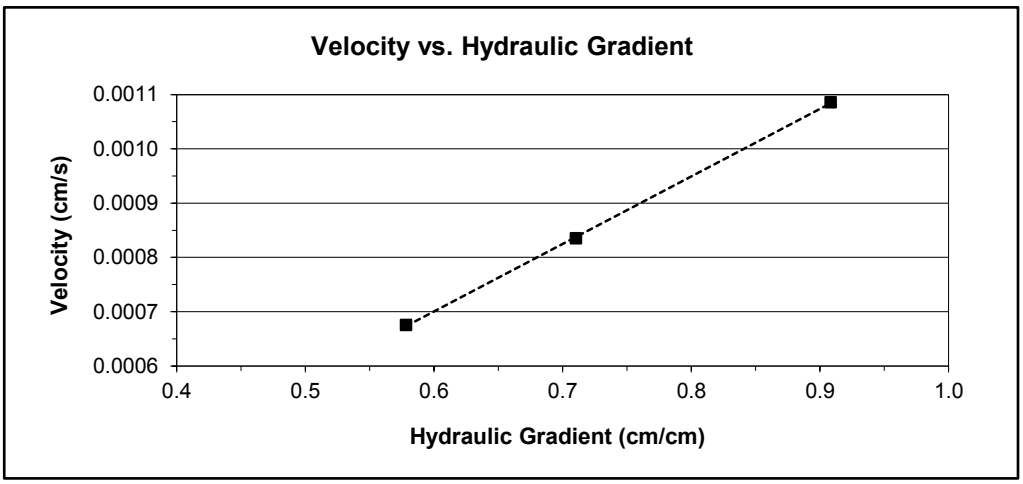
Type of water used: TAP
Collection vessel tare (g)*:* 10.96
Sample length (cm)*:* 7.57
Sample diameter (cm)*:* 7.32
Sample x-sectional area (cm^2)*:* 42.04

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Nov-14	14:15:24	18.5	6.5	16.27	5.3	122	1.2E-03	1.3E-03
20-Nov-14	14:17:26							
Test # 2:								
20-Nov-14	14:31:46	18.5	5	14.92	4.0	120	1.2E-03	1.2E-03
20-Nov-14	14:33:46							
Test # 3:								
20-Nov-14	14:43:35	18.5	4	14.14	3.2	121	1.2E-03	1.2E-03
20-Nov-14	14:45:36							

Average Ksat* (cm/sec)*: **1.2E-03**
Oversize Corrected Ksat* (cm/sec)*: **9.3E-04**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill (90.2%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): 3/8
Calculated Porosity of Fines (% vol)*:* 33.5

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	24.66	75.34	100.00
Bulk Density (g/cm^3)*:*	2.65	1.78	1.94
Volume of Solids (cm^3)*:*	9.31	28.19	37.49
Volume of Voids (cm^3)*:*	0.00	14.17	14.17
Total Volume (cm^3)*:*	9.31	42.36	51.66
Volumetric Fraction (%)*:*	18.01	81.99	100.00
Mass Fraction (%)*:*	24.66	75.34	100.00
Ksat (cm/sec)*:*	NM	1.2E-03	9.3E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill (89.6%)
Ring Number: NA
Depth: NA

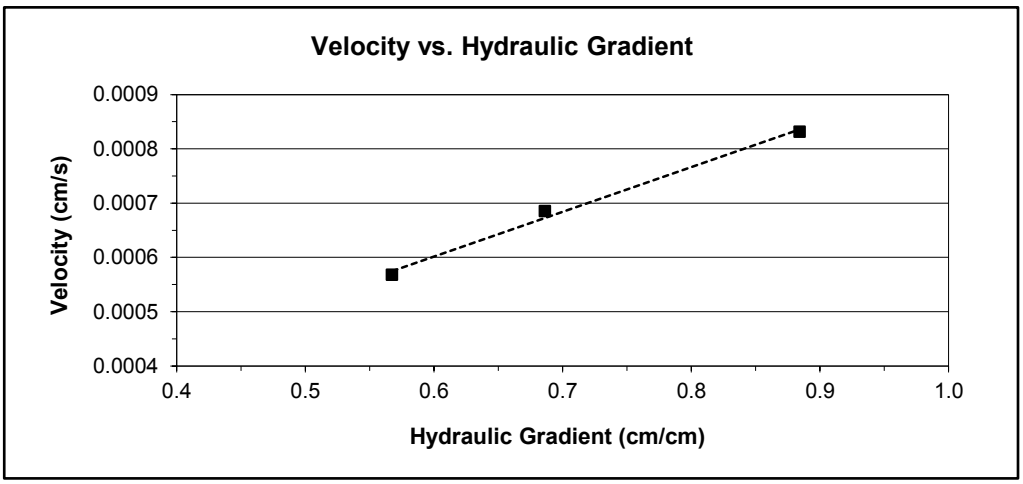
Type of water used: TAP
Collection vessel tare (g)*:* 10.89
Sample length (cm)*:* 7.58
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.55

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Nov-14	14:15:03	18.5	6.7	13.73	2.8	123	8.8E-04	9.2E-04
20-Nov-14	14:17:06							
Test # 2:								
20-Nov-14	14:31:32	18.5	5.2	13.16	2.3	121	9.2E-04	9.6E-04
20-Nov-14	14:33:33							
Test # 3:								
20-Nov-14	14:43:16	18.5	4.3	12.74	1.9	121	9.1E-04	9.5E-04
20-Nov-14	14:45:17							

Average Ksat* (cm/sec)*: **9.4E-04**
Oversize Corrected Ksat* (cm/sec)*: **8.6E-04**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill (89.6%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4
Calculated Porosity of Fines (% vol)*:* 36.5

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	8.48	91.52	100.00
Bulk Density (g/cm^3)*:*	2.65	1.71	1.76
Volume of Solids (cm^3)*:*	3.20	34.07	37.27
Volume of Voids (cm^3)*:*	0.00	19.56	19.56
Total Volume (cm^3)*:*	3.20	53.63	56.83
Volumetric Fraction (%)*:*	5.63	94.37	100.00
Mass Fraction (%)*:*	8.48	91.52	100.00
Ksat (cm/sec)*:*	NM	9.4E-04	8.6E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Moisture Retention Characteristics

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
DDT Fill (90.2%)	0	34.4
	6	34.1
	22	33.6
	74	24.6
	337	19.2
	29574	8.2
	99838	6.4
	199677	5.2
	839828	4.1
ET Fill (89.6%)	0	37.1
	6	36.9
	22	36.7
	74	33.9
	337	18.7
	16113	9.3
	79544	7.2
	150930	5.9
	839828	4.5

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
DDT Fill (90.2%)	0.0351	1.2752	2.71	35.13	2.22	28.80
ET Fill (89.6%)	0.0076	1.8637	6.50	37.23	6.13	35.13

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill (90.2%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 566.02
Tare wt., ring (g): 220.70
Tare wt., screen & clamp (g): 27.63
Initial sample volume (cm^3): 318.22
Initial dry bulk density (g/cm^3): 1.78
Measured particle density (g/cm^3): 2.67
Initial calculated total porosity (%): 33.46

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	21-Nov-14	10:40	923.90	0	34.43
	28-Nov-14	10:00	922.95	6.0	34.13
	5-Dec-14	13:45	921.30	22.0	33.61
	12-Dec-14	13:15	892.60	74.0	24.59
Pressure plate:	22-Dec-14	8:55	875.50	337	19.22

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	6.0	---	---	---	---
	22.0	---	---	---	---
	74.0	---	---	---	---
Pressure plate:	337	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: DDT Fill (90.2%)

Initial sample bulk density (g/cm^3)*:* 1.78

Fraction of test sample used (<2.00mm fraction) (%): 83.01

Dry weight of dew point potentiometer sample* (g)*:* 163.92

Tare weight, jar (g)*:* 118.34

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	26-Nov-14	9:51	166.46	29574	8.23
	25-Nov-14	15:20	165.91	99838	6.45
	26-Nov-14	8:30	165.54	199677	5.25

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	29574	---	---	---	---
	99838	---	---	---	---
	199677	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 72.97

Tare weight (g)*:* 40.97

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	24-Nov-14	13:15	73.85	839828	4.07

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	839828	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

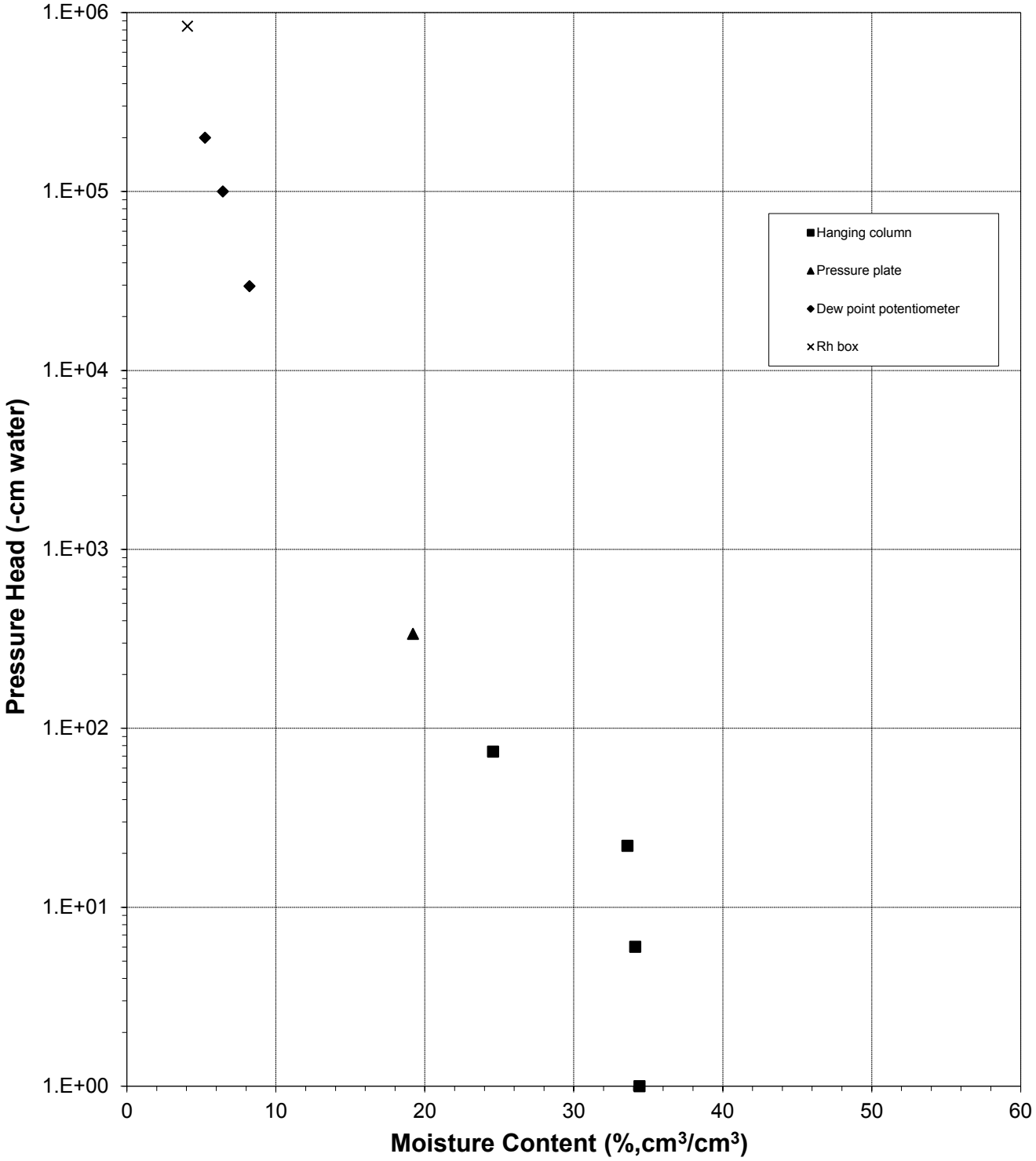
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

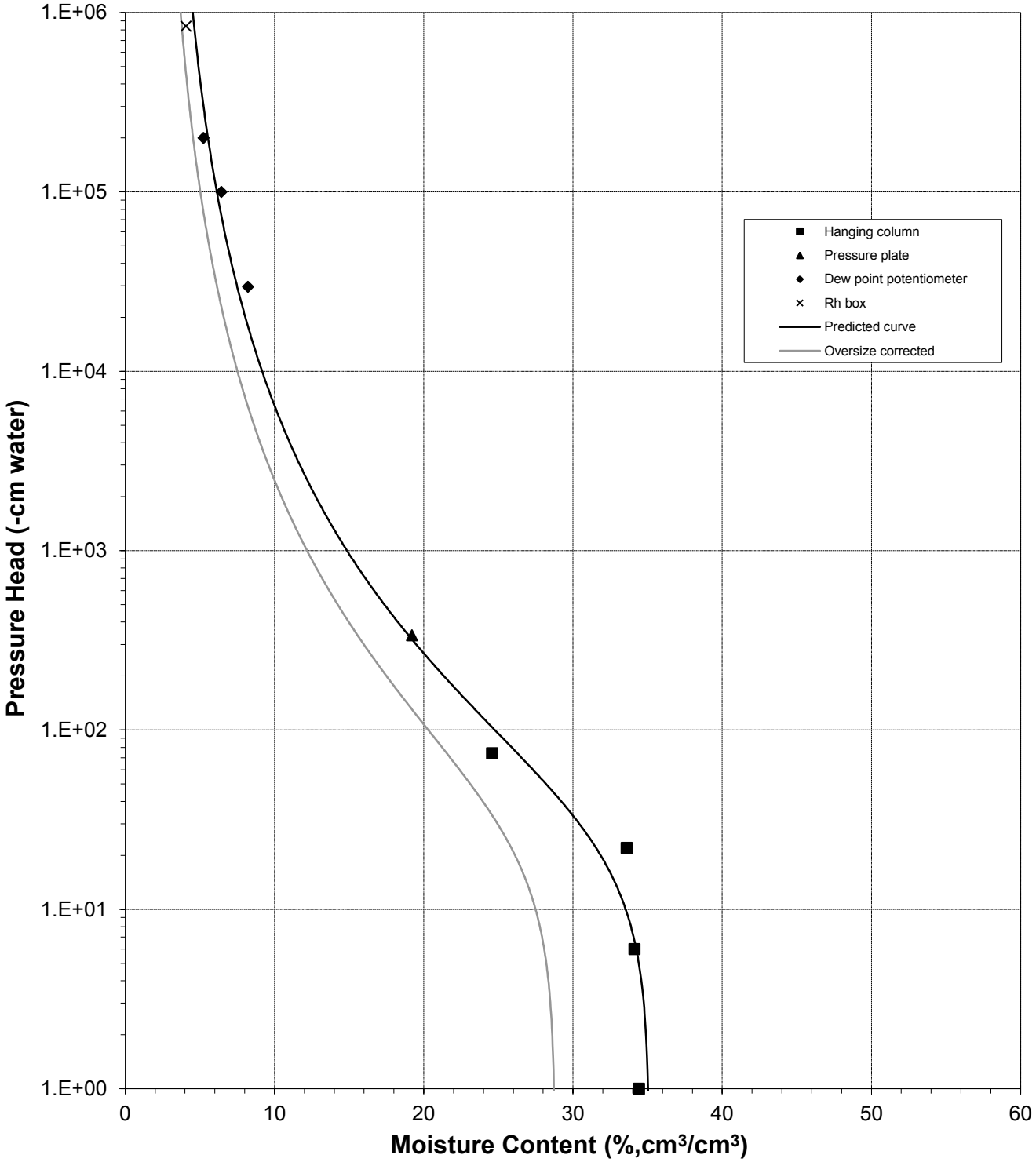
Water Retention Data Points

Sample Number: DDT Fill (90.2%)



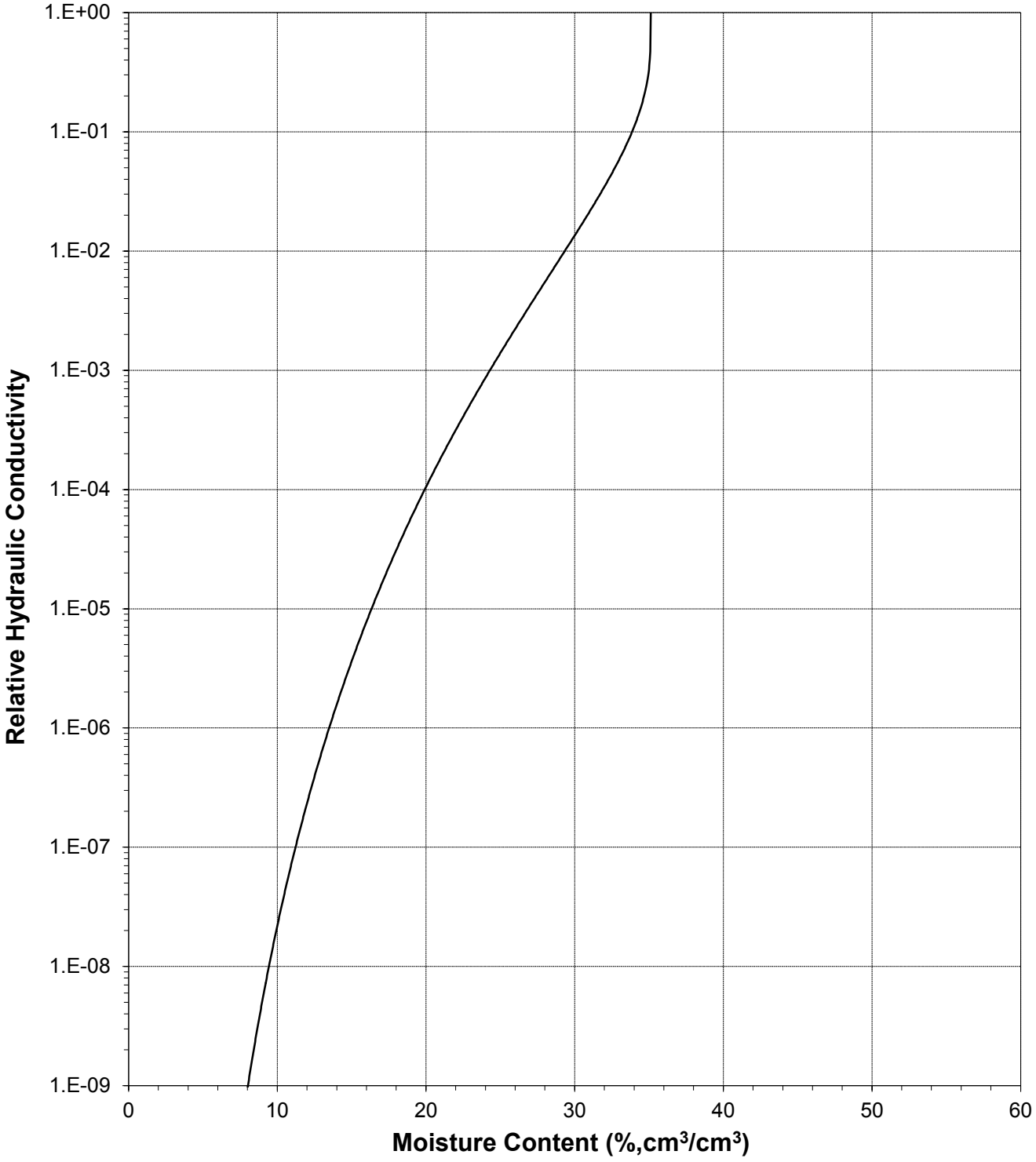
Predicted Water Retention Curve and Data Points

Sample Number: DDT Fill (90.2%)



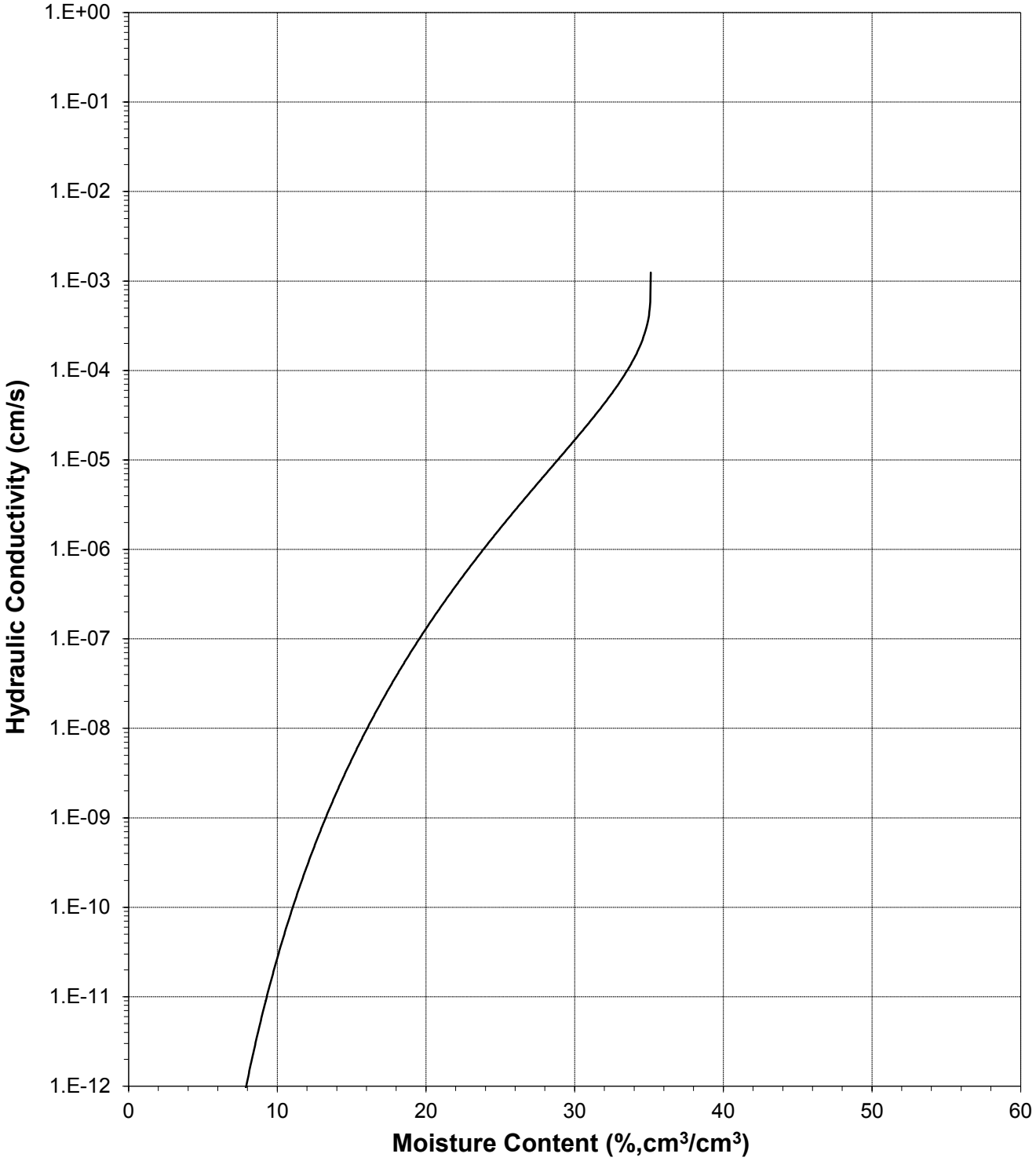
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: DDT Fill (90.2%)



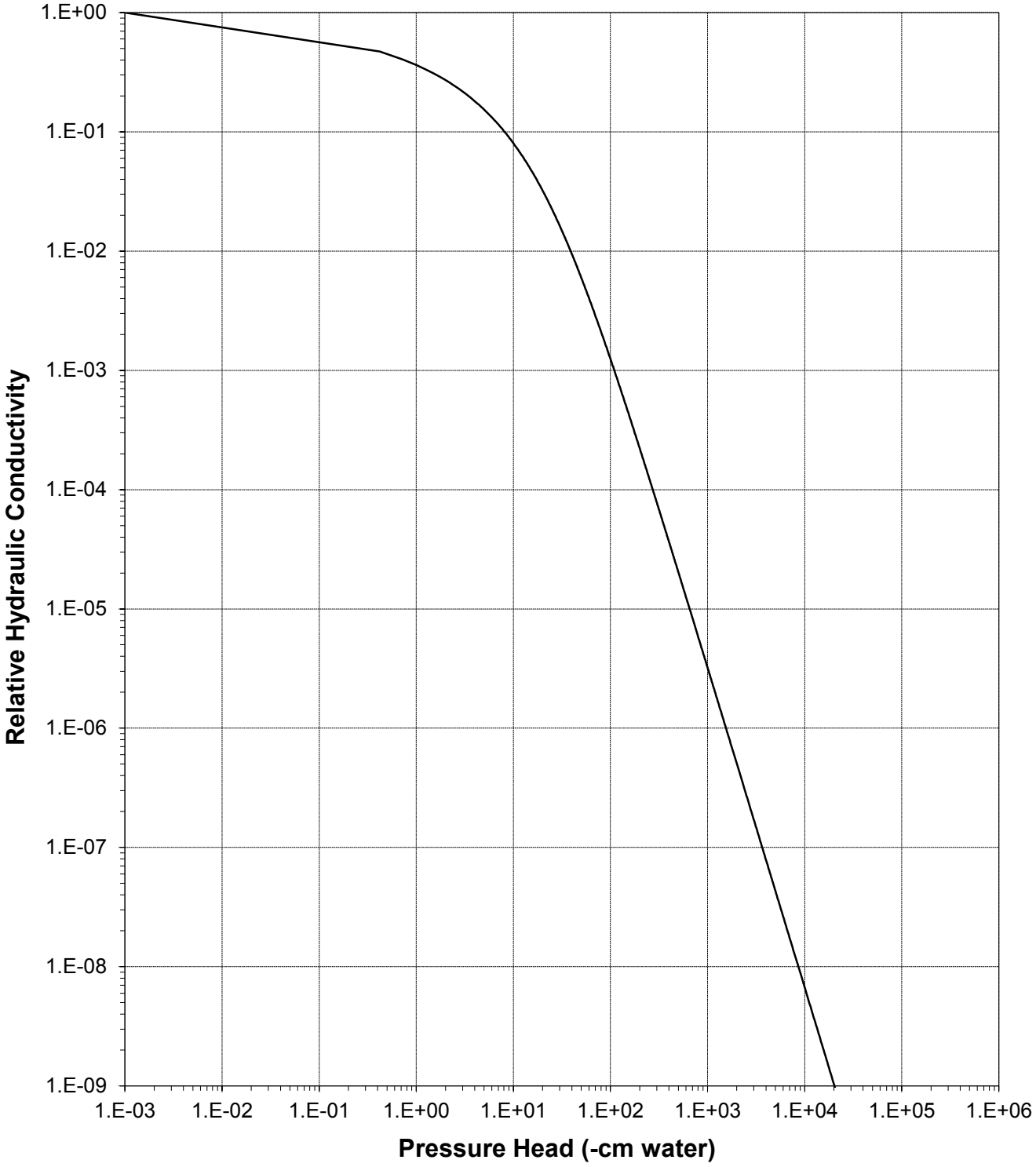
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: DDT Fill (90.2%)



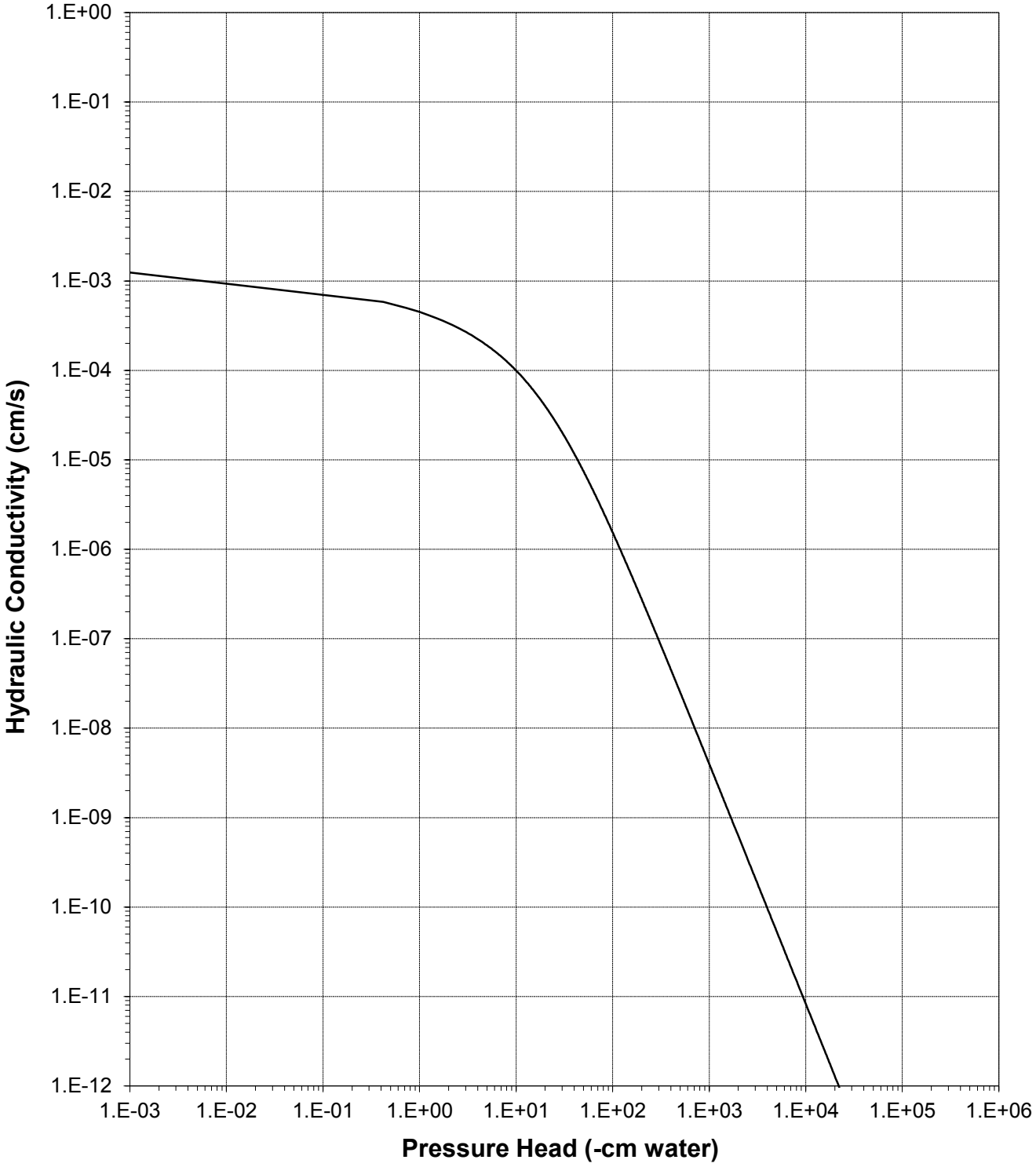
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: DDT Fill (90.2%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: DDT Fill (90.2%)



Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill (90.2%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): 3/8

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	24.66	75.34	100.00
Mass Fraction (%):	24.66	75.34	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.78	1.94
Calculated Porosity (% vol):	0.00	33.46	27.43
Volume of Solids (cm^3):	9.31	28.19	37.49
Volume of Voids (cm^3):	0.00	14.17	14.17
Total Volume (cm^3):	9.31	42.36	51.66
Volumetric Fraction (%):	18.01	81.99	100.00
Initial Moisture Content (% vol):	0.00	15.52	12.73
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.78	1.94
Calculated Porosity (% vol):	0.00	33.46	27.43
Volume of Solids (cm^3):	9.31	28.19	37.49
Volume of Voids (cm^3):	0.00	14.17	14.17
Total Volume (cm^3):	9.31	42.36	51.66
Volumetric Fraction (%):	18.01	81.99	100.00
Saturated Moisture Content (% vol):	0.00	35.13	28.80
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.78	1.94
Calculated Porosity (% vol):	0.00	33.46	27.43
Volume of Solids (cm^3):	9.31	28.19	37.49
Volume of Voids (cm^3):	0.00	14.17	14.17
Total Volume (cm^3):	9.31	42.36	51.66
Volumetric Fraction (%):	18.01	81.99	100.00
Residual Moisture Content (% vol):	0.00	2.71	2.22
Ksat (cm/sec):	NM	1.2E-03	9.3E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill (89.6%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 382.00
Tare wt., ring (g): 132.85
Tare wt., screen & clamp (g): 24.23
Initial sample volume (cm^3): 223.85
Initial dry bulk density (g/cm^3): 1.71
Measured particle density (g/cm^3): 2.69
Initial calculated total porosity (%): 36.47

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	21-Nov-14	10:30	622.16	0	37.11
	28-Nov-14	10:00	621.79	6.0	36.95
	5-Dec-14	13:45	621.30	22.0	36.73
	12-Dec-14	13:15	614.90	74.0	33.87
Pressure plate:	22-Dec-14	8:55	580.90	337	18.68

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	6.0	---	---	---	---
	22.0	---	---	---	---
	74.0	---	---	---	---
Pressure plate:	337	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: ET Fill (89.6%)

Initial sample bulk density (g/cm^3)*:* 1.71

Fraction of test sample used (<2.00mm fraction) (%): 97.44

Dry weight of dew point potentiometer sample* (g)*:* 162.03

Tare weight, jar (g)*:* 118.38

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	26-Nov-14	9:38	164.47	16113	9.29
	25-Nov-14	15:55	163.91	79544	7.16
	26-Nov-14	8:25	163.59	150930	5.94

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16113	---	---	---	---
	79544	---	---	---	---
	150930	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 67.83

Tare weight (g)*:* 41.04

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	24-Nov-14	13:15	68.56	839828	4.54

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	839828	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

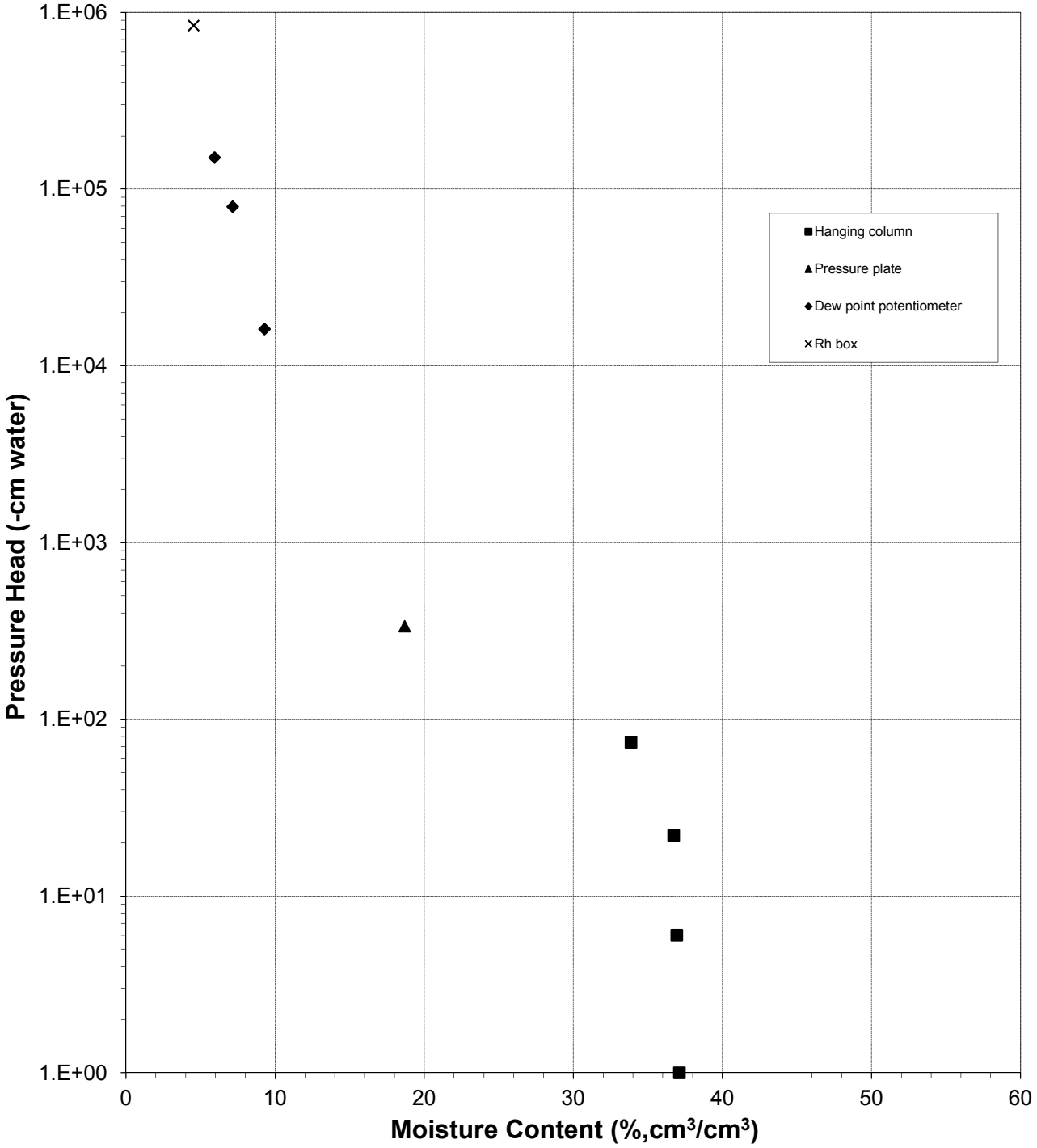
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

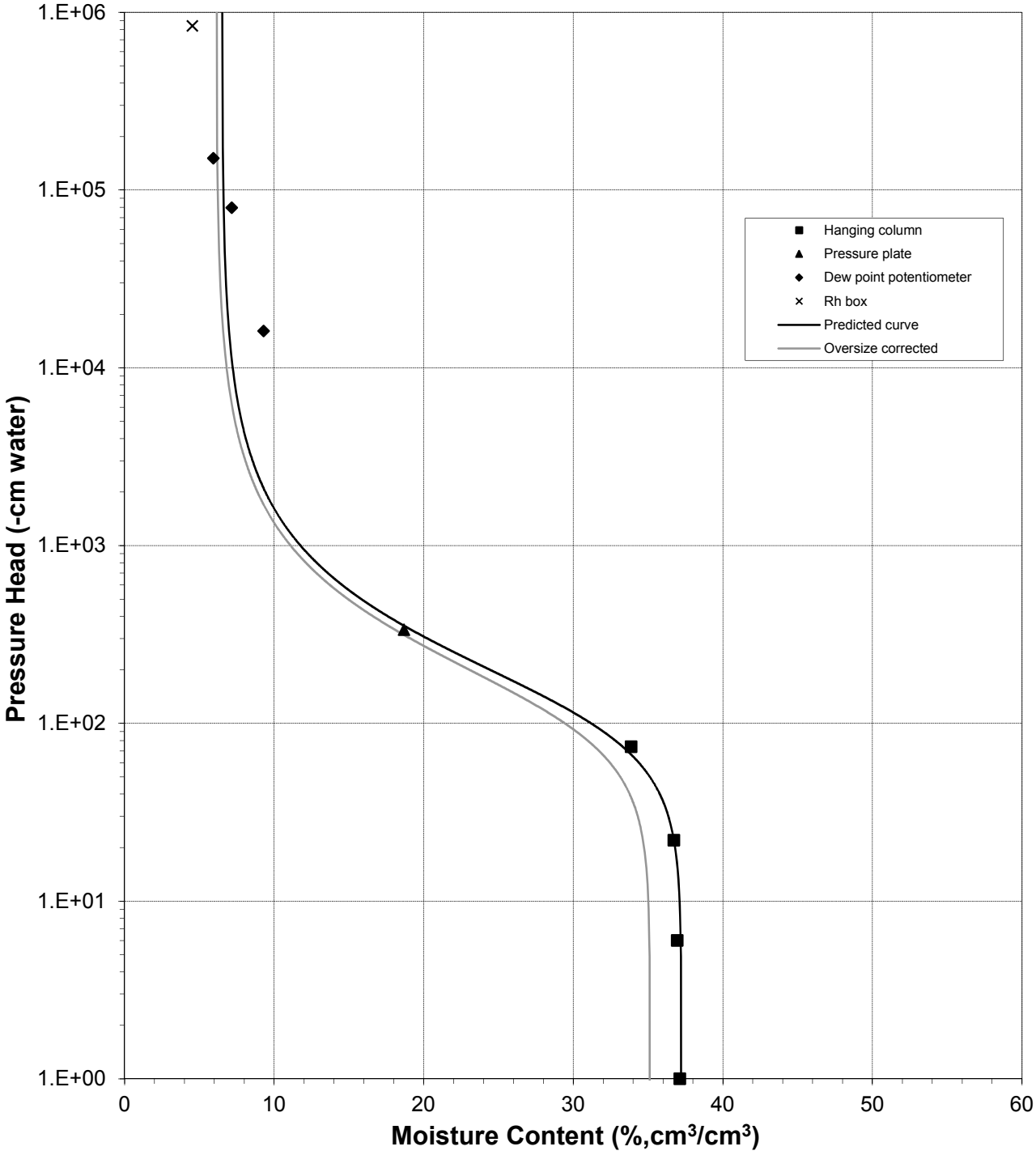
Water Retention Data Points

Sample Number: ET Fill (89.6%)



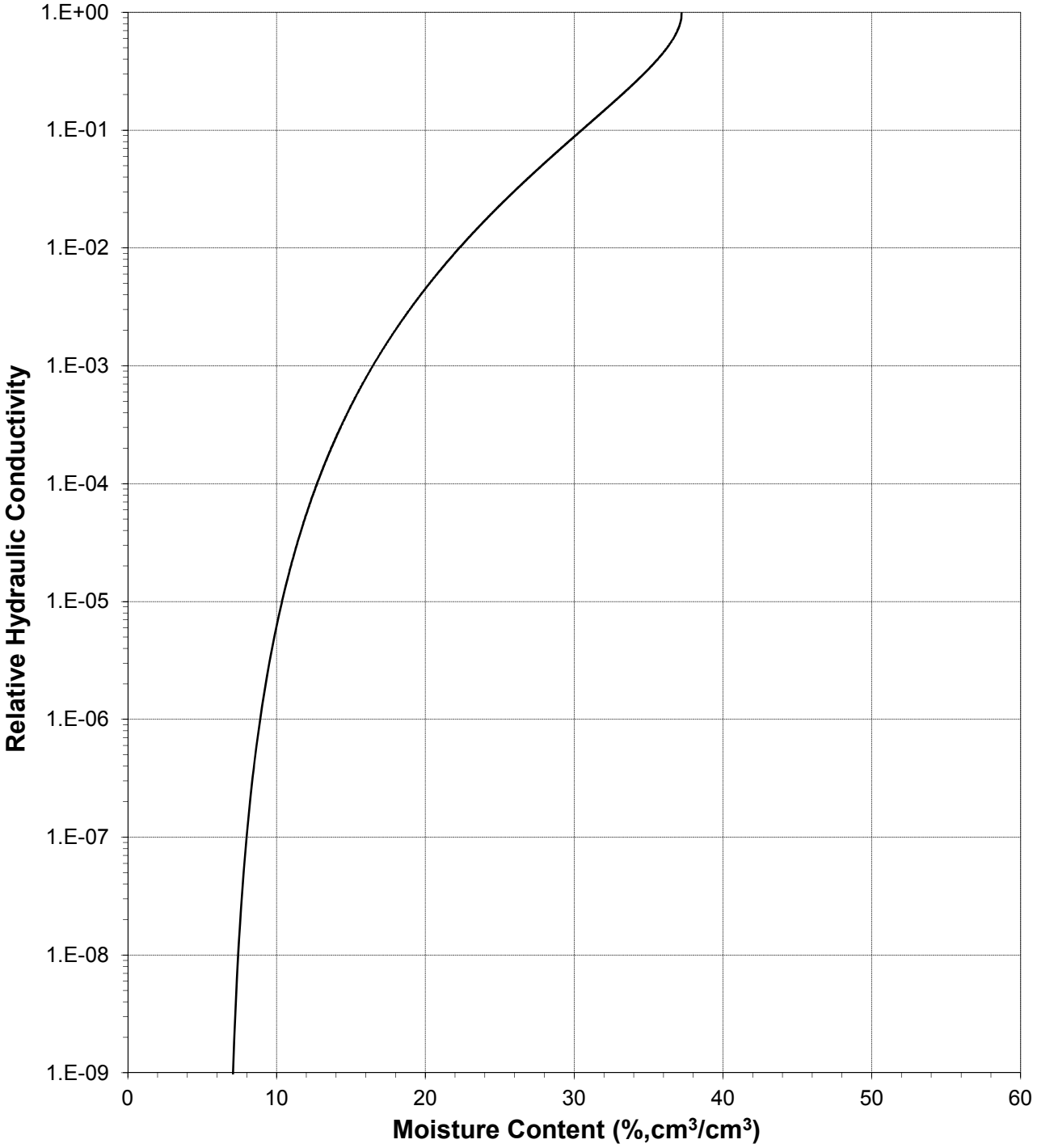
Predicted Water Retention Curve and Data Points

Sample Number: ET Fill (89.6%)



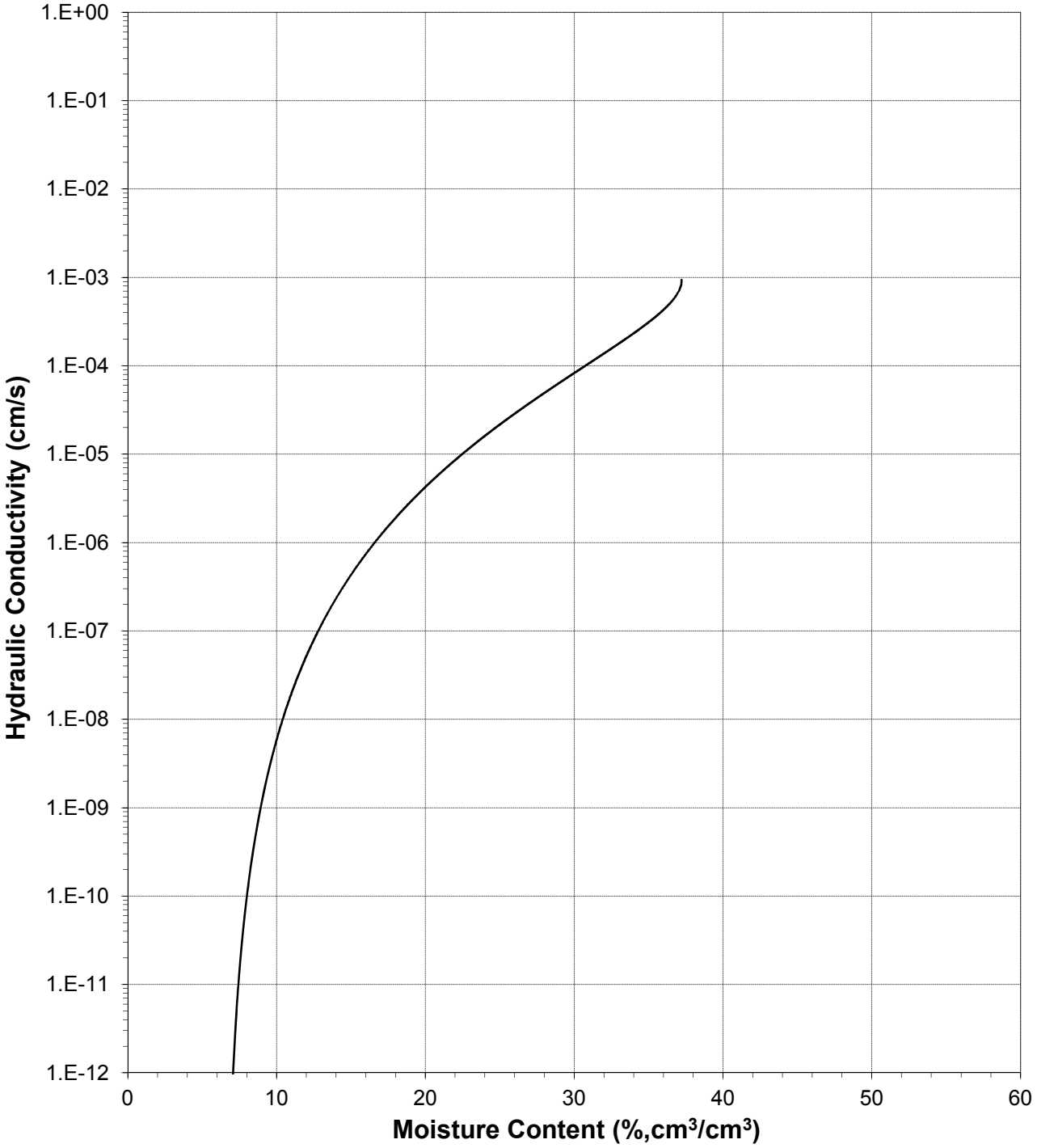
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: ET Fill (89.6%)



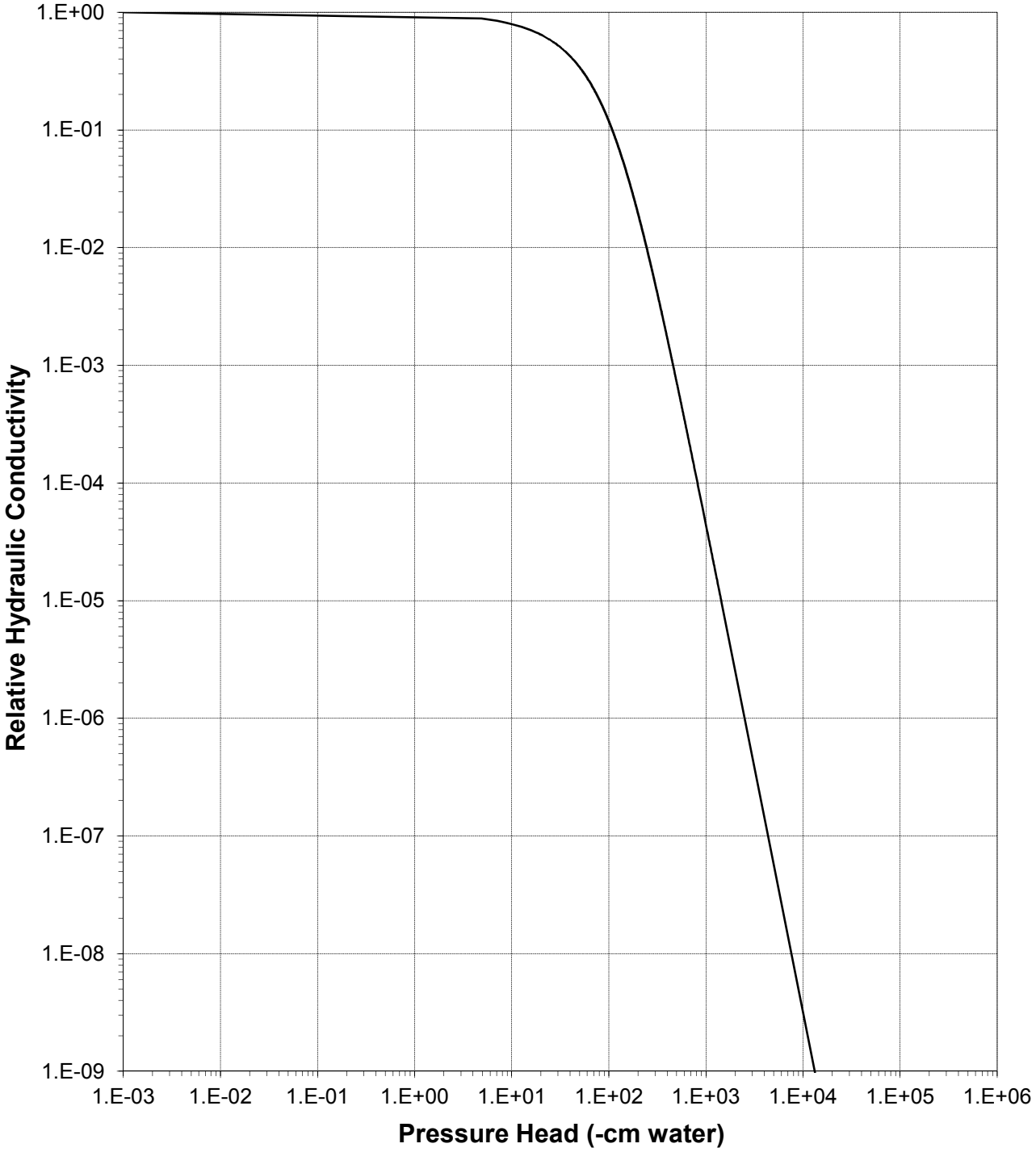
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: ET Fill (89.6%)



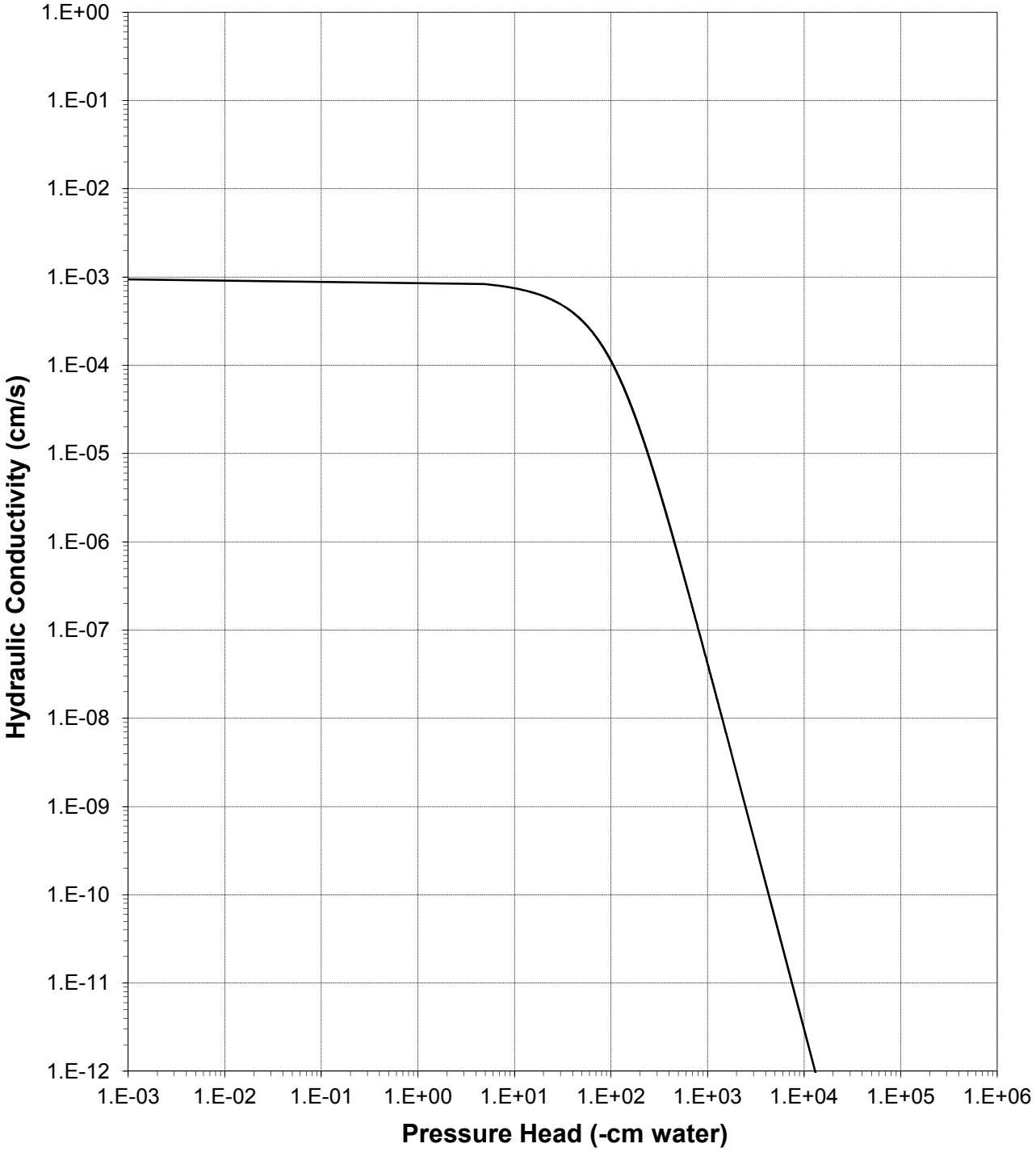
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: ET Fill (89.6%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: ET Fill (89.6%)



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Oversize Correction Data Sheet

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill (89.6%)
Ring Number: NA
Depth: NA

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	8.48	91.52	100.00
Mass Fraction (%):	8.48	91.52	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.71	1.76
Calculated Porosity (% vol):	0.00	36.47	34.42
Volume of Solids (cm^3):	3.20	34.07	37.27
Volume of Voids (cm^3):	0.00	19.56	19.56
Total Volume (cm^3):	3.20	53.63	56.83
Volumetric Fraction (%):	5.63	94.37	100.00
Initial Moisture Content (% vol):	0.00	16.80	15.85
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.71	1.76
Calculated Porosity (% vol):	0.00	36.47	34.42
Volume of Solids (cm^3):	3.20	34.07	37.27
Volume of Voids (cm^3):	0.00	19.56	19.56
Total Volume (cm^3):	3.20	53.63	56.83
Volumetric Fraction (%):	5.63	94.37	100.00
Saturated Moisture Content (% vol):	0.00	37.23	35.13
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.71	1.76
Calculated Porosity (% vol):	0.00	36.47	34.42
Volume of Solids (cm^3):	3.20	34.07	37.27
Volume of Voids (cm^3):	0.00	19.56	19.56
Total Volume (cm^3):	3.20	53.63	56.83
Volumetric Fraction (%):	5.63	94.37	100.00
Residual Moisture Content (% vol):	0.00	6.50	6.13
Ksat (cm/sec):	NM	9.4E-04	8.6E-04

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
DDT Fill	0.010	0.49	1.2	120	1.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †
ET Fill	0.011	0.14	0.19	17	2.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
DDT Fill	33.6	43.0	17.8	5.6
ET Fill	8.5	61.4	24.1	6.0

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA

Test Date: 18-Nov-14

Initial Dry Weight of Sample (g): 27780.20
Weight Passing #4 (g): 18434.41
Weight Retained #4 (g): 9345.79
Weight of Hydrometer Sample (g): 94.61
Calculated Weight of Sieve Sample (g): 142.57

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	27780.20	100.00
	2"	50	0.00	0.00	27780.20	100.00
	1.5"	38.1	0.00	0.00	27780.20	100.00
	1"	25	26.18	26.18	27754.02	99.91
	3/4"	19.0	1943.81	1969.99	25810.21	92.91
	3/8"	9.5	4880.29	6850.28	20929.92	75.34
	4	4.75	2495.51	9345.79	18434.41	66.36
-4			(Based on calculated sieve wt.)			
	10	2.00	5.44	53.40	89.17	62.54
	20	0.85	6.26	59.66	82.91	58.15
	40	0.425	14.47	74.13	68.44	48.00
	60	0.250	15.22	89.35	53.22	37.33
	140	0.106	15.65	105.00	37.57	26.35
	200	0.075	4.26	109.26	33.31	23.36
	dry pan		1.48	110.74	31.83	
	wet pan			31.83	0.00	

d_{10} (mm): 0.010 d_{50} (mm): 0.49
d_{16} (mm): 0.037 d_{60} (mm): 1.2
d_{30} (mm): 0.14 d_{84} (mm): 13

Median Particle Diameter --d_{50} (mm): 0.49
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 120
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 4.5

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA

Test Date: 13-Nov-14
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Measured particle density: 2.67

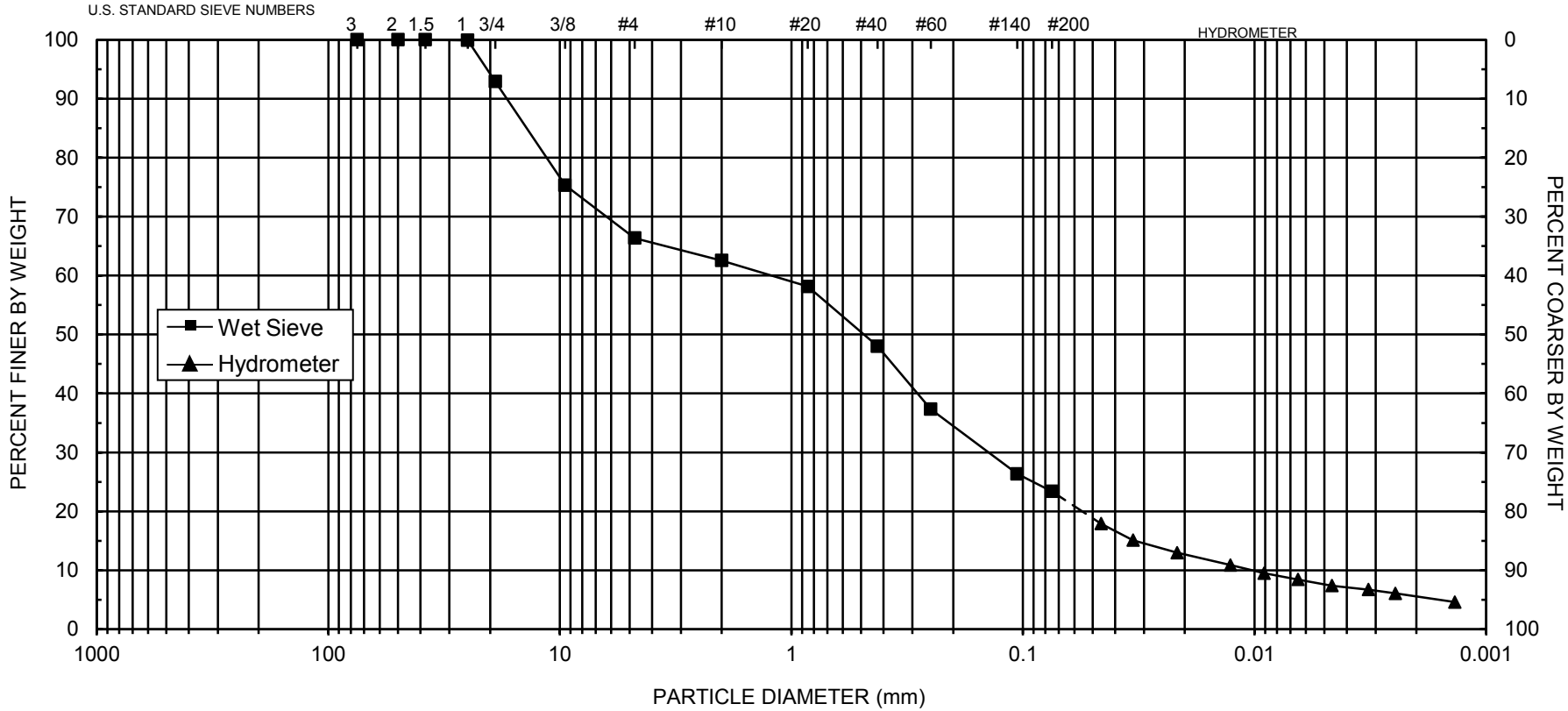
Initial Wt. (g)*:* 94.61
Total Sample Wt. (g)*:* 27780.20
Wt. Passing #4 (g): 18434.41

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
13-Nov-14	1	18.4	32.0	6.5	25.5	11.1	0.04593	27.0	17.9
	2	18.4	28.0	6.5	21.5	11.7	0.03342	22.7	15.1
	5	18.4	25.0	6.5	18.5	12.2	0.02158	19.6	13.0
	15	18.4	22.0	6.5	15.5	12.7	0.01271	16.4	10.9
	30	18.5	20.0	6.5	13.5	13.0	0.00909	14.3	9.5
	60	18.5	18.5	6.5	12.0	13.3	0.00649	12.7	8.4
	120	18.5	17.0	6.5	10.5	13.5	0.00463	11.1	7.4
	250	18.8	16.0	6.4	9.6	13.7	0.00321	10.1	6.7
	425	19.3	15.0	6.3	8.7	13.8	0.00246	9.2	6.1
14-Nov-14	1440	18.7	13.0	6.4	6.6	14.2	0.00137	6.9	4.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND				SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine		

d_{10} = **0.010**	d_{30} = **0.14**	d_{50} = **0.49**	d_{60} = **1.2**	C_u = **120**	C_c = **1.6**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
DDT Fill	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA
Test Date: 18-Nov-14

Initial Dry Weight of Sample (g): 24439.30
Weight Passing #4 (g): 22366.76
Weight Retained #4 (g): 2072.54
Weight of Hydrometer Sample (g): 99.10
Calculated Weight of Sieve Sample (g): 108.28

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	24439.30	100.00
	2"	50	0.00	0.00	24439.30	100.00
	1.5"	38.1	132.92	132.92	24306.38	99.46
	1"	25	410.97	543.89	23895.41	97.77
	3/4"	19.0	415.28	959.17	23480.13	96.08
	3/8"	9.5	616.64	1575.81	22863.49	93.55
	4	4.75	496.73	2072.54	22366.76	91.52
-4			(Based on calculated sieve wt.)			
	10	2.00	2.54	11.72	96.56	89.17
	20	0.85	2.86	14.58	93.70	86.53
	40	0.425	5.56	20.14	88.14	81.40
	60	0.250	12.18	32.32	75.96	70.15
	140	0.106	32.74	65.06	43.22	39.91
	200	0.075	10.64	75.70	32.58	30.09
	dry pan		3.03	78.73	29.55	
	wet pan			29.55	0.00	

d_{10} (mm): 0.011 d_{50} (mm): 0.14
d_{16} (mm): 0.040 d_{60} (mm): 0.19
d_{30} (mm): 0.075 d_{84} (mm): 0.60

Median Particle Diameter --d_{50} (mm): 0.14
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 17
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.26

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Loamy Sand †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA

Test Date: 13-Nov-14
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Measured particle density: 2.69

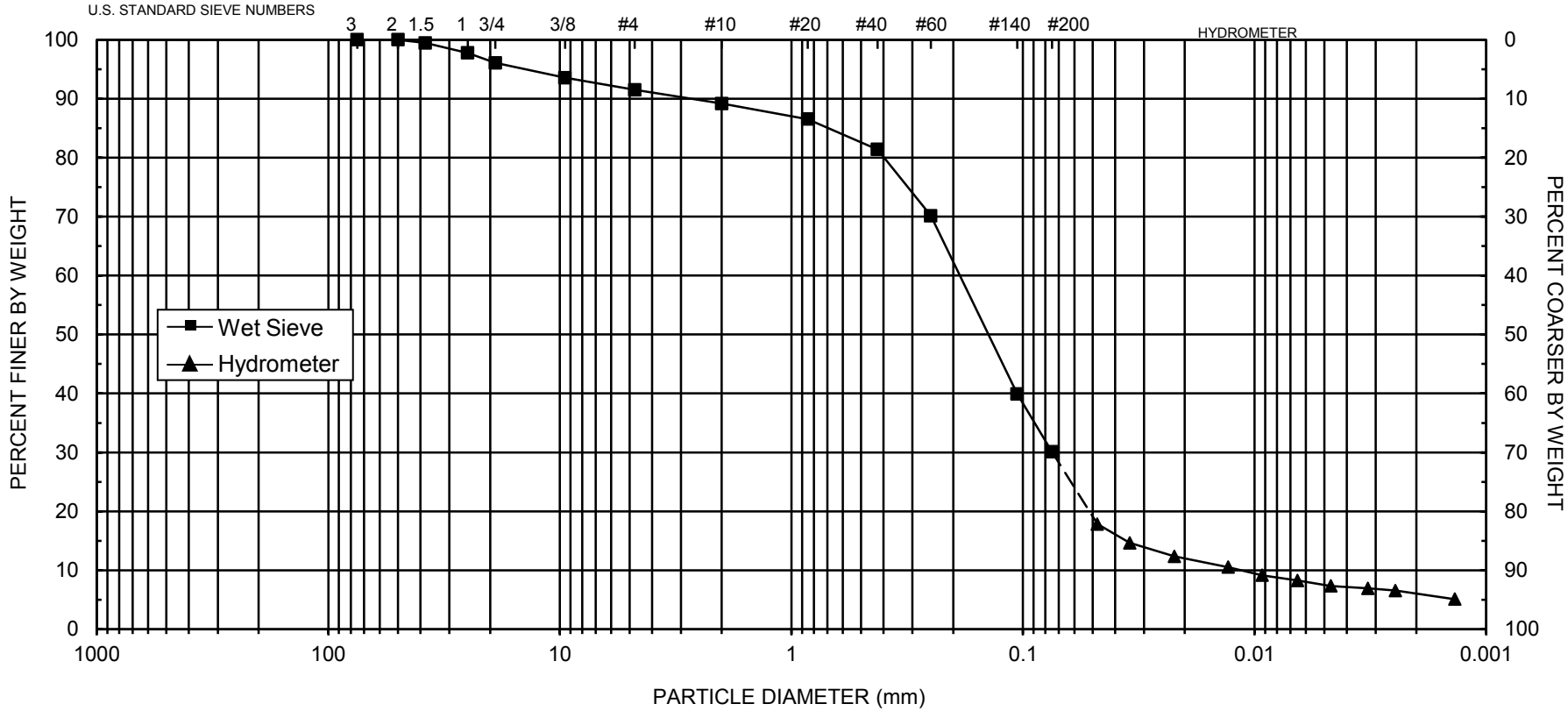
Initial Wt. (g)*:* 99.10
Total Sample Wt. (g)*:* 24439.30
Wt. Passing #4 (g): 22366.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
13-Nov-14	1	18.4	26.0	6.5	19.5	12.0	0.04774	19.5	17.8
	2	18.4	22.5	6.5	16.0	12.6	0.03455	16.0	14.6
	5	18.4	20.0	6.5	13.5	13.0	0.02220	13.5	12.4
	15	18.4	18.0	6.5	11.5	13.3	0.01298	11.5	10.5
	30	18.4	16.5	6.5	10.0	13.6	0.00926	10.0	9.2
	61	18.5	15.5	6.5	9.0	13.8	0.00653	9.0	8.3
	120	18.5	14.5	6.5	8.0	13.9	0.00468	8.0	7.3
	250	18.8	14.0	6.4	7.6	14.0	0.00324	7.6	6.9
	430	19.3	13.5	6.3	7.2	14.1	0.00246	7.2	6.6
14-Nov-14	1445	18.7	12.0	6.4	5.6	14.3	0.00137	5.6	5.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.011**	d_{30} = **0.075**	d_{50} = **0.14**	d_{60} = **0.19**	C_u = **17**	C_c = **2.7**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
ET Fill	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Loamy Sand †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Specific Gravity

Summary of Specific Gravity Tests

	Test Sample			Oversize Material			Bulk Sample
Sample Number	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity[1]
DDT Fill	2.68	<4.75mm	66.4%	NR	>4.75mm	33.6%	2.68
ET Fill	2.69	<4.75mm	91.5%	NR	>4.75mm	8.5%	2.69

[1]Based on the <4.75mm material

--- = Unnecessary since specified fraction < 5% of composite mass

NA = Not analyzed

NR = Not requested

Data for Specific Gravity of Test Sample: DDT Fill

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA

ASTM D854 (<4.75mm Fraction)

Test Date:	14-Nov-14	
Percent of Test Sample (% g/g):	88.1	
Percent of Bulk Sample (% g/g):	66.4	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.58	95.14
Weight of pycnometer filled w/soil (g):	143.61	145.33
Weight of pycnometer filled w/soil & water (g):	374.47	375.91
Weight of pycnometer filled w/water (g):	343.07	344.53
Specific Gravity (g/g):	2.68	2.67
Observed temperature (°C):	17.20	17.50
Density of water at observed temperature (g/cm^3):	0.9987	0.9987
Correction factor, K:	1.0005	1.0005
Specific Gravity at 20°C (g/g):	2.69	2.67
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm^3):	2.67	

ASTM C127 (>4.75mm Fraction)

Test Date:	NR	
Percent of Test Sample (% g/g):	11.9	
Percent of Bulk Sample (% g/g):	33.6	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	NR = Test not requested.
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Test Sample*: **2.68** ** Weighted Average*

Particle Density (Apparent) of Test Sample (g/cm^3)*: 2.67

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Data for Specific Gravity of Test Sample: ET Fill

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA

ASTM D854 (<4.75mm Fraction)

Test Date:	14-Nov-14	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	91.5	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.90	95.94
Weight of pycnometer filled w/soil (g):	143.90	146.47
Weight of pycnometer filled w/soil & water (g):	374.51	377.12
Weight of pycnometer filled w/water (g):	342.44	345.41
Specific Gravity (g/g):	2.69	2.68
Observed temperature (°C):	17.00	17.10
Density of water at observed temperature (g/cm^3):	0.9988	0.9988
Correction factor, K:	1.0006	1.0006
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity (g/g):	2.69	
Average Particle Density (g/cm^3):	2.69	

ASTM C127 (>4.75mm Fraction)

Test Date:	NR	
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	8.5	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	NR = Test not requested.
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Test Sample*: **2.69** ** Weighted Average*

Particle Density (Apparent) of Test Sample (g/cm^3)*: 2.69

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Proctor Compaction

Summary of Proctor Compaction Tests

Sample Number	Measured: Optimum Moisture Content (% g/g)	Measured: Maximum Dry Bulk Density (g/cm^3)	Oversize Corrected: Optimum Moisture Content (% g/g)	Oversize Corrected: Maximum Dry Bulk Density (g/cm^3)
DDT Fill	10.5	1.97	7.9	2.10
ET Fill	11.7	1.90	10.6	1.95

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Proctor Compaction Data

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA
Test Date: 15-Nov-14
As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): 3/8
Mass of coarse material (g)*:* 24.65885775
Mass of fines material (g)*:* 75.34114225
Mold weight (g): 4202
Mold volume (cm^3)*:* 943.95
Compaction Method: Standard B
Preparation Method: Dry
Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm^3)	Moisture Content (% g/g)
1	6115	1125.90	1063.91	212.73	1.89	7.28
2	6229	1148.24	1067.96	212.71	1.96	9.39
3	6267	1195.60	1099.62	259.49	1.96	11.42
4	6222	1154.40	1043.96	210.83	1.89	13.26
5	6176	836.44	750.68	207.38	1.81	15.79

Soil Fractions
Coarse Fraction (% g/g): 24.7
Fines Fraction (% g/g): 75.3

Properties of Coarse Material
Assumed particle density (g/cm^3)*:* 2.65
Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm^3)	Moisture Content of Composite (% g/g)
1	2.03	5.49
2	2.10	7.07
3	2.10	8.61
4	2.03	9.99
5	1.96	11.89

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

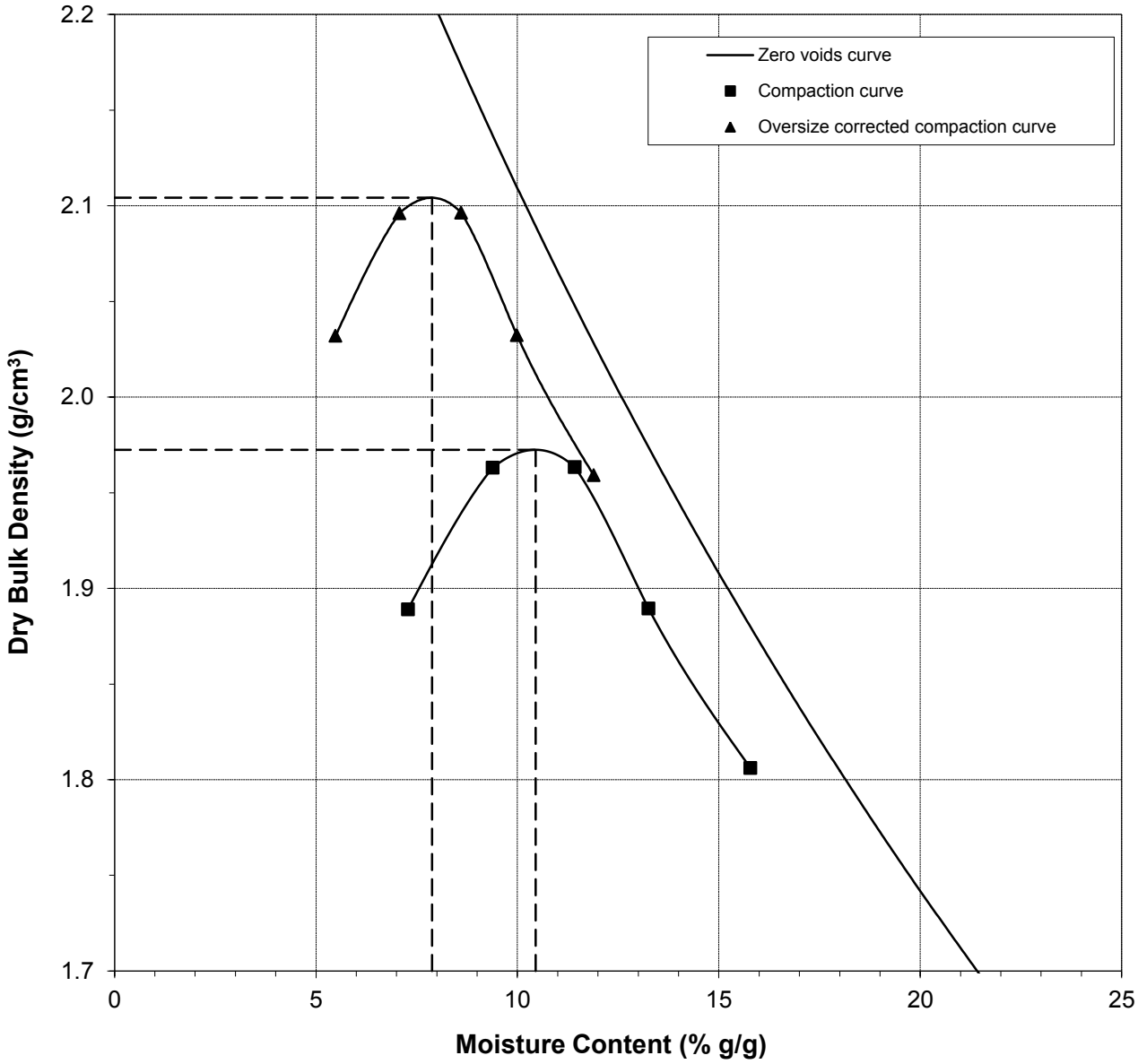
Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Proctor Compaction Data Points with Fitted Curve

Sample Number: DDT Fill

	Measured	Corrected
Optimum Moisture Content (% g/g):	10.5	7.9
Maximum Dry Bulk Density (g/cm^3):	1.97	2.10

Test Date: 15-Nov-14



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Proctor Compaction Data

Job Name: Dwyer Engineering
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA
Test Date: 15-Nov-14
As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4
Mass of coarse material (g)*:* 8.480357457
Mass of fines material (g)*:* 91.51964254
Mold weight (g): 4202
Mold volume (cm^3)*:* 943.95
Compaction Method: Standard A
Preparation Method: Dry
Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm^3)	Moisture Content (% g/g)
1	6042	736.19	699.08	208.48	1.81	7.56
2	6121	793.32	742.55	209.72	1.86	9.53
3	6209	1013.13	929.50	209.25	1.90	11.61
4	6209	1028.02	930.16	212.86	1.87	13.64
5	6167	1004.83	905.64	269.28	1.80	15.59

Soil Fractions
Coarse Fraction (% g/g): 8.5
Fines Fraction (% g/g): 91.5

Properties of Coarse Material
Assumed particle density (g/cm^3)*:* 2.65
Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm^3)	Moisture Content of Composite (% g/g)
1	1.86	6.92
2	1.90	8.72
3	1.95	10.63
4	1.92	12.49
5	1.85	14.27

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

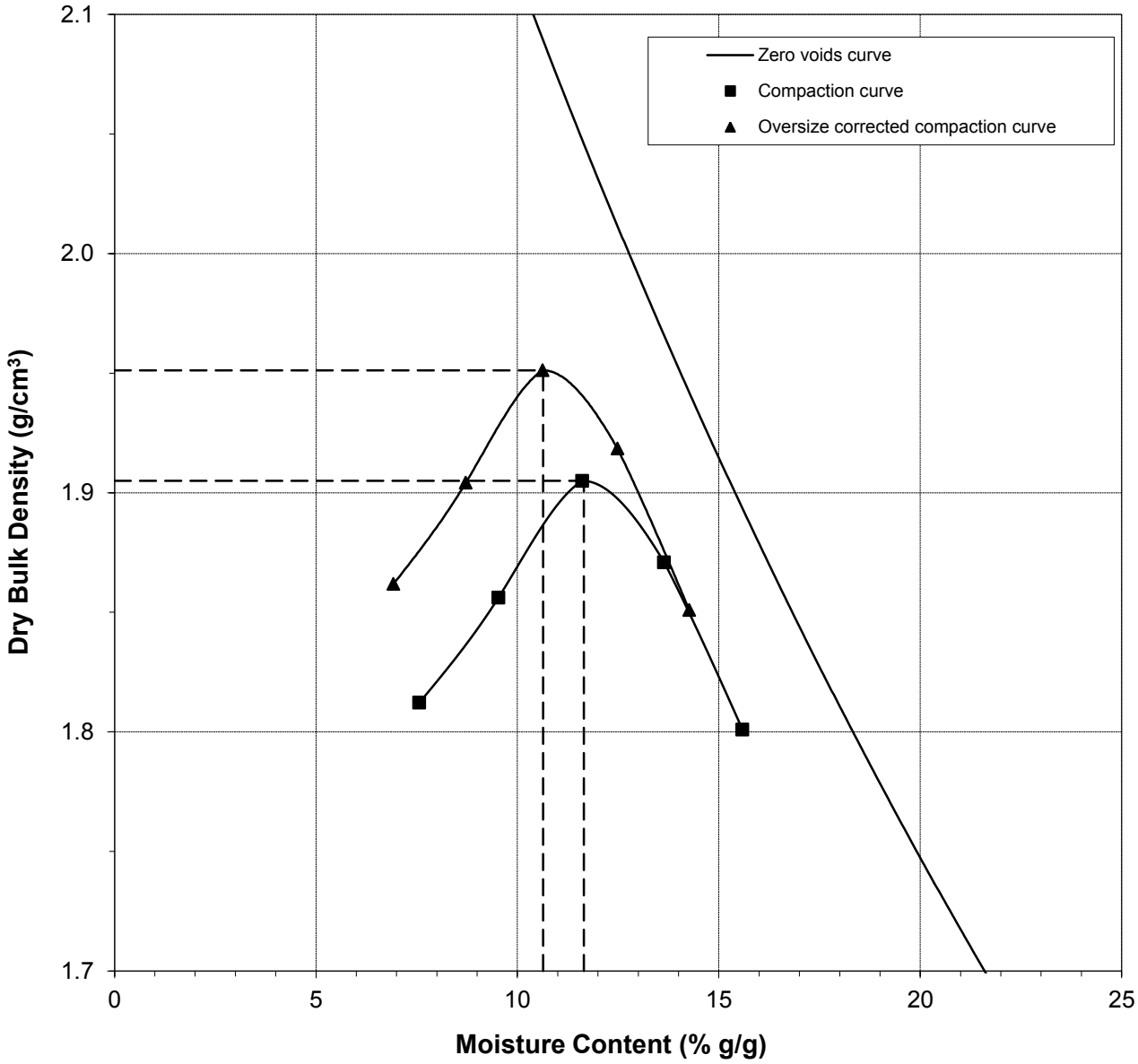
Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Proctor Compaction Data Points with Fitted Curve

Sample Number: ET Fill

	Measured	Corrected
Optimum Moisture Content (% g/g):	11.7	10.6
Maximum Dry Bulk Density (g/cm^3):	1.90	1.95

Test Date: 15-Nov-14



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity: Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Specific Gravity Fine:	ASTM D854
Particle Size Analysis:	ASTM D422
USDA Classification:	ASTM D422, USDA Soil Textural Triangle
Standard Proctor Compaction:	ASTM D698
Coarse Fraction (Gravel) Correction (calc):	ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
DDT Fill	0.010	0.49	1.2	120	1.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †
ET Fill	0.011	0.14	0.19	17	2.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
DDT Fill	33.6	43.0	17.8	5.6
ET Fill	8.5	61.4	24.1	6.0

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer (11-14)
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA

Test Date: 18-Nov-14

Initial Dry Weight of Sample (g): 27780.20
Weight Passing #4 (g): 18434.41
Weight Retained #4 (g): 9345.79
Weight of Hydrometer Sample (g): 94.61
Calculated Weight of Sieve Sample (g): 142.57

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	27780.20	100.00
	2"	50	0.00	0.00	27780.20	100.00
	1.5"	38.1	0.00	0.00	27780.20	100.00
	1"	25	26.18	26.18	27754.02	99.91
	3/4"	19.0	1943.81	1969.99	25810.21	92.91
	3/8"	9.5	4880.29	6850.28	20929.92	75.34
	4	4.75	2495.51	9345.79	18434.41	66.36
-4			(Based on calculated sieve wt.)			
	10	2.00	5.44	53.40	89.17	62.54
	20	0.85	6.26	59.66	82.91	58.15
	40	0.425	14.47	74.13	68.44	48.00
	60	0.250	15.22	89.35	53.22	37.33
	140	0.106	15.65	105.00	37.57	26.35
	200	0.075	4.26	109.26	33.31	23.36
	dry pan		1.48	110.74	31.83	
	wet pan			31.83	0.00	

d_{10} (mm): 0.010 d_{50} (mm): 0.49
d_{16} (mm): 0.037 d_{60} (mm): 1.2
d_{30} (mm): 0.14 d_{84} (mm): 13

Median Particle Diameter --d_{50} (mm): 0.49
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 120
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 4.5

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer (11-14)
Job Number: LB14.0223.00
Sample Number: DDT Fill
Ring Number: NA
Depth: NA

Test Date: 13-Nov-14
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Measured particle density: 2.67

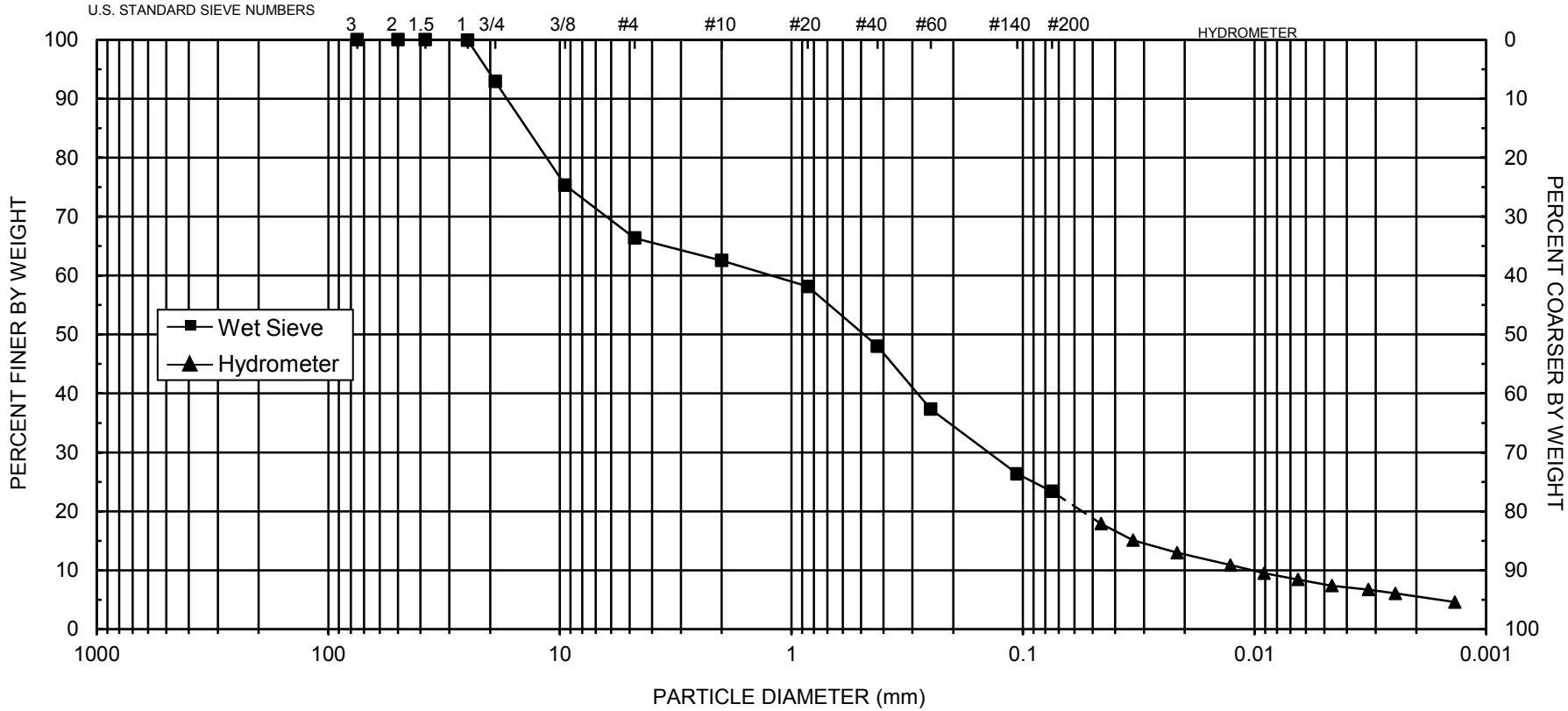
Initial Wt. (g)*:* 94.61
Total Sample Wt. (g)*:* 27780.20
Wt. Passing #4 (g): 18434.41

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
13-Nov-14	1	18.4	32.0	6.5	25.5	11.1	0.04593	27.0	17.9
	2	18.4	28.0	6.5	21.5	11.7	0.03342	22.7	15.1
	5	18.4	25.0	6.5	18.5	12.2	0.02158	19.6	13.0
	15	18.4	22.0	6.5	15.5	12.7	0.01271	16.4	10.9
	30	18.5	20.0	6.5	13.5	13.0	0.00909	14.3	9.5
	60	18.5	18.5	6.5	12.0	13.3	0.00649	12.7	8.4
	120	18.5	17.0	6.5	10.5	13.5	0.00463	11.1	7.4
	250	18.8	16.0	6.4	9.6	13.7	0.00321	10.1	6.7
	425	19.3	15.0	6.3	8.7	13.8	0.00246	9.2	6.1
14-Nov-14	1440	18.7	13.0	6.4	6.6	14.2	0.00137	6.9	4.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.010**	d_{30} = **0.14**	d_{50} = **0.49**	d_{60} = **1.2**	C_u = **120**	C_c = **1.6**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
DDT Fill	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer (11-14)
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA

Test Date: 18-Nov-14

Initial Dry Weight of Sample (g): 24439.30
Weight Passing #4 (g): 22366.76
Weight Retained #4 (g): 2072.54
Weight of Hydrometer Sample (g): 99.10
Calculated Weight of Sieve Sample (g): 108.28

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	24439.30	100.00
	2"	50	0.00	0.00	24439.30	100.00
	1.5"	38.1	132.92	132.92	24306.38	99.46
	1"	25	410.97	543.89	23895.41	97.77
	3/4"	19.0	415.28	959.17	23480.13	96.08
	3/8"	9.5	616.64	1575.81	22863.49	93.55
	4	4.75	496.73	2072.54	22366.76	91.52
-4			(Based on calculated sieve wt.)			
	10	2.00	2.54	11.72	96.56	89.17
	20	0.85	2.86	14.58	93.70	86.53
	40	0.425	5.56	20.14	88.14	81.40
	60	0.250	12.18	32.32	75.96	70.15
	140	0.106	32.74	65.06	43.22	39.91
	200	0.075	10.64	75.70	32.58	30.09
	dry pan		3.03	78.73	29.55	
	wet pan			29.55	0.00	

d_{10} (mm): 0.011 d_{50} (mm): 0.14
d_{16} (mm): 0.040 d_{60} (mm): 0.19
d_{30} (mm): 0.075 d_{84} (mm): 0.60

Median Particle Diameter --d_{50} (mm): 0.14
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 17
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 2.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.26

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Loamy Sand †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer (11-14)
Job Number: LB14.0223.00
Sample Number: ET Fill
Ring Number: NA
Depth: NA

Test Date: 13-Nov-14
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Measured particle density: 2.69

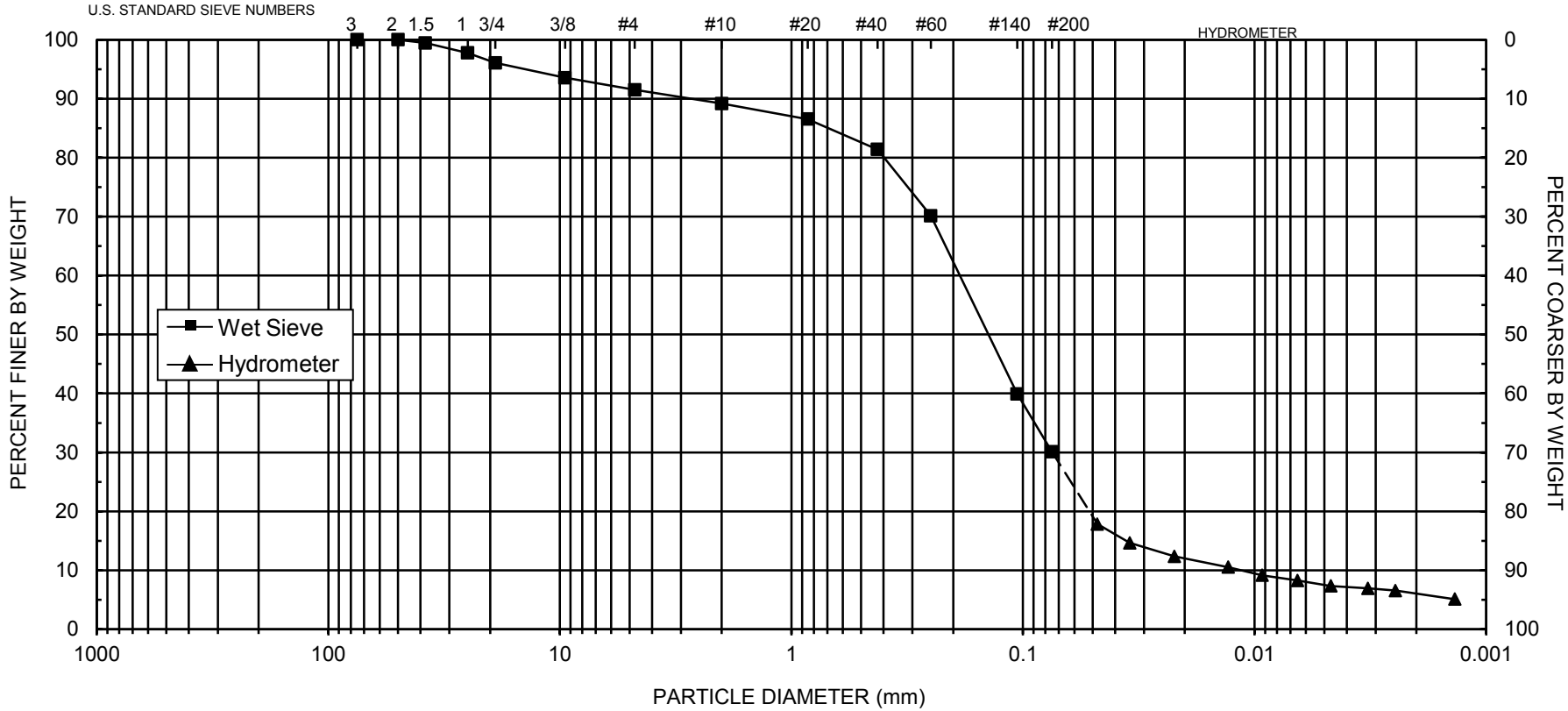
Initial Wt. (g)*:* 99.10
Total Sample Wt. (g)*:* 24439.30
Wt. Passing #4 (g): 22366.76

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
13-Nov-14	1	18.4	26.0	6.5	19.5	12.0	0.04774	19.5	17.8
	2	18.4	22.5	6.5	16.0	12.6	0.03455	16.0	14.6
	5	18.4	20.0	6.5	13.5	13.0	0.02220	13.5	12.4
	15	18.4	18.0	6.5	11.5	13.3	0.01298	11.5	10.5
	30	18.4	16.5	6.5	10.0	13.6	0.00926	10.0	9.2
	61	18.5	15.5	6.5	9.0	13.8	0.00653	9.0	8.3
	120	18.5	14.5	6.5	8.0	13.9	0.00468	8.0	7.3
	250	18.8	14.0	6.4	7.6	14.0	0.00324	7.6	6.9
	430	19.3	13.5	6.3	7.2	14.1	0.00246	7.2	6.6
14-Nov-14	1445	18.7	12.0	6.4	5.6	14.3	0.00137	5.6	5.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.011**	d_{30} = **0.075**	d_{50} = **0.14**	d_{60} = **0.19**	C_u = **17**	C_c = **2.7**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
ET Fill	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Loamy Sand †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
Clay	7.4E-05	0.014	0.056	757	0.29	WS/H	Classification by ASTM 2487 requires Atterberg test	Clay Loam † (Est)
Silt	0.0033	0.073	0.096	29	4.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam
Overburden	0.0056	0.15	0.20	36	4.8	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
Clay	11.4	24.0	30.2	34.3
Silt	0.5	48.4	41.9	9.2
Overburden	12.0	57.3	23.2	7.5

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA

Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 1145.18
Weight Passing #4 (g): 1014.28
Weight Retained #4 (g): 130.90
Weight of Hydrometer Sample (g): 78.59
Calculated Weight of Sieve Sample (g): 88.73

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1145.18	100.00
	2"	50	0.00	0.00	1145.18	100.00
	1.5"	38.1	0.00	0.00	1145.18	100.00
	1"	25	0.00	0.00	1145.18	100.00
	3/4"	19.0	46.82	46.82	1098.36	95.91
	3/8"	9.5	41.26	88.08	1057.10	92.31
	4	4.75	42.82	130.90	1014.28	88.57
-4			(Based on calculated sieve wt.)			
	10	2.00	2.06	12.20	76.53	86.25
	20	0.85	2.40	14.60	74.13	83.54
	40	0.425	2.90	17.50	71.23	80.27
	60	0.250	3.19	20.69	68.04	76.68
	140	0.106	7.30	27.99	60.74	68.45
	200	0.075	3.47	31.46	57.27	64.54
	dry pan		0.85	32.31	56.42	
	wet pan			56.42	0.00	

d_{10} (mm): 7.4E-05 d_{50} (mm): 0.014
d_{16} (mm): 0.00017 d_{60} (mm): 0.056
d_{30} (mm): 0.0011 d_{84} (mm): 0.98

Median Particle Diameter --d_{50} (mm): 0.014
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 757
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.29
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.33

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Clay Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

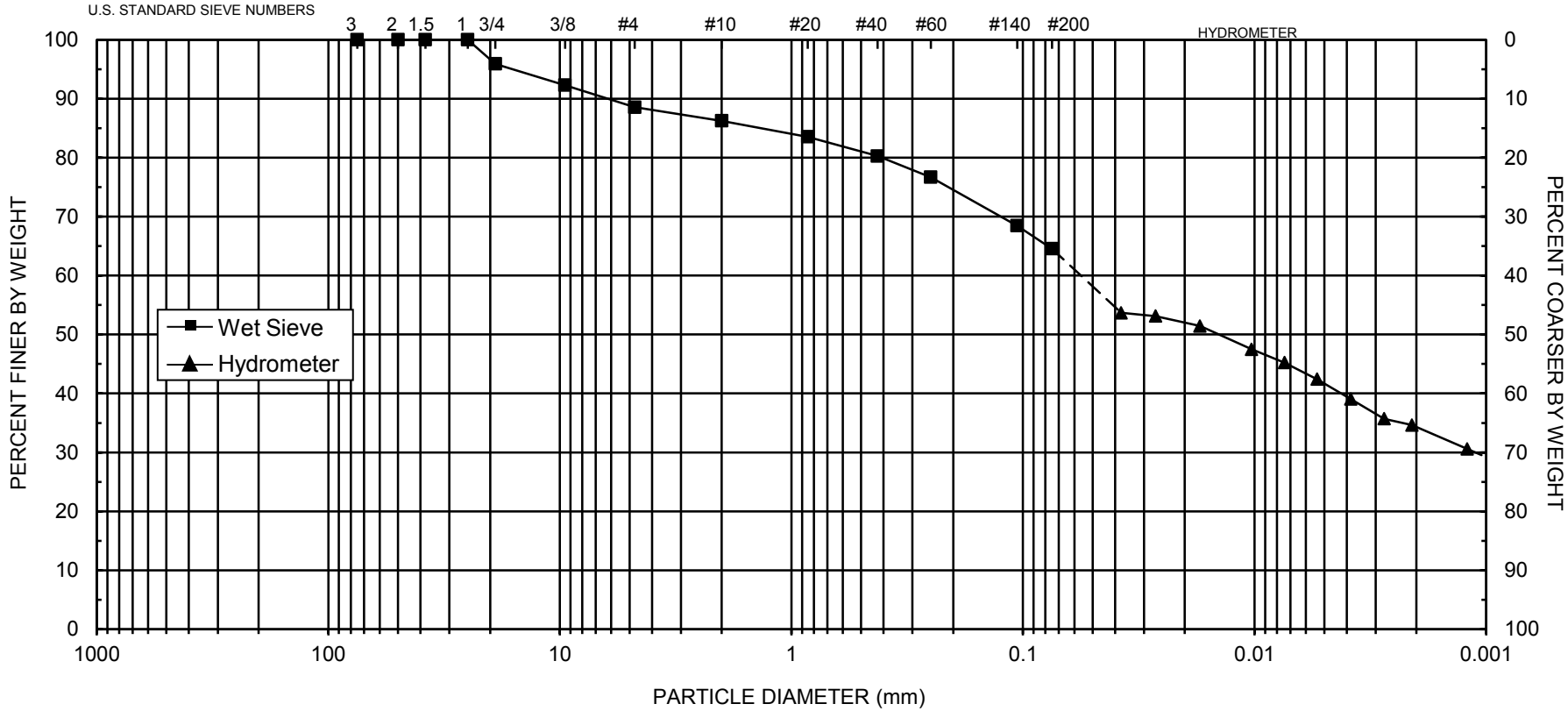
Initial Wt. (g)*:* 78.59
Total Sample Wt. (g)*:* 1145.18
Wt. Passing #4 (g): 1014.28

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	54.0	6.4	47.6	7.4	0.03763	60.6	53.7
	2	19.1	53.5	6.4	47.1	7.5	0.02675	60.0	53.1
	5	19.1	52.0	6.4	45.6	7.8	0.01719	58.1	51.4
	15	19.1	48.5	6.4	42.1	8.3	0.01029	53.6	47.5
	30	19.1	46.5	6.4	40.1	8.7	0.00741	51.1	45.2
	60	19.1	44.0	6.4	37.6	9.1	0.00537	47.9	42.4
	124	19.1	41.0	6.4	34.6	9.6	0.00383	44.1	39.0
	250	19.5	38.0	6.3	31.7	10.1	0.00276	40.3	35.7
	438	19.7	37.0	6.3	30.7	10.2	0.00209	39.1	34.6
28-Jan-15	1410	19.1	33.5	6.4	27.1	10.8	0.00121	34.5	30.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **7.4E-05**	d_{30} = **0.0011**	d_{50} = **0.014**	d_{60} = **0.056**	C_u = **757**	C_c = **0.29**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Clay	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Clay Loam †**

† Greater than 10% of sample is coarse material

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Silt
Ring Number: NA
Depth: NA
Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 957.59
Weight Passing #4 (g): 952.59
Weight Retained #4 (g): 5.00
Weight of Hydrometer Sample (g): 79.14
Calculated Weight of Sieve Sample (g): 79.56

Shape: Angular
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	957.59	100.00
	2"	50	0.00	0.00	957.59	100.00
	1.5"	38.1	0.00	0.00	957.59	100.00
	1"	25	0.00	0.00	957.59	100.00
	3/4"	19.0	0.00	0.00	957.59	100.00
	3/8"	9.5	4.80	4.80	952.79	99.50
	4	4.75	0.20	5.00	952.59	99.48
-4			(Based on calculated sieve wt.)			
	10	2.00	0.77	1.19	78.37	98.51
	20	0.85	0.31	1.50	78.06	98.12
	40	0.425	0.47	1.97	77.59	97.53
	60	0.250	1.83	3.80	75.76	95.23
	140	0.106	25.12	28.92	50.64	63.65
	200	0.075	9.97	38.89	40.67	51.12
	dry pan		4.64	43.53	36.03	
	wet pan			36.03	0.00	

d_{10} (mm): 0.0033 d_{50} (mm): 0.073
d_{16} (mm): 0.0086 d_{60} (mm): 0.096
d_{30} (mm): 0.038 d_{84} (mm): 0.18

Median Particle Diameter --d_{50} (mm): 0.073
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 29
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.6
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.087

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Silt
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

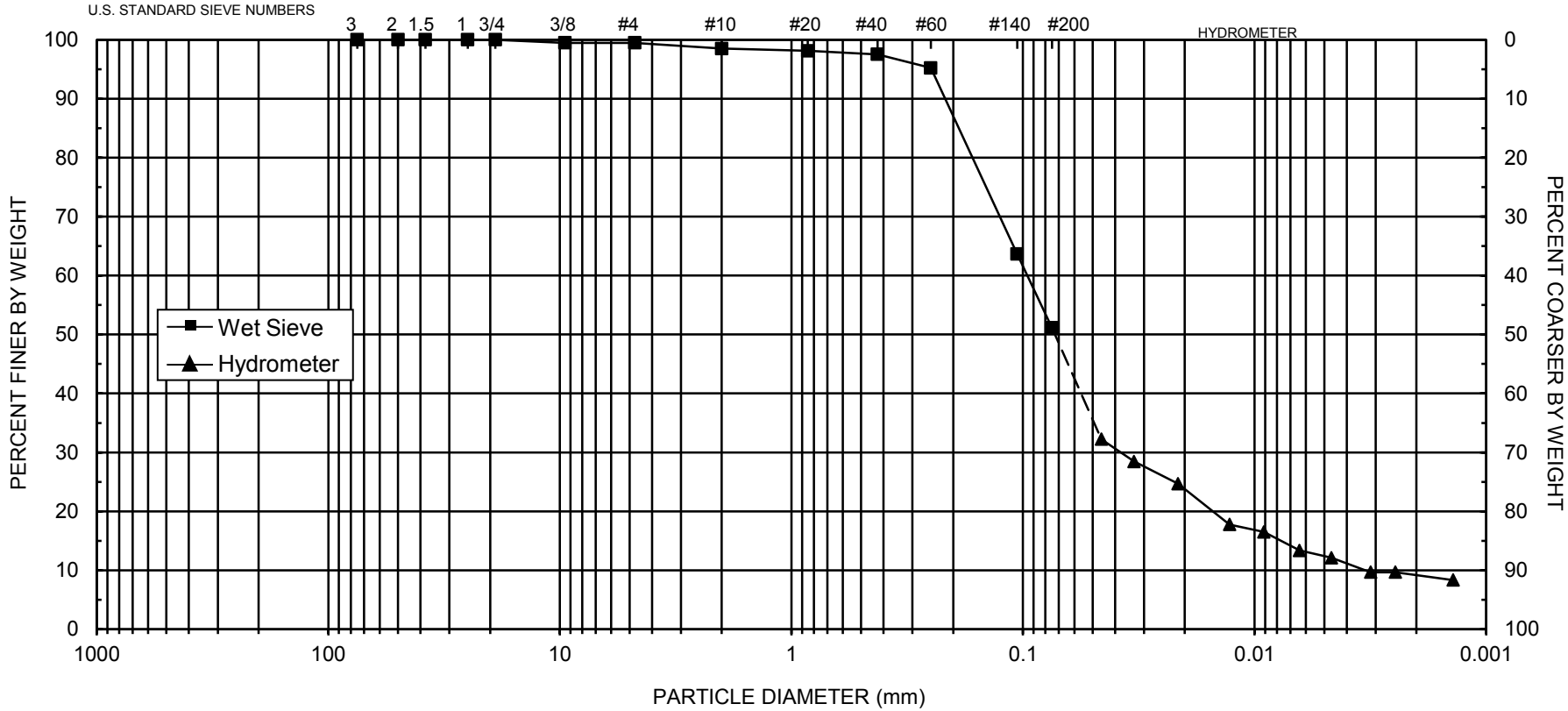
Initial Wt. (g)*:* 79.14
Total Sample Wt. (g)*:* 957.59
Wt. Passing #4 (g): 952.59

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	32.0	6.4	25.6	11.1	0.04584	32.4	32.2
	2	19.1	29.0	6.4	22.6	11.5	0.03313	28.6	28.4
	5	19.1	26.0	6.4	19.6	12.0	0.02139	24.8	24.7
	15	19.1	20.5	6.4	14.1	12.9	0.01281	17.9	17.8
	30	19.1	19.5	6.4	13.1	13.1	0.00911	16.6	16.5
	63	19.1	17.0	6.4	10.6	13.5	0.00639	13.4	13.4
	120	19.1	16.0	6.4	9.6	13.7	0.00465	12.2	12.1
	266	19.5	14.0	6.3	7.7	14.0	0.00315	9.7	9.7
	433	19.7	14.0	6.3	7.7	14.0	0.00246	9.7	9.7
28-Jan-15	1405	19.1	13.0	6.4	6.6	14.2	0.00138	8.4	8.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

d_{10} = **0.0033**	d_{30} = **0.038**	d_{50} = **0.073**	d_{60} = **0.096**	C_u = **29**	C_c = **4.6**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Silt	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam**

Daniel B. Stephens & Associates, Inc.

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Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Overburden
Ring Number: NA
Depth: NA
Test Date: 28-Jan-15

Initial Dry Weight of Sample (g): 1361.49
Weight Passing #4 (g): 1197.72
Weight Retained #4 (g): 163.77
Weight of Hydrometer Sample (g): 78.65
Calculated Weight of Sieve Sample (g): 89.40

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1361.49	100.00
	2"	50	0.00	0.00	1361.49	100.00
	1.5"	38.1	0.00	0.00	1361.49	100.00
	1"	25	73.27	73.27	1288.22	94.62
	3/4"	19.0	41.40	114.67	1246.82	91.58
	3/8"	9.5	25.57	140.24	1221.25	89.70
	4	4.75	23.53	163.77	1197.72	87.97
-4			(Based on calculated sieve wt.)			
	10	2.00	1.70	12.45	76.95	86.07
	20	0.85	2.19	14.64	74.76	83.62
	40	0.425	5.03	19.67	69.73	77.99
	60	0.250	10.25	29.92	59.48	66.53
	140	0.106	24.68	54.60	34.80	38.92
	200	0.075	7.38	61.98	27.42	30.67
	dry pan		1.89	63.87	25.53	
	wet pan			25.53	0.00	

d_{10} (mm): 0.0056 d_{50} (mm): 0.15
d_{16} (mm): 0.027 d_{60} (mm): 0.20
d_{30} (mm): 0.073 d_{84} (mm): 0.97

Median Particle Diameter --d_{50} (mm): 0.15
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 36
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 4.8
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.38

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Overburden
Ring Number: NA
Depth: NA

Test Date: 27-Jan-15
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

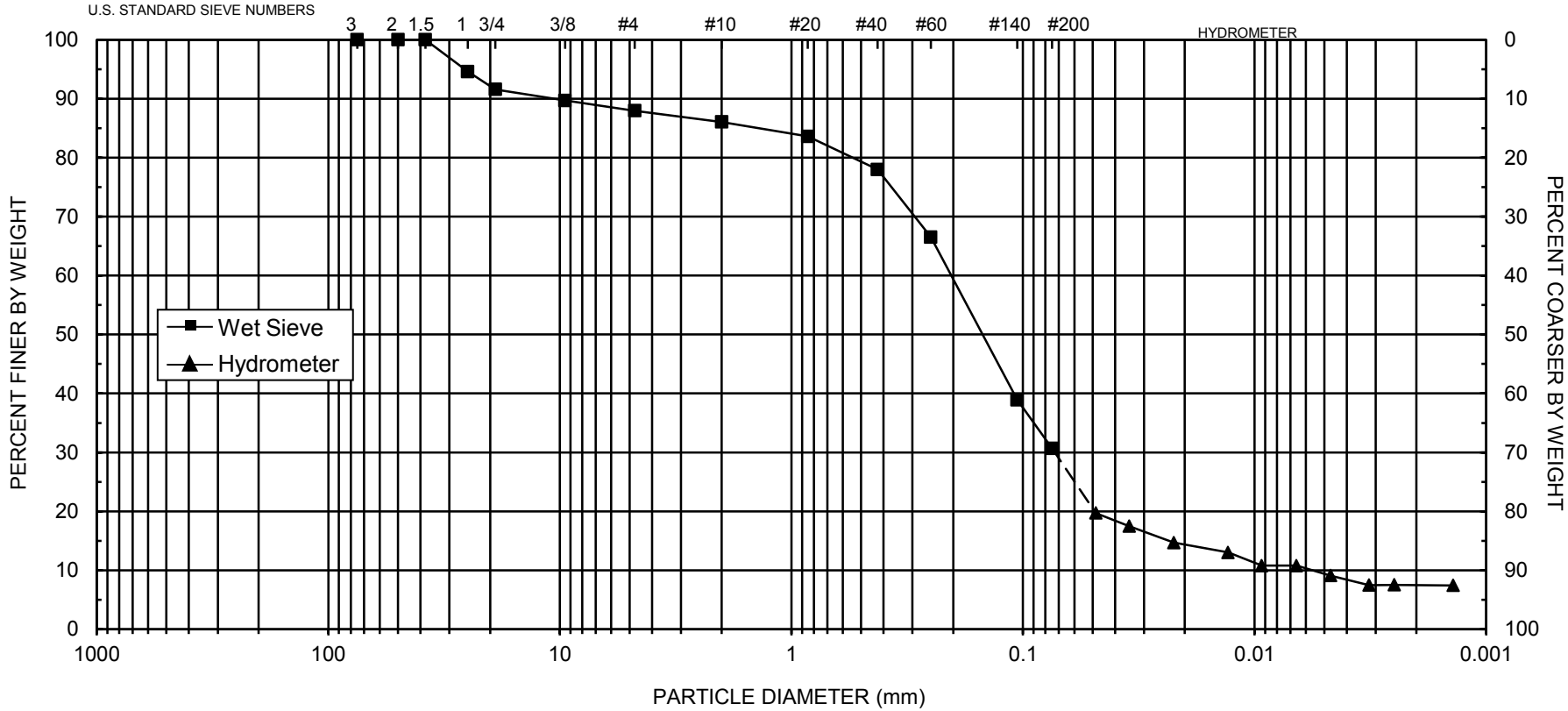
Initial Wt. (g)*:* 78.65
Total Sample Wt. (g)*:* 1361.49
Wt. Passing #4 (g): 1197.72

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jan-15	1	19.1	24.0	6.4	17.6	12.4	0.04848	22.4	19.7
	2	19.1	22.0	6.4	15.6	12.7	0.03473	19.9	17.5
	5	19.1	19.5	6.4	13.1	13.1	0.02232	16.7	14.7
	15	19.1	18.0	6.4	11.6	13.3	0.01301	14.8	13.0
	30	19.1	16.0	6.4	9.6	13.7	0.00931	12.2	10.8
	60	19.1	16.0	6.4	9.6	13.7	0.00658	12.2	10.8
	120	19.1	14.5	6.4	8.1	13.9	0.00470	10.3	9.1
	261	19.5	13.0	6.3	6.7	14.2	0.00320	8.5	7.5
	428	19.7	13.0	6.3	6.7	14.2	0.00249	8.6	7.5
28-Jan-15	1400	19.1	13.0	6.4	6.6	14.2	0.00139	8.4	7.4

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0056**	d_{30} = **0.073**	d_{50} = **0.15**	d_{60} = **0.20**	C_u = **36**	C_c = **4.8**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Overburden	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
Clay	0.00017	0.11	0.17	1000	14	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam (Est)
Clay Loam	0.00056	0.57	1.3	2321	7.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam † (Est)
Rocky Loam	0.039	2.7	6.9	177	0.62	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †
LA Borrow	0.0029	0.17	0.48	166	1.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
Clay	0.5	55.9	23.7	19.8
Clay Loam	26.3	43.7	16.6	13.4
Rocky Loam	44.6	39.2	12.2	4.0
LA Borrow	17.8	38.9	35.1	8.3

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA

Test Date: 25-Feb-15

Initial Dry Weight of Sample (g): 751.89
Weight Passing #4 (g): 748.07
Weight Retained #4 (g): 3.82
Weight of Hydrometer Sample (g): 65.62
Calculated Weight of Sieve Sample (g): 65.96

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	751.89	100.00
	2"	50	0.00	0.00	751.89	100.00
	1.5"	38.1	0.00	0.00	751.89	100.00
	1"	25	0.00	0.00	751.89	100.00
	3/4"	19.0	0.00	0.00	751.89	100.00
	3/8"	9.5	0.00	0.00	751.89	100.00
	4	4.75	3.82	3.82	748.07	99.49
-4			(Based on calculated sieve wt.)			
	10	2.00	0.52	0.86	65.10	98.70
	20	0.85	2.47	3.33	62.63	94.96
	40	0.425	6.56	9.89	56.07	85.01
	60	0.250	11.44	21.33	44.63	67.67
	140	0.106	12.12	33.45	32.51	49.29
	200	0.075	3.79	37.24	28.72	43.54
	dry pan		1.77	39.01	26.95	
	wet pan			26.95	0.00	

d_{10} (mm): 0.00017 d_{50} (mm): 0.11
d_{16} (mm): 0.00076 d_{60} (mm): 0.17
d_{30} (mm): 0.020 d_{84} (mm): 0.41

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 1000
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 14
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.17

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Clay Loam

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay
Ring Number: NA
Depth: NA

Test Date: 17-Feb-15
Start Time: 9:36

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

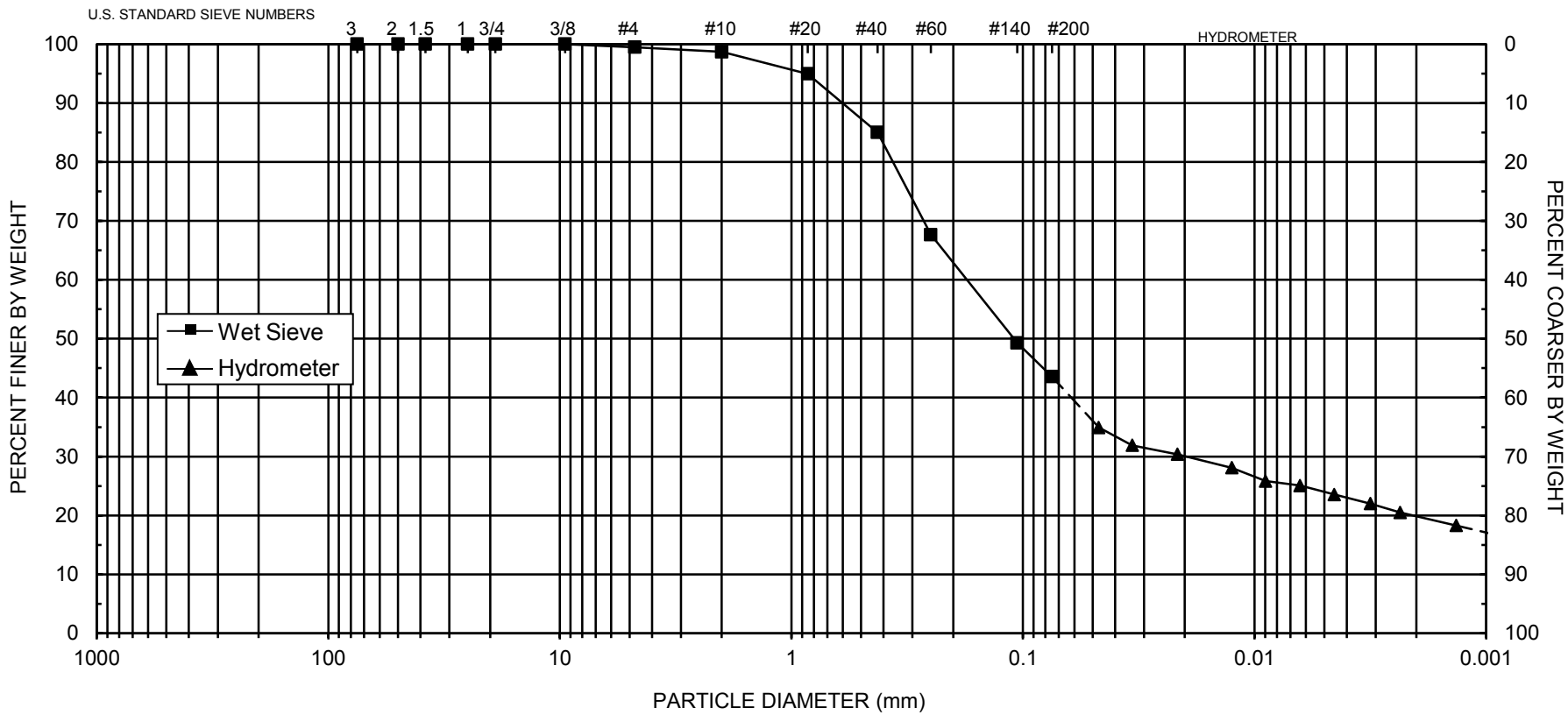
Initial Wt. (g)*:* 65.62
Total Sample Wt. (g)*:* 751.89
Wt. Passing #4 (g): 748.07

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-Feb-15	1	18.5	29.5	6.5	23.0	11.5	0.04703	35.1	34.9
	2	18.5	27.5	6.5	21.0	11.8	0.03373	32.0	31.9
	5	18.5	26.5	6.5	20.0	12.0	0.02148	30.5	30.4
	15	18.5	25.0	6.5	18.5	12.2	0.01253	28.2	28.1
	30	18.5	23.5	6.5	17.0	12.4	0.00895	26.0	25.8
	60	18.5	23.0	6.5	16.5	12.5	0.00635	25.2	25.1
	120	18.5	22.0	6.5	15.5	12.7	0.00452	23.7	23.5
	250	18.4	21.0	6.5	14.5	12.9	0.00315	22.1	22.0
	456	18.4	20.0	6.5	13.5	13.0	0.00235	20.6	20.5
18-Feb-15	1415	18.6	18.5	6.5	12.1	13.3	0.00134	18.4	18.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.00017**	d_{30} = **0.020**	d_{50} = **0.11**	d_{60} = **0.17**	C_u = **1000**	C_c = **14**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Clay	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Clay Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay Loam
Ring Number: NA
Depth: NA

Test Date: 25-Feb-15

Initial Dry Weight of Sample (g): 1031.30
Weight Passing #4 (g): 759.79
Weight Retained #4 (g): 271.51
Weight of Hydrometer Sample (g): 72.09
Calculated Weight of Sieve Sample (g): 97.85

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1031.30	100.00
	2"	50	0.00	0.00	1031.30	100.00
	1.5"	38.1	0.00	0.00	1031.30	100.00
	1"	25	48.37	48.37	982.93	95.31
	3/4"	19.0	27.71	76.08	955.22	92.62
	3/8"	9.5	92.09	168.17	863.13	83.69
	4	4.75	103.34	271.51	759.79	73.67
-4			(Based on calculated sieve wt.)			
	10	2.00	7.98	33.74	64.11	65.52
	20	0.85	9.88	43.62	54.23	55.42
	40	0.425	9.18	52.80	45.05	46.04
	60	0.250	4.72	57.52	40.33	41.22
	140	0.106	7.78	65.30	32.55	33.26
	200	0.075	3.21	68.51	29.34	29.98
	dry pan		2.40	70.91	26.94	
	wet pan			26.94	0.00	

d_{10} (mm): 0.00056 d_{50} (mm): 0.57
d_{16} (mm): 0.0047 d_{60} (mm): 1.3
d_{30} (mm): 0.075 d_{84} (mm): 9.7

Median Particle Diameter --d_{50} (mm): 0.57
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 2321
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 7.7
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 3.4

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Clay Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Clay Loam
Ring Number: NA
Depth: NA

Test Date: 17-Feb-15
Start Time: 9:42

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

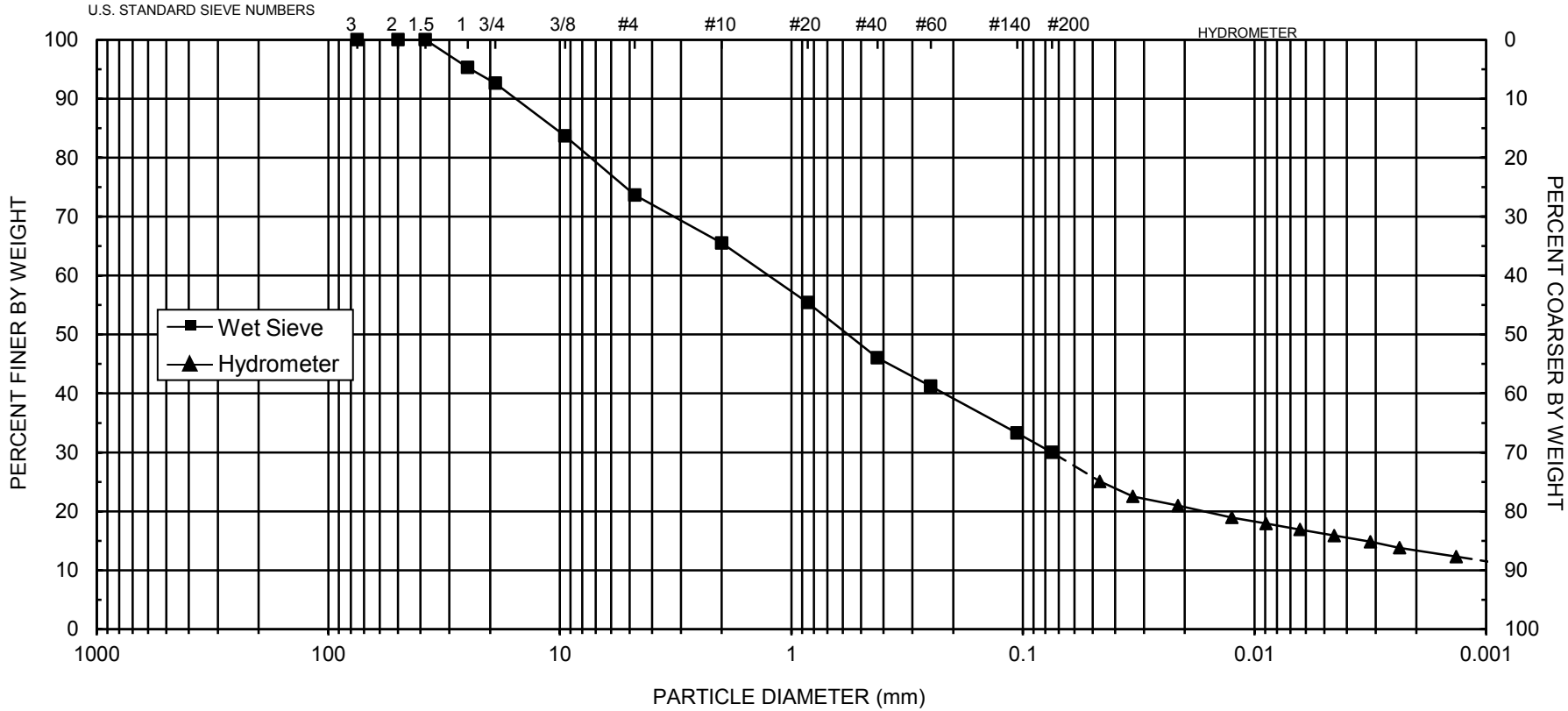
Initial Wt. (g)*:* 72.09
Total Sample Wt. (g)*:* 1031.30
Wt. Passing #4 (g): 759.79

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-Feb-15	1	18.5	31.0	6.5	24.5	11.2	0.04653	34.0	25.1
	2	18.5	28.5	6.5	22.0	11.6	0.03349	30.6	22.5
	5	18.5	27.0	6.5	20.5	11.9	0.02141	28.5	21.0
	15	18.5	25.0	6.5	18.5	12.2	0.01253	25.7	18.9
	30	18.5	24.0	6.5	17.5	12.4	0.00892	24.3	17.9
	60	18.5	23.0	6.5	16.5	12.5	0.00635	22.9	16.9
	120	18.5	22.0	6.5	15.5	12.7	0.00452	21.5	15.9
	250	18.4	21.0	6.5	14.5	12.9	0.00315	20.1	14.8
	451	18.4	20.0	6.5	13.5	13.0	0.00236	18.7	13.8
18-Feb-15	1410	18.6	18.5	6.5	12.1	13.3	0.00135	16.7	12.3

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.00056**	d_{30} = **0.075**	d_{50} = **0.57**	d_{60} = **1.3**	C_u = **2321**	C_c = **7.7**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Clay Loam	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Clay Loam †**

† Greater than 10% of sample is coarse material

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Rocky Loam
Ring Number: NA
Depth: NA
Test Date: 25-Feb-15

Initial Dry Weight of Sample (g): 1539.31
Weight Passing #4 (g): 852.04
Weight Retained #4 (g): 687.27
Weight of Hydrometer Sample (g): 90.66
Calculated Weight of Sieve Sample (g): 163.79

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1539.31	100.00
	2"	50	0.00	0.00	1539.31	100.00
	1.5"	38.1	0.00	0.00	1539.31	100.00
	1"	25	263.25	263.25	1276.06	82.90
	3/4"	19.0	66.49	329.74	1209.57	78.58
	3/8"	9.5	222.14	551.88	987.43	64.15
	4	4.75	135.39	687.27	852.04	55.35
-4			(Based on calculated sieve wt.)			
	10	2.00	13.64	86.77	77.02	47.02
	20	0.85	11.95	98.72	65.07	39.73
	40	0.425	15.47	114.19	49.60	30.28
	60	0.250	8.95	123.14	40.65	24.82
	140	0.106	10.26	133.40	30.39	18.55
	200	0.075	3.91	137.31	26.48	16.17
	dry pan		2.03	139.34	24.45	
	wet pan			24.45	0.00	

d_{10} (mm): 0.039 d_{50} (mm): 2.7
d_{16} (mm): 0.074 d_{60} (mm): 6.9
d_{30} (mm): 0.41 d_{84} (mm): 26

Median Particle Diameter --d_{50} (mm): 2.7
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 177
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.62
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 9.6

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: Rocky Loam
Ring Number: NA
Depth: NA

Test Date: 17-Feb-15
Start Time: 9:54

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

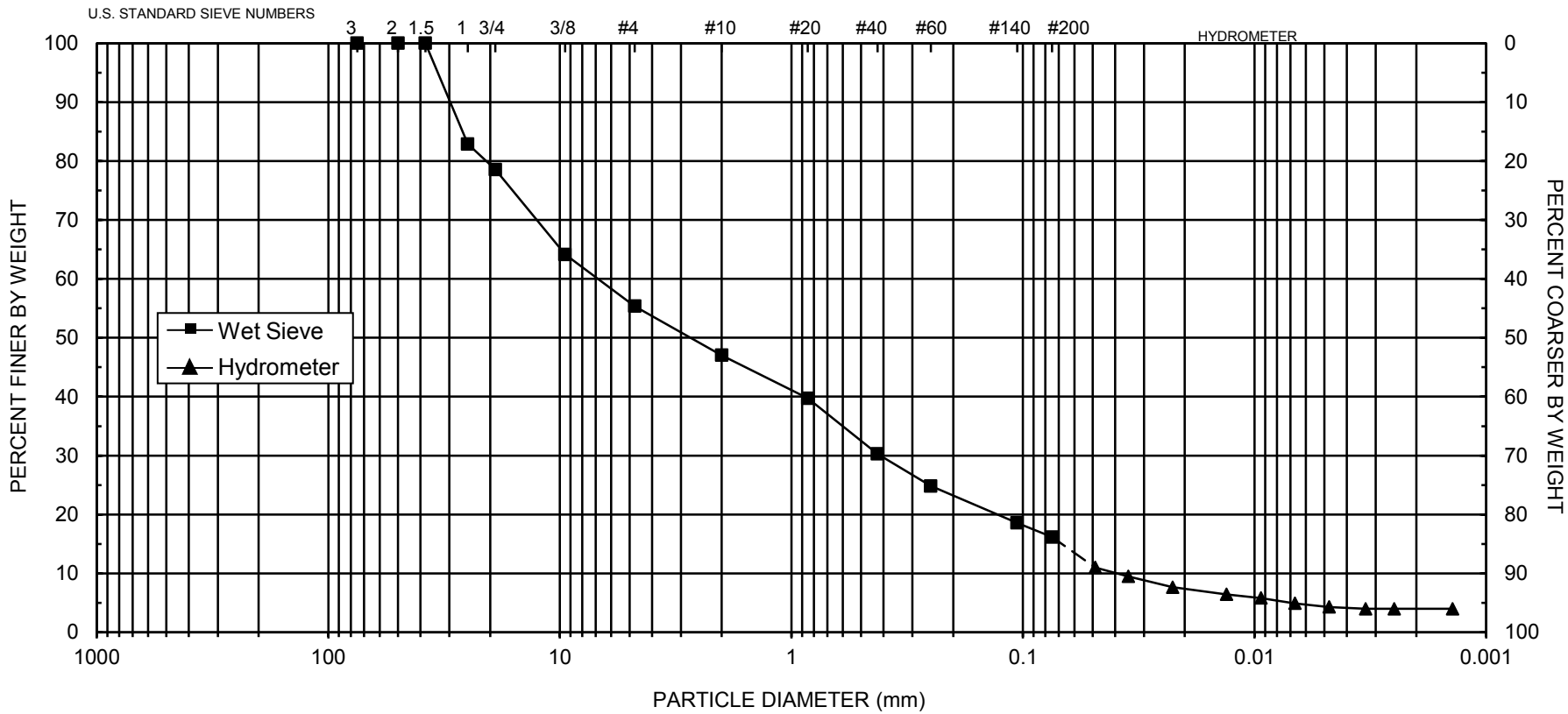
Initial Wt. (g)*:* 90.66
Total Sample Wt. (g)*:* 1539.31
Wt. Passing #4 (g): 852.04

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-Feb-15	1	18.5	24.5	6.5	18.0	12.3	0.04869	19.9	11.0
	2	18.5	22.0	6.5	15.5	12.7	0.03500	17.1	9.5
	5	18.5	19.0	6.5	12.5	13.2	0.02256	13.8	7.7
	15	18.5	17.0	6.5	10.5	13.5	0.01318	11.6	6.4
	30	18.5	16.0	6.5	9.5	13.7	0.00938	10.5	5.8
	60	18.5	14.5	6.5	8.0	13.9	0.00669	8.9	4.9
	120	18.5	13.5	6.5	7.0	14.1	0.00476	7.8	4.3
	250	18.4	13.0	6.5	6.5	14.2	0.00331	7.2	4.0
	441	18.4	13.0	6.5	6.5	14.2	0.00249	7.2	4.0
18-Feb-15	1400	18.6	13.0	6.5	6.5	14.2	0.00140	7.2	4.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND				SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine		

d_{10} = **0.039**	d_{30} = **0.41**	d_{50} = **2.7**	d_{60} = **6.9**	C_u = **177**	C_c = **0.62**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
Rocky Loam	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA Borrow
Ring Number: NA
Depth: NA
Test Date: 25-Feb-15

Initial Dry Weight of Sample (g): 1252.81
Weight Passing #4 (g): 1029.96
Weight Retained #4 (g): 222.85
Weight of Hydrometer Sample (g): 87.78
Calculated Weight of Sieve Sample (g): 106.77

Shape: Angular
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	1252.81	100.00
	2"	50	0.00	0.00	1252.81	100.00
	1.5"	38.1	0.00	0.00	1252.81	100.00
	1"	25	54.86	54.86	1197.95	95.62
	3/4"	19.0	28.03	82.89	1169.92	93.38
	3/8"	9.5	81.26	164.15	1088.66	86.90
	4	4.75	58.70	222.85	1029.96	82.21
-4			(Based on calculated sieve wt.)			
	10	2.00	6.24	25.23	81.54	76.37
	20	0.85	10.50	35.73	71.04	66.53
	40	0.425	8.39	44.12	62.65	58.68
	60	0.250	5.81	49.93	56.84	53.23
	140	0.106	7.29	57.22	49.55	46.41
	200	0.075	3.27	60.49	46.28	43.34
	dry pan		3.62	64.11	42.66	
	wet pan			42.66	0.00	

d_{10} (mm): 0.0029 d_{50} (mm): 0.17
d_{16} (mm): 0.012 d_{60} (mm): 0.48
d_{30} (mm): 0.038 d_{84} (mm): 6.2

Median Particle Diameter --d_{50} (mm): 0.17
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 166
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 1.0
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 2.1

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA Borrow
Ring Number: NA
Depth: NA

Test Date: 17-Feb-15
Start Time: 9:48

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

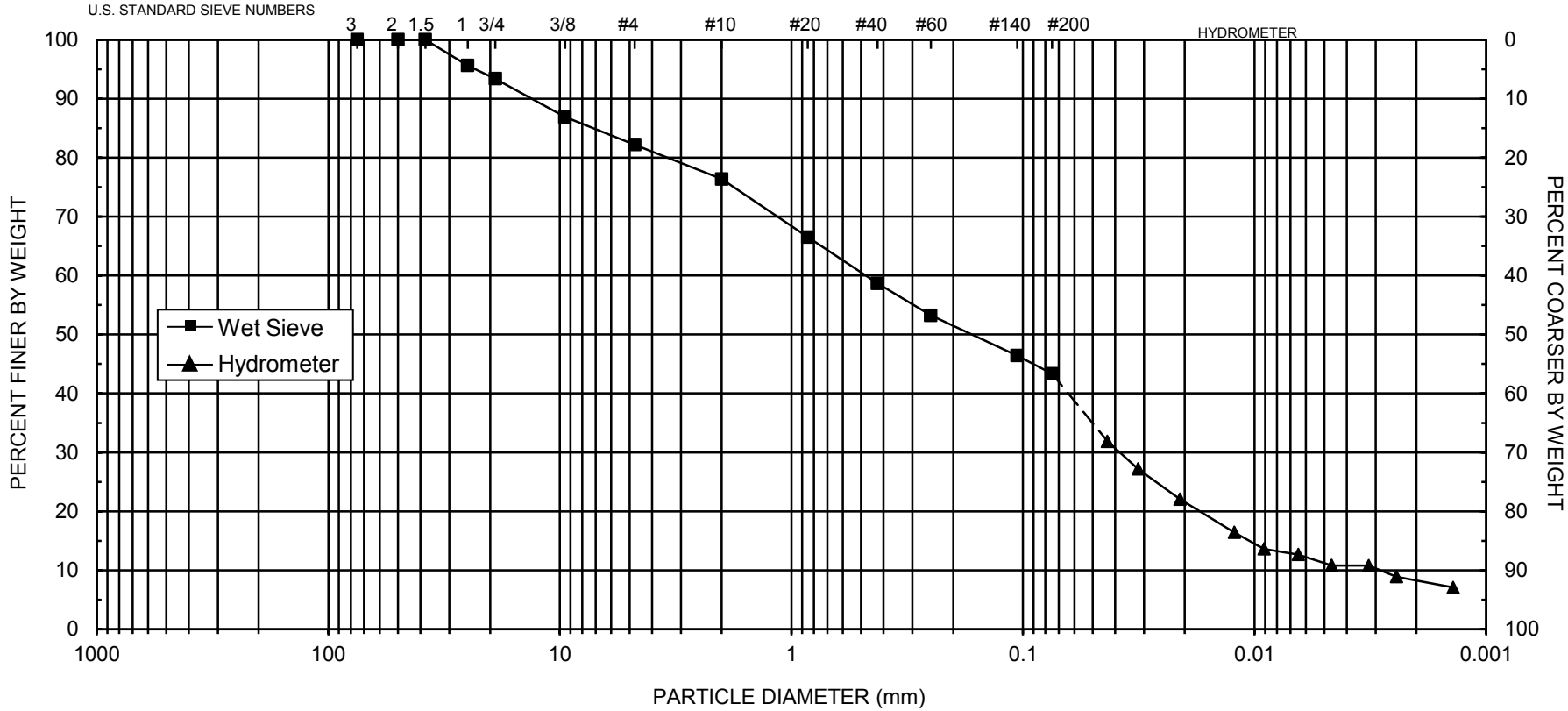
Initial Wt. (g)*:* 87.78
Total Sample Wt. (g)*:* 1252.81
Wt. Passing #4 (g): 1029.96

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-Feb-15	1	18.5	40.5	6.5	34.0	9.7	0.04318	38.8	31.9
	2	18.5	35.5	6.5	29.0	10.5	0.03180	33.1	27.2
	5	18.5	30.0	6.5	23.5	11.4	0.02096	26.8	22.0
	16	18.5	24.0	6.5	17.5	12.4	0.01221	20.0	16.4
	30	18.5	21.0	6.5	14.5	12.9	0.00909	16.6	13.6
	60	18.5	20.0	6.5	13.5	13.0	0.00647	15.4	12.7
	120	18.5	18.0	6.5	11.5	13.3	0.00463	13.1	10.8
	250	18.4	18.0	6.5	11.5	13.3	0.00321	13.1	10.8
	446	18.4	16.0	6.5	9.5	13.7	0.00244	10.8	8.9
18-Feb-15	1405	18.6	14.0	6.5	7.6	14.0	0.00139	8.6	7.1

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0029**	d_{30} = **0.038**	d_{50} = **0.17**	d_{60} = **0.48**	C_u = **166**	C_c = **1.0**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
LA Borrow	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
LA54																X	X					

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
LA54	0.0098	0.51	1.0	102	0.42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
LA54	22.5	45.1	27.8	4.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification
LA54	0.0098	0.51	1.0	102	0.42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam †

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
LA54	22.5	45.1	27.8	4.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#4 Split)

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA54
Ring Number: NA
Depth: NA

Test Date: 8-Apr-15

Initial Dry Weight of Sample (g): 19348.27
Weight Passing #4 (g): 14997.34
Weight Retained #4 (g): 4350.93
Weight of Hydrometer Sample (g): 88.63
Calculated Weight of Sieve Sample (g): 114.34

Shape: Rounded
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+4						
	3"	75	0.00	0.00	19348.27	100.00
	2"	50	151.31	151.31	19196.96	99.22
	1.5"	38.1	147.28	298.59	19049.68	98.46
	1"	25	288.42	587.01	18761.26	96.97
	3/4"	19.0	569.04	1156.05	18192.22	94.03
	3/8"	9.5	1988.86	3144.91	16203.36	83.75
	4	4.75	1206.02	4350.93	14997.34	77.51
-4			(Based on calculated sieve wt.)			
	10	2.00	8.86	34.57	79.77	69.76
	20	0.85	14.07	48.64	65.70	57.46
	40	0.425	11.52	60.16	54.18	47.38
	60	0.250	6.55	66.71	47.63	41.66
	140	0.106	8.04	74.75	39.59	34.62
	200	0.075	2.57	77.32	37.02	32.38
	dry pan		0.21	77.53	36.81	
	wet pan			36.81	0.00	

d_{10} (mm): 0.0098 d_{50} (mm): 0.51
d_{16} (mm): 0.019 d_{60} (mm): 1.0
d_{30} (mm): 0.064 d_{84} (mm): 9.7

Median Particle Diameter --d_{50} (mm): 0.51
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 102
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 0.42
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 3.4

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Dwyer Engineering
Job Number: NM15.0010.00
Sample Number: LA54
Ring Number: NA
Depth: NA

Test Date: 6-Apr-15
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2*:* NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

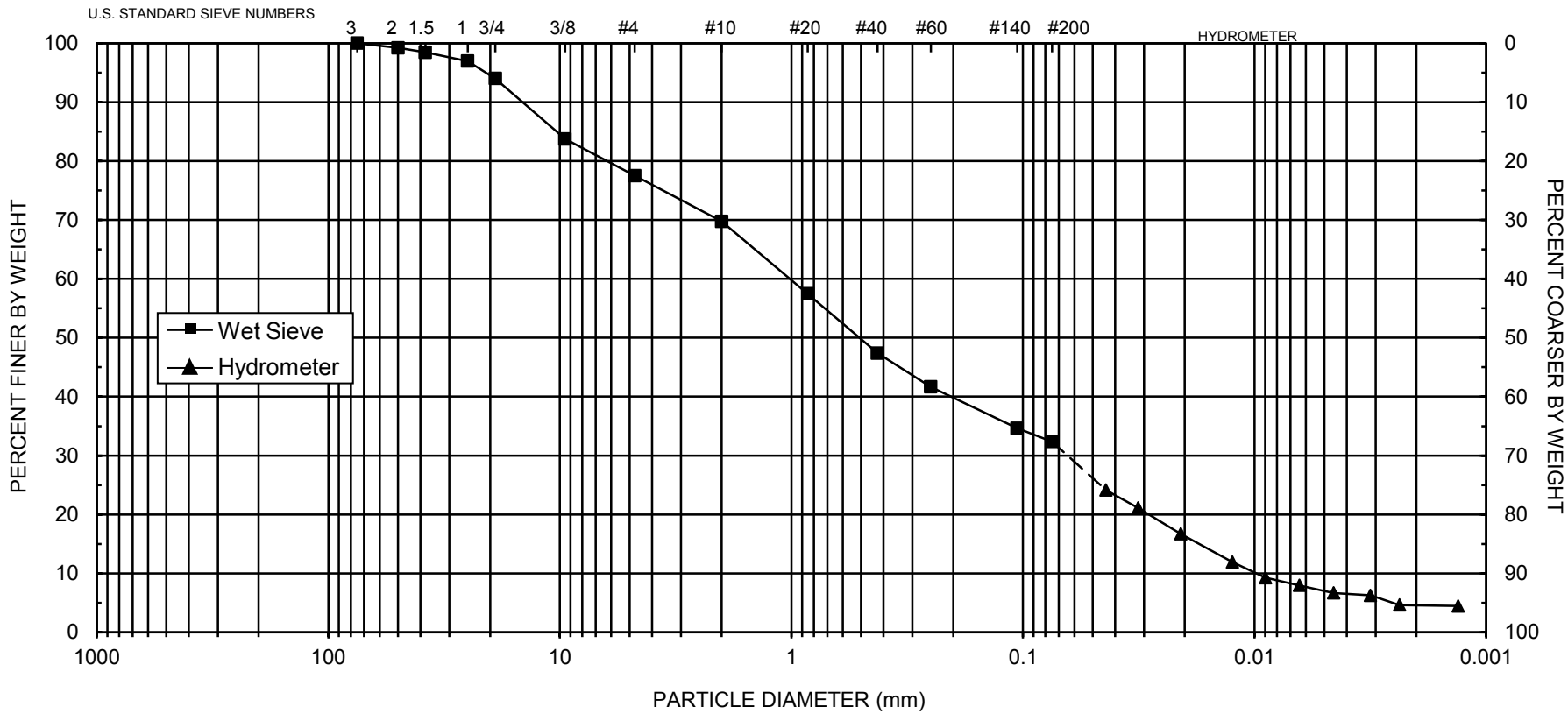
Initial Wt. (g)*:* 88.63
Total Sample Wt. (g)*:* 19348.27
Wt. Passing #4 (g): 14997.34

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
6-Apr-15	1	21.9	33.5	5.9	27.6	10.8	0.04377	31.1	24.1
	2	21.9	30.0	5.9	24.1	11.4	0.03176	27.2	21.1
	5	21.9	25.0	5.9	19.1	12.2	0.02080	21.6	16.7
	15	21.9	19.5	5.9	13.6	13.1	0.01244	15.3	11.9
	30	21.9	16.5	5.9	10.6	13.6	0.00896	12.0	9.3
	60	21.9	15.0	5.9	9.1	13.8	0.00639	10.3	8.0
	120	22.1	13.5	5.9	7.6	14.1	0.00455	8.6	6.7
	250	22.3	13.0	5.8	7.2	14.2	0.00315	8.1	6.3
	449	22.9	11.0	5.7	5.3	14.5	0.00236	5.9	4.6
7-Apr-15	1480	21.9	11.0	5.9	5.1	14.5	0.00132	5.8	4.5

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: N. Candelaria
Data entered by: C. Krous
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT		CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = **0.0098**	d_{30} = **0.064**	d_{50} = **0.51**	d_{60} = **1.0**	C_u = **102**	C_c = **0.42**

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
LA54	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam †**

† Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.

Albuquerque Materials Laboratory
Laboratory Form S-1
Particle Analysis

Test Designation Used: [ ] AASHTO T-11 [ ] AASHTO T-27 [X] ASTM C-117 [X] ASTM C-136 [X] ASTM C-566

Material: Engineered Fill
Lab Number: TW-052
Date/Time Sampled: 2/4/2015
Sampled By/Emp. No.: D. Groneman 11050
Date Tested: 2/10/2015
Sample Source: On Site Material
Tested By/Emp No.: MD 07804
Sample Location: CDI 2 Test Hole Sta 13+52 (Storm Drain)

Tare ID / Weight (g)		(A) Wet Weight of Soil Before Wash (g)	(B) Dry Weight of Soil Before Wash (g)	(C) Dry Weight of Soil After Wash (g)	Percent Sieving Loss (± 0.3%)
P16	0	1,255.8	1,094.9	484.6	0.0

[(C-Pan)/C]*100

Screen Size	Cumulative Weight Retained (g)	Percent Retained	Percent Passing	Specifications
2.0"	0.0	0.0	100	**100**
1.5"	0.0	0.0	100	
1.0"	0.0	0.0	100	
3/4"	0.0	0.0	100	
1/2"	18.6	1.7	98	
3/8"	32.3	3.0	97	
1/4"	49.4	4.5	95	**40-100**
#4	62.7	5.7	94	
#8	86.0	7.9	92	
#10	98.0	9.0	91	
#16	168.8	15.4	85	
#30	258.4	23.6	76	
#40	290.6	26.5	73	
#50	317.6	29.0	71	
#100	367.8	33.6	66	
#200	455.3	41.6	58.4	**25-45**
Pan	484.5	N/A	N/A	

Percent Moisture

[(A-B)/B]*100

14.7%

Percent -#200 Loss

[(B-C)/B]*100

55.7%

Minimum Sample Size based on Nominal Maximum Sieve Size

- 3/8"	300 g	**3/8"**	1,000 g
1/2"	2,000 g	**3/4"**	5,000 g
1.0"	10,000 g	**1.5"**	20,000 g

See Table 7.4 of AASHTO T-27 or ASTM C-136 for complete table of sample sizes

Comments:

Albuquerque Materials Laboratory
Laboratory Form S-1
Particle Analysis

Test Designation Used: [ ] AASHTO T-11 [ ] AASHTO T-27 [X] ASTM C-117 [X] ASTM C-136 [X] ASTM C-566

Material: Engineered Fill
Lab Number: TW-053
Date/Time Sampled: 2/4/2015
Sampled By/Emp. No.: D. Groneman 11050
Date Tested: 2/10/2015
Sample Source: On Site Material
Tested By/Emp No.: MD 07804
Sample Location: CDI 1 Test Hole Sta 12+10

Tare ID / Weight (g)		(A) Wet Weight of Soil Before Wash (g)	(B) Dry Weight of Soil Before Wash (g)	(C) Dry Weight of Soil After Wash (g)	Percent Sieving Loss (± 0.3%)
P15	0	1,260.3	1,124.0	367.4	0.0

[(C-Pan)/C]*100

Screen Size	Cumulative Weight Retained (g)	Percent Retained	Percent Passing	Specifications
2.0"	0.0	0.0	100	**100**
1.5"	0.0	0.0	100	
1.0"	0.0	0.0	100	
3/4"	0.0	0.0	100	
1/2"	3.0	0.3	100	
3/8"	10.9	1.0	99	
1/4"	23.0	2.0	98	**40-100**
#4	32.0	2.8	97	
#8	48.0	4.3	96	
#10	57.5	5.1	95	
#16	111.8	9.9	90	
#30	182.6	16.2	84	
#40	208.8	18.6	81	
#50	230.7	20.5	79	
#100	269.5	24.0	76	
#200	346.7	30.8	69.2	**25-45**
Pan	367.4	N/A	N/A	

Percent Moisture

[(A-B)/B]*100

12.1%

Percent -#200 Loss

[(B-C)/B]*100

67.3%

Minimum Sample Size based on Nominal Maximum Sieve Size

- 3/8"	300 g	**3/8"**	1,000 g
1/2"	2,000 g	**3/4"**	5,000 g
1.0"	10,000 g	**1.5"**	20,000 g

See Table 7.4 of AASHTO T-27 or ASTM C-136 for complete table of sample sizes

Comments:

Albuquerque Materials Laboratory
Laboratory Form S-1
Particle Analysis

Test Designation Used: [ ] AASHTO T-11 [ ] AASHTO T-27 [X] ASTM C-117 [X] ASTM C-136 [X] ASTM C-566

Material: Engineered Fill
Lab Number: TW-054
Date/Time Sampled: 2/4/2015
Sampled By/Emp. No.: D. Groneman 11050
Date Tested: 2/10/2015
Sample Source: On Site Material
Tested By/Emp No.: MD 07804
Sample Location: Manhole #1 test hole Sta 11+40

Tare ID / Weight (g)		(A) Wet Weight of Soil Before Wash (g)	(B) Dry Weight of Soil Before Wash (g)	(C) Dry Weight of Soil After Wash (g)	Percent Sieving Loss (± 0.3%)
P14	0	1,274.9	1,128.6	497.1	0.0

[(C-Pan)/C]*100

Screen Size	Cumulative Weight Retained (g)	Percent Retained	Percent Passing	Specifications
2.0"	0.0	0.0	100	**100**
1.5"	0.0	0.0	100	
1.0"	0.0	0.0	100	
3/4"	0.0	0.0	100	
1/2"	40.3	3.6	96	
3/8"	75.6	6.7	93	
1/4"	108.9	9.6	90	**40-100**
#4	120.7	10.7	89	
#8	146.3	13.0	87	
#10	159.1	14.1	86	
#16	223.6	19.8	80	
#30	301.9	26.7	73	
#40	330.4	29.3	71	
#50	354.9	31.4	69	
#100	399.8	35.4	65	
#200	472.2	41.8	58.2	**25-45**
Pan	497.0	N/A	N/A	

Percent Moisture

[(A-B)/B]*100

13.0%

Percent -#200 Loss

[(B-C)/B]*100

56.0%

Minimum Sample Size based on Nominal Maximum Sieve Size

- 3/8"	300 g	**3/8"**	1,000 g
1/2"	2,000 g	**3/4"**	5,000 g
1.0"	10,000 g	**1.5"**	20,000 g

See Table 7.4 of AASHTO T-27 or ASTM C-136 for complete table of sample sizes

Comments:

August 2015

WORK PLAN

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

prepared for:
Department of Energy
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos Field Office
Los Alamos, NM 87544

prepared by:
Dwyer Engineering LLC
1813 Stagecoach Rd.
Albuquerque, NM 87123
(505)270-0215

Revision 01

WORK PLAN

LOS ALAMOS COUNTY AIRPORT LANDFILL COVER REPLACEMENT

August 2015

Responsible Project Engineer:

Printed Name	Signature	Title	Organization	Date:
Stephen F. Dwyer	Stephen F. Dwyer	Principal Engineer	Dwyer Engr. LLC	August 6, 2015

Responsible Federal Project Director:

Printed Name	Signature	Title	Organization	Date:
Ramoncita Massey		Project Manager	DOE: EM-LA	

Responsible DOE Field Office Manager:

Printed Name	Signature	Title	Organization	Date:
David Rhodes		Supervisor	DOE: EM-LA	

Table of Contents

LIST OF ACRONYMS **4**

EXECUTIVE SUMMARY **5**

REFERENCED DOCUMENTS SUBMITTED WITH WORK PLAN **5**

1.0 INTRODUCTION **6**

1.1 ORIGINAL CLOSURE CRITERIA COMPARSION WITH NEW CLOSURE DESIGN 7
1.1.1 MINIMIZE MAINTENANCE 8
1.1.2 PROMOTE DRAINAGE 8
1.1.3 MINIMIZE EROSION 8
1.1.4 ACCOMODATE SETTLEMENT 8
1.1.5 PERMEABILITY LESS THAN BOTTOM LINER. 8
1.1.6 GAS EMISSION MONITORING. 8

2.0 SITE HISTORY AND BACKGROUND **9**

2.1 LAC AIRPORT LANDFILL BACKGROUND 9
2.2 PHYSICAL SETTING 12
2.2.1 LAC Airport Land Use 12
2.2.2 Regional Climate 12
2.2.3 Physiography 13
2.3 AIRPORT LANDFILL DESIGN BACKGROUND 14

3.0 PREVIOUS INVESTIGATIONS / CHARACTERIZATION **15**

3.1 WASTE INVESTIGATIONS 15
3.2 POST-CONSTRUCTION INSPECTIONS 15
3.3 METHANE MONITORING 17
3.4 ENGINEERING INSPECTION OF LANDFILL 18

4.0 MAINTENANCE AND REPAIRS PERFORMED ON THE AIRPORT LANDFILL 21

4.1 MAINTENANCE PERFORMED ON THE LAC AIRPORT LANDFILL COVER SURFACE 21
4.2 REPAIRS PERFORMED AT THE AIRPORT LANDFILL SITE 22

5.0 PRE-DESIGN STUDIES **28**

5.1 LOS ALAMOS COUNTY REQUIREMENTS 28
5.2 SOIL BORROW INVESTIGATION 28
5.3 SURVEY 30
5.4 SLOPE STABILITY 32
5.5 GEOPROBE AND VOC INVESTIGATION 32
5.6 INTERIM COVER SOIL INVESTIGATION 37

6.0 APPLICABLE REGULATIONS **38**

7.0 COVER SYSTEM DESIGN **39**

8.0 CONSTRUCTION QUALITY ASSURANCE PLAN 41
9.0 CONSTRUCTION SCHEDULE 42
10.0 COST ESTIMATE 43
11.0 REPLY TO NMED CONCERNS 44
12.0 GROUNDWATER MONITORING DATA 48
13.0 POST-CLOSURE CARE AND MONITORING PLAN 49
14.0 HEALTH AND SAFETY PLAN 51
15.0 REFERENCES 52
ATTACHMENT 55

FIGURES

Figure 1. Aerial View of Airport Landfill with MatCon Cover & Concrete Hangar Pads..... 6
Figure 2. Landfill Locations (LANL 1998) 11
Figure 3. Los Alamos, NM Typical Climate's Demand for Water (PET) vs. Supply of Water (Precipitation) 13
Figure 4. Estimated Waste Volume and Extent (LANL 1998)..... 15
Figure 5. Differential Settlement: Asphalt below Concrete Hangar Pad..... 16
Figure 6. Surface Cracking 16
Figure 7. Ponding due to Differential Settlement 17
Figure 8. Methane Monitoring Locations 18
Figure 9. Ponding near PS-02 19
Figure 10. Repaired Crack from May 2010 with Degradation since Application 21
Figure 11. Repaired Cracking in Landfill Asphalt Cover..... 22
Figure 12. Gully Adjacent to Retaining Structure 23
Figure 13. Damaged Perimeter Fence on Eastern edge of Airport Landfill Site..... 24
Figure 14. Repaired Airport Landfill Perimeter Fence 24
Figure 15. Riprap Protected Slope 25
Figure 16. Permanent Erosion Repair East of Retaining Structures 26
Figure 17. Check Dams on North Slope 26
Figure 18. Repaired Berms on Eastern Slopes of Landfill 27
Figure 19. Relationship Between water Storage Capacity and Soil Texture (Schroeder et al 1994) 30
Figure 20. Sketch with Measured Settlement Noted at Corners and Mid-Point of each Hangar Pad..... 31
Figure 21. Estimated Waste Cross Section (LANL 1998)..... 33
Figure 22. Geoprobe Locations..... 34

Figure 23. Typical ET Cover Profile 39
Figure 24. Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998) 40
Figure 25. Photo of Los Alamos County Airport Landfill, February 2002 46

TABLES

Table 1. Average Methane Levels (% of LEL through March 2015)..... 19
Table 2. Summary of Soil Depth via Geoprobe Drilling performed in Oct. 2014 35

LIST OF ACRONYMS

ASTM	American Society of Testing Materials
BGS	below ground surface
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CPT	cone penetrometer testing
CQAP	Construction Quality Assurance Plan
CY	cubic yards
DDA	Debris Disposal Area
DOE	Department of Energy
EA	Environmental Assessment
EM-LA	Environmental Management Los Alamos Field Office
ET	Evapotranspiration
FAA	Federal Aviation Administration
HASP	Health and Safety Plan
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LEL	Lower Explosive Limit
MatCon	Modified Asphalt Technology for Waste Containment
MSL	mean sea level
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PCMP	Post-Closure Care and Monitoring Plan
PET	Potential Evapotranspiration
PID	photoionization detector
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
RFI	Remedial Feasibility Investigation
SB	Soil Boring
SWMU	Solid Waste management Unit
TA	Technical Area
TRM	Turf reinforcement matting
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

The Los Alamos County Airport Landfill was closed with a cover system in 2007 that consisted of an asphaltic surface combined with five reinforced concrete hangar pads. Monitoring of the cover system since its installation has identified significant degradation, differential settlement, and problems with surface drainage.

The Department of Energy (DOE) has decided to replace the existing covers system with an Evapotranspiration (ET) Cover that will better isolate the buried municipal waste. This Work Plan is submitted with accompanying documents describing the new design and subsequent construction of the new cover system.

REFERENCED DOCUMENTS SUBMITTED WITH WORK PLAN

- Technical Drawings (8 sheets). Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. June 2015.
- Technical Specifications. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. June 2015.
- ET Cover Design Report. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. June 2015.
- Cover Soil Borrow Investigation. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
- Construction Implementation Plan. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
- Post-Closure Care and Monitoring Plan. Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. June 2015.
- Design Health and Safety Plan (HASP). Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. April 2015.
- Construction Quality Assurance Plan (CQAP). Los Alamos Airport Landfill Cover Replacement, Los Alamos, NM. June 2015.

1.0 INTRODUCTION

A cover system was installed in early 2007 on the solid waste landfill located adjacent to the Los Alamos County (LAC) Airport. This cover system is composed of an asphalt surface (MatCon) in conjunction with five reinforced concrete slabs (Figure 1). A passive gas collection system was also incorporated into the cover system. The north and east perimeter of the LAC Airport Landfill are side slopes composed of compacted soil with a vegetated surface. There is no waste beneath these side slopes. The eastern slope is reinforced by retaining structures. The existing airport hangar facilities are located adjacent to the western edge of the landfill. A surface water drainage trench is located to the south.

The LAC airport landfill was closed as a hazardous waste landfill following guidelines set forth in the Resource Conservation and Recovery Act (RCRA) Subtitle C closures (40 CFR 264, Subpart N as incorporated by 20.4.1.600 NMAC). The intent of the cover system was to perform equivalent to a prescriptive cover for at least the duration of the 30-year post-closure care period (DOE/EA-1515 Final Environmental Assessment for Proposed Closure of the Airport Landfills within TA73). The additional intent of the reinforced concrete slabs was to provide a foundation for future airplane hangars to be built upon. The surrounding asphalt surface was to provide access for the airplanes in and out of the hangars. The asphaltic surface was a specialty product produced by MatCon, Inc. marketed to be relatively impermeable.

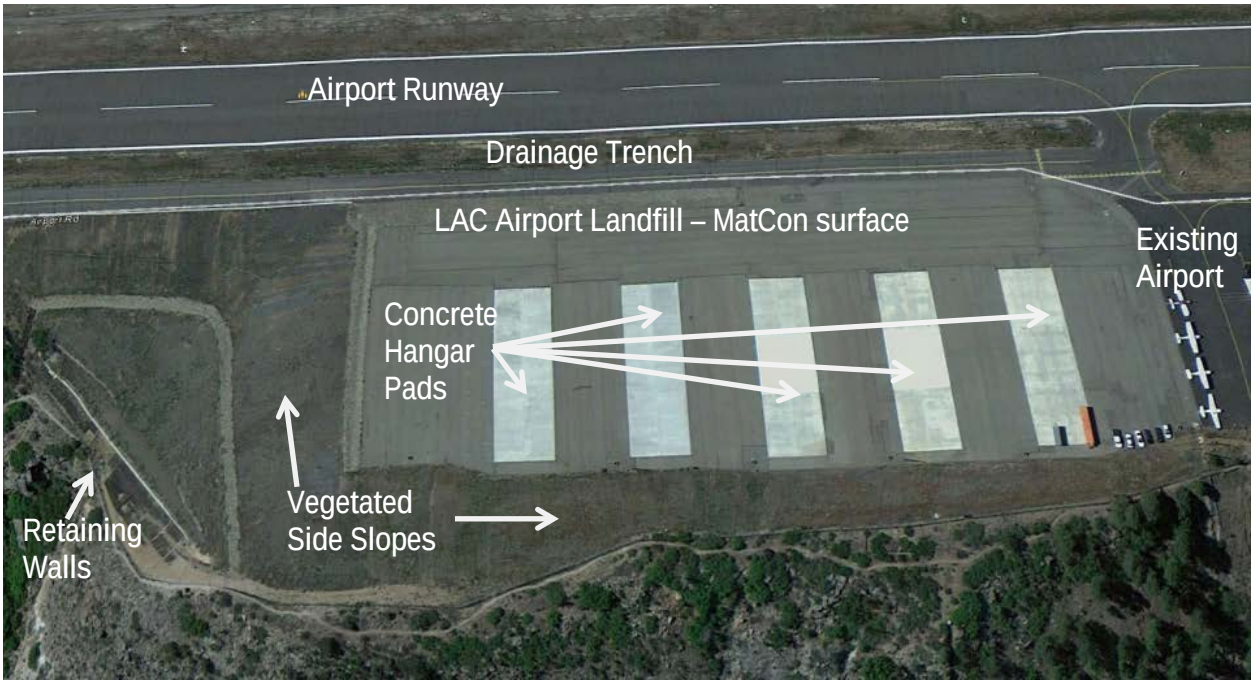


Figure 1. Aerial View of Airport Landfill with MatCon Cover & Concrete Hangar Pads

The US Department of Energy (DOE) began monitoring the LAC Airport Landfill in 2010. In December 2013, the DOE submitted to the New Mexico Environment Department (NMED) a *Formal Notification of Methane Levels at 100 Percent of the Lower Explosive Limit at Vent*

Risers along the North Edge of the Los Alamos Airport Landfill Cap and Request for a Waiver of the Implementation of an Active Gas Collection Using Blowers (Notification).

The NMED replied to this notification and waiver for active gas collection on July 25, 2014. The reply stated:

> *"The Permittees must implement an active gas collection system or propose an alternative remedial measure to reduce infiltration of water into the landfill and to reduce methane levels below 100% LEL."* The reply further stated: "*The Permittees must submit a work plan for the implementation of an active gas collection system or an alternate remedial measure to NMED no later than September 30, 2014. Until the work plan is submitted to NMED, the Permittees must continue weekly monitoring at SWMU 73-001 (a) and continue to submit data to NMED on a monthly basis."*

Ongoing monitoring of the existing asphaltic surface landfill cover has determined that it is not performing as intended – refer to Section 3 and 4 for specifics. In addition, due to the noted degradation; the cover system is no longer able to effectively serve as a foundation for the airport hangars planned for installation on the concrete hangar pads. Converting the methane collection system from a full passive system to a partial active system will not correct the cover deficiencies identified as summarized in Section 3 and 4.

DOE then submitted a Pre-Design Work Plan (Dwyer Engineering 2014) formally notifying the NMED the DOE plans to replace the final cover system for the Los Alamos Airport Landfill that would better meet the regulated performance objectives than the currently installed asphaltic cover system. This cover replacement would be performed in lieu of installing an active gas collection. The NMED comments related to the Pre-Design Work Plan are contained and addressed in Section 11 of this Work Plan.

The MatCon asphalt cover surface and reinforced concrete pads will be removed. The cover will be replaced with a soil cover referred to as an Evapotranspiration (ET) Cover. This ET Cover will meet the requirements of the final cover system for the site as described in 40 CFR 264, Subpart N. Refer to Section 7 for more information on the proposed replacement cover system.

1.1 ORIGINAL CLOSURE CRITERIA COMPARSION WITH NEW CLOSURE DESIGN

The original Work Plan submitted in 2004 (Northwind 2004) included a design that was stated to satisfy the following criteria include for the final cover system per 40 CFR 265.310 as adopted by the NMAC:

- Minimize maintenance;
- Promote drainage
- Minimize erosion
- Accommodate Settlement
- Permeability less than bottom liner or subsoils
- The previous Closure was stated to be exempt from emission requirements for municipal solid waste facility because the landfill did not operate after November 8, 1987.

As described in sections 3 and 4 of this Work Plan, the installed cover system based on the 2004 Work Plan did not meet much of these stated criteria. The new cover system is intended to meet all of the prior criteria as described in the following subsections.

1.1.1 MINIMIZE MAINTENANCE

The planned ET Cover is designed to require minimal maintenance. That is, it is composed of natural materials (soil) that will provide for a quality rooting medium for native vegetation without the possibility of degradation. The cover is designed to mimic natural conditions intended to perform in perpetuity. The previous cover was composed of an asphaltic surface that quickly degraded.

1.1.2 PROMOTE DRAINAGE

The planned ET Cover is to be built with a positive slope of not less than three percent to ensure shedding of surface water to installed surface water collection ditches and culverts that will quickly route the water off site. The previous cover was designed to be flat but actually included multiple low spots that allowed for ponding and concentrated infiltration due to subsidence problems.

1.1.3 MINIMIZE EROSION

The planned ET Cover has a rock/soil admixture in its top layer that is design to minimize soil loss and mitigate the potential for rill or gully formation.

1.1.4 ACCOMODATE SETTLEMENT

The planned ET Cover is composed of an all soil profile that can accommodate potential subsidence. The planned slope of the ET Cover should provide for positive drainage even if differential settlement occurs. Furthermore, the post-closure monitoring to be performed after the construction of the new cover shall include inspection of any physical degradation of the site including subsidence issues. Should these issues be identified, they can readily be remedied by simply adding soil to the surface of the cover area that experienced a depression due to subsidence.

1.1.5 PERMEABILITY LESS THAN BOTTOM LINER.

The site is unlined. The soils at the base of the waste are predominantly crushed tuff or sand with a relatively high permeability. The soil to be used in the cover system is generally a sandy loam with permeability lower than these crushed tuff sands. Furthermore, modeling performed has estimated there to be no net flux through the cover and thus percolation into the waste is minimized.

1.1.6 GAS EMISSION MONITORING.

The original closure did not include gas emission monitoring. However, DOE adopted monitoring of methane since the site was closed and continues to monitor it to present. DOE also agrees to continue to monitor methane emissions through not less than three locations as described in the Post-Closure Care and Monitoring Plan submitted with this Work Plan.

2.0 SITE HISTORY AND BACKGROUND

2.1 LAC AIRPORT LANDFILL BACKGROUND

Two inactive solid waste disposal sites [the airport landfill, SWMU 73-001(a) and the debris disposal area (DDA), SWMU 73-001(d)] are located at the LAC Airport (Figure 1). This report focuses on the airport landfill, not the DDA. The DDA is mentioned for background information only. In late 2006 and early 2007, the Final Remedy landfill cover system was installed at the LAC airport landfill. The Final Remedy design and completion activities for the LAC airport landfill and the DDA are provided in the *Remedy Completion Report, DOE LASO TA-73 Airport Landfill SWMUs 73-001(a) and 73-001(d) April 2007*. As a condition of the remedy approval, NMED required post-closure care and monitoring of these two inactive solid waste disposal sites and submission of an annual report summarizing results from this activity.

The LAC airport landfill operated from 1943 to 1973 for the disposal of solid waste consisting of household trash from the Los Alamos town site and office trash from Los Alamos Scientific Laboratory. Before 1965, some of the waste was incinerated and subsequently buried in the airport landfill. Approximately 489,500 cubic yards of waste was disposed of in the landfill. The LAC airport landfill continued to receive waste until June 1973. From 1984 to 1986, wastes were excavated from the western portion of the LAC airport landfill and placed in the DDA (Figure 2). The excavations were backfilled in preparation for construction of airport hangars and tie-down areas (LANL, 1998).

From 1984 to 1986, approximately 126,000 cubic yards of burned debris were excavated from the western end of the airport landfill and reburied in a pair of parallel trenches at the DDA. In late 2006 and early 2007, the final remedy landfill cover system was installed at the airport landfill (Figure 1). The final remedy design and completion activities for the landfill and the DDA are provided in the "Remedy Completion Report, DOE LASO TA-73 Airport Landfill, SWMUs 73-001(a) and 73-001(d)" (North Wind and Weston 2007). Approximately 50,000 cubic yards of waste were relocated within the SWMU boundary during the 2006 final remedy construction activities. With the exception of a single container of Freon-113, uncovered and subsequently managed off-site, no other hazardous or radioactive materials were discovered. After waste relocation, regrading and compaction were conducted; the following features were installed for the LAC airport landfill cover (Figure 1):

- Approximately six acres of MatCon (Modified Asphalt Technology for Waste Containment) asphalt pavement;
- Five concrete hangar pads within the MatCon pavement area;
- Landfill-gas collection system;
- Two rock retaining walls;
- Concrete retaining wall;
- Turf reinforcement matting (TRM);
- Revegetation of approximately four acres with native grasses; and
- A storm water collection system consisting of five trench drains, seven drain inlets, approximately 1950-ft of associated buried concrete storm-sewer lines, an 18-in.-diameter high-density polyethylene outfall pipe approximately 110-ft in length, and three riprap drainage channels.

- Side slopes composed of a vegetated 2.5-ft thick earthen cover with a composite drainage layer within its profile.

The first formal inspection of the airport landfill was conducted in July 2009. Inspection activities were conducted as part of post-closure and care and monitoring requirements required under 40 CFR 265.310 for Resource Conservation and Recovery Act (RCRA) Subtitle C landfill facilities. The inspection focused on the individual elements of the landfill cover including: the MatCon pavement area and hangar pads, vegetated areas, rip rap drainage channels, concrete and rock retaining walls, the storm water collection system and all temporary erosion control features. Inspection activities and findings were documented in annual inspection reports generally submitted to NMED by February of the following year.

Several erosion control modifications and storm water enhancements were made in late 2009 and the spring of 2010; however, noticeable settlement directly impacting hangar pads was not addressed. Significant differential settlement (as much as 2-ft in areas) has been measured in the cover surface to date (Figure 20).

Although the land and hangar pads have been under LAC ownership and management since the 2007 land transfer, the County has not built hangars on the pads to date.

In 2009 and 2010, erosion features (rills and small gullies) associated with storm water runoff from the paved areas above the vegetated slopes were repaired. In addition, the curb along the taxiway was repaired and extended to redirect storm water away from the main vegetated slope. These repairs and enhancements are detailed in the "Final Construction Report for Los Alamos Airport Landfill TA-73, SWMU 73-001(a) Cover Improvements, Los Alamos, New Mexico."

The NMED's approval with modifications for the remedy completion report requires monitoring of the storm water runoff from the site. This monitoring is being performed under the Laboratory's individual permit for storm water discharges from SWMUs and areas of concern.

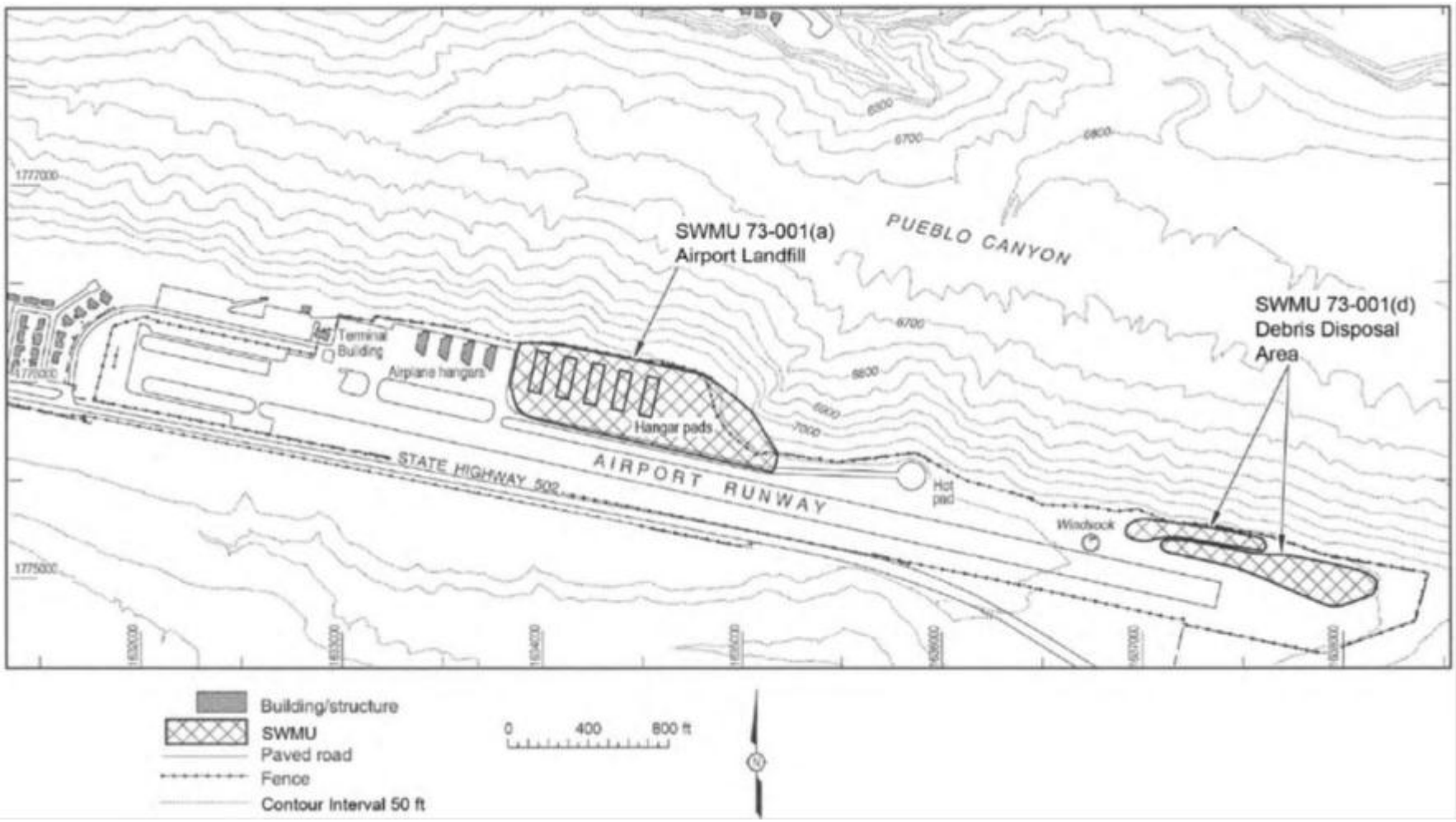


Figure 2. Landfill Locations (LANL 1998)

2.2 PHYSICAL SETTING

2.2.1 LAC Airport Land Use

The LAC Airport is situated on the eastern edge of the town site of Los Alamos, NM on a narrow mesa between State Road 502 and Pueblo Canyon (Figure 1). The LAC Airport was built in 1947 by the Atomic Energy Commission (predecessor to DOE) to serve the transportation needs of the Los Alamos National Laboratory (LANL). The airport is currently owned and operated by the County of Los Alamos. The airport property was conveyed from DOE to the Los Alamos County in October 2008 and was formerly part of LANL Technical Area (TA) 73.

The airport is predominately used for general aviation purposes such as recreation and air taxi. An average of 30 operations (takeoffs and landings) occur daily (Ploeger 2009). The vast majority of operations involve single-engine propeller aircraft. Business jets and air-ambulance helicopters occasionally use the airport.

The single runway is 5,500-ft long. The airport facilities consist of a terminal building, a two-story storage building (formerly the landfill incinerator building), four rows of T-hangars, various taxiways, two parking aprons, a self-service fueling station, the Hot Pad, and a strip of older hangars on the west end of the airport. Prior to 2000, the Hot Pad was used for loading and unloading LANL sensitive cargo. The Hot Pad is now used for aircraft parking and has six tie-down spots.

Pueblo Canyon extends along the north side of the airport and is undeveloped land. An unpaved road trends along the floor of the canyon. Road traffic typically consists of a few vehicles a day. The newer LAC waste-water treatment plant is located approximately 1.1 miles down the canyon from the Airport landfill.

The airport property and Pueblo Canyon are not located within the boundaries of the Santa Fe National Forest. There have been no burned areas in the canyon or nearby area due to recent forest fires, including the 2000 Cerro Grande fire.

2.2.2 Regional Climate

Los Alamos, NM has a temperate mountain climate with four distinct seasons (LANL 1999). For the LANL meteorological station nearest the airport, the mean precipitation including snowmelt is approximately 18.7-in per year (LANL 2006). The peak months for precipitation are July and August (Figure 3) when afternoon thunderstorms can produce high intensity rainfall. Figure 3 depicts the average monthly distribution of precipitation as well as the monthly climatic demand for water, referred to as potential evapotranspiration (PET).

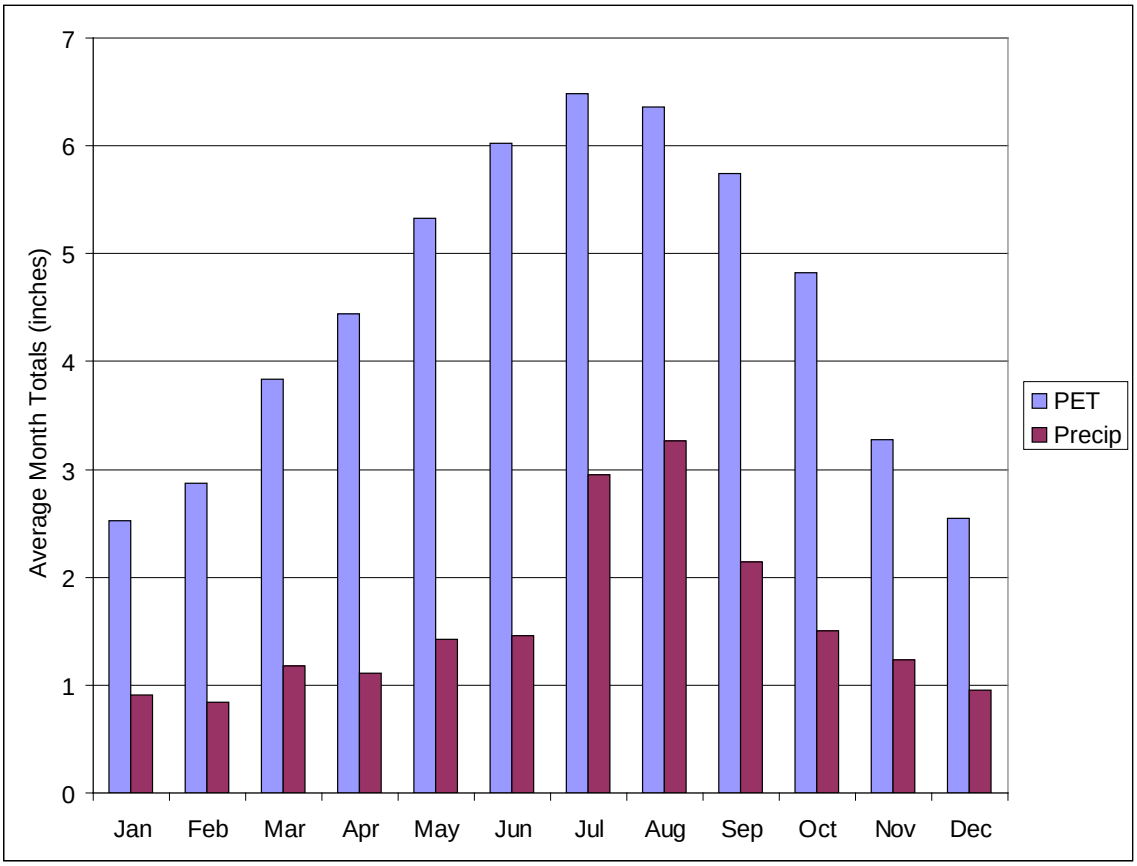


Figure 3. Los Alamos, NM Typical Climate's Demand for Water (PET) vs. Supply of Water (Precipitation)

2.2.3 Physiography

The airport is situated on one of the narrow mesas of the Pajarito Plateau that flank the eastern edge of the Jemez Mountains. The airport covers approximately 89 acres. Ground elevations range from about 7170-ft above mean sea level (MSL) on the western end of the airport to about 7050-ft on the eastern end. The runway grade is approximately 1.5-degrees toward the east. The airport is bounded on the north and east by steep slopes of the Pueblo Canyon. State Road 502 trends along the south side of the property. Single unit housing is located on the west side of the airport.

The Bandelier Tuff (consolidated volcanic ash) forms the bedrock underlying the airport. The Hackroy series is developed from the tuff and is characterized as a well-drained sandy loam (NRCS 2008). The uppermost north-facing slope near the airport is steep and rocky with scattered scrub oak, chamisa, bunch grass, and juniper. Near the canyon floor, the slope lessens and the vegetation is dominated by ponderosa pine. The channel along the canyon floor is ephemeral and has stream flow only in response to heavy precipitation. The vertical relief from the airport paved area to the canyon floor is approximately 500-ft. The depth to groundwater beneath the airport is about 1200-ft (North Wind 2006). No water supply wells are located on the airport property or nearby in Pueblo Canyon.

2.3 AIRPORT LANDFILL DESIGN BACKGROUND

The initial remedy design included a vegetated earthen cover referred to as an evapotranspiration (ET) cover combined with passive landfill gas control measures, and was approved by NMED, with stipulations, in September 2004. Weston Solutions, Inc. subcontracted to North Wind Inc. in the preparation of the design package. Los Alamos County expressed concern that this initial design would not accommodate airport expansion plans. To address this concern, alternative designs were prepared which then required compliance with the National Environmental Policy Act (NEPA), i.e. preparation of an Environmental Assessment (EA). The EA was released for public comment on April 4, 2005 and a Finding of No Significant Impact (FONSI) was issued by DOE in May 2005. After considering stakeholder input, an alternative was selected that included leaving waste in place at the main landfill; relocating waste from the east side and placing it to achieve rough grade at the main landfill; installing a passive gas collection system; constructing hangar pads and aircraft tie-downs; and paving over much of the Airport Landfill with a proprietary product referred to as Modified Asphalt Technology for Waste Containment (MatCon). The combination of hangar pads and paving were to serve as an impermeable cover over the Landfill with vegetation covering the surface of the side slopes (North Wind, 2006).

3.0 PREVIOUS INVESTIGATIONS / CHARACTERIZATION

A series of investigations of the LAC Airport Landfill were performed prior to the design and construction of the existing MatCon cover system. These investigations were conducted under the direction of the Los Alamos National Laboratory and documented in the Remedial Feasibility Investigation (RFI) completed in 1998 (LANL 1998).

3.1 WASTE INVESTIGATIONS

The waste investigation of the Airport Landfill was conducted in several phases that included three primary tasks: Task 1 - Field Surveys; Task 2 - Surface Sampling: and Task 3 - Subsurface Sampling (LANL 1998). Specific investigations performed included a site survey, surface radiological survey, geophysical surveys, geomorphologic mapping, infrared photography survey, soil gas surveys, surface soil and channel sediment sampling, borehole drilling, and cone penetrometer testing (CPT).

The intent of the investigations was to identify the volume, location and type of waste. The type of waste was determined to be typical solid waste as compared to municipal waste found in 60 municipal landfills in the State of California (LANL 1998). The depth and extent of waste estimated from the investigations performed as described in the RFI (LANL 1998) is depicted in Figure 4.

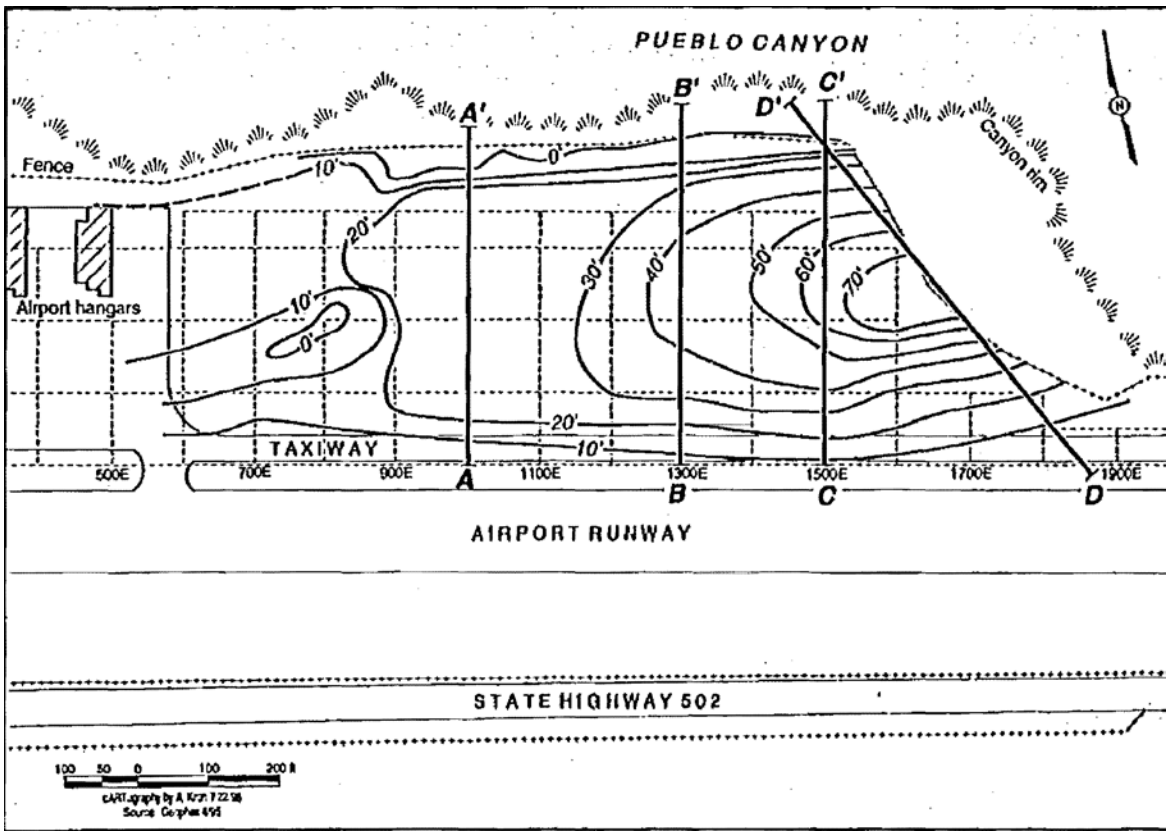


Figure 4. Estimated Waste Volume and Extent (LANL 1998)

3.2 POST-CONSTRUCTION INSPECTIONS

Post-closure inspections began in July 2009 in accordance with the submitted Inspection and Maintenance Plan (North Wind 2006). Findings from these inspections have identified significant differential settlement and subsequent degradation of the MatCon

cover surface, (Figures 5 to 7) including cracking in the asphalt and separation of dissimilar materials (asphalt separating from adjacent concrete hangar pads). Cracking in the reinforced concrete (Figure 6) hangar pads and surface water collection gutters has also been documented. The surface cracking appears to be in response to ongoing differential settlement in the landfill subsurface. The material separation is predominantly in response to this ongoing differential settlement as well as the different expansion and contraction rates of the dissimilar materials.

Figure 5. Differential Settlement: Asphalt below Concrete Hangar Pad

Figure 6. Surface Cracking

Figure 7. Ponding due to Differential Settlement

3.3 METHANE MONITORING

A gas collection system was installed beneath the existing MatCon cover system. It consists of slotted PVC piping laid within the base coarse under the MatCon asphalt surface connected to six risers with passive venting (Figure 8). Methane monitoring was scheduled to be completed on a quarterly basis beginning with the conclusion of construction. It was to continue for a period of not less than two years. If after two years methane concentrations did not exceed 25% of the lower explosive limit (LEL), the monitoring would be reduced to semi-annual for the third year. If measurements were still below 25% during the third year, monitoring could be discontinued.

The inspections and monitoring did not begin until about three years after the completion of construction. Monitoring began in July 2010, where all methane readings were below 25% of the LEL. Subsequent measurements found lower methane with the exception of a 25% exceedance in January 2011. In December 2011, measurements at vents PS-04 and PS-05 reached 100% of LEL. By 2013 methane readings at PS-02 and PS-05 were commonly high.

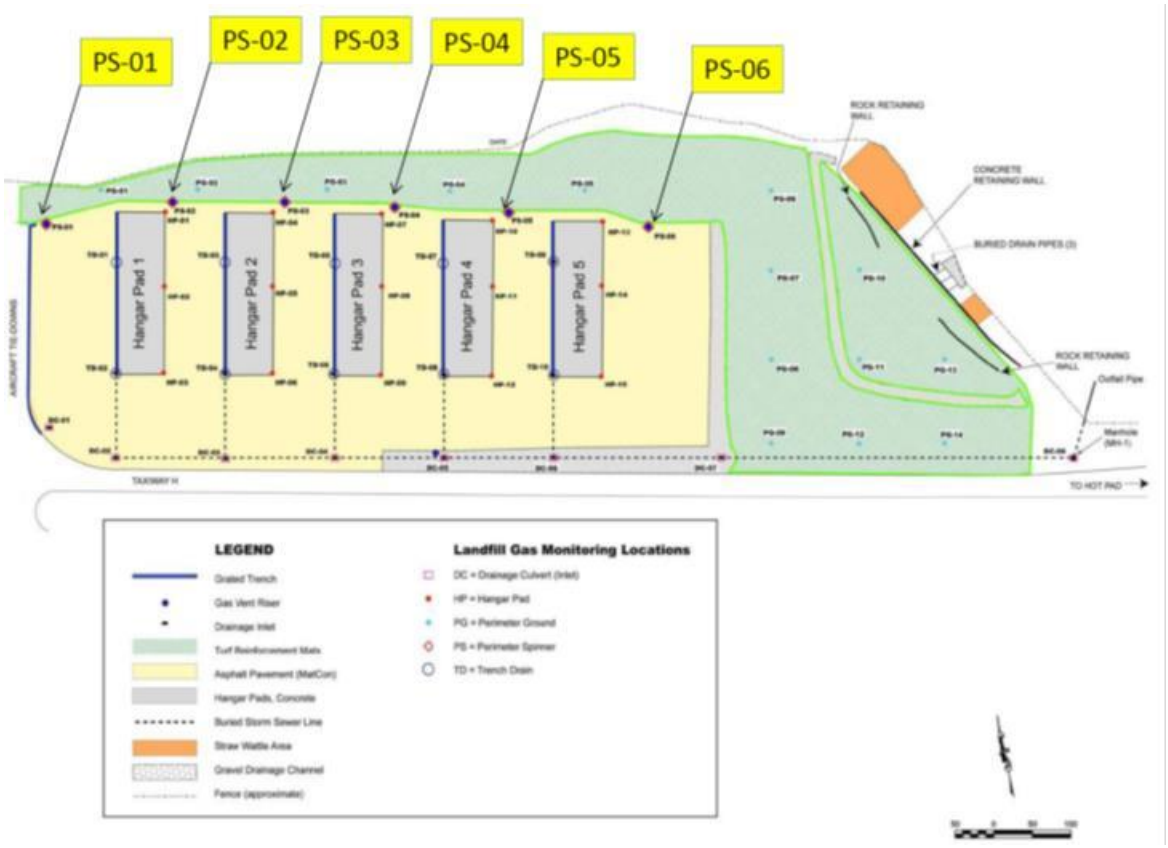


Figure 8. Methane Monitoring Locations

3.4 ENGINEERING INSPECTION OF LANDFILL

Dwyer Engineering LLC was contracted to perform an engineering inspection of the LAC Airport Landfill in 2012. Dr. Stephen F. Dwyer, PE performed the inspection and evaluated available data. Findings from this inspection concluded that differential settlement due to waste biodegradation caused significant degradation of the cover system including cracking in both the asphalt cover and reinforced concrete hangar pads. It has allowed for ponding that can easily allow water to migrate though the degraded cover surface into the underlying waste via preferential flow paths (e.g. cracks). The increased infiltration of meteoric water into the waste has increased the biodegradation rate of the underlying waste and increased methane production from the landfill. The site was surveyed and compared to the as-built condition where it was found to have significant differential settlement - as much as 2-ft in some areas of deeper waste (Figure 20). The differential settlement is generally aligned with the volume and depth of waste. Variation in underlying waste (household waste versus construction debris) disallowed a full correlation of measured settlement compared with waste depths. However, it was noted that earlier investigations (LANL 1998) noted a deep pocket of waste (approximately 75-ft deep) near PS-02 that appears to correlate with this methane monitoring location having the highest methane measurements on average (Table 1). The deeper waste correlates with differential settlement above this area that allows for frequent ponding and thus increased infiltration in this localized area (Figure 9).

Table 1. Average Methane Levels (% of LEL through March 2015)

Monitoring Location	Average Methane Level (% of LEL)
PS-01	0.0
PS-02	77.9
PS-03	12.3
PS-04	5.9
PS-05	52.0
PS-06	9.7

The inspection also identified that the installed surface water collection system is not working as intended. The significant settlement has left the installed surface water drainage system ineffective. The surface water is designed to be routed to concrete gutters adjacent to the hangar pads where it is gravity fed to collection points leading to a subsurface drainage piping network located along the southern perimeter of the landfill. However, the slope of the gutters has reversed due to settlement; consequently drainage is not routed to the collection points. That is, the gutters were designed and built to drain water from the north toward the south, but the settlement has left much of the gutter drainage system sloping from south to north. This results in ponding within the gutters and along the northern end of these gutter systems (Figure 9).

Figure 9. Ponding near PS-02

The findings of this inspection concluded that maintenance of the site would likely be required for decades. The increase in infiltration due to the cover degradation has allowed for biodegradation to increase and thus methane levels to increase. This would not stop in the near term until the infiltration was minimized.

The airport concrete pads have settled and cracked to the point where they cannot be used for their intended use as a surface and foundation for future airplane hangars. The sliding doors on the hangar pads would be inoperable with a very small amount of differential settlement. The settlement received has already far exceeded this minimal level.

The MatCon asphalt cover does not allow for the natural climatic conditions to remove any infiltrated water from the system (Figure 3). That is, Los Alamos, NM has a climate with a significantly higher demand for water or PET than supply of water or precipitation. With this type of semi-arid climate; water that infiltrates into a shallow soil profile will easily be removed by the combination of surface evaporation and plant transpiration. However, the MatCon and concrete cover surface blocks the removal of infiltrated water. The asphalt cover underlain by gravel base coarse allows for water to infiltrate through the various cracks inclusive of cracking in the concrete gutter system. This water quickly flows through the underlying gravel into the waste and soil beneath the gravel. At this point the water is no longer able to be removed from the system via ET because the overlying gravel and underlying finer grained soils have created a reverse capillary barrier and are preventing the water from moving upward. Thus the water can only move down. This has created an environment where moisture within the waste has increased leading to the higher biodegradation and methane production. This will be corrected by removal of the existing MatCon cover system and replacing it with a soil cover.

The existing MatCon/concrete cover will be removed and replaced with a soil cover referred to as an Evapotranspiration (ET) Cover that is designed to minimize flux and erosion while being able to accommodate some settlement. Furthermore, the soil profile would enable the oxidation of a significant portion of the ongoing methane emitted. The ET Cover is consistent with that approved in the initial remedy design which included a vegetated earthen cover combined with passive landfill gas control measures, approved by NMED with stipulations, in September 2004.

4.0 MAINTENANCE AND REPAIRS PERFORMED ON THE AIRPORT LANDFILL

The DOE has performed maintenance and repairs on the existing LAC Airport Landfill cover system. Asphalt contractors have been hired multiple times to repair cracking in the asphalt and concrete surface. Significant erosion and fencing damaged was incurred at the site as a result of the extreme intensity of the precipitation received in September 2013. The fencing has been repaired while the erosion remediation is underway.

4.1 MAINTENANCE PERFORMED ON THE LAC AIRPORT LANDFILL COVER SURFACE

Differential settlement and degradation of the cover surface was first identified by DOE in 2009. The following repairs were made between July 2009 and June 2010 (One-Stop Environmental and North Wind 2010).

- Repair of Erosional Rills;
- Repair of Subsidence at the Rip Rap Bench;
- Replacement of Seed and Turf Reinforcement Mat (TRM);
- Filling of Cracks within Hangar Pads;
- Construction of a Curb and Gutter and Earthen Berm Barrier; and
- Construction of Porous Detention Areas east of the Retaining Walls.

MatCon, Inc. provided additional repairs to the asphaltic surface through their cover warranty in 2011. Non-warranty work was also performed by MatCon, Inc. to repair cracks resulting from differential settlement. The contractor filled observed cracking with liquid applied asphalt. This maintenance activity has required reapplication as the cracking increase and the prior patch degrades (Figure 10).

Figure 10. Repaired Crack from May 2010 with Degradation since Application

The most recent asphaltic patching work was completed in May 2014 (Figure 11). This work was performed under the supervision of engineers from CTI and Associates (Dwyer Engineering 2014).

Figure 11. Repaired Cracking in Landfill Asphalt Cover

4.2 REPAIRS PERFORMED AT THE AIRPORT LANDFILL SITE

Los Alamos received rainfall events of extreme intensity in September 2013. These rains caused widespread flooding and significant damage throughout the Los Alamos area. The Los Alamos County received FEMA aid to help repair and rebuild infrastructure damaged as a result of these storms. The LAC Airport Landfill received significant erosion adjacent to the retaining structures east of the landfill as well as damage to a security fence located at the eastern perimeter of the site (Figures 12 and 13).

Figure 12. Gully Adjacent to Retaining Structure

Figure 13. Damaged Perimeter Fence on Eastern edge of Airport Landfill Site

The damaged fence was replaced and the eroded area was repaired (Figure 14). A design intended to implement a permanent fix for the erosion incurring along the outer perimeter of the retaining walls at the eastern edge of the landfill was completed and built in 2014 by CTI & Associates (Figures 15 to 18).

Figure 14. Repaired Airport Landfill Perimeter Fence

The erosion damage was repaired during the late fall and early winter of 2014. Permanent erosion prevention measures were installed including rip rap protected slopes, rock check

dams, regrading of surface water drainage channels, and repair and reinforcement of slope berms (Figures 15 to 18).

Figure 15. Riprap Protected Slope

Figure 16. Permanent Erosion Repair East of Retaining Structures

Figure 17. Check Dams on North Slope

Figure 18. Repaired Berms on Eastern Slopes of Landfill

5.0 PRE-DESIGN STUDIES

The pre-design studies included information gathering and additional investigations required to complete the project design. These pre-design activities included:

- Interactions with Los Alamos County and Airport officials on their future growth requirements and how the replacement of the cover system will impact them (section 5.1).
- A borrow soil investigation to identify an adequate quantity of cover soil meeting design requirements (Section 5.2).
- A site elevation survey of the existing cover system was performed to assess the amount of settlement experienced to date compared with the as-built condition (Section 5.3).
- A slope stability evaluation of the northern slope of the Airport Landfill was completed (Section 5.4).
- A drilling investigation utilizing a geoprobe within the footprint of the existing landfill to identify the depth and type of waste in areas for the potential expansion of airport hangars and the quantity and quality of available interim cover soil beneath the asphalt cover surface (Section 5.5 & 5.6).

5.1 LOS ALAMOS COUNTY REQUIREMENTS

DOE, Dwyer Engineering, and Los Alamos County personnel met on multiple occasions to develop the final closure plans while ensuring compliance with LAC needs. Subjects discussed included future expansion of the hangar requirements for the airport, helicopter requirements for the County of Los Alamos including helicopters used in fighting fires, Federal Aviation Administration (FAA) requirements for adjacent projects to airports and construction activities related to ongoing aviation activities. The outcome of these meetings is as follows:

- The design included in the Technical Specifications and Design Drawings meets the applicable LAC and FAA requirements.
- The closure project will include constructing an additional airport hangar pad located 80-ft east of the eastern most existing hangar facility. The specifics of this hangar expansion including the hangar concrete pad and storm water control requirements are shown in the Design Drawings (Dwyer Engineering 2015a). The hangar facility will be constructed at a later date by the Los Alamos County.
- The waste within the footprint of the hangar expansion will be excavated and relocated within the existing footprint of the landfill as shown in the Design Drawings (Dwyer Engineering 2015a). This will minimize the potential for differential settlement and production of methane within the hangar expansion footprint. Furthermore, a vertical barrier composed of a 40 mil polyethylene liner will be placed between the hangar expansion area and the landfill to the bottom of waste to mitigate the potential for lateral subsurface methane migration from the landfill toward the proposed hangar facility. (Dwyer Engineering 2015a and Dwyer Engineering 2015b)

5.2 SOIL BORROW INVESTIGATION

The requested replacement cover is to be a soil cover referred to as an ET Cover. The cover is estimated to be about 5.2 acres and 3-ft thick; therefore about 25,000 cubic yards (CY) of cover soil are required. The need for a quality cover soil is complicated because the town site is surrounded by federal lands that are generally not accessible for borrow material. Furthermore, deep excavated soil in the Los Alamos area is typically volcanic tuff. Potential sources in the Los Alamos have been investigated both for the quality of soil and its availability. Multiple sources within the town of Espanola, NM were also investigated. Another source on private property in Alcalde, NM was also sampled and investigated. Representative soil samples were taken from each potential borrow source and tested for soil texture and/or hydraulic properties. This borrow soil investigation is summarized in the Cover Soil Borrow Investigation report (Dwyer Engineering 2015d).

The laboratory analysis for the soil index properties and characteristics to design the ET cover included the following tests:

- Grain Size Distribution (ASTM D1140, ASTM D422)
- Moisture Retention:
  - Hanging Column (ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI)
  - Pressure Plate Method (ASTM D6836; ASTM D2325)
  - Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity: (ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991)
- Hydraulic Conductivity (ASTM D5084 or ASTM D2434)
- Standard Compaction Proctor (ASTM D698)

Requirements of the cover soil include adequate water storage capacity while having the ability to serve as a rooting medium for native vegetation. Loamy soil tends to offer the highest storage capacity and are less susceptible to desiccation cracking compared to expansive clays (Figure 19). The soil data evaluation included unsaturated flow modeling for moisture flux to ensure that the performance objective to minimize flux was achieved. This effort is summarized in the Design Report (Dwyer Engineering 2015c).

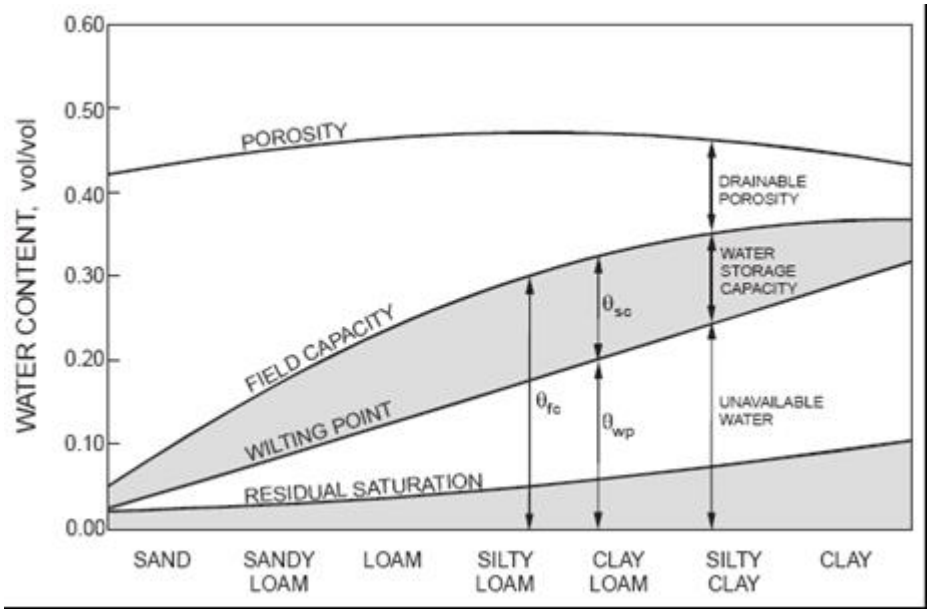


Figure 19. Relationship Between water Storage Capacity and Soil Texture (Schroeder et al 1994)

Potential borrow sources for cover soil identified in Los Alamos, NM were tested to verify the soil is clean and free of significant contaminants. These test results are included in the Attachment at the end of this document.

5.3 SURVEY

A cursory elevation survey was performed to evaluate the amount of settlement the site has experienced since the MatCon cover was installed. The survey (May 2014) compares the elevation of the site today to its as-built condition. The survey revealed that at the corners of the concrete hangar pads, there has been settlement as high as 2-ft (Figure 20). There are isolated locations within the asphaltic surface where settlement has exceeded 2-ft.

Figure 20. Sketch with Measured Settlement Noted at Corners and Mid-Point of each Hangar Pad

A detailed aerial survey was performed of the Airport Landfill and surrounding area. This detailed aerial survey was utilized in the final design of the replacement cover system and surface water management system and is included in the Design Drawings (Dwyer Engineering 2015a).

5.4 SLOPE STABILITY

A prior slope stability analysis of the eastern portion of the Airport Landfill was performed by Weston Engineers (Weston 2005) that was submitted with the Pre-Design Work Plan (Dwyer Engineering 2014). The analysis stated that the eastern slope was stable. Subsequent engineering resulted in removal of some of the waste in the eastern portion of the landfill and relocated elsewhere within the Landfill. Reinforced retaining walls (concrete and secured rock) were installed to provide additional stability of the eastern perimeter of the Landfill.

The Weston (2005) analysis also stated that the northern slope of the Landfill was stable based on the 2004 permit application for construction of the landfill cover system. The original analysis was not located by the authors of this report. Consequently, a recent evaluation of the slope was performed by CTI & Associates. This analysis stated that the northern slope is stable and poses no adverse issues to the final cover system or Landfill (Dwyer Engineering 2014). .

5.5 GEOPROBE AND VOC INVESTIGATION

Apparent inconsistencies from physical observations of the site compared to findings from the LANL (1998) investigation described in section 3.1 created a need to conduct a waste and interim cover soil investigation. Visually observed differential settlement described in Section 5.3 did not completely correlate with the LANL (1998) report findings for waste depth and location. From the LANL (1998) report, the waste locations and depth appear to be thinnest toward the west (nearest the hangars) and uniform across its cross section while being deepest toward the east and also relatively uniform across its cross section (Figures 4 and 21). Observed differential settlement is most significant toward the east and decreases toward the west. Furthermore, observed differential settlement supports parallel trenches rather than a uniform cross section. This could be the result of varied waste composition (or degradation status) rather than waste depth.

A drilling program was performed whereby the landfill site had multiple locations drilled (Figure 22) to verify depth and extent of waste as well as the depth of interim cover soil. The quantity of interim cover soil was investigated to potentially allow for inclusion of this clean soil if it was determined to be of an adequate quality to be considered an acceptable soil for an ET Cover.

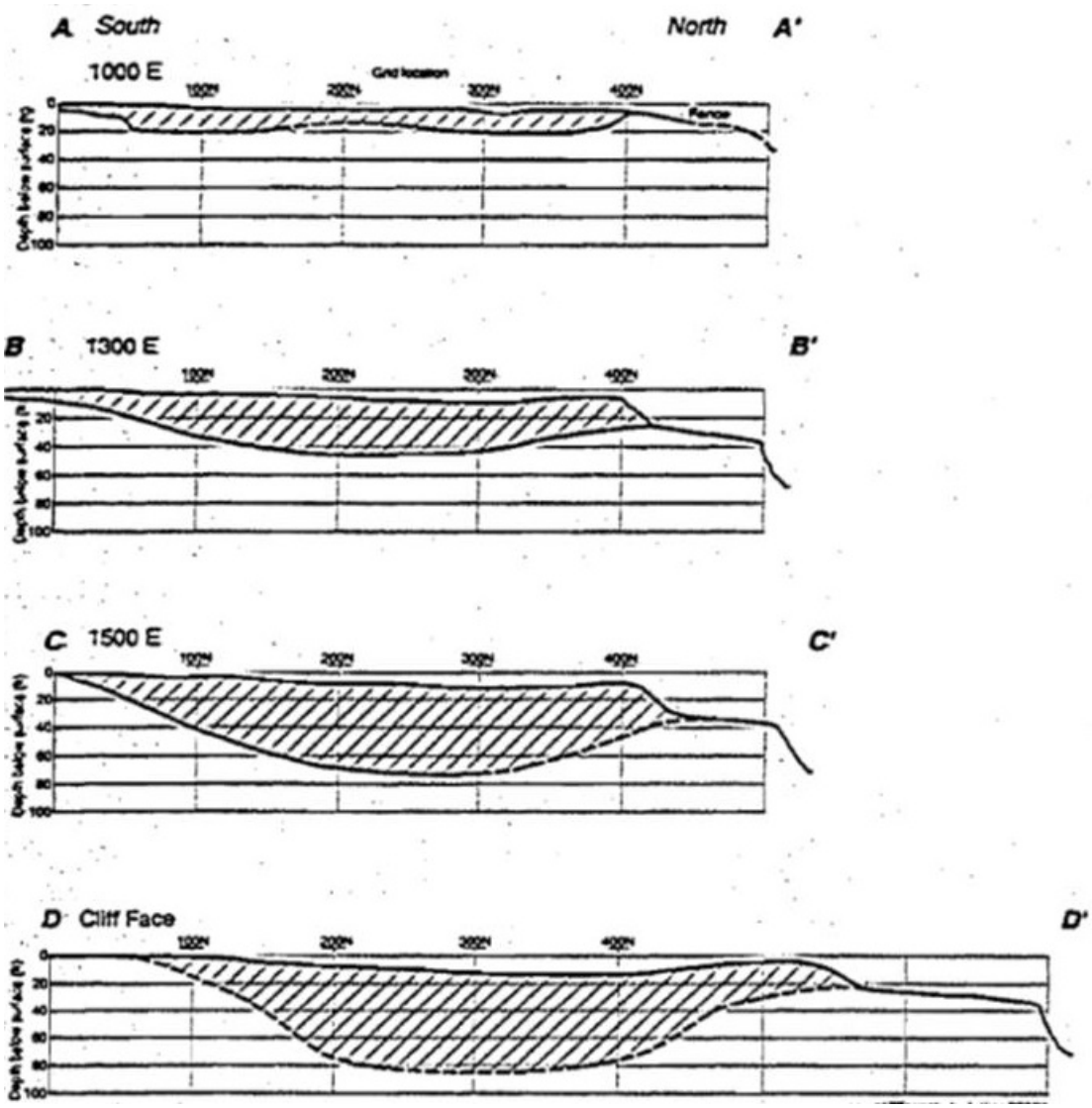


Figure 21. Estimated Waste Cross Section (LANL 1998)

Drilling was performed on the landfill in October 2014 using a 3-inch diameter geoprobe. Soil borings SB-01 through SB-20 were drilled to the bottom of waste or until refusal. SB-21 to SB-70 were drilled to the top of waste. The results of the drilling effort are summarized in table 2.

The objectives of the drilling program was to assess the extent and depth of waste in the proposed vicinity of where a new airplane hangar (SB-01 to SB-20) is to be built to determine the potential for continued differential settlement and methane production in this specific area while the remainder of the landfill was drilled to the top of waste to determine the amount and quality of clean useable soil beneath the asphaltic cover system. To better delineate the extent of waste where the new hangar is to be built, four additional borings (SB-E1, SB-E2, SB-E3, and SB-E4) were drilled to the bottom of waste. The results of the drilling show the actual extent of waste in Figure 22. Table 2 summarizes the depth below ground surface (BGS) where waste was encountered at each location and the depth BGS where waste stopped.

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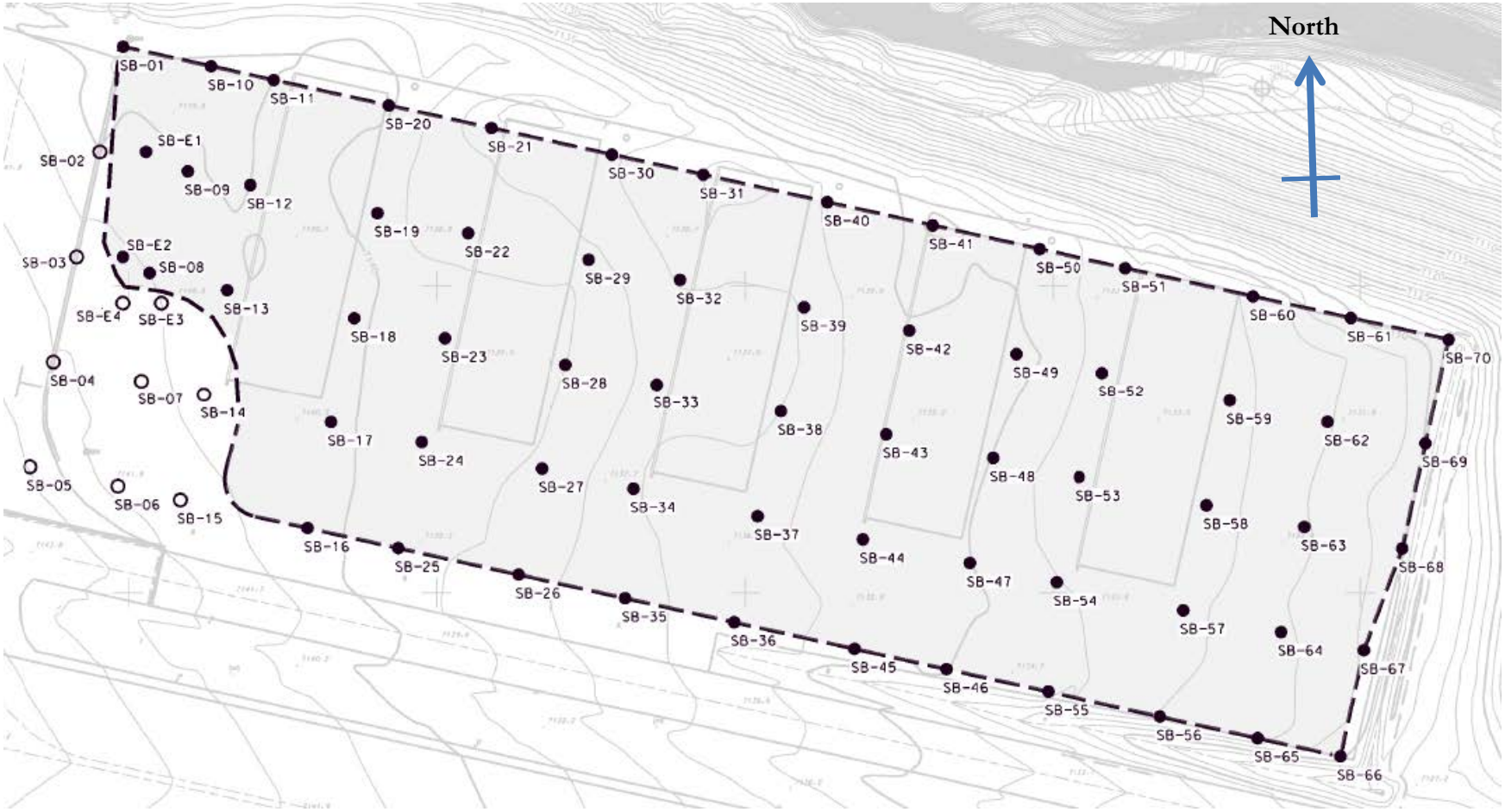

Figure 22. Geoprobe Locations

Table 2. Summary of Soil Depth via Geoprobe Drilling performed in Oct. 2014

SOIL BORING	TOP OF SOIL DEPTH (ft BGS)[1]	BOTTOM OF SOIL DEPTH (ft BGS)[1]	TOP OF WASTE (ft BGS)[1]	BOTTOM OF WASTE (ft BGS)[1]
SB-E1	0.7	5.0	5.0	22.50
SB-E2	0.7	4.5	4.5	8.00
SB-	0.7	9.5	no waste	no waste
SB-	0.7	7.5	no waste	no waste
SB-01	1.0	3.0	3	11
SB-02	2.0	9.0	no waste	no waste
SB-03	2.0	10.0	no waste	no waste
SB-04	2.0	4.0	4	4.3
SB-05	2.0	10.0	no waste	no waste
SB-06	1.0	10.0	no waste	no waste
SB-07	1.0	7.0	no waste	no waste
SB-08	2.0	4.0	4	11.5
SB-09	2.0	4.5	4.5	16
SB-10	1.5	7.0	7	10
SB-11	1.0	9.0	9	13
SB-12	2.0	7.5	7.5	17
SB-13	2.5	6.0	6	12
SB-14	2.0	7.5	no waste	no waste
SB-15	2.0	11.0	no waste	no waste
SB-16	1.5	6.0	6	10
SB-17	1.0	6.5	no waste	no waste
SB-18	2.0	3.0	3	3.5
SB-19	1.0	3.0	3	16
SB-20	1.0	3.0	3	6
SB-21	1.5	3.0		
SB-22	1.5	3.0		
SB-23	2.0	6.0		
SB-24	2.0	8.0		
SB-25	3.5	3.6		
SB-26	1.5	3.0		
SB-27	2.0	5.0		
SB-28	2.0	4.0		
SB-29	2.0	3.5		
SB-30	2.0	4.0		
SB-31	6.5	6.6		
SB-32	2.0	3.5		
SB-33	3.5	6.0		
SB-34	1.5	5.8		

SOIL BORING	TOP OF SOIL DEPTH (ft BGS)[1]	BOTTOM OF SOIL DEPTH (ft BGS)[1]	TOP OF WASTE (ft BGS)[1]	BOTTOM OF WASTE (ft BGS)[1]
SB-35	1.5	4.8		
SB-36	2.5	4.5		
SB-37	1.5	6.5		
SB-38	1.5	5.0		
SB-39	0.3	5.0		
SB-40	1.5	6.8		
SB-41	1.5	3.0		
SB-42	1.0	3.0		
SB-43	1.0	5.5		
SB-44	2.0	2.1		
SB-45	2.5	2.6		
SB-46	1.5	3.0		
SB-47	1.0	3.0		
SB-48	1.0	3.0		
SB-49	1.5	3.0		
SB-50	1.0	2.5		
SB-51	1.0	3.5		
SB-52	1.0	1.1		
SB-53	1.0	1.1		
SB-54	1.0	3.0		
SB-55	1.0	3.0		
SB-56	1.0	2.5		
SB-57	1.0	2.5		
SB-58	1.3	1.4		
SB-59	2.0	3.0		
SB-60	1.0	3.0		
SB-61	2.0	2.5		
SB-62	2.0	2.1		
SB-63	2.0	2.1		
SB-64	1.5	1.6		
SB-65	1.0	2.5		
SB-66	1.8	1.9		
SB-67	1.5	1.6		
SB-68	0.5	1.5		
SB-69	1.0	2.5		
SB-70	1.0	2.3		

[1] depth are feet below ground surface (BGS)

Air monitoring for Volatile Organic Compounds (VOC) was performed by TPMC during the drilling activities. Furthermore, six soil samples were tested in a laboratory for VOCs.

The sampling results did not reveal any significantly high levels or suggest there are concerns beyond that encountered for typical solid waste landfills.

During the soil sampling, VOCs were sampled for in key geoprobe locations. Specifically, soil cores from locations SB-20, SB-11, SB-19, SB-12 (Figure 22) near PS-02 (methane riser vent #2 – Figure 8) and SB-50 and SB-51 (Figure 22) near PS-05 (methane riser vent #5 – Figure 8) were sampled for VOCs. The PS-02 and PS-05 have experienced the highest methane concentrations measured to date (Table 1).

One sample was collected from each of the boring locations SB-11, 12, 19, 20, 50 and 51 at the interval that coincides with a strata change, staining or unusual soil condition. The collected soils were screened visually, olfactory and with a photoionization detector (PID). PID readings were recorded on the soil boring logs. A soil sample from each boring (interval exhibiting highest PID value or notable soil characteristic) for six (6) total soil samples was submitted for laboratory analysis. The selected soil samples were placed on ice, submitted to the environmental laboratory under Chain-of-Custody (COC) protocols and analyzed for volatile organic compounds (VOCs) in soil per United States Environmental Protection Agency (USEPA) Method 5035/8260." The contaminants tested for in the soil samples were all below the NMED standards for residential soil.

In addition, surface-vapor samples were analyzed at boring locations SB-11, 12, 19, 20, 50 and 51 for gas constituents (CH_4, CO_2, H_2S, N_2, etc.).

Results summarized in the Analytical Report are contained in an Analytical Report prepared by Test America (2014) and on a submitted spreadsheet contained in a CD.

5.6 INTERIM COVER SOIL INVESTIGATION

Available cover soil is not abundant in the Los Alamos area. Consequently, an investigation to determine how much interim cover soil may be available for incorporation into the replacement ET Cover and the quality of that soil was performed. Geoprobing was performed on a grid (Figure 22) to determine the depth and quality of interim cover across the Landfill (Table 2).

Fifty bore holes (SB-21 to SB-70) were drilled through the MatCon paved area to determine the soil profile below the pavement (MatCon and base coarse) and above the buried waste. Drilling at these locations was terminated once the bottom of interim cover soil/fill or top of waste is identified. Additionally, twenty-four bore holes (SB-1 to SB–20 and SB-E1 to SB-E4) were drilled to a depth to identity the bottom of the waste in the western. Each borehole was backfilled with auger cuttings and the paved area was patched with a cold asphalt patch upon completion of the boring. The direct push method (Geoprobe) provided a continuous soil sample to the required depth. The soil sample are stored on-site.

Results of the interim cover soil investigation concluded that there is not a significant volume of available soil meeting ET Cover requirements directly beneath the asphaltic cover. Consequently, all cover soil will be imported from tested and approved borrow sources.

6.0 APPLICABLE REGULATIONS

On April 1, 2003, NMED granted conditional approval of a VCM Plan for the main landfill and the debris disposal area designated potential release sites (PRSs) 73-001(a)-99 and 73-001(b)-99, respectively. Conditions of this approval were 1) the remedy must be equivalent to RCRA Subtitle C requirements, 2) the proposed engineered alternative cover (cap) must perform equivalent to or better than a standard Subtitle C prescriptive cover outlined in 40 CFR 264 Subpart N, incorporated by 20.4.1.500 NMAC, and 3) the alternative cover must function efficiently and in accordance with the design parameters for the duration of the 30-year post closure care period (DOE/EA-1515).

Consistent with the prior agreement, the DOE has followed 40 CFR 264 closure standards outlined in Subparts G and N, as adopted by the State of New Mexico in NMAC Title 20, Chapter 4 (20.4.1.500) in the design and construction of the proposed replacement cover system. The DOE is submitting this alternative cover design in compliance with NMAC 20.9.6.9.A (2):

> (2) The secretary may permit an alternative final cover design that includes:
>
> (a) an infiltration layer that achieves an equivalent reduction in infiltration as specified in Subparagraph (a) or (b) of Paragraph (1) of this subsection, as applicable; and
>
> (b) an erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in Subparagraph (c) of Paragraph (1) of this subsection;
>
> (c) for landfills that stopped accepting waste prior to the effective date of this part, finished grades different from those specified in Subparagraph (e) of Paragraph (1) of this subsection, provided a demonstration is made that the alternate grades will prevent erosion and will provide equivalent reduction in infiltration; and
>
> (d) for landfills accepting waste after the effective date of this part and lateral expansions permitted after the effective date of this part, finished grades different than those specified in Subparagraph (e) of Paragraph (1) of this subsection, provided no grade is greater than 33 percent and a demonstration is made in the closure plan or permit or modification application that the alternate grades will prevent erosion and will provide equivalent reduction in infiltration.

Additionally, because the Landfill is within the general operating area of an airport, applicable FAA regulations have also been complied with. Specifically, 14 CFR 77 (Safe Efficient Use, and Preservation of the Navigable Airspace) including notification requirements and obstruction identification regulations are applicable and Advisory Circular AC 150/5300/-13A by the US Department of Transportation (dated 2/26/14) that relates to Taxiway Design.

7.0 COVER SYSTEM DESIGN

In the Los Alamos, New Mexico area, the climate's demand for water referred to as potential evapotranspiration (PET) is more than three times greater than the actual supply of water (precipitation) (Figure 3). Consequently "store and release" type covers that take advantage of large variances between the demand for water and actual supply of that water such as an ET Covers is well suited for this climate.

The proposed ET Cover (Figure 23) consists of a single, vegetated soil layer constructed to represent an optimum mix of soil texture, soil thickness, and vegetation cover (Dwyer et al 2006). The ET Cover is a soil profile that has adequate soil water storage capacity to retain any infiltrated water until it can be removed via ET (Figure 1). ET Covers have been deployed throughout the country in arid and semi-arid climates. The EPA maintains a fact sheet on ET Covers available on the internet (http://www.clu-n.org/download/remed/epa542f03015.pdf#search='evapotranspiration%20epa%20fact%20sheet).

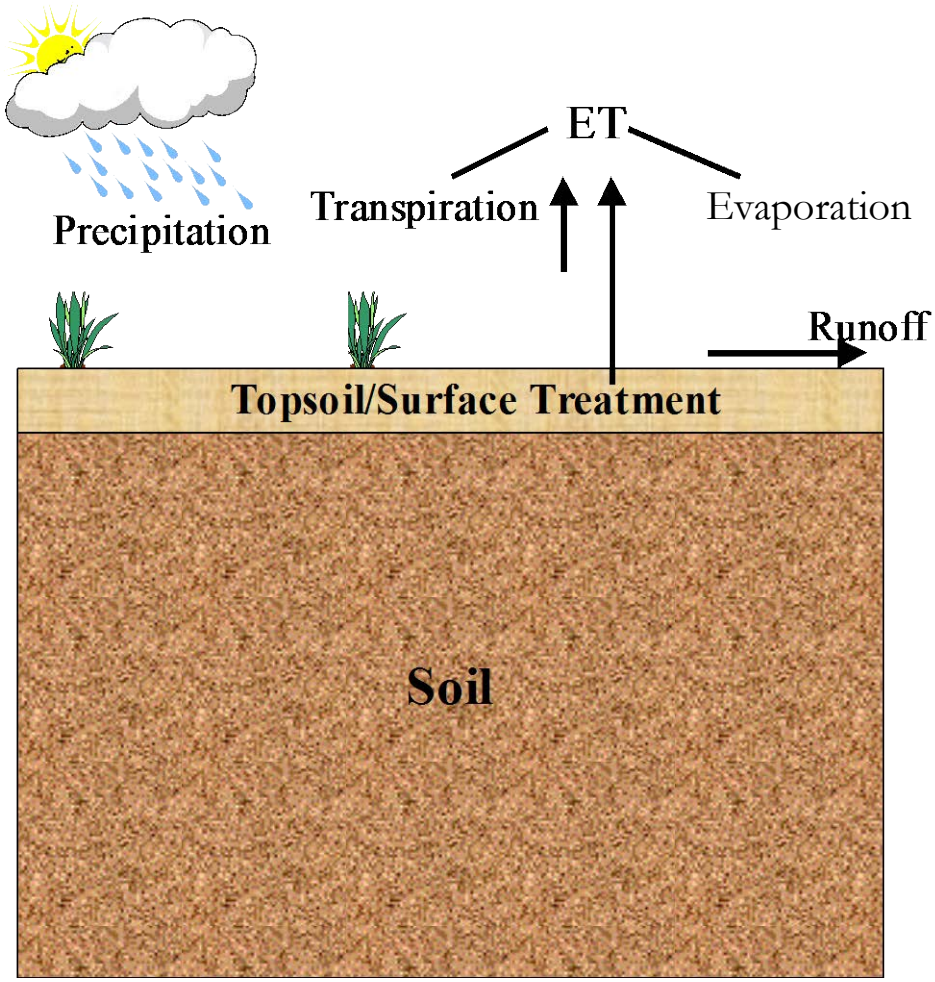

Figure 23. Typical ET Cover Profile

The ET Cover is based on the "store and release" concept whereby the cover soil is designed to act like a sponge. Any infiltrated water is held in this "sponge" until it can be released via ET. ET is defined as the combination of evaporation from the soil surface and transpiration through vegetation. Previous research has shown that a simple soil

cover can be very effective at minimizing percolation and erosion (Khire 1995, Scanlon et al. 2002, Dwyer 2003, Benson et al, 2005, Dwyer et al 2006).

ET provides the mechanism to remove stored water from the cover soil layer. Water can move upward in response to matric potential gradients induced from evaporation drying the upper portion of the cover soil layer. Matric potential gradients can be many orders of magnitude greater than the gradient component due to gravity. Evaporation from the surface will decrease the water content and increase the matric potential of the soil, resulting in an upward matric potential gradient and inducing upward flow.

Plant transpiration also relies upon matric potential gradients to remove water from the cover soil layer. Figure 24 shows the large matric potential difference between the soil and atmosphere. In dry environments, the total potential difference between soil moisture and atmospheric humidity can be up to 1000 atmospheres (bars) (Hillel 1998). The largest portion of this overall potential difference occurs between the leaves and the atmosphere. The larger the soil-plant-atmosphere potential gradient, the more effective an ET Cover System can be. For this reason, well-vegetated cover systems are very effective in regions where the demand for water is greater than the supply of water because these regions are characterized by large potential evapotranspiration compared to precipitation.

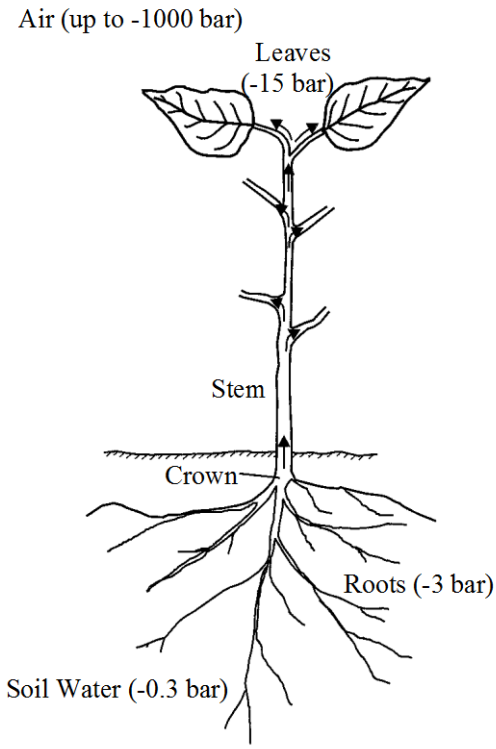

Figure 24. Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998)

The surface of the ET Cover was designed to resist soil loss due to erosion as well as formation of rills and gullies. A rock/soil admixture referred to as a 'desert pavement' (Dwyer et al 2006 and EPA 2012) was incorporated for this purpose.

Specifics including modeling and calculations supporting the design of the cover system are included in the ET Cover Design Report (Dwyer Engineering 2015c).

8.0 CONSTRUCTION QUALITY ASSURANCE PLAN

The Quality Assurance (QA) requirements for construction of the final cover system for the Los Alamos County Airport Landfill located in Los Alamos, NM. QA is a planned system of activities that provides the owner / operator and permitting agency documentation that the facility was constructed as specified in the design.

The purpose of this CQA/QC Plan is to address the Construction Quality Assurance (CQA) and Construction Quality Control (CQC) procedures and requirements to be used during construction activities at the site in order to assure that the project is constructed in conformance with the Technical Specifications, Drawings, and applicable regulatory requirements and permit conditions. The CQA/QC Plan, herein referred to as the CQA Plan (Dwyer Engineering 2015h) and is intended to: 1) define the individuals and organizations who will be involved in reclamation activities and their respective responsibilities and qualifications; 2) establish guidelines for the flow of information and project communication; 3) establish protocols for project documentation; and 4) establish specific CQA/QC procedures for the major components of the project.

The CQA Plan addresses construction of the following facilities:

- Removal of asphalt landfill cover surface;
- Removal of existing concrete hangar pads within the landfill footprint;
- Removal of concrete culvert;
- Replacement of concrete culvert;
- Borrow areas and stockpiles (if any);
- Diversion channels;
- Construction of a new reinforced concrete hangar pad;
- Relocation of waste within the landfill footprint;
- Construction of an evapotranspiration (ET) soil cover for the landfill;
- Construction of runoff control and diversion channels as necessary;
- Repair/replacement of disturbed asphalt pavement areas on the airport site; and
- Seeding of cover system.

Should an emergency occur at the site where an immediate evacuation is required before daily closure requirements or housekeeping standards are satisfied, the DOE shall alert the NMED of the situation. The DOE shall present planned requirements to repair the site or mitigate any damage caused by the emergency site evacuation (if any) to the NMED for the review and concurrence.

9.0 CONSTRUCTION SCHEDULE

The construction tasks and schedule are detailed in the Construction Implementation Plan (Dwyer Engineering 2015e). This Construction Implementation Plan identifies a planned set of construction activities to complete the installation of the cover replacement.

Many of the scheduled tasks are dependent upon completion of previous tasks and the successful completion of each task will require securing and coordinating resources, including funding. Additionally, the ability to complete field activities as scheduled is dependent upon favorable weather conditions and securing resources in a timely fashion. Every effort will be made to follow this schedule, but given the uncertainty of some of the conditions required to complete each task, adjustments will likely be required to the schedule. Any significant changes to the schedule will be discussed with NMED.

The planned start date of the construction is August 2015 and estimated to be complete by the end of October 2015. Details of the individual work elements, start and end dates for each, and schedule details are included in the Construction Implementation Plan (Dwyer 2015).

10.0 COST ESTIMATE

The construction estimate to construct the final cover system including associated tasks is $3,930,000. Details of the estimate are included in the Construction Implementation Plan (Dwyer Engineering 2015e). The cost breakdown of each construction element is an estimate based on available information and is subject to change as the construction progresses.

11.0 REPLY TO NMED CONCERNS

NMED replied to the Pre-Design Work Plan (Dwyer Engineering 2014) submitted on January 8, 2015 with the following comments:

1. *The final cover design must demonstrate (through modeling and calculations) that the ET cover will be able to accommodate snowmelt and freeze-thaw cycles during winter and early spring when vegetation is dormant. The Permittees must propose institutional or engineering controls that will prevent snowplows from stacking snow from the airport runway on top of the ET cover in order to reduce snowmelt on the ET cover.*
2. *The Permittees must provide an evaluation of gas emissions from the landfill and their impact on the ET cover and vegetation.*
3. *The Permittees must ensure that the volatile organic compound (VOC) sampling methods adhere to the most current EPA sampling methods.*
4. *The Permittees must include information on how the model input parameters (e.g., meteorological assumptions) were selected or calculated for the final cover design.*
5. *The Permittees propose a monolithic ET cover system. Due to the scarcity of suitable cover soil in the Los Alamos area, the Permittees should consider a capillary barrier ET cover system, since the capillary barrier ET cover system requires less soil than the monolithic cover system to achieve the same water retention.*

NMED also stated that *The Permittees must address the above comments in the forthcoming Work Plan for the final cover design. The Permittees must receive an approval of the Work Plan from NMED prior to placement of the ET cover.*

The Department of Energy responses to the NMED comments is as follows:

1. The cover modeling and calculations are summarized in the ET Cover Design Report (Dwyer Engineering 2015c). Results show that for typical conditions a 3-ft thick cover will yield no flux. Similarly, for the wettest year on record in Los Alamos, NM (reviewed all available weather data from 1910 to 2014) receiving almost twice the annual precipitation with substantial precipitation received during months where vegetation is not transpiring, the estimated flux is still zero for a 3-ft thick cover.

   The modeling performed was conservative in that all precipitation was forced to infiltrate into the cover profile while runoff was zero. Additional conservatism in the modeling disallows transpiration from vegetation Julian Day 335 (December 1) though 83 (March 24). Even with this conservative modeling approach the predicted flux is zero.

Dave Ploeger, Los Alamos County Airport Manager, stated that procedures in place at the airport for snow removal do not allow for piling of snow on the cover. There are designated locations in place where the snow is pushed to away for the cover area.

2. Currently, the cover system allows for preferential flow through the asphaltic cover whereby runoff penetrates cracking in the asphalt or open gaps between concrete and asphalt surfaces or through cracking in the concrete culverts. This preferential flow has significantly increased the infiltration of moisture into the waste compared to the status it was at prior to placement of the asphalt cover. The increased moisture in the waste has caused an increase in methane production due to increased waste biodegradation. Furthermore, the methane is concentrated in the passive gas collection system and vented in six locations where ongoing post-closure monitoring has monitored the methane release at these points (Table 1).

   The new ET Cover will not concentrate the gas at these six locations, rather allow it to vertical migrate up through the soil profile extrapolated over the entire cover surface. Furthermore, the methane will experience oxidization as it moves through the new cover profile prior to release to the atmosphere (Bohn et al 2011, Abushammala et al 2014, Abichou 2014).

   Vegetation can be seen growing in a healthy condition on the interim cover system in the following photo taken in 2002 prior to placement of the asphalt cover system (Figure 25). Thus, even without a quality ET Cover in place, the release of methane was not significantly reducing the available oxygen to vegetation and adversely impacting vegetation establishment. This condition will be improved with the placement of a high quality ET Cover composed of 3 ft. of soil capable of maintain native vegetation. Furthermore, the post-closure monitoring plan contained in this Work Plan (Dwyer Engineering 2015f) requires quarterly inspection of the cover system following construction that includes the condition of vegetation and any signs of adverse conditions on the cover created by methane gas.

Figure 25. Photo of Los Alamos County Airport Landfill, February 2002

3. The selected soil samples were placed on ice, submitted to the environmental laboratory under Chain-of-Custody (COC) protocols and analyzed for VOCs in soil per United States Environmental Protection Agency (USEPA) Method 5035/8260. The results of the analysis are contained in the Analytical report prepared by Test America (2015).
4. The input parameters, modeling methodology and approach, and boundary conditions are explained in detail in the ET Cover Design Report (Dwyer Engineering 2015c). Justification for each parameter or boundary condition is explained and referenced in this report.
5. It is agreed soils in the Los Alamos, NM area are harder to come by compared to other parts of the country predominantly because of the ownership of adjoining lands. DOE understands this and has consequently identified multiple borrow soil sources that are capable of providing a quality soil to construct the ET Cover. The Cover Soil Borrow Investigation Report (Dwyer Engineering 2015d).

   The investigation of existing soils beneath the existing asphaltic cover revealed that much of the soils in place is crushed volcanic tuff creating a soil texture of sand. This soil in combination with any waste/soil material will be regraded and compacted to provide a subgrade at the slope and density specified in the Technical Specifications and Drawings (Dwyer Engineering 2015a and 2015 b). This subgrade has hydraulic characteristics that will provide for some capillary barrier effect when considering the placement of the fine grained soil of the ET Cover on top of it. However, this effect was not considered in the modeling performed to ensure conservatism in the design. That is, inclusion of a capillary barrier in the modeling would have shown a thinner cover could minimize flux.

Capillary barriers can be more expensive and difficult to build than an ET Cover (Dwyer 1997, Dwyer 1998, Dwyer 2000, Williams et al 2010a, Williams et al 2010b, Williams et al 2011a, Williams et al 2011b). Furthermore, they can have unintended affects in the performance (Dwyer 2003). It is this engineer's opinion that for this site a simple ET Cover is a better choice than a capillary barrier.

12.0 GROUNDWATER MONITORING DATA

The depth to groundwater is estimated to be 1260-ft (LANL 1998). Consequently, groundwater monitoring was not included in the currently approved post-closure monitoring of the existing Los Alamos County Airport Landfill Closure. It is not included in the Post-Closure Monitoring Plan (Dwyer Engineering 2015f).

In the previously submitted and approved Work Plan for Closure of the Los Alamos Airport landfill (TA-73) (North Wind 2004), groundwater monitoring was addressed as follows:

> *In the VCM Plan conditional approval letter (NMED 2003), NMED inquired as to why certain monitoring well sampling data were collected and results not reported. The comment was in regard to Section 2.3.2.1, "Monitoring Well Sampling" of the VCM Plan (LANL 2002, 74007.2) which states:*
>
> > *"…Therefore, the data are of little or no use when evaluating the effectiveness of the run-on controls, and the monitoring well sampling results are not presented in this plan."*
>
> *LANL's response to the inquiry was that the above referenced data will be provided to NMED in the Phase II Work Plan. The following information provided by North Wind responds to NMED's inquiry and is included to satisfy LANL's commitment that the explanation will be included in the Phase II Work Plan.*
>
> > *"The pore water sampling from the existing monitoring wells that was attempted during the supplemental sampling campaign executed in 2001 failed to generate meaningful data. All wells were sampled in an attempt to collect pore water to verify the effectiveness of run on controls and to assess the moisture content within the landfill after two years of storm water diversion. Unfortunately, inadequate pore water was collected from any of the monitoring wells for meaningful analysis. It is believed that this is due to the ongoing drought conditions which has resulted in inadequate landfill moisture to sustain water in the subsurface coupled with the installation of the aforementioned storm water controls to divert runoff that formerly drained onto the landfill" (Rust 2004).*

13.0 POST-CLOSURE CARE AND MONITORING PLAN

This Post-Closure Care and Monitoring Plan (PCMP) (Dwyer Engineering 2015f) addresses post-closure care and monitoring for the U.S. Department of Energy (DOE) Los Alamos County Airport Landfill closure. This PCMP identifies post-closure care and monitoring requirements and activities for the landfill that satisfy NMAC 20.4.1.600 and 40 CFR 265.

Generally, landfills regulated under the Resource Conservation and Resource Act (RCRA) are subject to a 30-year post closure monitoring period. However, under §§ 265.117, the time period may be reduced or increased dependent on findings, the integrity of the closure and agreement by applicable officials and regulators.

The landfill cover physical attributes, surface vegetation, surface water controls, and erosion and sedimentation control measures will be inspected quarterly for a period not less than 5 years after the construction of the cover system by a qualified engineer registered in the State of New Mexico with not less than 10 years of expertise in alternative cover systems. In addition to the quarterly inspections, if the site experiences a precipitation event that exceeds 1 inch in any given hour (the 100-year, 1-hour design storm event is 2.17in/hr.); the site shall also be inspected. An inspection report shall be prepared by the engineer within one week of the inspection. An annual Post-Closure Care and Monitoring Report shall be prepared by this engineer and submitted through DOE to NMED. The annual report shall include all inspection reports and all monitoring performed to date along with any maintenance and/or repairs performed (if any). The quarterly monitoring will continue beyond the initial 5-year post-closure monitoring period unless DOE can provide adequate information to NMED that allows for a reduction in the number of inspections or elimination of inspections. The information will include all monitoring and inspections performed to date at the time of such a request.

The purpose of these inspections is not only to monitor the performance of the cover system but also to identify any areas of the site which may require repair to restore the intended functionality of the closure. The PCMP outlines the site elements to be inspected, the inspection schedule, reporting requirements, and a repair and notification procedure in the event a repair is required.

Water balance monitoring of the ET Cover shall be performed. The monitoring equipment shall be installed within three months after the completion of the cover construction. This monitoring is to include the monitoring of water content and soil suction within the cover profile. There shall be two locations within the cover system to be monitored (Figure 2). The two locations are to be used to provide duplication in case of instrumentation or software errors. Each location shall have five water content probes and 5 soil suction probes installed within the profile to measure the respective parameters on a daily basis (Figure 1). Each set of probes shall be connected to an on-site data logger that will compile the data to be downloaded by the Inspection Engineer on a quarterly basis. The summary and analysis of the data shall be submitted with each quarterly inspection report.

Methane monitoring shall be performed at three locations (Dwyer Engineering 2015e). The monitoring equipment shall be installed within three months after the completion of the cover construction. The monitoring shall include the installation of the three passive vent locations. Each location shall include a vertical riser installed into the underlying waste that rises above ground level where measurements can be made. The methane

monitoring shall be performed on a quarterly basis. If measured gas concentrations do not exceed 25% of the lower explosive limit (LEL) at any monitoring location for two years, the locations will be monitored twice the third year. If measured concentrations do not exceed 25% of the LEL the third year, monitoring will be discontinued. By mutual agreement between the NMED and DOE, if a descending trend is identified whereby the gas levels are decreasing - monitoring may also be discontinued prior to the time periods mentioned above.

If combustible gas levels exceed 25% of the LEL in any enclosed structure, or 100% of the LEL at the north edge of the cap, the owner or operator shall:

- Immediately take all necessary steps to ensure protection of public health, welfare and the environment and notify the NMED;
- Within 7 days of detection, record the methane gas levels detected and a description of the steps taken to protect public health, welfare and the environment and report them to NMED.

For the first year as a minimum, methane monitoring will be performed at three locations. This monitoring will be performed on a quarterly basis. The results of this methane monitoring shall be submitted to NMED for review. This monitoring shall continue until DOE and NMED concur that it is no longer warranted.

14.0 HEALTH AND SAFETY PLAN

The Design Health and Safety Plan (HASP) (Dwyer Engineering 2015g) has been prepared to meet the requirements of: Occupational Safety and Health Administration standards, 29 CFR Part 1910 and 29 CFR Part 1926; United States Army Corps of Engineers "Safety and Health Requirements Manual" (EM 385-1-1; 15 Sep 2008 edition). The included HASP is for the design team. The construction contractor shall complete and provide a separate HASP for their personnel and subcontractors.

The purpose of the HASP is to provide guidance for the design team personnel working on site so they can complete the project objectives in a safe and healthful manner. The evaluation of hazards, levels of protection and procedures specified in this HASP are based on the best information available during the writing of this plan. It is recognized that every feasible safety or health hazard faced on site may not be contained in this document and that site conditions change. Therefore, it is part of every employee's job to continuously assess site conditions in relation to his/her own knowledge of how to do a task safely.

15.0 REFERENCES

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ATTACHMENT

LOS ALAMOS COUNTY
Public Works Department

1000 Central Avenue, Suite 160 - Los Alamos, NM 87544
Phone (505) 662-8150
Website: www.losalamosnm.us

COUNTY COUNCIL
Kristin Henderson
Council Chair
David Izraelevitz
Council Vice-Chair

Councilors
James A. Chrobocinski
Steven Girrens
Susan O'Leary
Rick Reiss
Pete Sheehey
COUNTY MANAGER
Harry Burgess

July 23, 2015

Ms. Ramoncita Massey
Los Alamos Field Office
3747 West Jemez Road
MS A-316
Los Alamos, New Mexico 87544

Dear Ms. Massey:

With regard to the removal of snow at the Los Alamos Airport the following procedures are in place.

Snow from the runway and all taxiways is plowed to the edge of the runway or taxiway and windrowed in those locations. This means that some of the snow on the taxiway adjacent to the landfill that leads to the old hot pad may be plowed into the ditch that separates the taxiway from the landfill.

Snow that is located on the aircraft parking aprons or between the hangars on the north side of the airport is plowed to the north and windrowed along the edge of Pueblo Canyon.

We do not load snow into trucks and haul the snow to other locations on the airport; therefore, no snow will be hauled to, or dumped on, the cover of the landfill.

If you have any questions regarding these procedures please do not hesitate to contact me.

Sincerely,

David C. Ploeger
Airport Manager