Combustion By-Products Landfill Closure Plan

Intermountain Generating Facility

November 19, 2020

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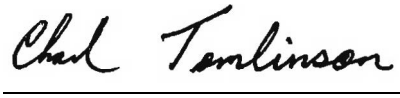
Approved by  _____
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Chad Tomlinson

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Abbreviations

amsl	Above Mean Sea Level
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
CB	Combustion By-Product
CCR	Coal Combustion Residual
CY	Cubic Yards
FT	Feet
HDPE	High-Density Polyethylene
IPA	Intermountain Power Agency
IPP	Intermountain Power Project
IPSC	Intermountain Power Services Corporation
L.L.	Liquid Limit
N.P.	Non-Plastic
Plan	Closure Plan
P.I.	Plasticity Index
P.L.	Plastic Limit
TDS	Total Dissolved Solids
UAC	Utah Administrative Code Rule
UDEQ	Utah Department of Environmental Quality

1.0 INTRODUCTION

This Closure Plan (Plan) has been prepared to describe the activities to be performed to obtain final closure of Intermountain Power Services Corporation's (IPSC's) Intermountain Power Project (IPP) Combustion By-Product (CB) Landfill. The site is located approximately ten miles north of Delta, Utah. The CB Landfill has been used to store CB waste.

This Plan has been prepared for IPSC by Stantec for review and approval by the Utah State Department of Environmental Quality (UDEQ) Division of Waste Management and Radiation Control.

1.1 PURPOSE AND SCOPE

The CB waste in the CB Landfill could pose both a long-term source of fugitive dust emissions from the surface and a potential threat to groundwater. Therefore, the purpose of this document is to present the closure plan to eliminate fugitive dust emissions and potential groundwater impacts from the CB waste in the CB Landfill in conformance with applicable regulatory requirements.

This document provides a detailed description of the activities to be performed as part of the proposed closure plan, to close and cover the CB Landfill with the CB waste in place.

The cover system presented in this Plan will utilize 18-inch low permeability compacted clay soil layer overlain by a 6-inch topsoil layer. The 18-inch compacted soil layer is designed to provide a low-permeability barrier that achieves the required maximum permeability of $1x10^{-5}$ cm/sec to minimize infiltration into the underlying CB waste material and to achieve a permeability that is equal to or lower than the native soils the CB Landfill was constructed directly over. The overlying topsoil layer will serve as an erosion protection layer and growth media for vegetation. The final cover system is designed to achieve the following:

- Eliminate fugitive dust CB material;
- Reduce infiltration of precipitation into the CB material;
- Minimize disruption of the integrity of the final cover system;
- Provide protection from wind and water erosion;
- Eliminate potential long-term impacts on groundwater; and
- Minimize long-term operation and maintenance.

This cover system has been designed to meet the Utah Administrative Code Rule (UAC) R315-319-102(d)D3) regulations for Closure and Post-Closure Care – Criteria for Conducting the Closure or Retrofit of CCR Units as discussed in Section 2.1.2.

In addition, a maintenance plan and post closure monitoring plan have been included, as part of the closure plan, to monitor the performance of the proposed closure.

2.0 PROJECT BACKGROUND

The IPP is a 1,900-megawatt coal-fired, steam electric generation station located on an approximately 4,600-acre site in the Sevier Desert approximately 10-miles North of Delta, Utah. The IPP is owned by the Intermountain Power Agency (IPA) and operated by IPSC. The IPP began generating power in 1986 and has operated continuously since that time. The IPP delivers power to users located in Utah and Sothern California. In May 2017, IPSC announced plans to cease power generation using coal and to develop new, natural-gas fueled generation at the project site by 2025. As a result of this transition, there are several CCR units at the plant that must be closed.

An initial written closure plan (Stantec, 2016) was developed in 2016 to comply with UAC R315-319-102(b) that requires IPSC to submit a written closure plan to the Division of Waste Management and Radiation Control. The basis of the initial written closure plan was closure of the CCR units by leaving CCR material in place.

2.1 APPLICABLE REGULATORY REQUIREMENTS

2.1.1 UDEQ Requirements

A review of current UDEQ regulations/guidelines was conducted to determine if there is a presumptive requirement for closure of the CB Landfill following cessation of its operation. The review identified the UAC R315-319-102 titled “Closure and Post-Closure Care – Criteria for Conducting the Closure or Retrofit of CCR Units” and is in effect as of September 1, 2016 (UDEQ, 2016). UAC R315-319-102 outlines the closure and post-closure process, minimum reporting, and performance criteria required for CCR landfills. UAC R315-319-102 was used as a reference guideline during the development of the proposed Closure Plan. Specifically, the UDEQ rule includes the following requirements, in **Table 2.1**, for the closure of an inactive CCR surface impoundment:

Table 2.1 Closure performance stand when leaving CCR in place (R315-319.10(d))

Section R315-319.102(d)	Description of Requirement	CB Landfill Closure Design
(1)(i)	Control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere	The compacted soil layer will act to prevent infiltration of liquids into the CB Landfill and prevent runoff from contacting the CCR.
(1)(ii)	Preclude the probability of future impoundment of water, sediment, or slurry	The cover and surrounding area will be graded to shed stormwater away from the cover. Diversion channels will be maintained upstream of the Landfill to prevent run-on from precipitation.

(1)(iii)	Include measures to provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure period	The CB Landfill existing waste material is assumed fully consolidated and requires no dewatering or geotechnical stabilization to prepare the material for closure given that material has had frequent heavy haul truck traffic and small amounts of precipitation typical of the site.
(1)(iv)	Minimize the need for further maintenance of the CCR unit	The cover will be vegetated with a native seed mix. Once established, the cover will require little or no long-term maintenance.
(1)(v)	Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.	Partial landfill closure will begin prior to final delivery of waste materials to reduce closure time post final waste delivery.
(3)(i)(A)	The permeability of the final cover system shall be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ m/sec, whichever is less.	The CB Landfill was constructed directly over native soils, including unconsolidated sands and silts. The compacted soil layer in the cover system will have a maximum permeability of $1x10^{-5}$ m/sec.
(3)(i)(B)	The infiltration of liquids through the closed CCR unit shall be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.	The compacted soil layer consists of a minimum thickness of 18-inches.
(3)(i)(C)	The erosion of the final cover system shall be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.	The design of the soil cover includes a 6-inch thick erosion protection layer. The erosion protection layer will be fertilized and seeded with a native seed mix to establish vegetation.
(3)(i)(D)	The disruption of the integrity of the final cover system shall be minimized through a design that accommodates settling and subsidence	The CB Landfill existing waste material is assumed stable and requires no dewatering or geotechnical stabilization to prepare the material for closure given that material has had frequent heavy haul truck traffic and small amounts of precipitation typical of the site.

Source: Utah Administrative Code Rule R315-319 (UDEQ, 2020)

2.1.2 Performance Standards for Landfill Covers

The UDEQ final rule for disposal of coal combustion residuals (UDEQ, 2016) requires that the permeability of the cover surface for CB Landfill be less than or equal to the permeability of the bottom liner, or 1×10^{-5} cm/sec, whichever is less. The CB Landfill was constructed directly over native soils, including unconsolidated sands and silts.

3.0 SITE CONDITIONS

This section presents a summary of the CB Landfill's characteristics as well as a description of the geological and hydrogeological conditions at the site. This information has been obtained from the Coal Combustion Residual Units Initial Closure Plan (Stantec, 2016).

3.1 CB LANDFILL DESIGN SUMMARY

This section presents a summary of the design and operating parameters of the CB Landfill

3.1.1 CB Landfill Design Details

The CB Landfill was constructed directly over native soils, including unconsolidated sands and silts. Hydraulic conductivity testing on remolded samples of the perceived foundation material underlying the CB Landfill indicates a hydraulic conductivity of $3.6x10^{-4}$ cm/sec, which is higher than the permeability of the proposed 18-inch thick compacted clay layer. The CB waste is transported to the CB Landfill by a conveyer from the power generating plant and stockpiled at the southwest corner of the CB Landfill area. From the stockpile area, CB waste is loaded onto trucks and placed on the CB Landfill in two (2) foot lifts. The material is then compacted to approximately 90% Standard Proctor Density (SPD). An estimated maximum inventory and aerial extent of waste material to be stored in the CB Landfill at closure is 16,500,000 cubic yards (CY) covering 199 acres, respectively (Stantec, 2016). Refer to **Figure 3.1** showing the CB Landfill as of November 2019.

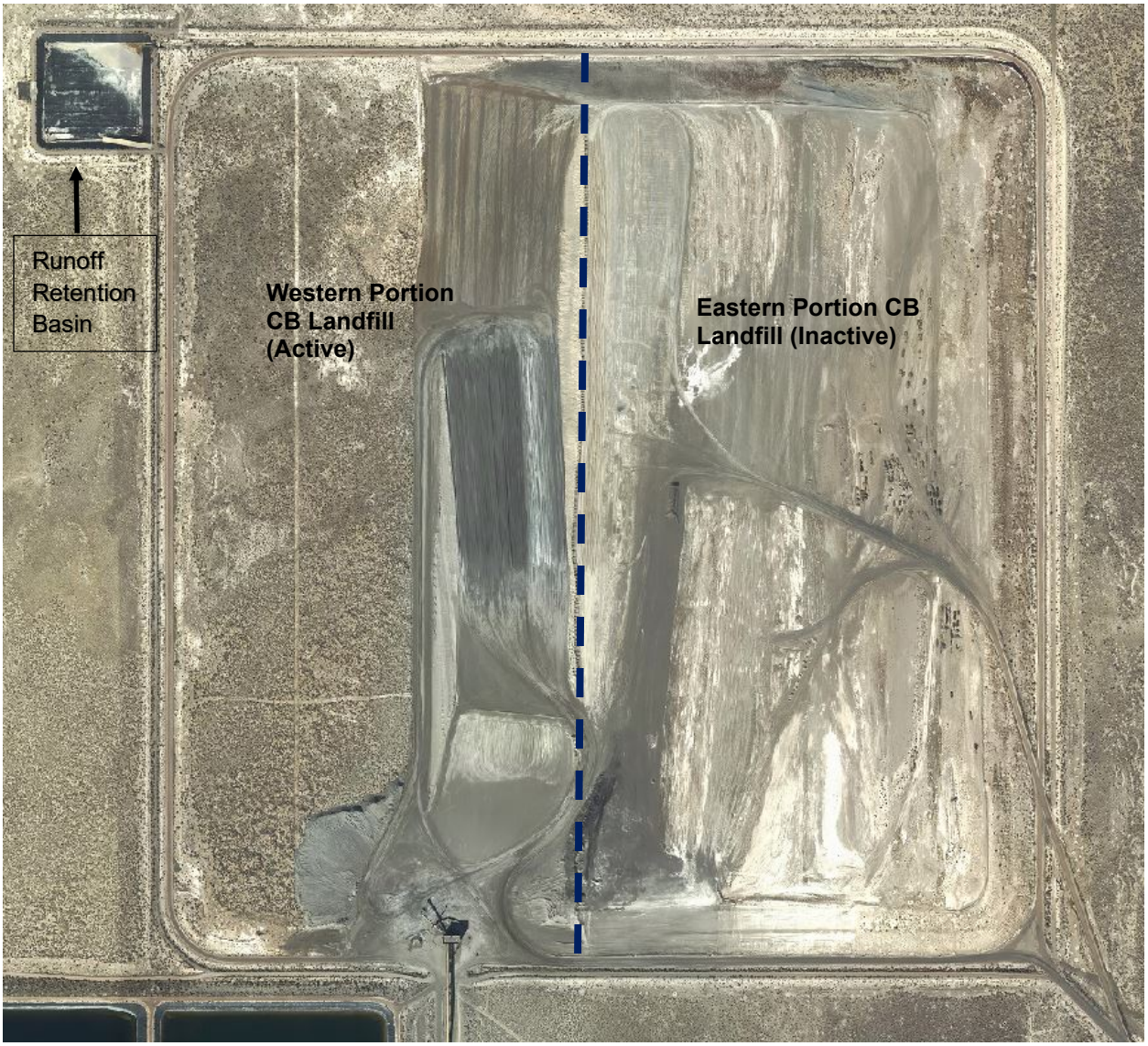

Figure 3-1 – CB Landfill (aerial imagery taken November 2019)

The existing CB Landfill stormwater controls are designed to convey the 50-year, 24-hr storm event. A diversion berm is constructed around the perimeter of the CB Landfill to prevent run-on. Inside of the diversion berm, a diversion ditch captures stormwater that has contacted the CB waste material. The diversion ditch routes the contact water to a high-density polyethylene (HDPE) lined runoff retention basin for containment. Water within the lined retention basin is controlled by evaporation.

Based on correspondence with IPSC staff, only a portion (approximately the western half) of the total expect of the CB Landfill will need to remain active to meet the needs of the operational period. The western area to remain active is shown in **Figure 3-1**. A large portion of the landfill,

the eastern portion shown in **Figure 3-1**, is currently storing CB waste but will no longer receive any additional material. Closure of this area could begin as soon as IPSC receives approval of the final closure plan from the regulating agencies.

Stantec assumes the fly ash disposed of in the CB Landfill is stable and will not require dewatering or geotechnical stabilization to prepare the material for closure given that material has had frequent heavy haul truck traffic and the small amounts of precipitation typical of the site. Further, Stantec has assumed that little to no regrading of the eastern portion of the CB Landfill will be necessary prior to placement of the final cover based relatively flat slopes (4H:1V) along the non-active faces of the CB Landfill.

3.2 SITE GEOLOGY

The CB landfill is near the center of the northern Sevier Desert in the Basin and Range Physiographic Province as shown in **Figure 3-2**. The area encompassing the CB Landfill is in the Sevier Lake drainage system and is located on a broad alluvial fan. The ground surface within this area is relatively flat, sloping only slightly to the west. No major drainages cross the area.

The upper unit consists primarily of interbedded lenses of sand and silty sand. This unit is approximately 15 to 20 feet thick. The top few feet of this deposit are comprised of eolian sand, fluvial sand, and fine gravel. The underlying unit consists of fine-grained silts and clays of lacustrine origin. This unit is thickly bedded and extends to a depth of at least one hundred feet below ground surface (bgs). Both of the two major subsurface units dip slightly toward the west, paralleling the existing topographic slope.

Figure 3-2 – IPP Physiographical Location

3.3 GROUNDWATER

Groundwater levels underlying the CB landfill indicate a relatively flat groundwater surface roughly paralleling the ground surface. The average groundwater surface gradient is about 0.5 percent to

the west-southwest. The depths of the groundwater surface in the area range between 17 to 45 feet below ground surface (bgs).

Groundwater levels are measured and recorded as part of the Plant groundwater monitoring program (Stantec, 2020). In general, groundwater level measurements are collected semi-annually from 37 wells at the site. The groundwater elevation at each respective well is provided in feet above mean sea level (amsl). The results of the groundwater monitoring program are documented in annual groundwater monitoring reports which are submitted to UDEQ. The *June 2020 Semi-Annual Progress Report* (Stantec, 2020) is summarized throughout the remainder of this section to provide a brief description of groundwater conditions in the vicinity of the CB Landfill.

Based on measurements collected in March-April 2020, groundwater elevations in the vicinity of the CB Landfill range between 4624.6 ft amsl (up-gradient of the CB Landfill) and 4609.5 feet amsl (down-gradient of the pond). The groundwater flow direction at the site is predominantly from northeast to southwest (Stantec, 2020).

The monitoring wells and associated groundwater elevations in the vicinity of the Pond that were sampled as part of the June 2020 Semi-Annual Progress Report (Stantec, 2020) are presented in **Table 3.1**.

Table 3.1 Representative Wells for CB Landfill

Well I.D.	Location	Groundwater Elevation (ft amsl) March 2020	Depth to Groundwater (ft bgs) March 2020
CL-U-1	Northeast of CB Landfill	4624.02	33.46
CL-U-2	Northeast of CB Landfill	4624.56	38.92
CLW-1	South of CB Landfill	4620.71	32.75
CLW-2	South of CB Landfill	4613.46	34.71
CLW-3	Southwest of CB Landfill	4611.16	32.87
CLW-4	Southwest of CB Landfill	4610.89	31.99
CLW-5	West of CB Landfill	4610.90	30.09
CLW-6	West of CB Landfill	4609.55	30.08
CLW-7	Southeast of CB Landfill	4622.64	36.70
CLW-8	South of CB Landfill	4621.68	33.95
CLW-9	West of CB Landfill	4580.43	36.13
CL-U-3	Southeast of CB Landfill	-	41.32

Water quality is monitored semi-annually at the Plant. During each sampling event, groundwater samples are collected from the representative wells listed in Table 2. All of the groundwater samples are analyzed for representative water quality parameters.

As reported to the UDEQ in the past, and as is the current status based upon existing information: the plume of groundwater containing TDS concentrations in excess of background concentrations is located within the uppermost aquifer beneath the IPSC-owned lands. The TDS plume is positioned well within the physical confines of IPSC-owned property and as such poses no risk to potential off-site receptors.

The plume monitoring and corrective actions being taken by IPSC are addressed in the Updated Corrective Action Plan (Stantec, 2016).

4.0 CLOSURE DESIGN

The following sections contain an overview of the anticipated closure activities for the CB Landfill. Design drawings are presented in **Appendix A**. The regulations described in Section 2.1 were used as guidance for this closure design.

4.1 CLOSURE PHASES

The Plan has been chosen to achieve the following performance objectives:

- Eliminate fugitive dust CB material;
- Reduce infiltration of precipitation into the CB material;
- Minimize disruption of the integrity of the final cover system;
- Provide protection from wind and water erosion;
- Eliminate potential long-term impacts on groundwater; and
- Minimize long-term operation and maintenance.

The closure of the CB Landfill will be completed beginning with cover construction on the eastern (non-operating) portion of the CB Landfill followed by cover construction on the western (operating) portion of the CB Landfill following final receipt of CB material. The construction of the final cover on the eastern portion of the CB Landfill could begin as soon as IPSC receives approval of the final closure plan from regulating agencies.

Closure activities to achieve the performance objectives include construction of a cover over the non-operating and operating portions of the CB Landfill. The cover construction will consist of a 18-inch compact clay soil layer, a 6-inch topsoil/vegetation layer and establishing vegetation on the soil cover. In addition, site monitoring will continue to track the performance of the implemented closure. The proposed closure design is presented in **Appendix A** and the major Closure Plan activities are outlined in the following subsections. Construction specifications are provided in **Appendix B**.

4.1.1 Step 1 Cover placement of Eastern Portion of the CB Landfill

4.1.1.1 Cover Infiltration Barrier

An 18-inch thick compacted clay soil layer shall be placed directly on the prepared subgrade to minimize the infiltration of precipitation into the underlying waste. The compacted soil layer shall have a permeability no greater than $1x10^{-5}$ cm/sec and will be constructed to maintain positive

drainage. The compacted soil layer shall be constructed out of clay-rich soils from Borrow Area 3 and if needed Borrow Area 1. Design drawings for the eastern and western portion of the cover system are provided in **Appendix A**. Placement specifications for the compacted soil layer are presented in **Appendix B**.

4.1.1.2 Erosion Layer

Section 3(i)c of the UDEQ CCR Regulations states that “erosion of the final cover system shall be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material capable of sustaining native plant growth.” To provide an earthen material that promotes soil moisture storage and reduce the potential for soil erosion of the cover, this material will be a blend of clay material and silty sand material obtained from Borrow Areas 3 and if needed Borrow Area 1.

4.1.2 Seedbed Preparation and Seeding of the CB Landfill

4.1.2.1 Seedbed Preparation

Seedbed preparation and seeding will take place in the fall or early spring after grading and topsoil placement is complete. Following placement of the final lift of soil, it will be tilled to a depth of 6-inches by ripping, discing, or other approved method to loosen compacted soil and leave a roughened, friable surface. Slopes shall be tilled on the contour leaving furrows perpendicular to the slope where practicable to reduce erosion and improve water capture and retention. Soil furrows and roughness are planned to shelter the seeds from wind and reduce development of erosion features, as well as collect water needed for the seeds to germinate.

4.1.2.2 Seeding

Following tilling the seed mix will be applied evenly over the entire area. Seeding will be applied in late Fall (mid-October or later) or in early Spring (before the first of May). Reclamation seed mixtures shall be similar to the native plant species of the site. Seed mixture should provide forage and cover species, which mimic pre-disturbance conditions. In addition, the established community will be adapted to the environmental conditions of the site to protect the area from wind and water erosion.

Immediately following seeding, the site will be mulched with weed-free straw or hay at a rate of 2 tons/acre. The straw or hay will be crimped into the soil to secure the mulch and to reduce movement by wind. Hydromulching with a wood fiber mulch may be used as an alternative to straw or hay and applied at a rate of 1.5 tons/acre along with a tackifier to bind the mulch to the soil.

Specifications for seeding and mulching of the soil cover are presented in **Appendix B**. If an alternative seeding method is utilized, IPSC will notify UDEQ and provide a modified seeding plan

for the alternative method prior to commencing seeding operations. Reclaimed borrow areas will also be re-vegetated to control runoff, reduce erosion, and blend into the surrounding topography.

4.1.2.3 Seed Mix Design

Seed mix selection will be based on a combination of factors including plant species, characteristics, and conditions at the site. Soil texture and chemistry, precipitation, temperature and growing season, seed availability, and ease of species establishment will all be used as criteria for the seed mix design. The following recommendations should be used in determining the proposed seed mixture:

- Native Plants are better adapted to the harsh desert climate of central Utah.
- Seed mixture should reflect the type of plants that grew prior to disturbance.
- Seed should come from a similar elevation and latitude to the site.
- Seed should be applied at a seeding rate between 14 to 28 pure live seed (PLS) pounds per acre for drill seeding (rates may be higher for broadcast seeding).

The seed mix should be comprised of a variety of native shrubs, grasses and forbs to provide habitat diversity and maximize transpiration at the site.

4.1.3 Stormwater Controls

An existing diversion berm has been constructed around the perimeter of the CB Landfill to prevent run-on. Inside of the diversion berm, a diversion ditch captures stormwater that has contacted the CB waste material. The diversion ditch routes the contact water to a high-density polyethylene (HDPE) lined runoff retention basin for containment. Water within the lined retention basin is controlled by evaporation. The diversion berm will remain in operation and maintained during cover placement. Once the cover is placed, the vegetative lining will reduce the likelihood of both water and wind erosion and prevent stormwater from contacting the CB waste. After the cover placement the stormwater controls will no longer be required.

4.2 BORROW SOURCE INVESTIGATOIN

The borrow source planned for the compacted soil layer and erosion layer will be obtained from an area directly south of the CB Landfill and labeled as Borrow Areas 1 and 3 on Sheet G-003 of **Appendix A**. Borrow material characterization consisted of excavation test pits, sample collection, and laboratory testing. Five-gallon bucket composite samples were collected for each material encountered in each of the 6 test pits. The associated test pit logs and laboratory testing are provided in **Appendix C** and **Appendix D**.

4.2.1 Borrow Source Sampling

Following the collection of the composite samples from the test pits, the samples were sent to Intermountain GeoEnvironmental Services, Inc. (IGES) in Salt Lake City, Utah for geotechnical and hydrological testing. The testing program is summarized in **Table 4.1** and **Table 4.2**.

Table 4.1 Borrow Area 1 Geotechnical and Hydrological Testing

Test	ASTM Method	Number of Samples	Comments
Organic Content	D2974	3	1 per test pit
Atterberg Limits	D4318 a	7	7 per borrow source
USCS Classification	D2487	8	1 per composite sample
Particle-Size Distribution	D6913	8	1 per composite sample
Hydrometer Analysis	D7928	8	1 per composite sample
Crumb Test	D6572	4	4 per borrow source
Standard Proctor	D698 b	2	2 per borrow source
Hydraulic Conductivity	D5084	2	2 per borrow source
Soil Water Characteristic Curve	D6836	2	2 per borrow source

Source: IGES Laboratory Testing Results (IGES, 2020)

Table 4.2 Borrow Area 3 Geotechnical and Hydrological Testing

Test	ASTM Method	Number of Samples	Comments
Organic Content	D2974	1	1 per borrow source
Atterberg Limits	D4318 a	6	2 per test pit sample
USCS Classification	D2487	6	2 per test pit sample
Particle-Size Distribution	D6913	6	2 per test pit sample
Hydrometer Analysis	D7928	6	2 per test pit sample
Crumb Test	D6572	2	2 per borrow source
Standard Proctor	D698 b	1	1 per borrow source
Hydraulic Conductivity	D5084	1	1 per borrow source

Source: IGES Laboratory Testing Results (IGES, 2020)

The test results are summarized in **Table 4.3** and **Table 4.4**. Complete laboratory reports for the testing are presented in **Appendix D**.

Table 4.3 Borrow Area 1 Geotechnical and Hydrological Testing on Composite Samples

Soil Test	B1TP 1	B1TP1	B1TP2	B1TP2	B1TP2	B1TP3	B1TP3	B1TP3	Comb. B1 TP1-3	Comb. B1 TP2-3
Composite Sample Depth	10-15’	15-25’	0-10’	10-20’	20-25’	0-10’	10-20’	20-30’	0-20’	10-30’
USCS Classification	SM	CL	SM	SM	CL	ML	CL	CL	SM	CL
Standard Proctor Compaction Test (MDD lbs/ft^3)	-	-	-	-	-	-	-	-	117.9	105.3
Optimum Moisture Content (OMC%)	-	-	-	-	-	-	-	-	14	19
Particle Size Distribution %Gravel %Sand %Fines	13.6 48.3 38.1	8.8 31.8 59.4	0 58.9 41.1	0 75 25	0 36 64	0.2 41.3 58.6	0 4.4 95.6	0 6.3 93.7	-	-
Atterberg Limits LL[a/] (%) PL[b/] (%) PI [c/] (%)	N.P.	25 14 11	NP	NP	23 15 8	NP	47 19 28	39 18 21	-	-
Organic Matter (%)	1.5	-	-	0.8	-	0.8	-	-	-	-
Crumb Test[e]	Grade 1	-	-	Grade 3	-	Grade 2	-	Grade 1	-	-
Average Hydraulic Conductivity K (cm/sec)	3.6E-04	-	-	2.1E-04	-	-	-	-	-	-

Notes:

[a]/ LL: Liquid Limit

[b]/ PL Plastic Limit

[c]/ PI: Plasticity Index

[d]/ N.P.: Non-Plastic

[e]/ Crumb Test Results: Grade 1 – Nondispersive, Grade 2 – Intermediate, Grade 3 – Dispersive,

Table 4.4 Borrow Area 3 Geotechnical and Hydrological Testing on Composite Samples

Soil Test	B3TP1	B3TP1	B3TP2	B3TP2	B3TP3	B3TP3	Comb. B3 TP1-3
Composite Sample Depth	0-10'	10-20'	0-15'	15-25'	0-15'	15-30'	10-30'
USCS Classification	SC	CL	CL	CL	SM	CL	CL
Standard Proctor Compaction Test (MDD lbs/ft^3)	-	-	-	-	-	-	105.4
Optimum Moisture Content (OMC%)	-	-	-	-	-	-	20.8
Particle Size Distribution %Gravel %Sand %Fines	3.3 69.3 27.4	0.9 23.6 75.5	0.8 32.7 66.5	1.3 30.1 68.6	2.1 73.6 24.3	0.8 20.6 78.6	-
Atterberg Limits LL[a/] (%) PL[b/] (%) PI [c/] (%)	29 17 12	34 15 19	31 14 17	30 15 15	N.P.[d/]	29 15 14	
Organic Matter (%)		3.2					
Crumb Test[e]				Grade 1	Grade 1		
Average Hydraulic Conductivity K (cm/sec)							1.5E-05

Notes:

[a]/ LL: Liquid Limit

[b]/ PL Plastic Limit

[c]/ PI: Plasticity Index

[d]/ N.P.: Non-Plastic

[e]/ Crumb Test Results: Grade 1 – Nondispersive

The test pitting and testing results indicated that a continuous clay layer is present at approximately 15 to 20 ft bgs. Based on the grain-size distribution and Atterberg limits testing data, this material is predominantly fine grained and has moderate to high plasticity indicating that it is a suitable material for achieving the required permeability.

5.0 POST CLOSURE OPERATION AND MAINTENANCE PLAN

This section describes activities that will be conducted as part of the post-closure process. Utah Administrative Code Rule R315-319-104 titled Closure and Post-Closure Care – Post-Closure Care Requirements (UDEQ, 2016) require that a post-closure plan be developed and implemented for a period of 30 years once closure and reclamation activities have been completed. Post-closure is the process which is used to allow a facility to stabilize to the point where it no longer presents a threat to human health or the environment. During this period, the facility will be routinely monitored to ensure that the integrity of the soil cover is not compromised by erosion and settlement and ensure that the soil cover's performance is acceptable. Therefore, this post-closure plan will provide the following:

- A plan for inspection and maintenance of the soil cover
- A maintenance plan to be followed if problems develop during the post-closure care period that could result in the release of CB material to the environment
- A description of the proposed use of the property during the post-closure care period.

IPSC may petition for the UDEQ to terminate the post-closure period earlier if they can demonstrate that the soil cover has stabilized and is protective of groundwater.

5.1 COVER INTEGRITY MONITORING AND MAINTENANCE

Following construction of the soil cover, routine monitoring will be performed to identify the need for maintenance of the soil covers. The monitoring will include both visual inspection and surveying of the soil cover to ensure that the integrity is not compromised. The monitoring plan, including the individual monitoring tasks, inspection locations, schedule, monitoring criteria, and possible maintenance is summarized in **Table 5.1**.

Table 5.1 Post-Closure Monitoring Summary

Monitoring Activity	Purpose	Monitoring Frequency	Monitoring Locations	Monitoring Method	Comments	Actions Items
Visual Cover Inspection	Visually inspect soil cover surface for ponding, sags, drainage interruptions, surface erosion, and vertical cracking.	Semi-Annually and Following major storm events of 1-inch or more of rainfall in 24-hrs.	Throughout entire cover.	Visual	The locations of ponding, sags, drainage interruptions, surface erosion, and vertical cracking shall be noted on the inspection form.	Ponding, sags, and drainage interruptions will be repaired and re-vegetated.
Vegetation Inspection	Inspect soil cover for vegetation establishment.	Semi-Annually	Throughout entire cover.	Visual	Any areas showing vegetation distress such as bare areas or significantly lower vegetative establishment compared to rest of the soil cover will be noted on the inspection form.	Bare areas will be repaired during the next seeding season.
Groundwater Monitoring	Detect potential migration of spent liquor from the Wastewater Basin.	Semi-Annually	In accordance with the approved groundwater monitoring well list for the Plant.	In accordance with the approved groundwater monitoring parameter list for the Plant	None	Record significant deviations in groundwater quality to UDEQ.

5.1.1 Visual Cover Inspection

Visual inspections of the soil cover will be performed to identify damage to or degradation of the soil cover including; the formation of rills, loss of vegetation over significant portions of the soil cover, and formation of visible animal burrows or trails over the soil cover. The visual inspections will be performed across the entire soil cover. Visual inspections of the soil cover will be performed semi-annually and following major storm events. The results of the visual inspections will be documented in site inspection reports and retained on-site for UDEQ review upon request.

5.1.2 Vegetation Monitoring

During the semi-annual soil cover monitoring, the cover vegetation will be inspected for burned areas, overall establishment, disease or pests, and noxious weed infestations. The inspections will be performed during the semi-annually visual inspection of the soil cover. Any areas showing vegetation distress such as bare areas or significantly lower vegetative establishment compared to rest of the soil cover will be clearly noted on the inspection form.

5.2 SOIL COVER MAINTENANCE

The purpose of the final cover maintenance procedures is to maintain the integrity of the soil cover over the long-term and to provide maintenance, scheduling, and documentation so that materials and maintenance practices are consistent with the final cover design and specifications. Semi-annual visual inspections and settlement monitoring will provide identification of erosion and settlement. A site representative, designated by IPSC, will be responsible for documenting the location and extent of repairs.

All final cover repairs and/or reconstruction shall be conducted in a manner directed to maintain the integrity of the as-built final cover system. Repair of fill materials will be performed in six to eighteen-inch layers consistent with the cover design layers, procedures, and specifications utilized during the final cover construction. The methods of repair will be performed for the following principal modes of final cover distress:

- Settlement related sags and drainage interruptions, which interfere with controlled flow and discharge of surface waters from the soil cover surface.
- Surface erosion as a result of drainage channel “overflow” associated with intense rains.
- Local surficial slumping on slopes resulting from intense rains.
- Vertical or near vertical cracking of cover soils as a result of settlement.

5.2.1 Depressions, Ponding, Drainage Interruptions and Surface Erosion

Any repairs of depressions in the final soil cover will be completed on an annual basis. If significant sags or ponding is identified during other times of the year, the IPSC representative will accurately locate the limits of the depressions. The IPSC representative will be responsible for directing fill placement in the sag area to facilitate drainage. The permanent repair of sags and ponding, when necessary, will be performed by adding sufficient cover soil material necessary to maintain the design slope. Cover soil will be placed in accordance with the design specifications. An IPSC representative shall inspect and certify any fill placed in the final cover layers. Repaired areas shall also be re-seeded in accordance with the design specifications.

5.3 POST-CLOSURE INSPECTION AND MAINTENANCE REPORTING

All copies of the operator's inspection and maintenance reports will be retained on-site for UDEQ review upon request to demonstrate that the site has been inspected on a routine basis to evaluate the integrity and stability of the soil cover and stormwater diversion systems. Any repairs or maintenance performed will be discussed in detail in maintenance reports.

5.4 GROUNDWATER MONITORING

The current groundwater monitoring and corrective actions being taken by IPSC are addressed in the Updated Corrective Action Plan (Stantec, 2016) and will continue following closure of the CB Landfill until conditions warrant revisions to the groundwater monitoring plan.

6.0 CLOSURE SCHEDULE

Per the requirements of UAC R315-319-102(b)(1)(vi), a preliminary closure schedule has been developed for the CB Landfill. The schedule showing key dates is presented in **Appendix E**. The schedule was developed based on the closure approach discussed in Section 3 and was based on the following assumptions:

- Closure of the eastern portion of the CB Landfill is currently at design grades and closure would be initiated following approval of this closure plan by UDEQ.
- Closure of the western portion of the CB Landfill would commence following conversion to gas and cessation of ash disposal, which is anticipated to be July 1, 2025.
- Seeding of the final cover system was fixed to only occur in the late fall to improve vegetation establishment.

Based on the schedule developed, closure activities for the CB Landfill are anticipated to be completed by November 13, 2026.

7.0 REFERENCES

IGES, 2014. Geotechnical Laboratory Testing Results – IPSC CCR Unit Closures, Delta, UT.

Stantec, 2016. Coal Combustion Residual (CCR) Units Initial Closure Plan. Intermountain Generating Facility. Delta, Utah. October 13, 2016.

Stantec, 2020. June 2020 Semi-Annual Progress Report. Intermountain Generating Facility. Delta, Utah. June 25, 2020.

UDEQ, 2016. R315. Environmental Quality, Waste Management and Radiation Control, Waste Management. R315-319. Coal Combustion Residual Requirements., Issued September 2016.

Appendix A

IPSC CCR CB Landfill Closure Design

PRELIMINARY DESIGN PHASE - 10/16/2020

NOT FOR CONSTRUCTION

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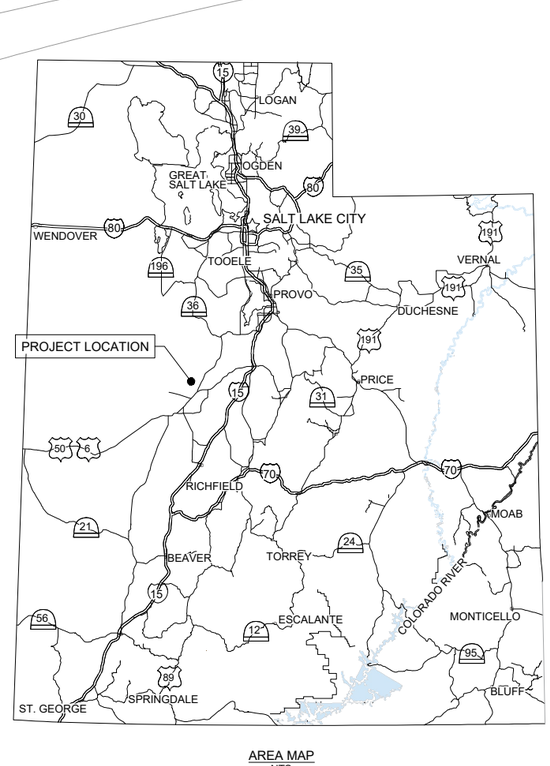
INTERMOUNTAIN POWER SERVICE CORP

Stantec

INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL

CLOSURE DESIGN SUBMITTAL - OCTOBER 2020



AREA MAP
NTS

INDEX OF DRAWINGS

DRAWING NO	DRAWING NAME
G-001	COVER SHEET AND DRAWING INDEX
G-002	GENERAL NOTES
G-003	EXISTING SITE LAYOUT
C-200	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - EXISTING CONDITIONS
C-210	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - EASTERN PORTION FINAL COVER DESIGN
C-211	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - EASTERN PORTION SECTIONS
C-220	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - WESTERN PORTION FINAL COVER DESIGN
C-221	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - WESTERN PORTION SECTIONS
C-240	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 EXCAVATION PLAN - SHEET 1
C-241	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 EXCAVATION PLAN - SHEET 2
C-242	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 EXCAVATION SECTIONS - SHEET 1
C-243	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 EXCAVATION SECTIONS - SHEET 2
C-244	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 STAGE STORAGE CURVE - SHEET 1
C-245	COMBUSTION BY-PRODUCTS LANDFILL CLOSURE - BORROW SOURCE 3 - PHASE 2 STAGE STORAGE CURVE - SHEET 2

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM BY: WOOLSEY, ROGER

DWG FILE: C:\pwwrk\dlr\dms40956\G-001.dwg

CIVIL GENERAL NOTES

GENERAL

THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.

THE CONTRACTOR SHALL PROPERLY DISPOSE OF ALL DEBRIS FROM DEMOLITION AT CONTRACTORS EXPENSE.

CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

UTILITIES

PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION.

THE CONTRACTOR SHALL PROTECT ALL REMAINING EXISTING UTILITIES.

LOCATIONS OF UNDERGROUND AND ABOVE GROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.

PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLIUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS-OF-WAY, THE CONTRACTOR SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES NOT LESS THAN 3 DAYS NOR MORE THAN 7 DAYS PRIOR TO EXCAVATION SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY THE REGIONAL OR LOCAL UNDERGROUND SERVICE ALERT COMPANY AT LEAST 3 DAYS, BUT NO MORE THAN 7 DAYS, PRIOR TO SUCH EXCAVATION.

EROSION CONTROL

THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK DURING THE CONSTRUCTION, SIGNED AND STAMPED BY A REGISTERED CIVIL ENGINEER PRIOR TO THE START OF CONSTRUCTION.

ALL SLOPES SHALL BE PROTECTED FROM EROSION DURING ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL INSTALLATION OF FINAL GROUNDCOVER.

ALL SLOPE PROTECTION SWALES SHALL BE CONSTRUCTED AT THE SAME TIME AS BANKS ARE GRADED.

THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES CONTAINED WITHIN THE CONTRACT SPECIFICATIONS. THE CONTRACTOR SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL MEASURES (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND BAGGING, DIVERSION DITCHES, ETC.) DICTATED BY FIELD CONDITIONS TO PREVENT EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS INTO EXISTING WATERWAYS, OR ONTO ADJACENT PROPERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.

CIVIL GENERAL NOTES - CONTINUED

SURVEY AND CONTROL

1. TOPOGRAPHY AND AERIAL IMAGERY BASED ON A NOVEMBER 2019 OLYMPUS AERIAL SURVEYS INC. SURVEY.
2. SURVEY IN LOCAL PLANT COORDINATE SYSTEM AND LOCAL DATUM IN INTERNATIONAL FEET.

PERMITTING

OWNER WILL BE RESPONSIBLE FOR OBTAINING PERMITS FROM THE UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY.

GENERAL CIVIL SYMBOLS

- 4600 — MAJOR CONTOURS
- MINOR CONTOURS
- 4600 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- P/L — PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE
- EASEMENT LINE
- TEMP ESMT — TEMPORARY EASEMENT LINE
- TRAIL OR DIRT ROAD
- FLOW LINE
- RAILROAD
- GUARDRAIL (PERMANENT)
- GUARDRAIL (REMOVABLE)
- VEGETATION
- WELL
- NEW
- EXISTING
- CENTERLINE
- 3:1 — BERM SLOPE (HORZ TO VERT)

GEOTECHNICAL SYMBOLS

- B-X — SOIL BORING LOCATION
- TEST PIT LOCATION
- XX — OBSERVATION HOLE
- MW — MONITORING WELL

STRUCTURES

- SITE OR RETAINING WALL
- X — X — FENCE (CHAINLINK)
- FENCE (WOOD)
- STRUCTURE
- STRUCTURE (BELOW GRADE)
- CONVEYOR SYSTEM

CONTROL SYMBOLS

- BM-XX — BENCH MARK
- ### — SITE COORDINATE NUMBER
- N XXXXXXX / E XXXXXXX — SITE COORDINATES
- EL XXXX.XX — MONUMENT
- HORZ AND VERT CONTROL POINT
- XXX.XX — FINISHED ELEVATION
- (XXX.XX) — EXISTING ELEVATION

REV 050215

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: NTS

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BERNHARD
DRAWN R. WOOLSEY
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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Stantec

INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
GENERAL
GENERAL NOTES
SYMBOLS

SHEET
G-002

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM BY: WOOLSEY, ROGER

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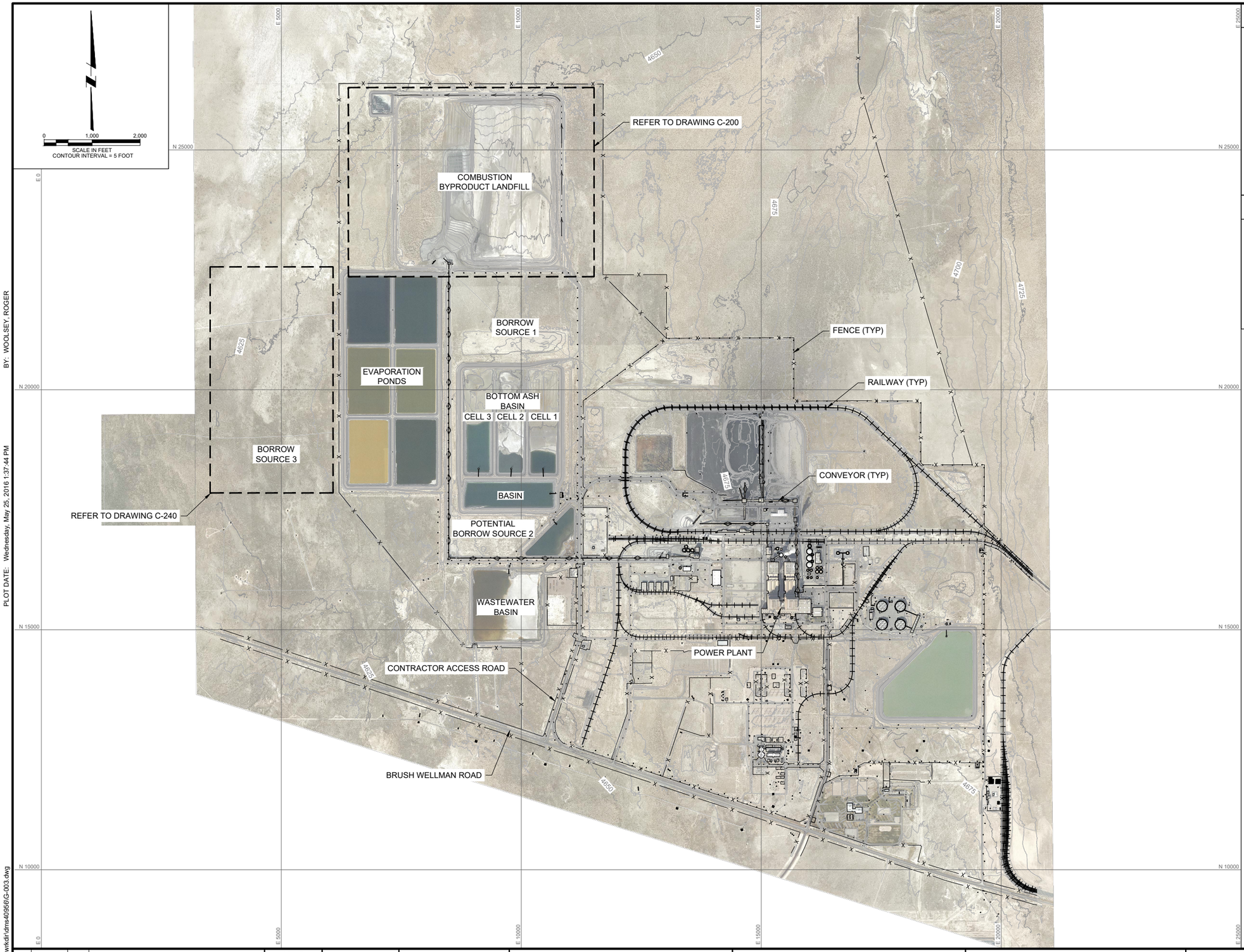

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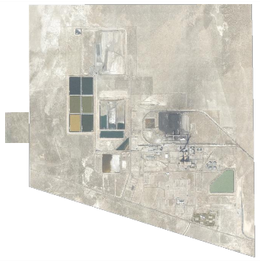

LEGEND

- EXISTING CONTOURS
- EXISTING RAILWAY
- CONVEYOR SYSTEM
- FENCE
- POWER POLE
- EXISTING WATER LEVEL

REV	DATE	BY	DESCRIPTION
B	11/18/2020	RNW	ISSUED FOR CLIENT REVIEW
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: 1" = 1000'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN C FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 11/18/2020

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INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
GENERAL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
EXISTING SITE LAYOUT

SHEET
G-003

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM BY: WOOLSEY, ROGER

DWG FILE: C:\pwwrkdir\dms40956\G-003.dwg

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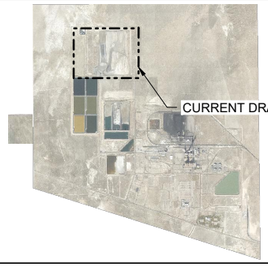

LEGEND

- 4600 — EXISTING CONTOURS
- CONVEYOR SYSTEM
- STORMWATER DRAINAGE
- DELINEATION LINE BETWEEN WESTERN AND EASTERN LANDFILL AREAS
- POWER POLE
- MONITORING WELL

GENERAL SHEET NOTES

1. TOPOGRAPHY BASED ON NOVEMBER 2019 AERIAL SURVEY AND REPRESENTS FINAL ASH GRADES ON EASTERN PORTION OF CB LANDFILL.
2. EAST PORTION OF COMBUSTION BYPRODUCT LANDFILL HAS BEEN GRADED TO THE REQUIRED SUBGRADE SLOPE AND WILL BE CLOSED PRIOR TO WESTERN PORTION.
3. SOIL FOR CLOSURE SHALL BE OBTAINED FROM BORROW SOURCE 3. REFER TO C-240 FOR BORROW EXCAVATION PLAN.

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: 1" = 200'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BERNHARD
DRAWN C. FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
CIVIL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
EXISTING CONDITIONS

SHEET
C-200

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
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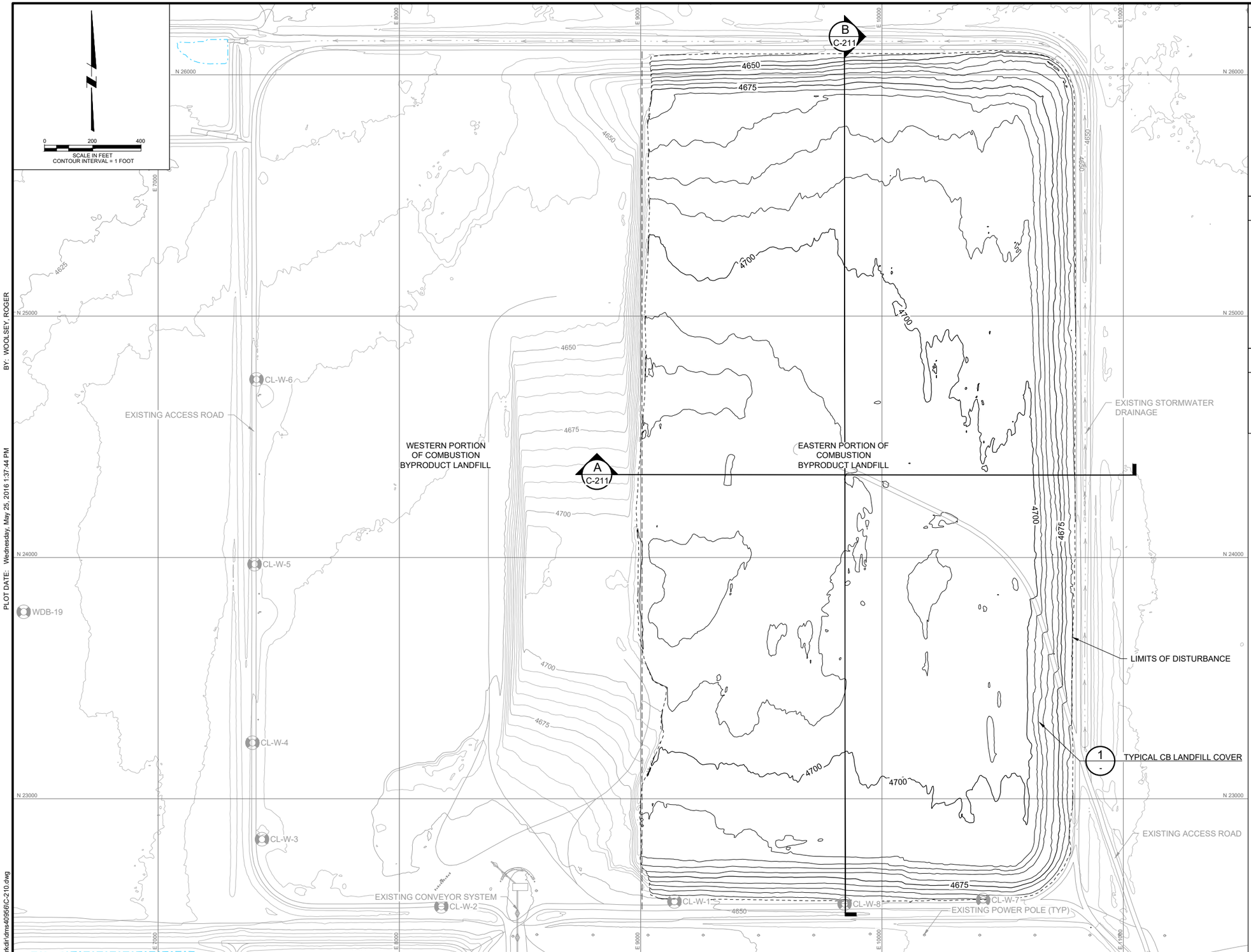

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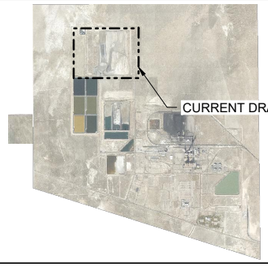

LEGEND

- 4600 — EXISTING CONTOURS
- 4600 — TOP OF CAP CONTOURS
- EXISTING CONVEYOR SYSTEM
- EXISTING STORMWATER DRAINAGE
- LIMITS OF DISTURBANCE
- EXISTING POWER POLE
- EXISTING WELL

GENERAL SHEET NOTES

1. CB LANDFILL CLOSURE COVER SHALL BE PLACED DIRECTLY ON SUBGRADE PREPARED BY OWNER.
2. PRIOR TO INSTALLATION OF FINAL COVER, EXISTING CB LANDFILL SURFACE SHALL BE GRADED TO ENSURE POSITIVE DRAINAGE.

QUANTITY TABLE

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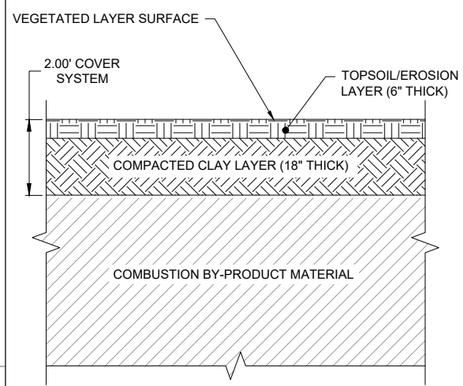
EASTERN PORTION	341,860	114,525



PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40956\C-210.dwg

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: 1" = 200'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN C. FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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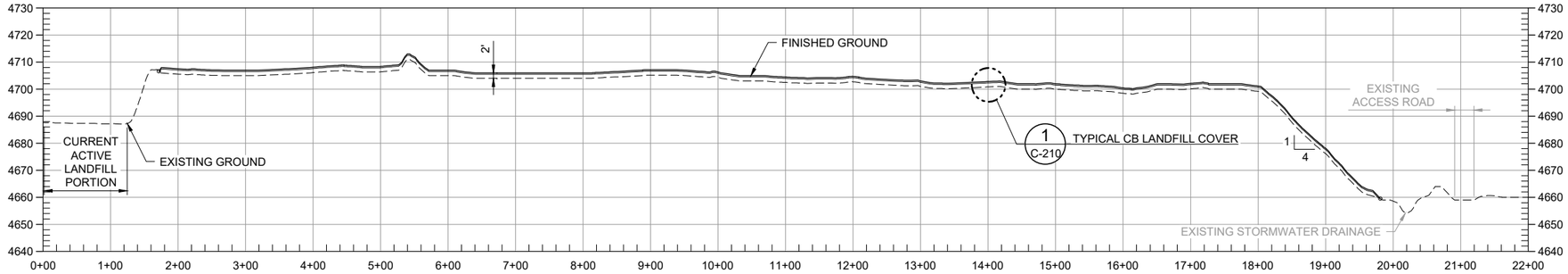
INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
CIVIL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
EASTERN PORTION FINAL COVER DESIGN

SHEET
C-210
Job# 233001396

GENERAL SHEET NOTES

1. PRIOR TO INSTALLATION OF FINAL COVER, EXISTING CB LANDFILL SURFACE SHALL BE GRADED TO ENSURE POSITIVE DRAINAGE.



A C-210 SECTION A

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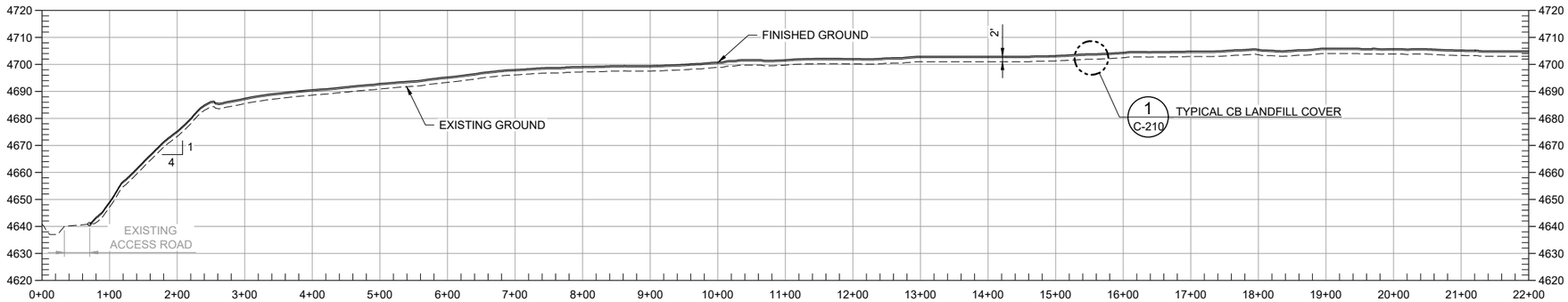

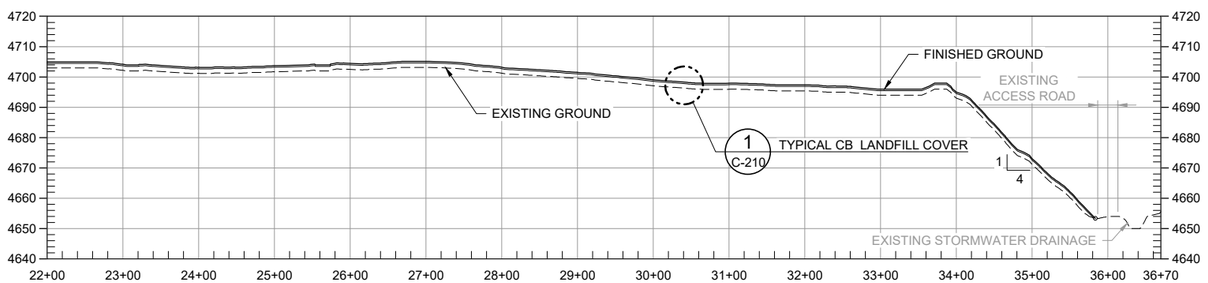

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HORZ 0 100 200
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SCALE IN FEET

REV	DATE	BY	DESCRIPTION
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SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BERNHARD
DRAWN C. FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
CIVIL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
EASTERN PORTION SECTIONS

SHEET
C-211
Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
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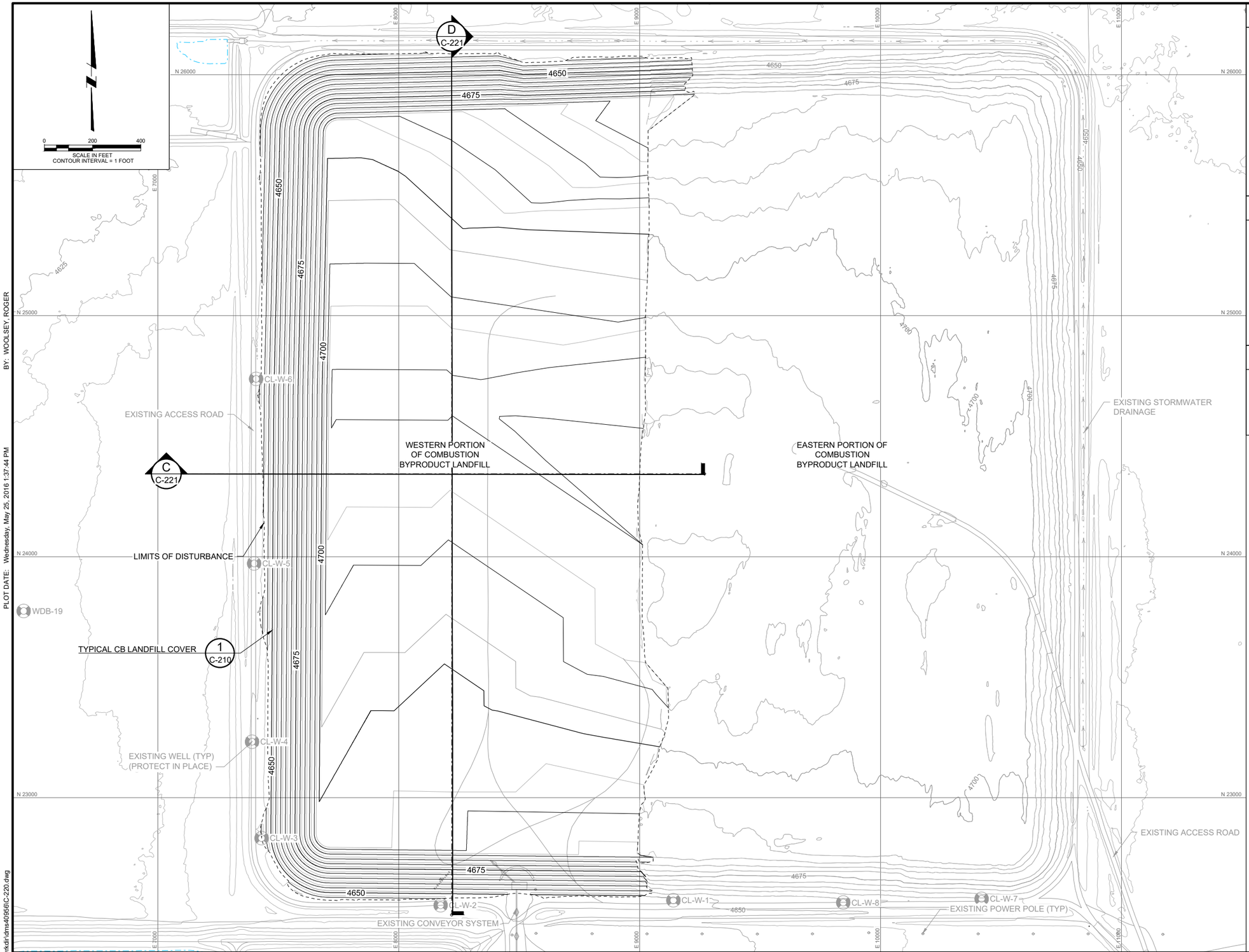

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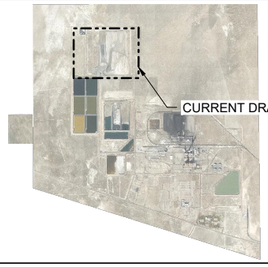

LEGEND

- 4600 — EXISTING CONTOURS
- 4600 — TOP OF CAP CONTOURS
- EXISTING CONVEYOR SYSTEM
- EXISTING STORMWATER DRAINAGE
- LIMITS OF DISTURBANCE
- EXISTING POWER POLE
- EXISTING WELL

GENERAL SHEET NOTES

1. CB LANDFILL CLOSURE COVER SHALL BE PLACED DIRECTLY ON SUBGRADE PREPARED BY OWNER.
2. PRIOR TO INSTALLATION OF FINAL COVER, EXISTING CB LANDFILL SURFACE SHALL BE GRADED TO ENSURE POSITIVE DRAINAGE.

QUANTITY TABLE

DESCRIPTION	COMPACTED CLAY (CY)	TOPSOIL (CY)
WESTERN PORTION	303,025	103,995

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: 1" = 200'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BERNHARD
DRAWN C. FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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Stantec

INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
CIVIL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
WESTERN PORTION FINAL COVER DESIGN

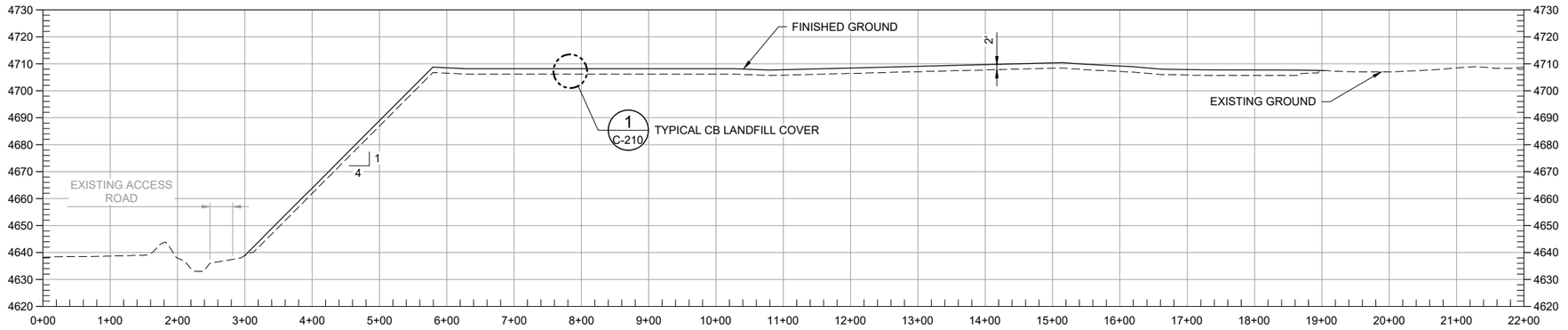
SHEET
C-220

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40956\C-220.dwg

GENERAL SHEET NOTES

1. PRIOR TO INSTALLATION OF FINAL COVER, EXISTING CB LANDFILL SURFACE SHALL BE GRADED TO ENSURE POSITIVE DRAINAGE.



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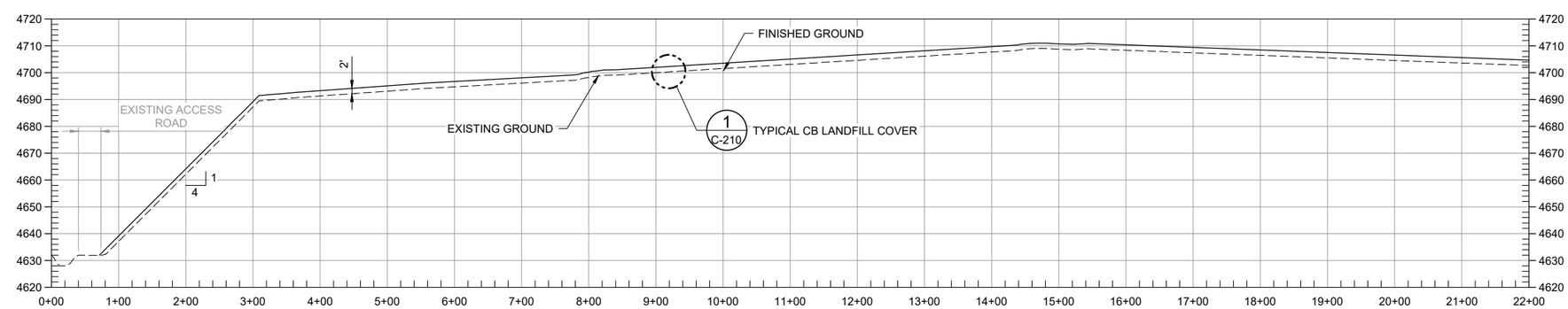
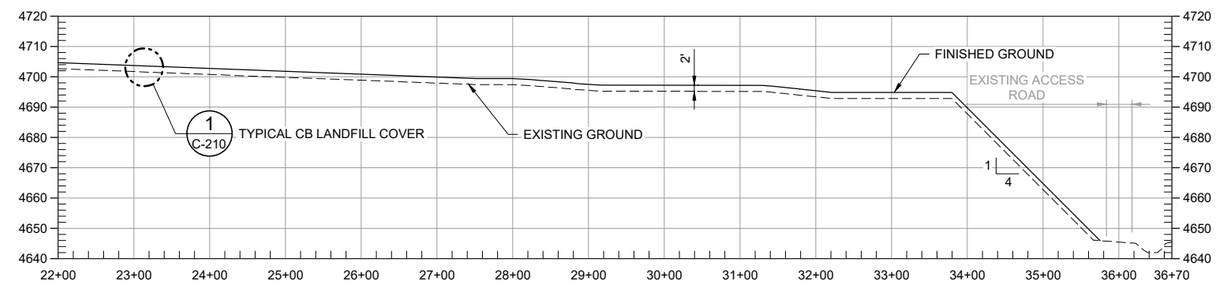




D C-220 SECTION D

HORZ 0 100 200
VERT 0 25 50
SCALE IN FEET

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BERNHARD
DRAWN C. FOWLER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

NOT FOR CONSTRUCTION

Stantec

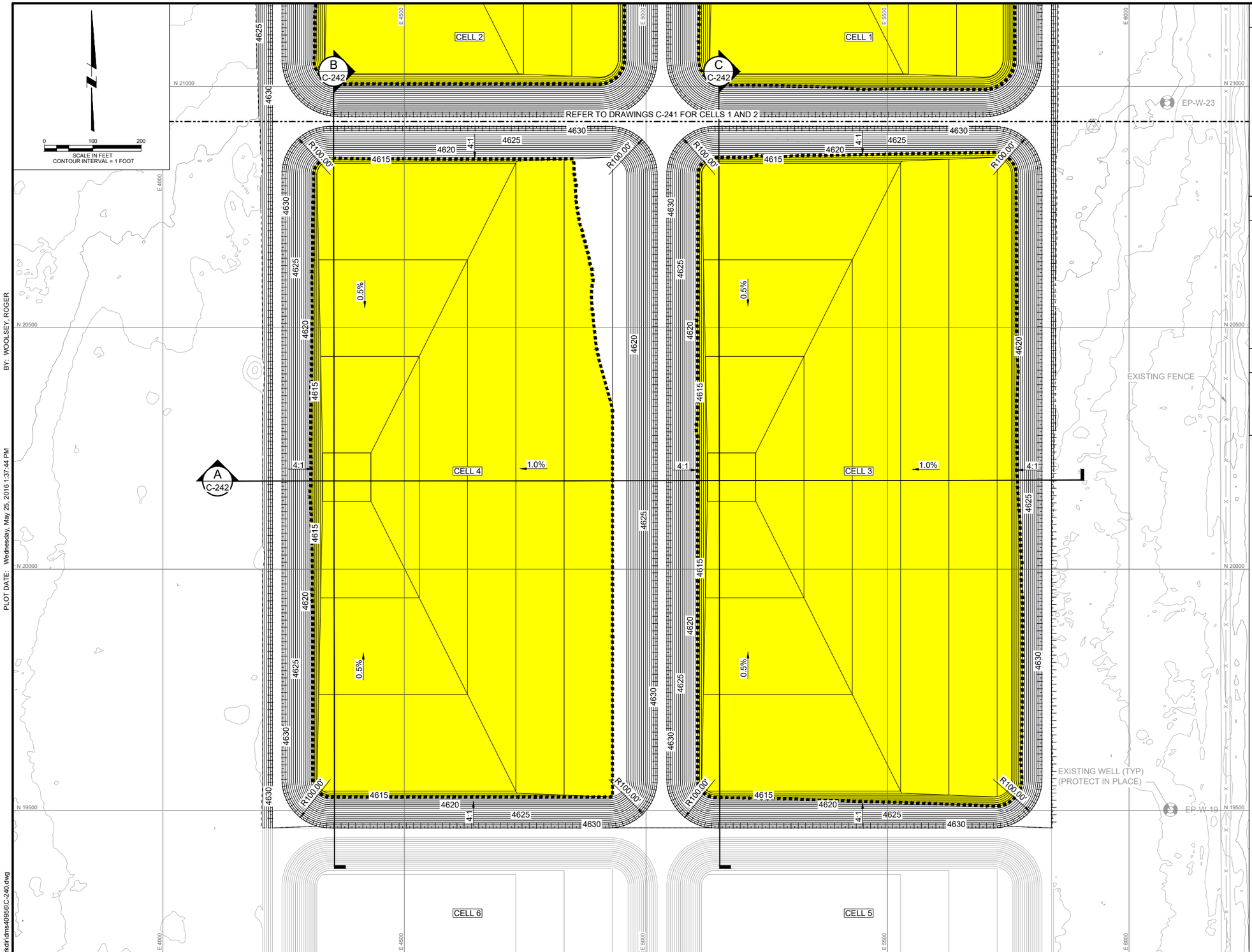
INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR CB LANDFILL
CIVIL
COMBUSTION BYPRODUCT LANDFILL CLOSURE
WESTERN PORTION SECTIONS

SHEET
C-221

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pw\wrkdir\dms40956\C-221.dwg



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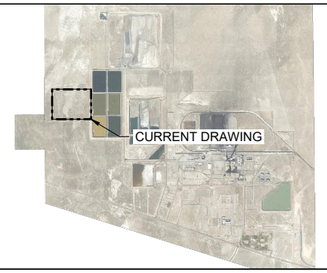

LEGEND

- 4600 — EXISTING CONTOURS
- 4600 — DESIGN CONTOURS
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXSTING TEST PIT
- CLAY EXCAVATION
- EXISTING WELL

GENERAL SHEET NOTES

1. REFER TO CLOSURE PLAN FOR DESCRIPTION OF BORROW AREA SOILS.
2. REFER TO WASTEWATER BASIN CLOSURE (C-470) FOR CELLS 5 AND 6.

QUANTITY TABLE			
DESCRIPTION	6" STRIP (CY)	GEN FILL (CY)	CLAY (CY)
EXCAVATION	38,220	667,592	198,860

QUANTITY TABLE	
DESCRIPTION	FILL (CY)
EMBANKMENT FILL	37,830

REV	DATE	BY	DESCRIPTION
A	10/16/2020	CF	ISSUED FOR CLIENT REVIEW

SCALE: 1" = 100'

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DRAWN R. WOOLSEY
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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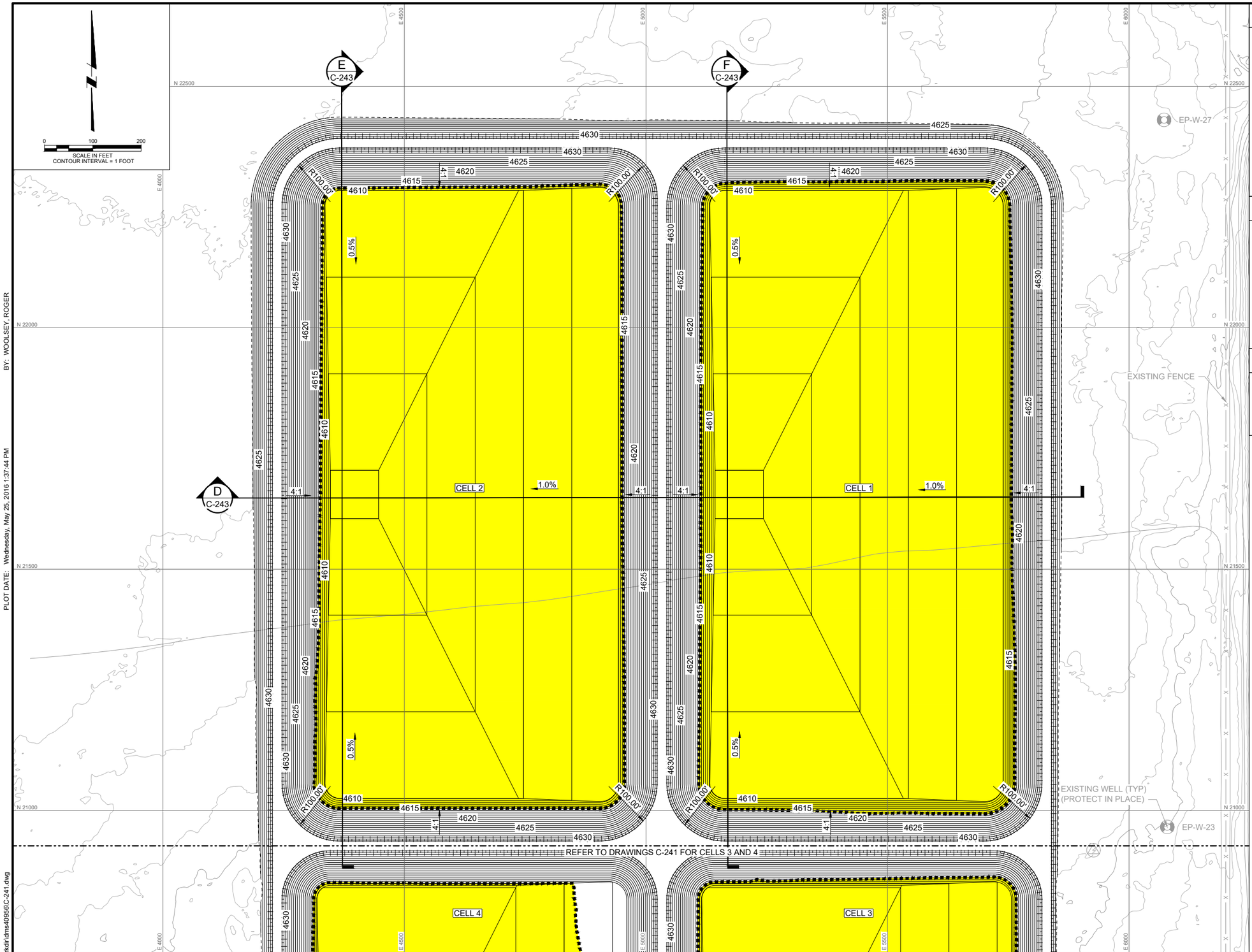
INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR BOTTOM ASH BASIN
CIVIL
COMBUSTION BYPRODCUT LANDFILL CLOSURE
BORROW SOURCE 3
PHASE 2 EXCAVATION PLAN - SHEET 1

SHEET
C-240

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40956\C-240.dwg



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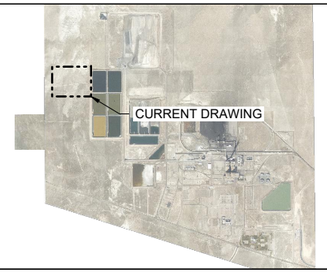

LEGEND

- 4600 — EXISTING CONTOURS
- 4600 — DESIGN CONTOURS
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXSTING TEST PIT
- CLAY EXCAVATION
- EXISTING WELL

GENERAL SHEET NOTES

1. REFER TO CLOSURE PLAN FOR DESCRIPTION OF BORROW AREA SOILS.
2. REFER TO WASTEWATER BASIN CLOSURE (C-470) FOR CELLS 5 AND 6.

QUANTITY TABLE

DESCRIPTION	6" STRIP (CY)	GEN FILL (CY)	CLAY (CY)
EXCAVATION	36,145	631,390	294,400

QUANTITY TABLE

DESCRIPTION	FILL (CY)
EMBANKMENT FILL	45,450

REV	DATE	BY	DESCRIPTION
A	10/16/2020	CF	ISSUED FOR CLIENT REVIEW

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INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR BOTTOM ASH BASIN
CIVIL
COMBUSTION BYPRODCUT LANDFILL CLOSURE
BORROW SOURCE 3
PHASE 2 EXCAVATION PLAN - SHEET 2

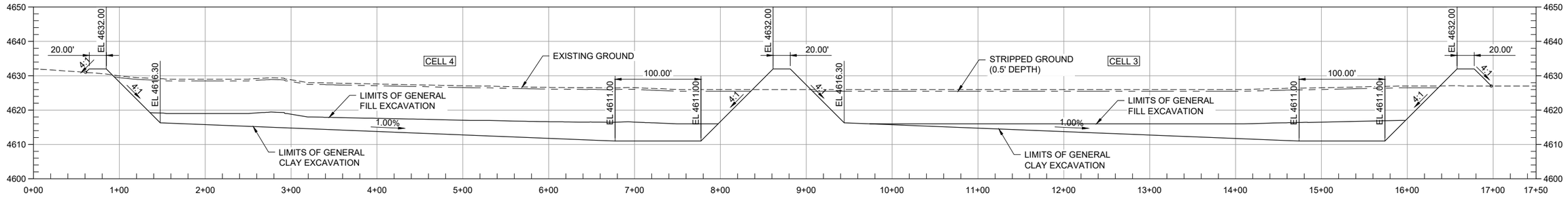
SHEET
C-241

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40966\C-241.dwg

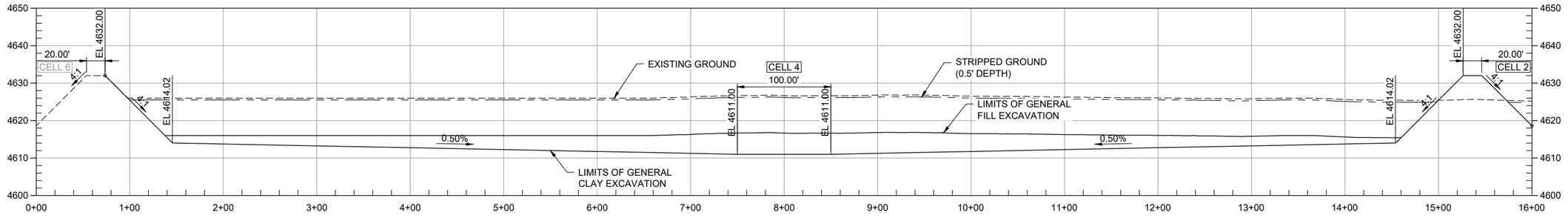
GENERAL SHEET NOTES

1. REFER TO CLOSURE PLAN FOR DESCRIPTION OF BORROW AREA SOILS.



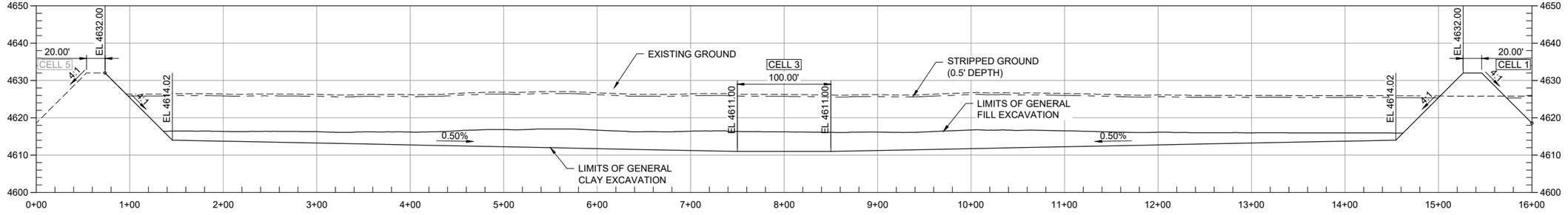
A SECTION A
C-240

HORZ 0 60 120
VERT 0 15 30
SCALE IN FEET



B SECTION B
C-240

HORZ 0 60 120
VERT 0 15 30
SCALE IN FEET



C SECTION C
C-240

HORZ 0 60 120
VERT 0 15 30
SCALE IN FEET

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

SCALE: AS SHOWN

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INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR WASTEWATER BASIN
CIVIL
WASTEWATER BASIN CLOSURE
BORROW SOURCE 3
PHASE 2 EXCAVATION SECTIONS - SHEET 1

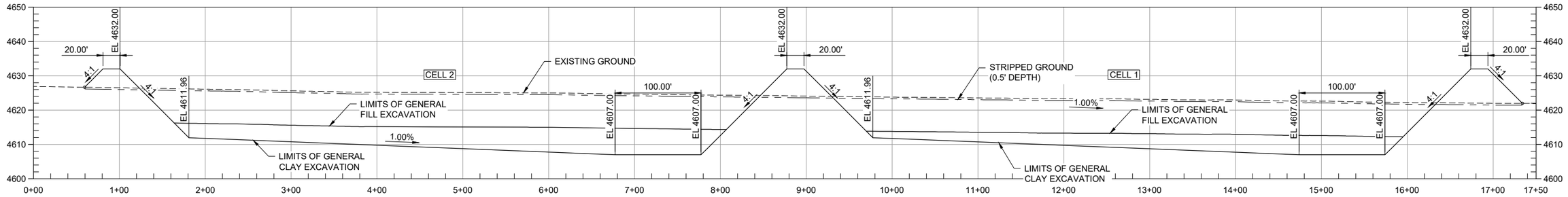
SHEET
C-242

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40956\C-242.dwg

GENERAL SHEET NOTES

1. REFER TO CLOSURE PLAN FOR DESCRIPTION OF BORROW AREA SOILS.



A C-241 SECTION A

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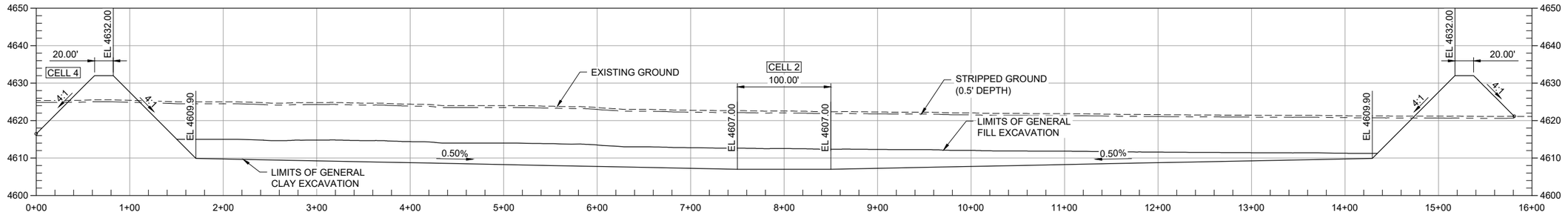
VERT 0 15 30
SCALE IN FEET



B C-241 SECTION B

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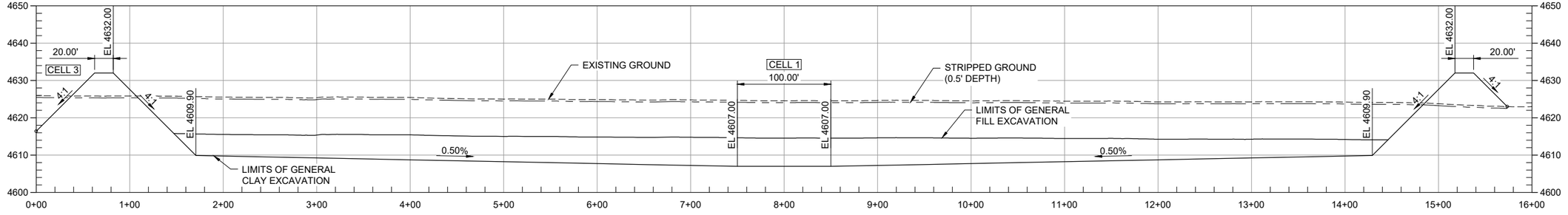
VERT 0 15 30
SCALE IN FEET



C C-241 SECTION C

HORZ 0 60 120
VERT 0 15 30
SCALE IN FEET

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

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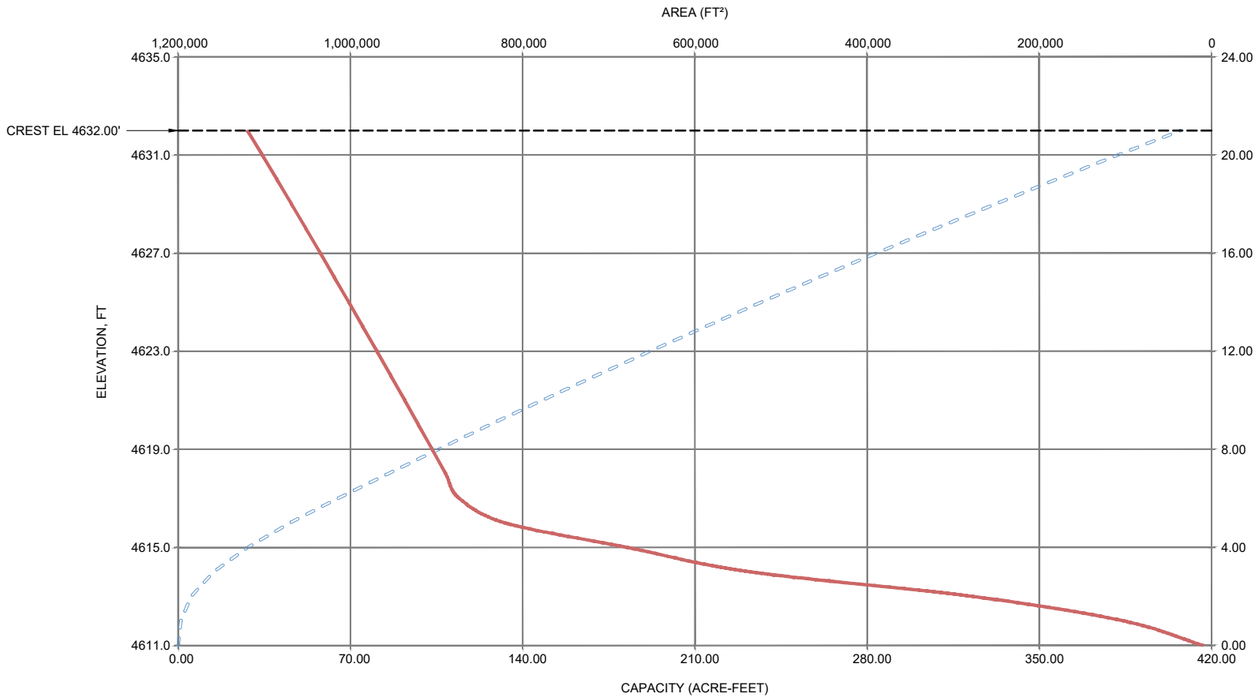
INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR WASTEWATER BASIN
CIVIL
WASTEWATER BASIN CLOSURE
BORROW SOURCE 3
PHASE 2 EXCAVATION SECTIONS - SHEET 2

SHEET C-243

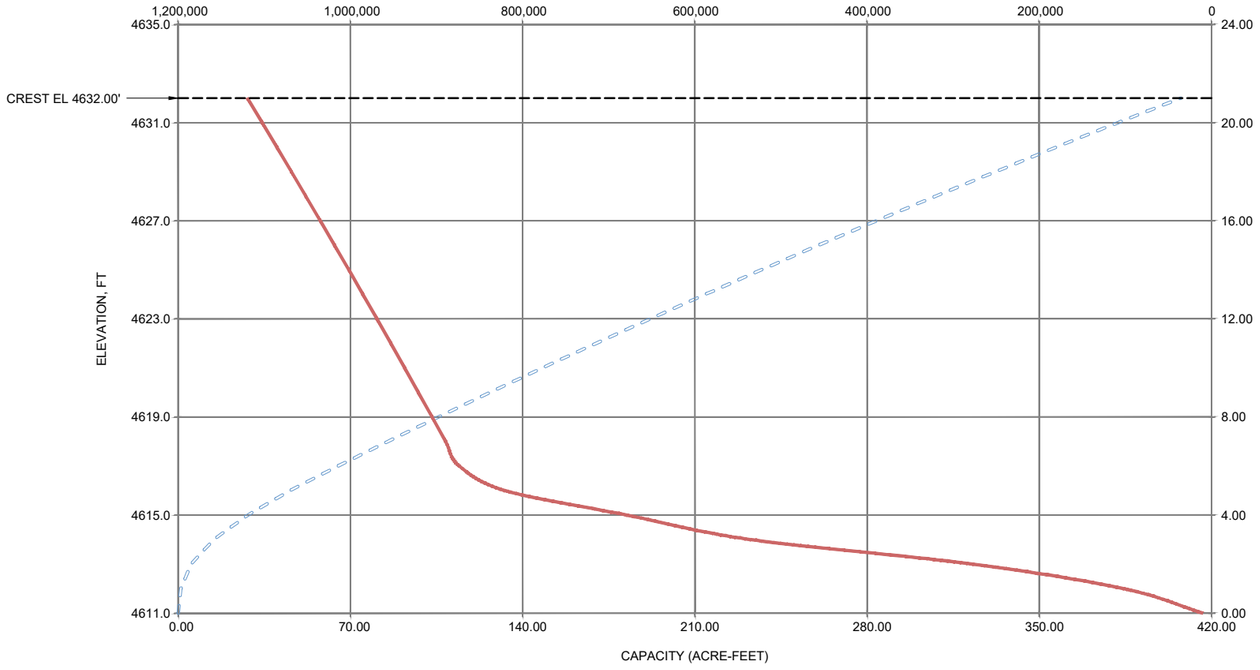
Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\dms40956\C-243.dwg



AREA CAPACITY CURVE - EVAP POND 3

AREA CAPACITY TABLE - EVAP POND 3		
ELEVATION (FT)	AREA (FT²)	CAPACITY (ACRE-FT)
4611.00	10,000.00	0.00
4612.00	102,000.00	1.10
4613.00	277,200.00	5.29
4614.00	535,416.14	14.46
4615.00	678,982.01	28.36
4616.00	820,758.87	45.55
4617.00	873,625.86	65.00
4618.00	889,315.00	85.23
4619.00	905,104.51	105.83
4620.00	920,994.37	126.79
4621.00	936,984.59	148.12
4622.00	953,075.17	169.81
4623.00	969,266.11	191.88
4624.00	985,557.40	214.31
4625.00	1,001,949.05	237.13
4626.00	1,018,441.06	260.32
4627.00	1,035,033.43	283.89
4628.00	1,051,726.16	307.84
4629.00	1,068,519.24	332.18
4630.00	1,085,412.68	356.90
4631.00	1,102,406.48	382.01
CREST EL 4632.00' → 4632.00	1,119,500.64	407.52



AREA CAPACITY CURVE - EVAP POND 4

AREA CAPACITY TABLE - EVAP POND 4		
ELEVATION (FT)	AREA (FT²)	CAPACITY (ACRE-FT)
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4612.00	102,000.00	1.10
4613.00	277,200.00	5.29
4614.00	535,416.14	14.46
4615.00	678,982.01	28.36
4616.00	820,758.87	45.55
4617.00	873,625.86	65.00
4618.00	889,315.00	85.23
4619.00	905,104.51	105.83
4620.00	920,994.37	126.79
4621.00	936,984.59	148.12
4622.00	953,075.17	169.81
4623.00	969,266.11	191.88
4624.00	985,557.40	214.31
4625.00	1,001,949.05	237.13
4626.00	1,018,441.06	260.32
4627.00	1,035,033.43	283.89
4628.00	1,051,726.16	307.84
4629.00	1,068,519.24	332.18
4630.00	1,085,412.68	356.90
4631.00	1,102,406.48	382.01
CREST EL 4632.00' → 4632.00	1,119,500.64	407.52

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\ldms40956\C-244.dwg

REV	DATE	BY	DESCRIPTION
A	10/16/2020	RNW	ISSUED FOR CLIENT REVIEW

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DESIGNED P. BERNHARD
DRAWN R. WOOLSEY
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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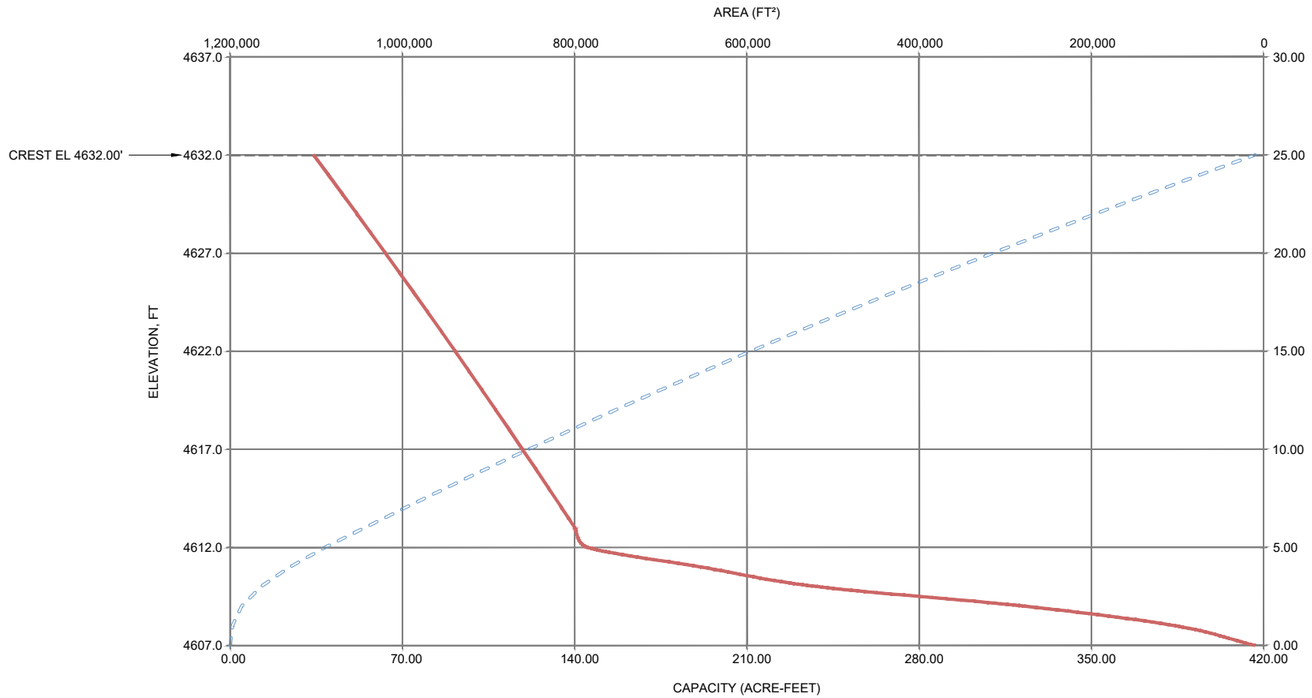
Stantec

INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR WASTEWATER BASIN
CIVIL
WASTEWATER BASIN CLOSURE
BORROW SOURCE 3
PHASE 2 STAGE STORAGE CURVE - SHEET 1

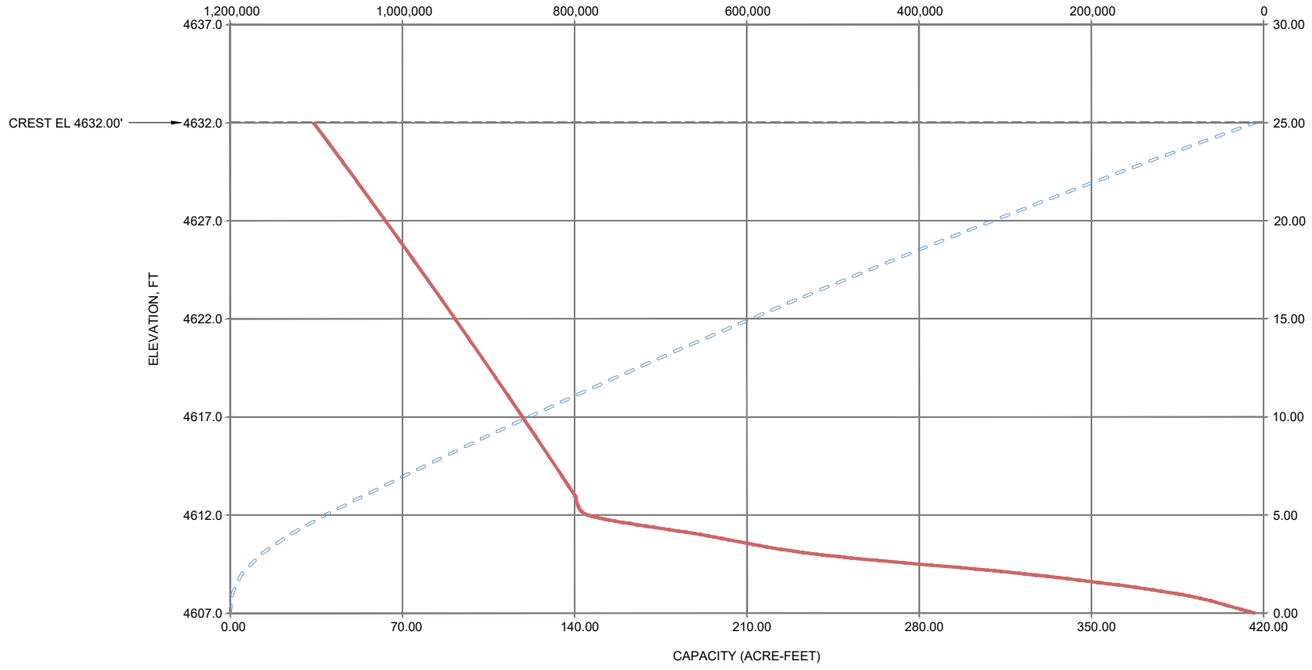
SHEET
C-244

Job# 233001396



AREA CAPACITY CURVE - EVAP POND 1

AREA CAPACITY TABLE - EVAP POND 1		
ELEVATION (FT)	AREA (FT²)	CAPACITY (ACRE-FT)
4607.00	10,000.00	0.00
4608.00	102,000.00	1.10
4609.00	277,200.00	5.29
4610.00	518,390.38	14.28
4611.00	653,369.39	27.70
4612.00	784,924.27	44.19
4613.00	799,849.32	62.38
4614.00	714,878.14	80.91
4615.00	830,010.74	99.79
4616.00	845,247.12	119.02
4617.00	860,587.28	138.60
4618.00	876,031.22	158.53
4619.00	891,578.93	178.82
4620.00	907,230.42	199.47
4621.00	922,985.69	220.48
4622.00	938,844.74	241.85
4623.00	954,807.56	263.58
4624.00	970,874.16	285.69
4625.00	987,044.54	308.16
4626.00	1,003,318.70	331.01
4627.00	1,019,696.63	354.23
4628.00	1,036,178.34	377.83
4629.00	1,052,763.83	401.80
4630.00	1,069,453.10	426.16
4631.00	1,086,246.15	450.91
CREST EL 4632.00' → 4632.00	1,103,142.97	476.04



AREA CAPACITY CURVE - EVAP POND 2

AREA CAPACITY TABLE - EVAP POND 2		
ELEVATION (FT)	AREA (FT²)	CAPACITY (ACRE-FT)
4607.00	10,000.00	0.00
4608.00	102,000.00	1.10
4609.00	277,200.00	5.29
4610.00	518,390.38	14.28
4611.00	653,369.39	27.70
4612.00	784,924.27	44.19
4613.00	799,849.32	62.38
4614.00	714,878.14	80.91
4615.00	830,010.74	99.79
4616.00	845,247.12	119.02
4617.00	860,587.28	138.60
4618.00	876,031.22	158.53
4619.00	891,578.93	178.82
4620.00	907,230.42	199.47
4621.00	922,985.69	220.48
4622.00	938,844.74	241.85
4623.00	954,807.56	263.58
4624.00	970,874.16	285.69
4625.00	987,044.54	308.16
4626.00	1,003,318.70	331.01
4627.00	1,019,696.63	354.23
4628.00	1,036,178.34	377.83
4629.00	1,052,763.83	401.80
4630.00	1,069,453.10	426.16
4631.00	1,086,246.15	450.91
CREST EL 4632.00' → 4632.00	1,103,142.97	476.04

REV	DATE	BY	DESCRIPTION
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SCALE: AS SHOWN

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DESIGNED P. BERNHARD
DRAWN R. WOOLSEY
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 10/16/2020

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Stantec

INTERMOUNTAIN POWER SERVICE CORP

IPSC CCR WASTEWATER BASIN
CIVIL
WASTEWATER BASIN CLOSURE
BORROW SOURCE 3
PHASE 2 STAGE STORAGE CURVE - SHEET 2

SHEET
C-245

Job# 233001396

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: WOOLSEY, ROGER
DWG FILE: C:\pwwrkdir\ldms40956\C-245.dwg

Appendix B

Construction Specifications

IPP CCR CLOSURE TECHNICAL SPECIFICATIONS

DIVISION 02 - SITEWORK

SECTION 02222 – EARTHWORK AND GRADING

PART 1 -- GENERAL

1.1 SUMMARY

A. The Contractor shall be responsible for all activities required to ensure that the designated areas are free from objectionable materials, in accordance with the Contract Documents.

B. Contractor shall be responsible for the excavation and grading of the site to configuration in accordance with the details and to the lines and grades indicated by the project drawings.

C. Contractor shall be responsible for construction of the soil covers to the grades and specifications presented herein.

D. The Contractor shall be responsible for development of borrow areas.

1.2 RELATED SPECIFICATION

A. The following specifications contain requirements that relate to this specification:

- 02272 – Geomembranes

1.3 DEFINITIONS

A. Company: Intermountain Power Service Corp.

B. Engineer: Stantec

C. Contractor: The party to whom the Contract for the work described herein has been awarded and any of its authorized representatives.

1.4 CONTRACTOR SUBMITTALS

A. The Contractor shall submit the following documents for Engineer approval and acceptance prior to mobilization:

1. Samples:

a. The Contractor shall submit samples of materials proposed for the Work.

b. Sample sizes shall be determined by the testing laboratory.

PART 2 -- EQUIPMENT AND MATERIALS

2.1 EQUIPMENT

A. Conventional earth-moving equipment shall be used for the material acquisition. All equipment shall be decontaminated prior to arrival at the site, in good working condition, and suitable for its intended use.

2.2 MATERIALS

A. The following materials shall be furnished by the Contractor from designated soil borrow areas or supplied by the Company as specified below.

1. General Fill: General fill material shall be obtained from the identified borrow areas located on the drawings and shall conform to the gradation limits given in Table 1 below, when tested in accordance with ASTM D 422:

Table 1: General Fill Gradation Requirements

U.S. Standard Sieve Size	% Passing	
	Coarse Range	Fine Range
1.5-inch	100	100
¾-inch	90	100
No.4	65	100
No. 40	30	80
No. 200	10	50

2. Compacted Clay Layer, Clay Trench, and Clay Dividing Berm: Compacted Clay Layer, Clay Trench and Clay Dividing Berm material shall be obtained from the identified borrow areas located on the drawings and shall conform to the gradation limits given in Table 2 below, when tested in accordance with ASTM D 422:

Table 2: Compacted Clay Layer, Clay Trench and Clay Dividing Berm Gradation Requirements

U.S. Standard Sieve Size	% Passing	
	Coarse Range	Fine Range
1-inch	100	100
¾-inch	95	100
No.4	90	100
No. 40	80	100
No. 200	60	100

Note that clay clay material can be used for gernal fill if necessary.

3. Topsoil / Erosion Layer: Topsoil / Erosion Layer material shall be 1.5-inch minus material, shall be a blend of 50% clay material and 50% slty sand to promote soil moisture storage and reduce the potential for soil erosion. The Topsoil / Erosion Layer shall conform to the gradation limits given in Table 3 below, when tested in accordance with ASTM D 422.

Table 3: Topsoil / Erosion Layer Material Gradation Requirements

`	% Passing	
	Coarse Range	Fine Range
1.5-inch	100	100
¾-inch	90	100
No. 4	65	100
No. 40	50	95
No. 200	30	75

PART 3 -- EXECUTION

3.1 EXCAVATION

A. General

1. Excavation is unclassified and includes excavation to required grade, or subgrade elevations, regardless of the character of materials or obstruction encountered.

2. Tolerances for all excavated surfaces shall be within ±0.1 foot of the elevation as specified in the design drawings.

3. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable state safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

4. The Contractor shall provide quantity surveys where so required to verify quantities for Unit Price Contracts.

5. Survey shall be performed prior to beginning Work and upon completion by a surveyor licensed in the State of Utah.

6. If stockpiles will be used, the material shall be transported and stockpiled in an approved stockpiling area.

B. Disposal Of Excess Excavated Material

1. The Contractor shall be responsible for the removal and stockpiling of any excess excavated material according to Section 01552 – Staging and Stockpile Areas.

2. Material shall be disposed of at an approved on-Site disposal area.

3.2 FILL PLACEMENT AND COMPACTION

A. Material Placement

1. Material shall be placed and spread evenly in approximately horizontal layers.

2. Lift thicknesses are specified by material types in the following sections.

3. Unless otherwise approved by the Engineer, loose lift thickness shall not exceed 6 inches, prior to compaction by hand operated compactors.

B. General Fill:

1. General Fill shall be spread in 18-inch loose lifts using equipment meeting the ground pressure requirements described in Section 02272 – Geomembrane to prevent damage to the geomembrane. The equipment shall have GPS elevation grade control capability.

2. Following placement and grading of each lift, the surface shall be compacted with a number of passes by equipment that is capale of achieving the required degree of compaction stated in Table 4.

3. Following placement and grading of the general fill for the liner protection layer, the surface shall be compacted with a number of passes (tracked) by the low-groud-pressure (LGP) dozer. The Contractor shall determine the appropriate number of passes to achieve the required degree of compaction stated in Table 4.

4. Moisture contents of the general fill during placement shall comply with Table 4.

C. Compacted Clay Layer, Clay Trench and Clay Divider Berm:

1. Compacted Clay Layer shall be spread in 8-inch loose lifts. The equipment used to spread lifts shall have GPS elevation grade control capability.

2. Clay Trench and Clay Divider Berm shall be spread in 12-inch loose lifts. The equipment used to spread lifts shall have GPS elevation grade control capability.

3. Following placement and grading of each lift, the surface shall be compacted with a number of passes by equipment that is capale of achieving the required degree of compaction stated in Table 4. The Contractor shall determine the appropriate number of passes.

4. Moisture contents of the Compacted Clay Layer, Clay Trench and Clay Divider Berm during placement shall comply with Table 4.

5. Where clay is to be used as General Fill the contractor shall place, spread, and compact the layer in accordance with Section 3.2.B

D. Topsoil / Erosion Layer:

1. Topsoil Layer shall be spread in one loose lift using equipment meeting the ground pressure requirements described in Section 02272 – Geomembrane to prevent damage to the geomembrane, graded to achieve final design grades, and compacted to meet the requirements of Table 4, by tracking to achieve the final thickness.

2. The surface of the layer shall be tracked into place to maintain the surface of the material, in the event of heavy rain, prior to vegetation.

E. Compaction Requirements:

1. Compaction equipment shall be of the appropriate type and weight for the fill materials being placed in order to achieve the compaction requirements of this Specification and meet the ground pressure requirements described in Section 02272 – Geomembrane where applicable.

2. The Contractor shall submit compaction procedures to the Engineer as part of the Construction Plan submitted. Procedures shall include details of the equipment proposed for use and the number of passes required. The Contractor shall state in the procedures, the steps that will be taken to control moisture content of the fill materials. Approval of the compaction procedures shall be given by the Engineer prior to Contractor undertaking any compaction work.

3. Coverages of Compaction Equipment: Coverages of the compaction equipment shall be carried out so that the compactive effort is uniformly distributed in a systematic manner over the entire lift. Compaction of individual lanes of a lift shall be completed before beginning compaction of adjacent portions of the lift. Individual lanes shall be overlapped by at least 1 ft.

4. In locations where compaction by normal mechanical equipment is not possible and compaction can only be completed by hand tamping, fill shall be moistened, placed and compacted with the aid of pneumatic or hand tampers. Pneumatic and hand tampers shall provide a minimum of 9 psi compactive force.

5. Compaction shall meet the requirements given in Table 4 below in accordance with:

   ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (400 ft-lbf/ft^3) where the material is graded such that 10 percent or more passes a No. 4 sieve.

Table 4: Compaction Requirements for Fill Materials

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density	Percentage of Optimum Moisture
General Fill	90% (±3% of MDD)	±2%
General Fill (Liner Protective Layer)	90% (±3% of MDD)	±2%
Compacted Clay Layer (CB Landfill)	95% (minimum)	±2%
Clay Trench (Wastewater Basin)	90% (±3% of MDD)	NA
Clay Divider Berm (Wastewater Basin)	90% (minimum)	±2%
Erosion Protection Layer (topsoil)	85% (+5%)	±2%

F. Moisture Content

1. For General Fill, Compacted Clay Layer, Clay Divider Berm and Topsoil, the moisture contents of materials to be placed and compacted or scarified and compacted shall be within +2.0 and -2.0 percent of the Optimum Moisture Content (OMC) as

determined by ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3).

2. The moisture content of materials shall be uniform throughout each layer of material placed prior to and during compaction.

3. Perform wetting and drying operations as necessary in order to achieve the required moisture contents prior to compaction.

4. Materials too dry for compaction shall be pre-wetted in the borrow areas. Supplemental water, if required, shall be added to the material at the placement area prior to compaction; by uniform sprinkling, followed by uniform mixing, prior to compaction.

5. Materials too wet for compaction shall be dried to the proper moisture content before compaction. Mixing of wet materials with drier materials may also be performed to achieve the appropriate moisture content, as approved by the Engineer.

6. If the moisture content of fill material placed into the work falls outside the required limits, the Contractor shall condition the material to bring it to within the required limits. If the material cannot be brought readily to the specified moisture content, the Contractor shall remove the material from the work.

3.3 MATERIALS TESTING

A. Samples:

1. Soils testing of samples submitted by the Contractor will be performed by a testing laboratory of the Contractor's choice and at the Contractor’s expense.

2. The Engineer may direct the Contractor to supply samples for testing of any material used in the Work.

3. Particle-size analyses of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-size Analysis of Soils.

4. References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

5. The Contractor shall be bound by applicable provisions of ASTM D 2487 in the interpretation of soil classifications.

B. Field and Laboratory Testing:

1. Field soils testing will be performed by a testing laboratory of the Contractor's choice at the Contractor's expense at the frequency given in Table 5 below.

Table 5: Minimum Required QC Field and Laboratory Testing Methods and Frequencies

Material	Test Name	Testing Method	Minimum QC Testing Frequency
General Fill / Liner Protective Layer	In-Place Moisture and Density – Nuclear Moisture Density Gauge	ASTM D6938	1 per 10,000 CY and per each material source or processing method
	Standard Proctor	ASTM D698	1 per 20,000 CY and per each material source or processing method
	Atterberg Limits	ASTM D4318	1 per Proctor test
	Classification of Soils	ASTM D2487	1 per Proctor test
	Grain-size Distribution	ASTM D6913	1 per Proctor test
Compacted Clay Layer (CB Landfill)	In-Place Moisture and Density – Nuclear Moisture Density Gauge	ASTM D6938	1 per 5,000 CY and per each material source or processing method
	Standard Proctor	ASTM D698	1 per10,000 CY and per each material source or processing method
	Atterberg Limits	ASTM D4318	1 per Proctor test
	Classification of Soils	ASTM D2487	1 per Proctor test
	Grain-size Distribution	ASTM D6913	1 per Proctor test
Clay Ternch / Clay Dividing Berm	In-Place Moisture and Density – Nuclear Moisture Density Gauge	ASTM D6938	1 per 5,000 CY and per each material source or processing method
	Standard Proctor	ASTM D698	1 per 10,000 CY and per each material source or processing method
	Atterberg Limits	ASTM D4318	1 per Proctor test
	Classification of Soils	ASTM D2487	1 per Proctor test
	Grain-size Distribution	ASTM D6913	1 per Proctor test
Topsoil/Erosion Layer	In-Place Moisture and Density – Nuclear Moisture Density Gauge	ASTM D6938	1 per 2,000 CY and per each material source or processing method
	Standard Proctor	ASTM D698	1 per 5,000CY and per each material source or processing method
	Atterberg Limits	ASTM D4318	1 per Proctor test
	Classification of Soils	ASTM D2487	1 per Proctor test
	Grain-size Distribution	ASTM D6913	1 per Proctor test

Notes:
1. The Engineer may revise the listed frequencies and test methods during the work.
2. Standard Proctor testing shall be performed at the frequencies listed in the table and as needed to obtain Proctor values representative of the placed material.

C. Contractor's Responsibilities:

1. Re-working to Attain Specified Limits: When the test results indicate that compaction, water content, or relative compaction is not in conformance with specified limits, the Contractor shall make immediate adjustments in procedures as necessary to conform to the specified limits. Re-working to attain the specified limits may include removal, rehandling reconditioning, re-rolling, or combinations of these procedures. The Contractor shall perform all re-work required to achieve the specified compaction water content and relative compaction at no cost to the Company.

2. Confirmation of In-Situ Material Properties: The Contractor shall independently confirm the geotechnical properties of the proposed Cover Soil material and determine the appropriate moisture conditioning and compaction methods to ensure that cover material meets the project specifications and are constructed to the design lines and grades as provided in the design drawings. Claims arising from material shrinkage and/or swelling will not be entertained.

- END OF SECTION -

SECTION 02272 –GEOMEMBRANES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall supply all labor, equipment, materials, and appurtenances for the complete installation of geomembranes as per contract documents.

B. Sufficient geomembrane material shall be furnished to cover all lined areas, including seam overlaps and anchor trenches. One percent shall be added to the length of each panel to allow for shrink and wrinkles. The geomembrane shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation.

1.2 SUBMITTALS

A. Prior to installation of geomembrane material, the CONTRACTOR shall submit the following for the ENGINEER's approval:

1. Resin Data, including a certification stating that the resin meets the specification requirements (see Paragraph 2.3.C).

2. Statement certifying that geomembrane materials have been tested and inspected in accordance with Paragraph 1.5.

3. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).

4. Specification sheet stating that the geomembrane meets the specification requirements (see Paragraph 2.3.E)

5. Installation layout drawings showing the proposed panel layout to cover the lined area shown, with proposed size, number, position, and sequence of placing all sheets and indicating the location and direction of all field joints and penetrations. Installation layout drawings shall also show complete details and/or methods for anchoring, field joints, seals at existing structures, etc.

6. Four 8-inch x 10-inch samples of the material proposed for the lining

7. A Statement of Qualifications for the geomembrane manufacturer and installation contractor with sufficient detail to satisfy the experience requirements of Paragraph 1.3.

8. Installation Contractor's Quality Control Plan.

B. Placement of geomembrane material shall not commence until the submittals required in Paragraph 1.2 A have been approved by the ENGINEER.

C. Upon completion of geomembrane installation, the CONTRACTOR shall submit the following:

1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.

2. Material and installation warranties

3. As-built drawings showing actual geomembrane placement and seams including complete details.

1.3 QUALIFICATIONS

A. **Qualifications of Manufacturer:** The manufacturer shall have at least five years continuous experience in manufacturing polyethylene geomembrane and/or experience totaling not less than 5 million square feet of manufactured polyethylene geomembrane.

1. The following manufacturers are approved by the COMPANY:

a. Agru America

b. Solmax

B. **Qualifications of Installation Contractor:** The installation contractor shall be the manufacturer, or shall be trained to install the manufacturer's material, and shall have experience of not less than 3 projects and not less than 1,000,000 square feet of successfully installed polyethylene geomembrane.

1. Field Installation Supervisor: Installation shall be performed under the constant direction of a Field Installation Supervisor who shall remain on site and be responsible, throughout the geomembrane installation, for layout, seaming, testing, repairs, and all other activities by the Installer. The Field Installation Supervisor shall have installed or supervised the installation of not less than 1,000,000 square feet of polyethylene geomembrane.

2. Master Seamer: Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor) who has seamed not less than 1,000,000 square feet of polyethylene geomembrane, using the same type of seaming apparatus specified for this project. The Field Installation Supervisor and/or Master Seamer shall be present whenever seaming is performed.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

ASTM D792	Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D1004	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1505	Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1603	Test Method for Carbon Black in Olefin Plastics
ASTM D3895	Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D4218	Standard Test Method for Determination of Carbon Black in Polyethylene Compounds
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D5596	Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D5994	Standard Test Method for Measuring Core Thickness of Textured Geomembranes
ASTM D6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
ASTM D6693	Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
ASTM D7240	Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)
GRI GM 13	Test Methods, Test Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
GRI GM 14	Standard Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
GRI GM 17	Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.5 QUALITY CONTROL

A. All WORK shall be constructed, monitored and tested in accordance with the requirements of the Installation Contractor's Quality Control Plan (CQP), which shall be submitted in accordance with Paragraph 1.2 A.

B. The CONTRACTOR shall be aware of all activities outlines in the CQP, and the CONTRACTOR shall account for these activities in the construction schedule. No additional costs to the COMPANY shall be allowed by the CONTRACTOR as a result of the performance of the CQP activities.

1.6 QUALITY ASSURANCE

A. The COMPANY shall conduct quality assurance monitoring and testing of the geomembrane installation under the direction of the ENGINEER. This testing is defined in Part 3 of the Specification and include, but are not limited to, trial welds (Section 3.2.F.5) and seam testing (Section 3.3).

1.7 WARRANTY

A. The CONTRACTOR shall procure and provide copies of the manufacturer's warranty for the geomembrane system and all appurtenances. The warranty shall cover materials for a period of 5 years prorated and workmanship for a period of 1 year from the date of the COMPANY's acceptance of the project. The warranty shall not be prorated for workmanship, but shall be a full replacement value warranty. Should defects or premature loss of use within the scope of the above warranty occur, repair and/or replacement of damaged material shall be performed by the CONTRACTOR at no cost to the COMPANY.

PART 2 -- PRODUCTS

2.1 SCHEDULE OF GEOMEMBRANES

TABLE 1 – SCHEDULE OF GEOMEMBRANES

Application	Geomembrane
Bottom Ash Basin Cover Geomembrane	60-mil HDPE, Textured (Single Side)
Wastewater Basin Cover Geomembrane	60-mil LLDPE, Textured (Single Side)

2.2 APPROVED GEOMEMBRANE PRODUCTS

A. 60-mil HDPE, Textured (Single Side)

1. Solmax HDPE Single Textured

2. Agru America HDPE MicroSpike Single Sided

B. 60-mil LLDPE, Textured (Single Side)

1. Solmax LLDPE Single Textured

2. Agru America LLDPE MicroSpike Single Sided

2.3 "OR EQUAL" PRODUCTS

A. CONTRACTOR shall provide the COMPANY approved geomembrane products listed in Paragraph 2.2, or provide "or equal" products that meet the requirement indicated below.

B. **Materials:** The material shall be black, coextruded high-density polyethylene (HDPE) geomembrane or black, coextruded linear low-density polyethylene (LLDPE) geomembrane as listed below and as shown on the Contract Drawings.

C. The geomembrane shall be manufactured from new, first quality resin produced in the United States and shall be compounded and manufactured specifically for producing geomembrane. Natural resin (without carbon black) shall meet requirements listed in Table 2:

TABLE 2 – RESIN PROPERTIES

Property	Test Method	HDPE Value	LLDPE Value
Density (g/cm3)	ASTM D 792 / ASTM D 1505	≥0.932	≤0.926
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	≤1.0	≤1.0

Reprocessed materials shall not be acceptable. No post-consumer resin of any type shall be added to the formulation.

D. **Fabrication:** The geomembrane shall have a minimum 20-foot seamless width. The geomembrane shall be supplied in rolls with labels identifying the thickness of material, the length and width of the roll, the lot and roll numbers, and the name of the manufacturer.

E. Properties:

1. The geomembrane shall not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.

2. The geomembrane shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

3. The finished product shall be uniform in color, thickness, and surface texture and shall meet the **minimum** average specifications listed in Table 3 and as stipulated in GRI Test Method GM13 and GM17 for HDPE and LLDPE liners, respectively.

F. Manufacturer Quality Control

1. All resins and additives used in the fabrication of the geomembrane shall be sampled, tested, and approved by the MANUFACTURER before being eligible for use. Sampling and testing of the resins and additives shall be performed in accordance with the Manufacturer's Quality Control program.

2. All roll goods shall be inspected for defects and impurities. Geomembrane thickness shall be measured for each roll.

3. All geomembrane sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Paragraph 2.3.E and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

4. The geomembrane shall be tested by the MANUFACTURER for the listed properties provided in the tables in Part 2. A log shall be maintained showing the testing date, time and results. Any rolls not meeting the visual inspection or requirements of the specification shall be rejected.

5. Certification that the material has been inspected, tested, and meets all requirements shall be submitted to the ENGINEER. Test results shall be made available to the ENGINEER upon request.

TABLE 3 – GEOMEMBRANE PROPERTIES

Tested Property	Test Method	Frequency	Textured HDPE	Textured LLDPE
Thickness, (minimum average) mil; Lowest individual reading (-10%);	ASTM D 5199 (Sm.) / ASTM D 5994 (Tx.)	every roll	60 54	60 54
Density, g/cm^3	ASTM D 792 / ASTM D 1505	200,000 lb	0.94	0.94
Tensile Properties (each direction) Strength at Yield, lb/in-width Strength at Break, lb/in-width Elongation at Yield, % Elongation at Break, %	ASTM D 6693, Type IV Dumbell, 2 ipm G.L. 1.3 in (33 mm) G.L. 2.0 in (51 mm)	20,000 lb	 126 90 12 100	 N/A 120 N/A 250
Tear Resistance, lb	ASTM D 1004	45,000 lb	42	33
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	90	66
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	18	18
Notched Constant Tensile Load(2), hr	ASTM D 5397, Appendix	200,000 lb	300	N/A
Oxidative Induction Time, min	ASTM D 3895, 200° C; O_2, 1 atm	200,000 lb	≥100	≥100

NOTES:
(1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3. *Modified

PART 3 -- EXECUTION

3.1 STORAGE

A. After delivery, all roll goods shall be stored so as to be protected from puncture, dirt, grease, moisture and excessive heat which may result in damage or degradation of the material. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface and should not be stacked more than two rolls high.

3.2 INSTALLATION

A. **General:** The geomembrane shall be installed in accordance with the following specifications and approved procedures submitted with the shop drawings.

B. Subgrade Preparation and Inspection:

1. Surfaces to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the membrane with no sudden, sharp, or abrupt changes or break in grade.

2. The CONTRACTOR shall, on a daily basis, approve the surface on which the geomembrane shall be installed. The surface shall be smooth, clean and free of foreign material, sharp objects, frost, standing water or excessive moisture. Installation shall proceed only if the surface conditions are found satisfactory.

C. Equipment:

1. Welding equipment and accessories shall meet the following requirements:

a. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.

b. An adequate number of welding apparati shall be available to avoid delaying work.

c. Power source must be capable of providing constant voltage under combined line load.

D. Deployment:

1. Each panel shall be assigned a simple and logical identifying code.

2. The coding system shall be subject to approval by the ENGINEER and shall be determined at the job site.

3. The CONTRACTOR shall visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

4. Deployment of geomembrane panels shall be performed in a manner that shall comply with the following guidelines:

a. Geomembranes shall be installed according to site-specific specifications and MANUFACTURER recommendations.

b. The geomembrane shall be placed in such a manner as to assure minimum handling.

c. Only those sheets of material which can be anchored and sealed together that same day shall be unpackaged and placed in position.

d. Deployment of the geomembrane shall proceed with ambient temperatures greater than 32° F. Placement can proceed below 32° F only after it has been verified by the ENGINEER that the material can be seamed in accordance with GRI GM9 (Cold weather seaming of geomembranes).. Placement shall not be done during any precipitation, in the presence of excessive moisture (fog, rain, dew) that deposits a residue on the liner that is detectable for sight or touch and could adversely impact the performance of the seam welding process.

e. Placement shall not be done in the presence of excessive winds which could adversely impact the ability to complete the seam welding process. In areas where wind is prevalent, installation should be started at the upwind side of the project and proceed downwind. The leading edge of the geomembrane shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

f. Geomembrane shall be unrolled using methods that shall not damage geomembrane and shall protect underlying surface from damage (spreader bar, protected equipment bucket).

g. Ballast (commonly sandbags) which shall not damage geomembrane shall be placed on geomembrane to prevent wind uplift.

h. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking shall not be permitted on the geomembrane.

i. No vehicle traffic shall travel on the geomembrane other than an approved low ground pressure vehicle.

j. Geomembrane shall be protected in areas of heavy traffic by placing protective cover over the geomembrane. Protective cover is material as approved by the ENGINEER that is placed over the geomembrane to reduce the ground pressure of heavy traffic to less than 8 psi on the liner.

5. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

E. Lining sheets shall be closely fitted and sealed around inlets, outlets, and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor or as approved by the ENGINEER. All piping, structures, and other projections through the lining shall be sealed with approved sealing methods.

F. Field Seams:

1. Seams shall meet the following requirements:

   a. To the maximum extent possible, seams shall be oriented parallel to line of slope, i.e., down and not across slope.

   b. The number of field seams in corners, odd-shaped geometric locations and outside corners shall be minimized.

   c. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

   d. Be designated using a sequential seam numbering system compatible with panel numbering system, and that is agreeable to the ENGINEER.

   e. Seam overlaps shall be aligned to be consistent with the requirements of the welding equipment being used.

2. During welding operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

3. Extrusion Welding

   a. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.

   b. Clean geomembrane surfaces by disc grinder or equivalent.

   c. Purge welding apparatus of heat-degraded extrudate before welding.

4. Hot Wedge Welding

   a. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.

   b. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.

   c. Protect against moisture build-up between sheets.

5. Trial Welds

   a. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

   b. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

   c. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

   d. Cut four, one-inch wide by six-inch long test strips from the trial weld.

   e. Quantitatively test specimens for peel adhesion, and then for shear strength.

f. Trial weld specimens shall pass when the results shown in the Table 4 are achieved in both peel and shear test:

TABLE 4 – SEAM PROPERTIES

Property	Test Method	Minimum Values	
		60-mil HDPE	60-mil LLDPE
Peel Strength (fusion) ppi (1), (2)	ASTM D6392	91	75
Peel Strength (extrusion) ppi (1), (2)	ASTM D6392	78	66
Shear Strength (fusion and ext.) ppi	ASTM D6392	120	90

Notes:
1) The break, when peel testing, occurs in the geomembrane material itself, not through peel separation (FTB).
2) The break is ductile.

g. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

h. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

i. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the geomembrane installation. CONTRACTOR shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

j. Defects and Repairs

1) Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

2) Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

G. **Anchor Trench:** The geomembrane shall be placed and secured in an earth anchor trench as indicated in the Contract Drawings. The installer shall coordinate with the earthwork contractor regarding excavation and backfilling of the anchor trench. Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. If damage occurs, it shall be repaired prior to backfilling.

3.3 SEAM TESTING

A. Field Destructive Testing

1. Destructive seam tests shall be performed to evaluate bonded seam strength. The frequency of sample removal shall be one sample per 500 linear feet of seam. Location of the destructive samples shall be selected by the ENGINEER. Field testing shall take place as soon as possible after completion of the seam.

   a. At the sole discretion of the ENGINEER, destructive seam tests may be reduced in frequency by following the procedures of Geosynthetic Research Institute (GRI) Standard Guide GM 14.

2. Sample labeling shall be the responsibility of the ENGINEER and shall include test number, seam number, seaming machine number, job number, date welded, and welding tech number.

3. The samples shall be approximately 12 inches x 25 inches. The samples shall then be cut into two samples approximately 12 inches x 12 inches: one for field testing and one for archiving or independent testing.

4. The sample for field testing shall have ten coupons cut and be tested with a tensiometer adjusted to a pull rate as shown below. The strength of four out of five specimens shall meet or exceed the values below, and the fifth value must meet or exceed 80% of the value below.

   a. Seam must exhibit film tear bond (FTB). Welds shall have less than 25% incursion into the weld.

   b. Peel and shear values shall meet or exceed the values in Table 4 (at 2 inches/minute)

5. All destructive weld test data shall be logged by the ENGINEER.

6. If a test fails, additional samples shall be cut, approximately ten feet on each side of the failed test, and retested. This procedure shall be repeated until a sample passes. Then the area of the failed seam between the two tests that pass shall be capped or reconstructed.

B. Non-Destructive Testing

1. The CONTRACTOR shall non-destructively test all seams their full length for continuity using an air pressure or vacuum test.

2. Air Pressure Testing

   a. Air pressure testing shall be performed on all seams welded with a double seam fusion welder.

   b. The equipment used for air pressure testing shall consist of an air tank or pump capable of producing a minimum of 35 psi and a sharp needle with a pressure gauge attached to insert into the air chamber.

   c. Both ends of the seam to be tested shall be heated and squeezed together.

d. The needle with gauge shall be inserted into the air channel and the channel shall be pressurized to 30 psig.

e. If the pressure in the air channel drops by more than 4 psig over a period of five minutes, then the seam has failed.

f. If the seam fails the air pressure test, the leak shall be located and the area cut away. Air pressure testing shall be performed on the remaining portions of the seam until all portions of the seam pass the test.

g. The area cut away shall be repaired with a patch. The patch shall be tested according to the procedures outlined below for vacuum testing.

3. Vacuum Testing

a. Vacuum testing shall be performed on all seams welded with an extrusion welder.

b. The equipment used for vacuum testing shall consist of a vacuum pumping device, a vacuum box, and a foaming agent in solution.

c. The section of seam to be tested shall be wetted with a foaming agent and the vacuum box shall be placed over the wetted area. Air shall be evacuated from the vacuum box until a seal between the box and the geomembrane has been formed.

d. The minimum vacuum shall be equivalent to 5 psig (10 inches of mercury).

e. If fusion welded seams are being tested, the overlap flap must be cut off prior to testing.

f. The seam shall be observed through the viewing window for bubbles emitting from the seam.

g. If no bubbles are observed, the box shall be moved on to the next area for testing. If bubbles are observed, the area of the leak shall be marked for repair.

h. After completion of repairs, the repair seam shall be retested according to the requirements of paragraph 3.3B.

3.4 INSPECTION AND REPAIR

A. **Field Inspection:** All seals to penetrations as well as all seams and non-seam areas of the geomembrane shall be inspected for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. Each suspect location shall be non-destructively tested as appropriate and repaired accordingly.

B. Repair Procedures:

1. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

2. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

3. CONTRACTOR shall be responsible for repair of defective areas.

4. Agreement upon the appropriate repair method shall be decided between ENGINEER and CONTRACTOR by using one of the following repair methods:

   a. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

   b. Abrading and Re-welding- Used to repair short section of a seam.

   c. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

   d. Capping- Used to repair long lengths of failed seams.

   e. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

   f. Remove the unacceptable seam and replace with new material.

5. The following procedures shall be observed when a repair method is used:

   a. All geomembrane surfaces shall be clean and dry at the time of repair.

   b. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

   c. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

6. Repair Verification

   a. Number and log each patch repair (performed by ENGINEER).

   b. Non-destructively test each repair using methods specified in this Specification.

7. The CONTRACTOR shall also keep detailed record drawings showing the location, size, type, and frequency of all repairs made during the installation of the geomembrane. These record drawings shall be updated by the CONTRACTOR on a daily basis and submitted to the COMPANY upon completion of the project. Inspection of these record drawings shall be made available to the ENGINEER or the COMPANY for verification and review at any time during the construction period.

3.5 ACCEPTANCE

A. The CONTRACTOR shall retain all ownership and responsibility for the geomembrane system until acceptance by the ENGINEER. Final acceptance shall occur when the following conditions are met:

   1. Installation is finished.

2. Verification of the adequacy of all field seams and repairs is complete.

3. Submittals required in Paragraph 1.2 D have been accepted by the ENGINEER.

- END OF SECTION –

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SECTION 02930 - SEEDING

PART 1 -- GENERAL

1.1 SUMMARY

A. The Contractor shall apply reclamation seed mix to the completed cover, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications:

FS O-F-241D	Fertilizer, Mixed, Commercial.

B. Commercial Standards:

ANSI/ASTM D 422	Method for Particle-size Analysis of Soils.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals for approval.

B. Materials List: A list of all materials to be used in the seeding operations together with the source of those materials. The list shall include mulches, soil amendments, seed mixtures, and erosion control blanketing. Manufacturer's literature showing physical characteristics, applications, and installation instrumentation shall be included.

C. Schedules: The following work plans, before work is started.

1. Delivery schedule at least 10 days prior to the intended date of the first delivery.

2. Seeding Operation: A list of seeding and mulching equipment to be used.

D. Reports

1. Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

2. Reports for the following materials shall be included.

a. Fertilizer: For chemical analysis and composition percent.

b. Seed: For mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed content, date tested and state certification.

E. Certificates: Certificates of compliance that materials meet the indicated requirements prior to the delivery of materials.

F. Records:

1. Plant Establishment Period

2. Maintenance Report

3. Maintenance Instructions

1.4 CLEANUP

A. Upon completion of all seeding operations, the portion of the Site used for a work or storage area by the Contractor shall be cleaned of all debris, superfluous materials, equipment, and garbage.

1.5 MAINTENANCE OF LANDSCAPING PLANTING PRIOR TO ACCEPTANCE OF PROJECT

A. General: The Contractor shall be responsible for protecting seeded areas until final acceptance of the Work.

B. Upon completion of seeding, the entire planted area shall be soaked to saturation by a fine spray. Care shall be taken to avoid excessive washing, or puddling on the surface, and any such damage caused thereby shall be repaired by the Contractor.

C. Protection: The Contractor shall provide adequate protection to all newly seeded areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until the end of the one-year warranty period.

1.6 FINAL INSPECTION AND GUARANTEE

A. Inspection of seeded areas will be made at final acceptance

B. Written notice requesting inspection shall be submitted to the Engineer at least 10 days prior to the anticipated inspection date.

C. Any delay in completing the Work of this Section beyond a single season will be cause for extending the correction of defects period an equal time.

D. The Contractor shall, without additional expense to the Company, replace seeding which develops defects or dies during the correction period.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Cover soil shall be obtained from onsite borrow sources.

2.2 TOPSOIL

A. General fill and clay to be blended to generate the topsoil shall be obtained from the pre-established borrow source at a location directed by the Company and placed in accordance with Section 02222 – Earthwork and Grading.

2.3 FERTILIZER AND ADDITIVES

A. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.

B. Fertilizers shall be uniform in composition, dry, and free flowing.

C. Chemical fertilizers shall be a mixed uncommercial fertilizer with nitrogen (N), phosphorous (P), and potassium (K) at the following application rates. Nitrogen shall be applied at 70 lbs /acre in the form of ammonium nitrate (33-0-0). This is an equivalent of 23 lbs of total N/acre (70 x 33%). Phosphorous shall be applied at 150 lbs/acre in the form of triple super phosphate (0-44-0). This form of phosphorous contains 20% total P, so the application of total P will be 30 lbs/acre. Potassium shall be applied at 60 lbs/acre in the form of potassium chloride (0-0-60). This form of potassium contains 50% total K, so the application of total K will be 30 lbs/acre. Fertilizer recommendations may be modified as to the forms or blends of fertilizer used as formulations vary by region. The total nutrient application rate for each of the nutrients shall be matched within ±10% of what is recommended. Fertilizers shall be uniform in composition, dry, and free flowing.

2.4 MULCH

A. Wood Cellulose Fiber: shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to aid visual monitoring during application. Composition will include at least 70 percent specially prepared virgin cellulose fiber and shall contain the following properties: recycled cellulose fiber (30 percent minimum), ash content (0.8 to 1.1 percent maximum), water holding capacity (10 to 1 ratio of water to fiber), and pH range from 4.5 to 5.5.

B. Weed free straw mulch, or native hay, for a soil/seed stabilizer shall be clean hay or straw applied at a rate of 2 tons per acre. Mulch shall be crimped into soil with a mulch crimper. Spacing on the blades of the mulch crimper shall be 6-inches minimum and 9-inches maximum. Blades shall be sufficiently weighted to penetrate the ground 3 inches.

2.5 SEED MIXTURES

A. All seed shall conform to applicable County, State of Utah, and Federal regulations. Seed shall be mixed by the seed supplier. The Contractor shall furnish the seed supplier's guaranteed germination of each variety listed in the seed mixture. Grass seed shall not be delivered to the Site until samples have been approved by the Engineer. Approval of samples, however, shall not affect the right of the Engineer to reject seed upon or after delivery. Seed which has become wet, moldy, or otherwise damaged prior to use will not be accepted.

B. Seed shall be delivered in strong, clearly marked bags not exceeding 50 pounds each.

C. Seed shall be fresh, clean, and new-crop seed composed of the following varieties mixed in the proportions by weight as indicated. Seed shall be tested for compliance with the minimum percentage of purity and germination requirements. All rates specified shall be pure live seed (PLS).

D. The seed mixture shall not contain more than 5 percent weeds or other species that are not required.

E. Any deviation of the indicated seed mixture composition shall be approved by the Engineer prior to delivery.

SEED MIXTURE	
Common Names	**Drill Seeding Rate (lbs pf Pure Live Seed/Acre)**
Tall Wheatgrass	2.0
Hercules Tall Wheatgrass	2.0
AC Saltlander Green Wheatgrass	4.0
Garrison Creeping Foxtail	2.5
Intermediate Wheatgrass	2.5
FSG423ST Salt Tolerant Alfalfa	1.5
Strawberry Clover	1.5
Total	16.0

PART 3 -- EXECUTION

3.1 GENERAL

A. Delivery of seed and fertilizer may begin only after samples and tests have been approved by the Engineer. Seed and fertilizer furnished shall not be different from the approved sample.

B. Seeding shall not be performed at any time when it may be impaired by climatic conditions.

3.2 SOIL PREPARATION

A. The seeding shall not begin until the Contractor has repaired all areas of settlement, erosion, rutting, etc. and the soils have been placed, compacted, and contoured to finish grade. The Engineer shall be notified of areas that prevent the planting work from being executed.

B. After removal of waste materials in the planting areas, such as weeds, roots, rocks 6 inches and larger, construction materials, etc., the seeding subgrade shall be tilled to a depth of 6 inches and all surface irregularities removed.

C. Areas requiring grading by the Contractor including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.

D. Any unusual subsoil condition that will require special treatment shall be reported to the Engineer.

E. Topsoil: Topsoil shall be placed in accordance with Section 02222 – Earthworks and Grading. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, excessively compacted or in a condition detrimental to the proposed planting or grading.

F. Fertilizer: Fertilizer shall be applied at the following rates:

1. Nitrogen shall be applied at 70 lbs /acre in the form of ammonium nitrate (33-0-0). This is an equivalent of 23 lbs of total N/acre (70 x 33%).

2. Phosphorous shall be applied at 150 lbs/acre in the form of triple super phosphate (0-44-0). This form of phosphorous contains 20% total P, so the application of total P will be 30 lbs/acre.

3. Potassium shall be applied at 60 lbs/acre in the form of potassium chloride (0-0-60). This form of potassium contains 50% total K, so the application of total K will be 30 lbs/acre.

G. Fertilizer shall be incorporated into the soil to a minimum depth of 6 inches and may be incorporated as part of the tillage operation.

H. Tillage

1. Preparation. Seed areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Seed areas compacted by construction operations shall be completely pulverized by tillage.

2. Protection. Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3. Finish Grading. Finished grade shall be 1-inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing. Make minor adjustments of finish grades as directed by the Engineer.

I. No seeding shall be done when wind velocity exceeds 4 mph, within 4 hours after rain, or if the surface has been compacted without first loosening the ground.

3.3 HYDROSEEDING

A. **Equipment:** Mixing shall be performed in a tank. The tank shall have a built-in continuous agitation and circulation system, of sufficient operating capacity to produce a homogenous slurry of mulch, stabilizer, seed, fertilizer and water in the designated unit proportions for a minimum coverage of one-half acre. The tank shall have a discharge system which will permit attachment of at least 500-feet of hose extensions, a change of elevation of 150-feet in height from tank to discharge nozzle, and still retain enough pressure to apply the slurry to the areas at a continuous and uniform rate.

B. **Proportions:** Proportions of mulch, seed, stabilizer and water per acre shall be as indicated in the approved Revegetation Plan, or as otherwise approved by the ENGINEER.

C. Application

1. With agitation system operating at part speed, water shall be added to the tank and good recirculation shall be established. Materials shall be added in such a manner that they are uniformly blended into the mixture.

2. Slurry distribution shall begin immediately. Application of slurry shall be done only when rain is not anticipated for at least three days after slurry application.

3. The entire tank of each batch of slurry shall be emptied and the slurry evenly applied to areas to be hydroseeded within a 2 hour period following the mixing of each slurry batch. Slurry batches not applied during this time will be rejected.

3.4 DRILL SEEDING

A. **Equipment:** Seeding drill shall be a mechanical grass drill with depth bands and have multiple seed boxes to appropriate to the size and weight of the specified seeds.

B. All seed shall be drilled to one-quarter (1/4) inch to one half (1/2) inch into the soil at the specified seed rate.

C. CONTRACTOR shall drill on-half (1/2) of the required seed in one direction, and then drill the remaining half of the required seed in a direction 90° to the first half.

3.5 SEEDING COMPLETION

A. Mulching: Immediately after seeding, the entire area shall be mulched with one of the two following methods:

1. Weed free straw or native hay at a rate of 2 tons per acre. Weed free straw mulch or native hay for a soil/seed stabilizer shall be clean hay or straw. Mulch shall be crimped into soil with a mulch crimper. Spacing on the blades of the mulch crimper shall be 6-inches minimum and 9-inches maximum. Blades shall be sufficiently weighted to penetrate the ground 3-inches.

2. Hydromulching with wood fiber mulch can be used as an alternative to straw or hay and applied at a rate of 1.5 tons/acre along with a tackifier to bind the mulch to the soil.

3.4 INSPECTION

A. At the completion of the work, the Contractor shall request a preliminary inspection by the Engineer to determine the condition of seeding.

B. A final inspection shall be requested 48 hours following seed germination. The Contractor and Engineer will be present for the inspection. Seeded areas considered for final inspection shall show uniform smooth ground surface without eroded ruts or gullies and evidence of uniform seed germination.

3.5 ACCEPTANCE

A. If the installation is found satisfactory, the Company will approve the work in writing.

B. If the installation is found unsatisfactory, the Engineer will submit a punch list of conditions to correct at the Contractor's expense. The Contractor shall be responsible for requesting additional inspections after the conditions of the punch list have been corrected.

C. The final acceptance criteria for seeding will be an average of one seedling (from seeded species) per square foot after the first growing season. Therefore, for seeding performed in late fall, the evaluation of final acceptance will be determined in the fall of next year.

D. Any areas not achieving the acceptance criteria presented above will be re-seeded at the expense of the Contractor.

3.6 REPAIRS

A. Seed shall be re-applied in any area, including washout gullies and/or slopes, where growth has not initiated during the first rainy season, November through April, following initial application. Washout gullies will require the placement of additional topsoil to fill washouts in accordance with Section 02222 – Earthwork and Grading, prior to re-seeding.

- END OF SECTION -

Appendix C

Borrow Area 1 & 3 Test Pit Logs

TRENCH TEST PIT LOG FORM

Project IPSC CCR Closures **Project Number** 233001396

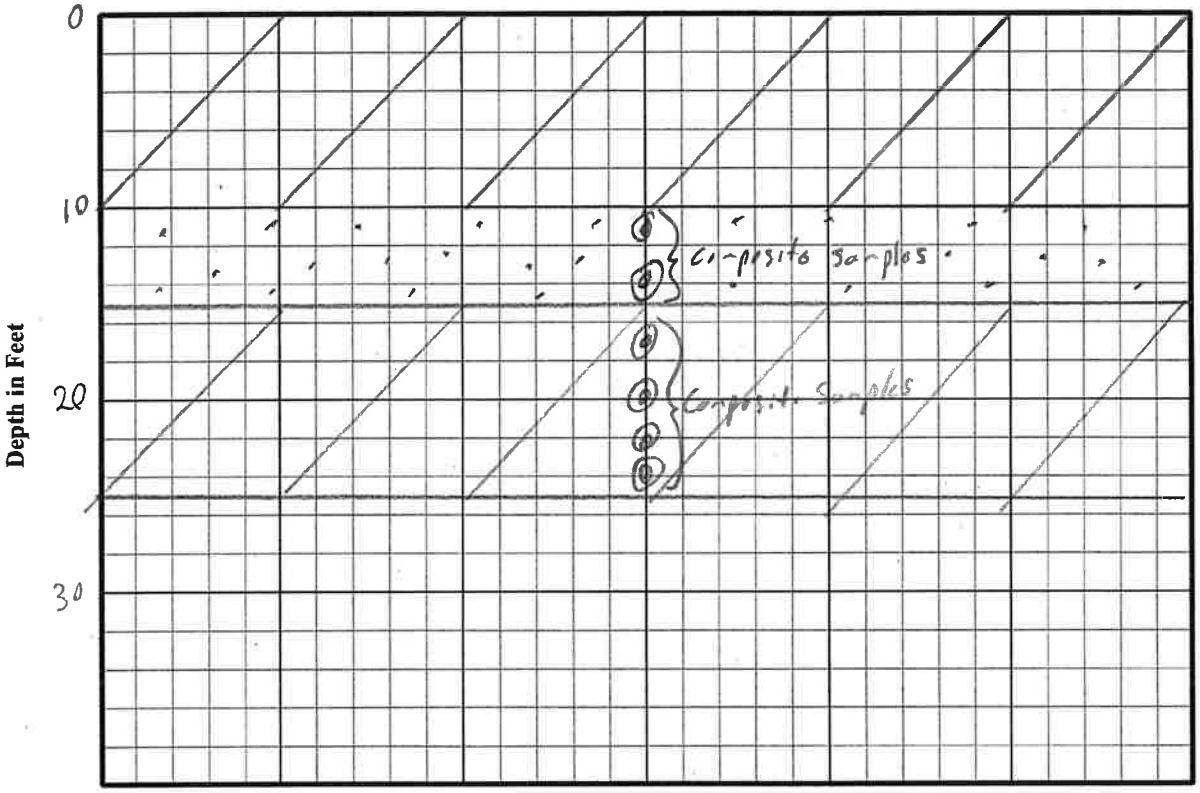
Sample Location Borrow Area 1 **Trench Number** B1TP-1 **Date** 10/29/20

Coordinates: Inside Stake _____ **Outside Stake** _____

Native/Fill Stake _____

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-10' - Sand and gravel, No samples collected

10-15' - Light brown, silty sand, no plasticity

15-25' - Light brown, transitions to sandy clay, moderate plasticity

Begin Trench 12:45 **Finish Trench** 1200 **Trenching Contractor** IPSC

Total Depth 20' **Total Length** 10'

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project IPSC CCR Closures Project Number 233001396

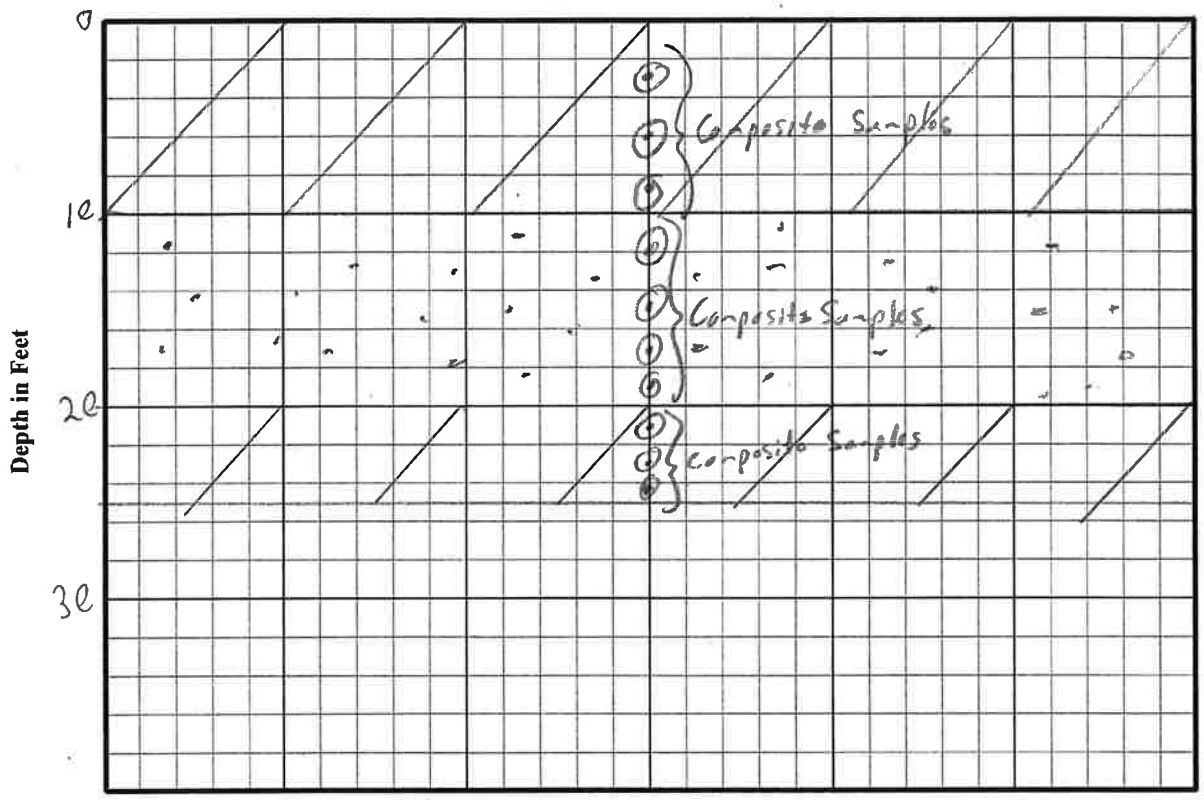
Sample Location Borrow Area 1 Trench Number BTP-2 Date 10/29/20

Coordinates: Inside Stake See map Outside Stake

Native/Fill Stake

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-10' - Light brown, silty sand (SM), no plasticity

10-20' - Same as above transitioning to sandy clay

20-25' - Light brown, sandy clay (CL), moderate plasticity

Begin Trench 1:10 Finish Trench 1:25 Trenching Contractor IPSC

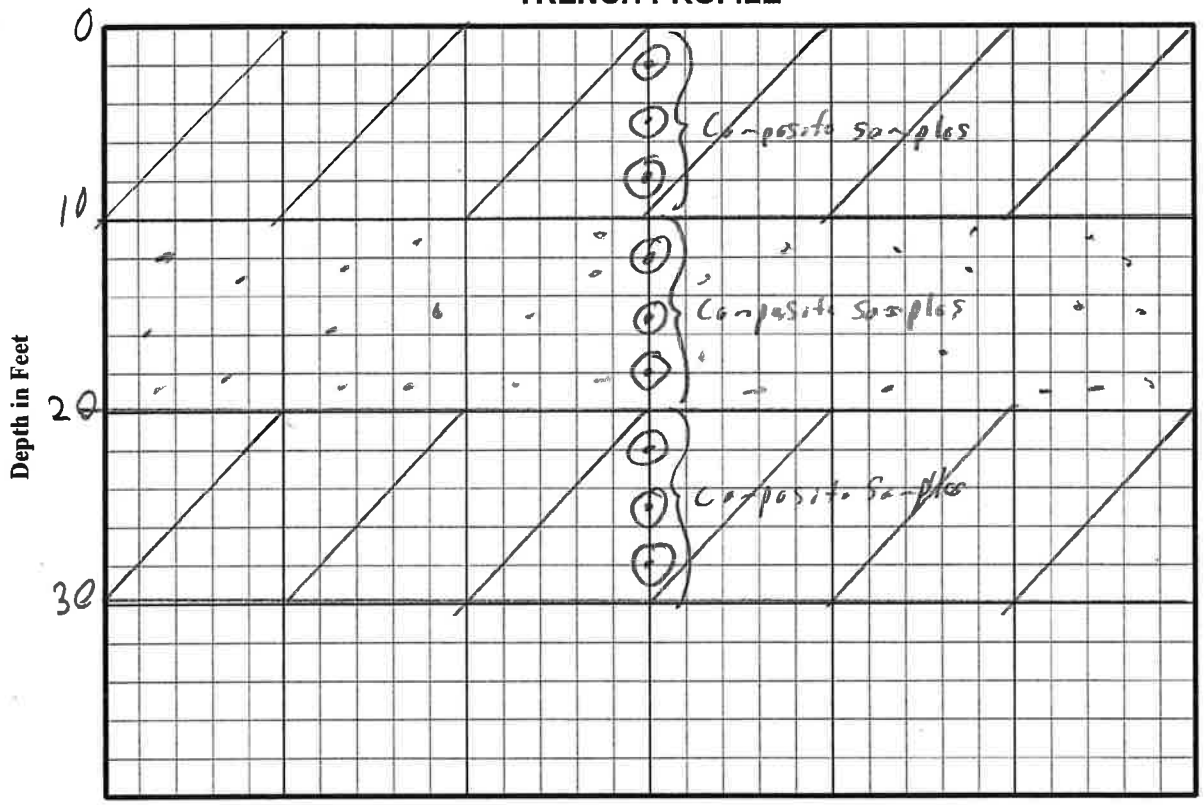
Total Depth 25 Total Length 10

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project IPSC CCR Closures
Project Number 233001396
Sample Location Borrow Area 1
Trench Number BI TP-3
Date 10/29/20
Coordinates: Inside Stake See map
Outside Stake
Native/Fill Stake
Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-10' - Light brown, sandy silt (ML), low to no plasticity, beginning to transition to clay at bottom of composite interval.
10'-20' - Light brown, clay, moderately dense, high plasticity
20'-30' - Same as above.

Begin Trench 1:35
Finish Trench 1:50
Trenching Contractor IPSC
Total Depth 30
Total Length 10

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project IPSC CCR Closures Project Number 233001396

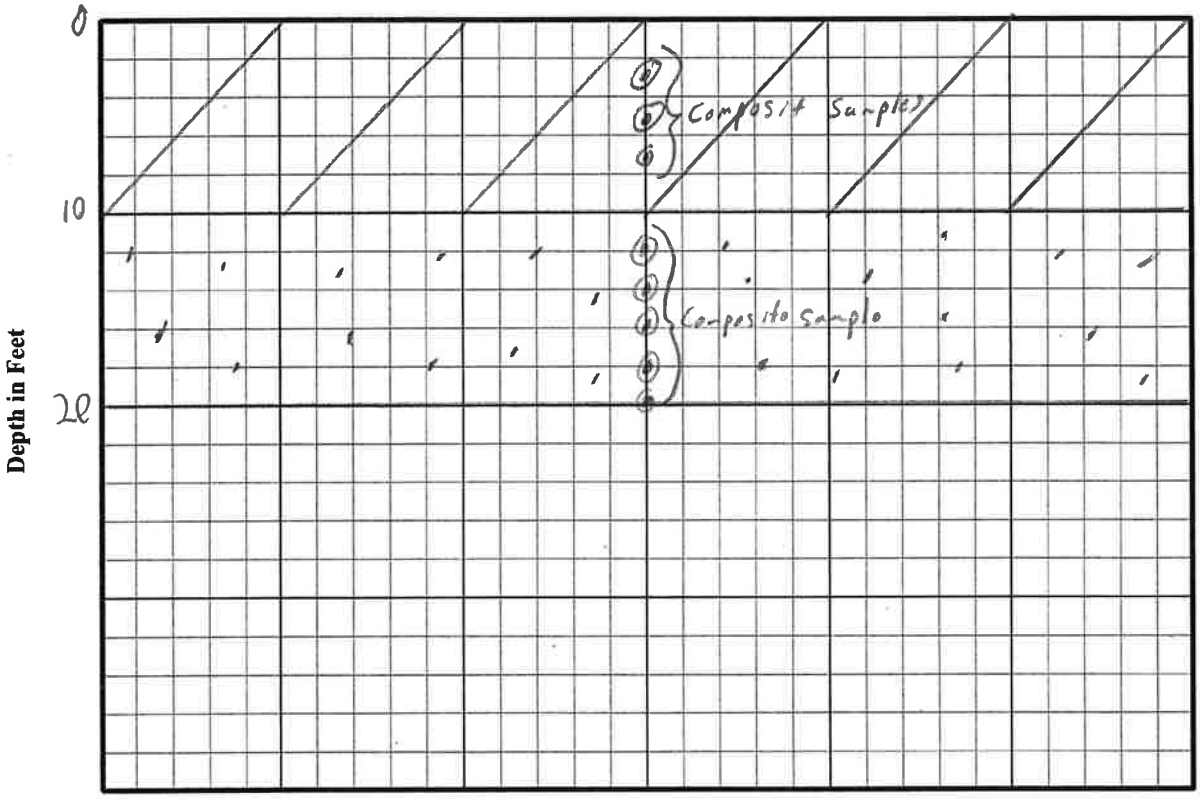
Sample Location Borrow Area 3 Trench Number B3TP-1 Date 10/29/20

Coordinates: Inside Stake Outside Stake

Native/Fill Stake

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-10' - Light brown in color, clayey sand (SC), low plasticity

10-20' - Light brown in color, transitioning to clay with sand (CL), moderate plasticity

Begin Trench 10:20 Finish Trench 10:35 Trenching Contractor IPSC

Total Depth 20' Total Length 10'

TRENCH TEST PIT LOG FORM

Page 1 of 1

Project IPSC CCR Closure | Project Number 233001396

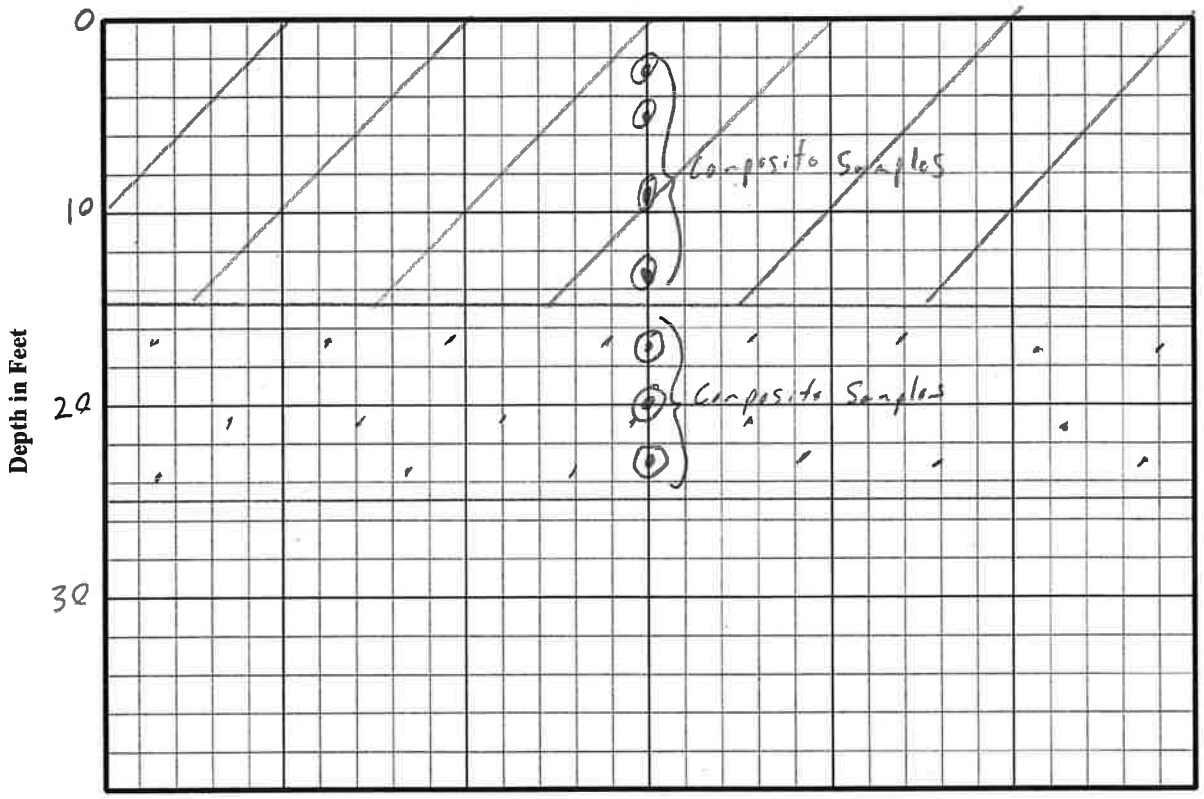
Sample Location Borrow Area 3 | Trench Number B3TP-2 | Date 10/29/19

Coordinates: Inside Stake | Outside Stake

Native/Fill Stake

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-15' - light brown, sandy Clay, moderate plasticity

15-25' - Same as above.

Begin Trench 10:40 | Finish Trench 10:50 | Trenching Contractor IPSC

Total Depth 25' | Total Length 10'

TRENCH TEST PIT LOG FORM

Project IPSC CCR Closures Project Number 233001396

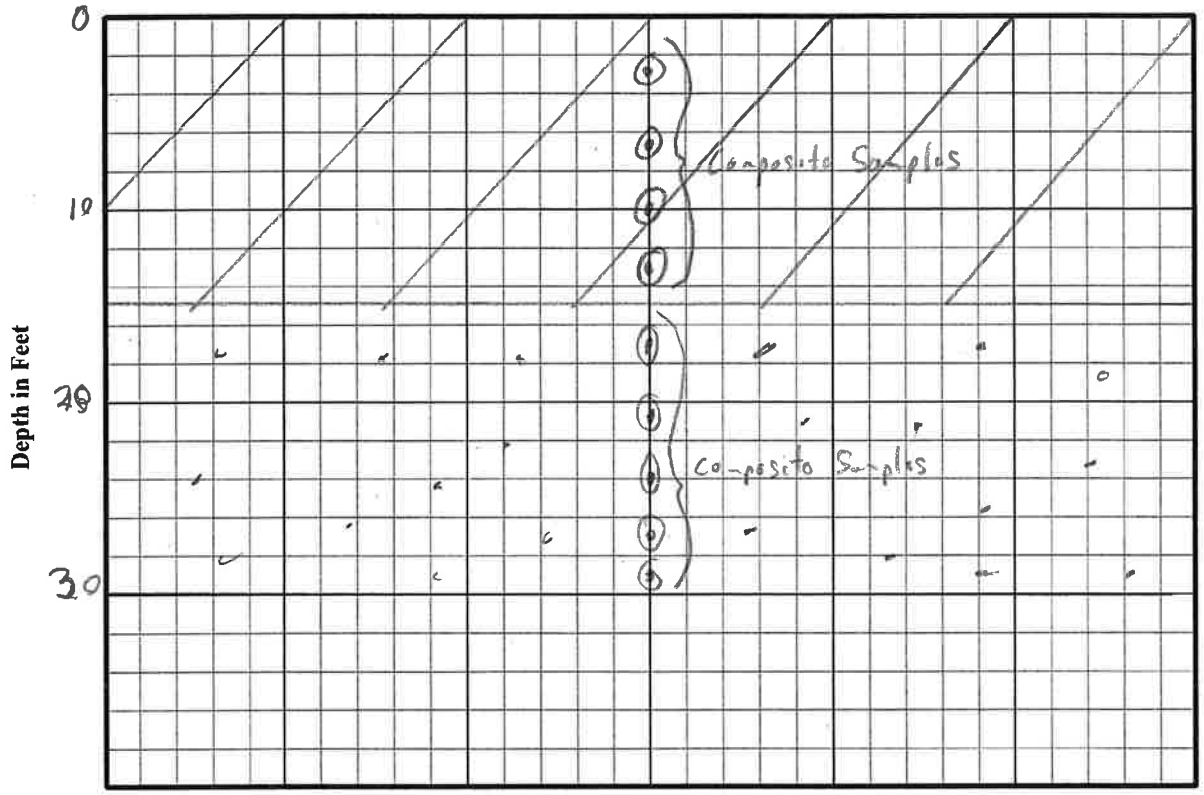
Sample Location Borrow Area 3 Trench Number B3TP-3 Date 10/29/20

Coordinates: Inside Stake Outside Stake

Native/Fill Stake

Logged By Chad Tomlinson

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-15' - Light brown, silty sand, low to no plasticity

15-30' - Light brown, transition from silty sand to clayey sand, moderate plasticity

Begin Trench 10:55 Finish Trench 11:15 Trenching Contractor IPSC

Total Depth 30' Total Length 10'

Appendix D

Borrow Area 1 & 3 Laboratory Test Results

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/2/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Description: SILT, light brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 1"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

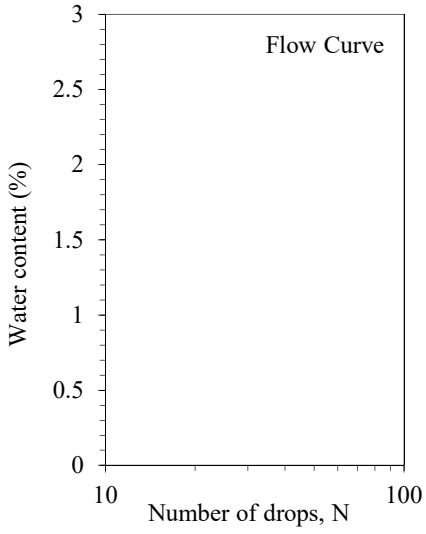
Plastic Limit

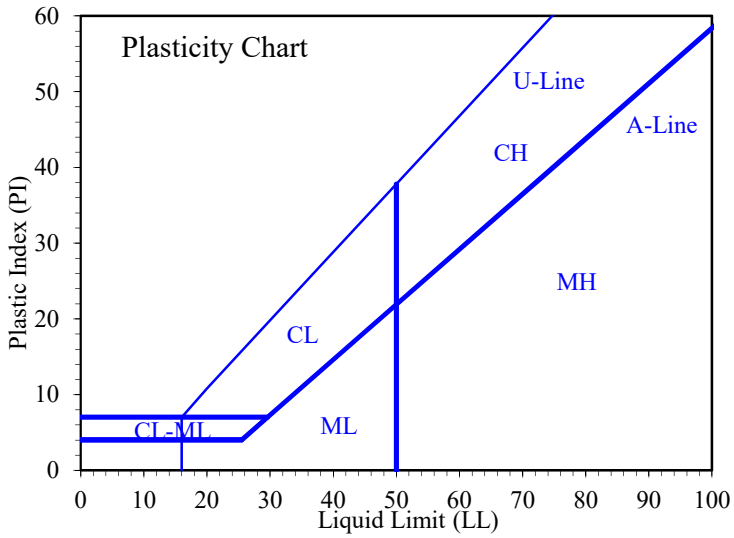
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





Entered by:_____
Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-1
Depth: 15-25'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/4"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

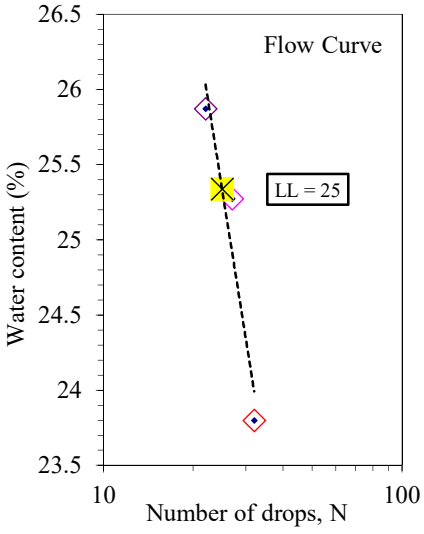
Plastic Limit

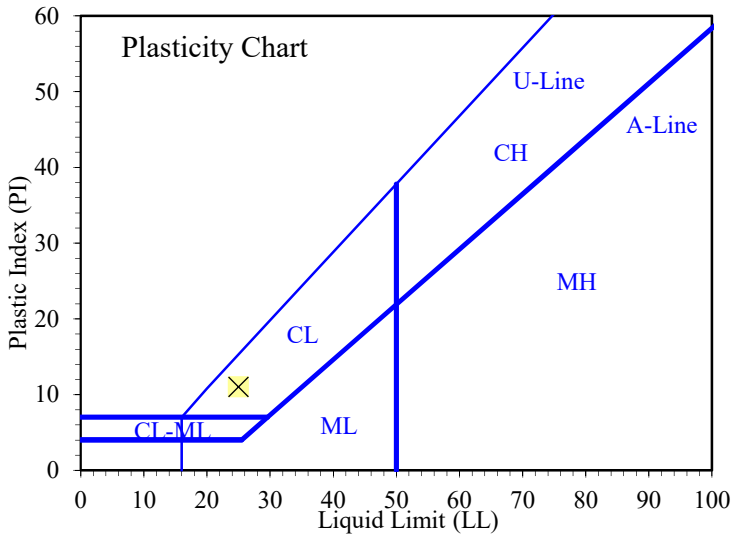
Determination No	1	2				
Wet Soil + Tare (g)	18.55	15.58				
Dry Soil + Tare (g)	17.17	14.58				
Water Loss (g)	1.38	1.00				
Tare (g)	7.55	7.54				
Dry Soil (g)	9.62	7.04				
Water Content, w (%)	14.35	14.20				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	27	22			
Wet Soil + Tare (g)	16.29	16.29	17.49			
Dry Soil + Tare (g)	14.56	14.43	15.41			
Water Loss (g)	1.73	1.86	2.08			
Tare (g)	7.29	7.07	7.37			
Dry Soil (g)	7.27	7.36	8.04			
Water Content, w (%)	23.80	25.27	25.87			
One-Point LL (%)		26	25			

Liquid Limit, LL (%)	**25**
Plastic Limit, PL (%)	**14**
Plasticity Index, PI (%)	**11**





Entered by:_____
Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/2/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-2
Depth: 0-10'
Description: SILT, light brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

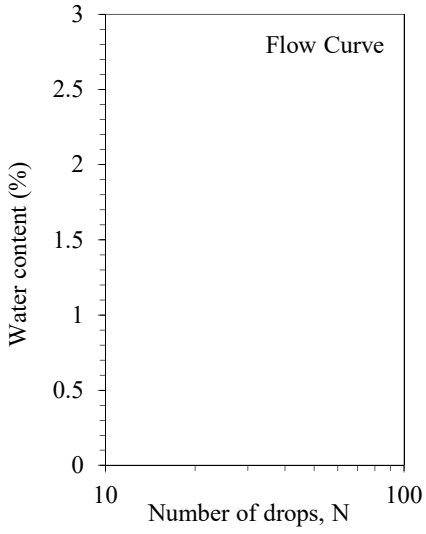
Plastic Limit

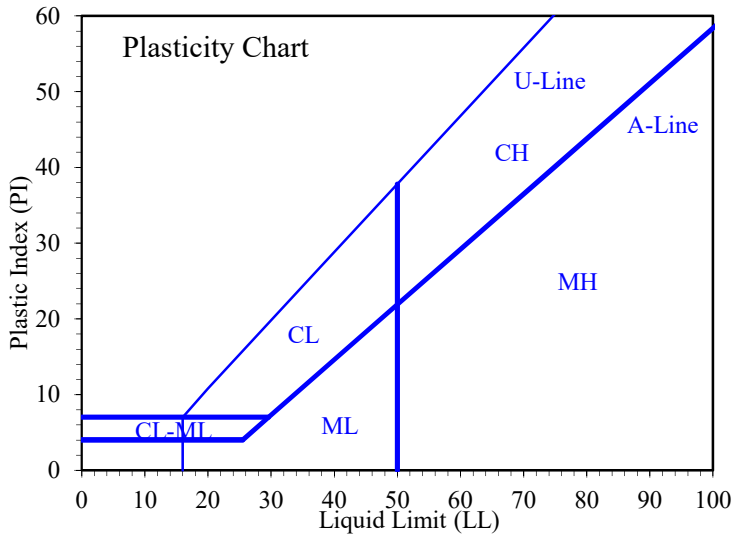
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)		Unable to obtain an adequate blow count.				
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/6/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-2
Depth: 10-20'
Description: SILT, brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

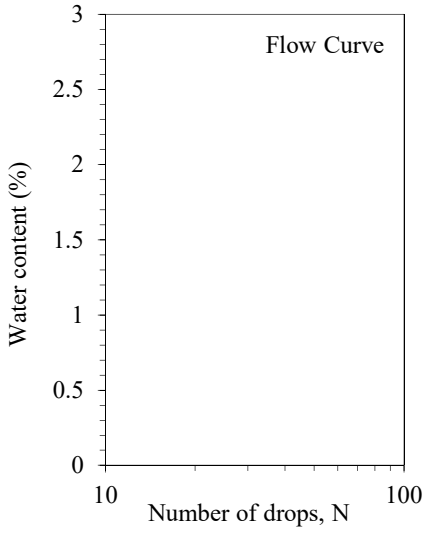
Plastic Limit

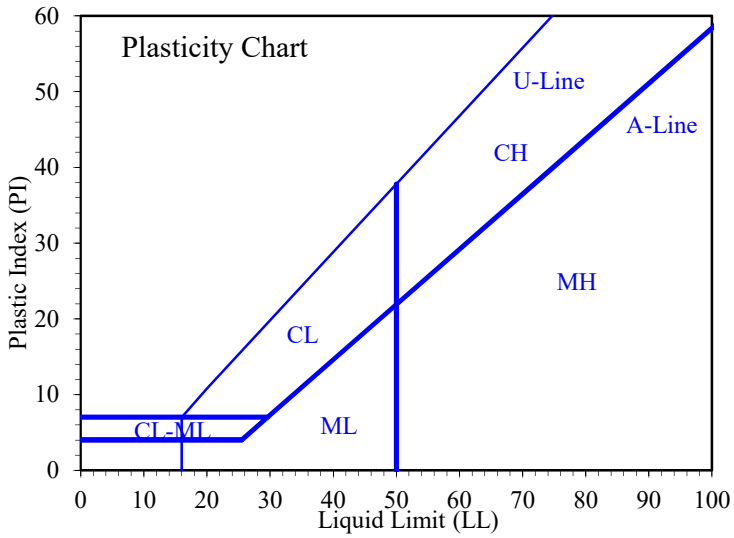
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





Entered by:_____
Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/7/2020
By: LJ

Boring No.:
Sample: B1TP-2
Depth: 20-25'
Description: Lean CLAY, brown

Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

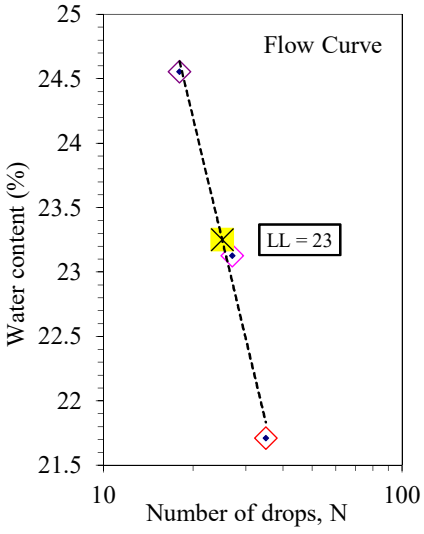
Plastic Limit

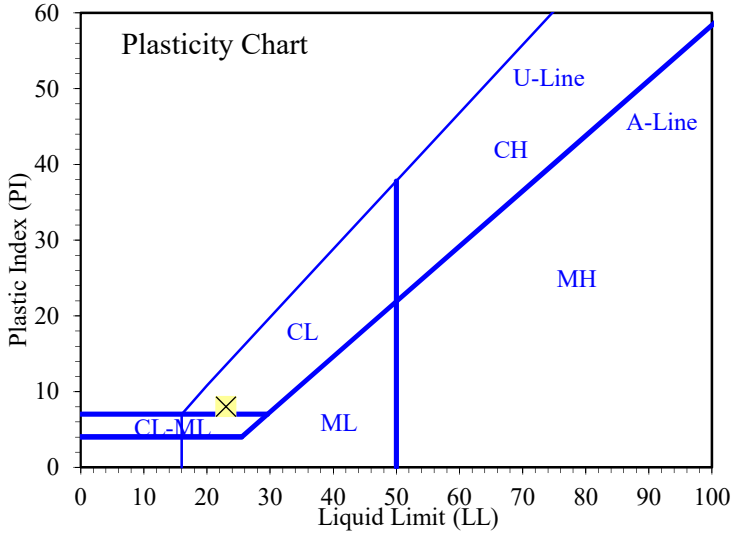
Determination No	1	2				
Wet Soil + Tare (g)	16.24	15.62				
Dry Soil + Tare (g)	15.04	14.50				
Water Loss (g)	1.20	1.12				
Tare (g)	7.34	7.08				
Dry Soil (g)	7.70	7.42				
Water Content, w (%)	15.58	15.09				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	27	18			
Wet Soil + Tare (g)	17.85	16.80	16.48			
Dry Soil + Tare (g)	15.92	14.98	14.69			
Water Loss (g)	1.93	1.82	1.79			
Tare (g)	7.03	7.11	7.40			
Dry Soil (g)	8.89	7.87	7.29			
Water Content, w (%)	21.71	23.13	24.55			
One-Point LL (%)		23				

Liquid Limit, LL (%)	**23**
Plastic Limit, PL (%)	**15**
Plasticity Index, PI (%)	**8**





Entered by:_____
Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/6/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-3
Depth: 0-10'
Description: SILT, brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.4
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

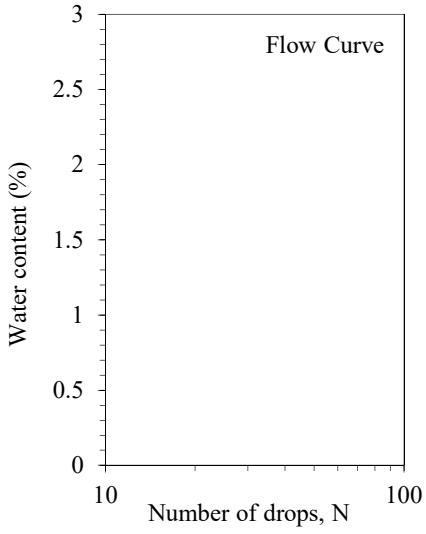
Plastic Limit

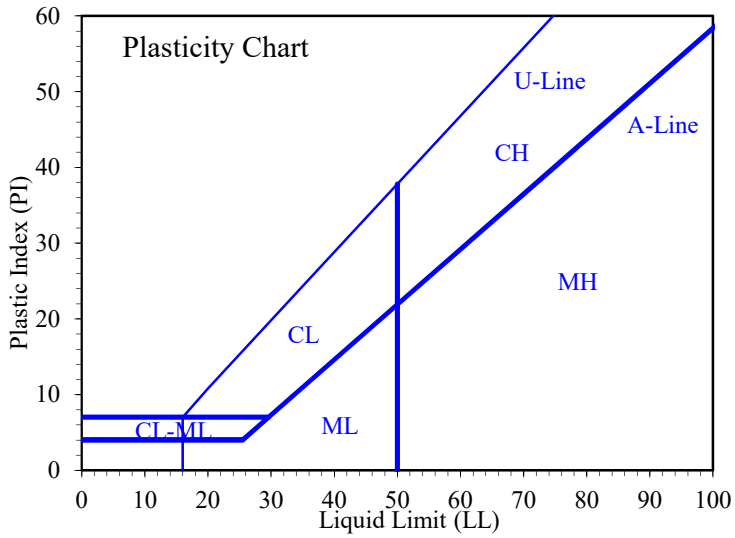
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





Entered by:_____
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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/6/2020
By: LJ
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B1TP-3
Depth: 10-20'
Description: Lean CLAY, grey

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

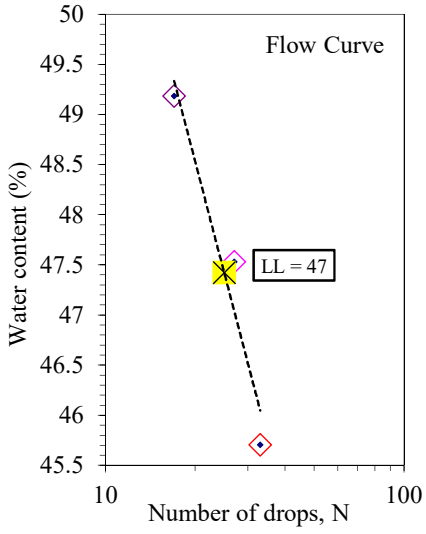
Plastic Limit

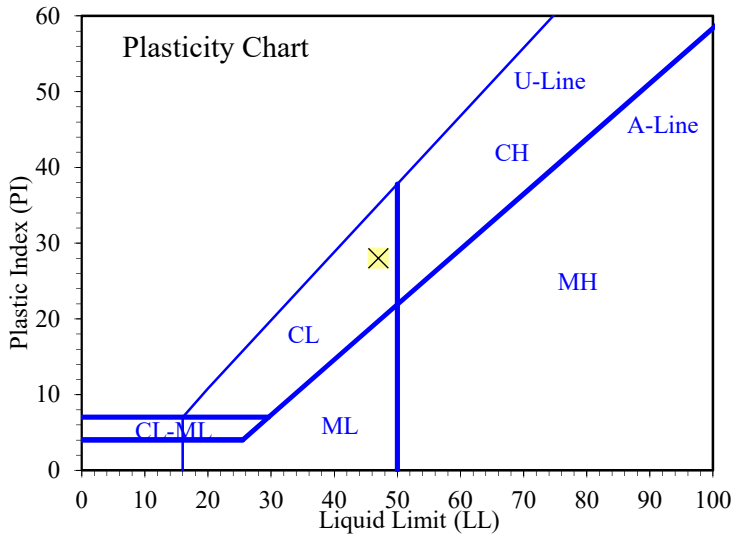
Determination No	1	2				
Wet Soil + Tare (g)	15.19	15.69				
Dry Soil + Tare (g)	13.87	14.39				
Water Loss (g)	1.32	1.30				
Tare (g)	7.05	7.55				
Dry Soil (g)	6.82	6.84				
Water Content, w (%)	19.35	19.01				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	27	17			
Wet Soil + Tare (g)	15.78	14.57	14.66			
Dry Soil + Tare (g)	13.28	12.26	12.25			
Water Loss (g)	2.50	2.31	2.41			
Tare (g)	7.81	7.40	7.35			
Dry Soil (g)	5.47	4.86	4.90			
Water Content, w (%)	45.70	47.53	49.18			
One-Point LL (%)		48				

Liquid Limit, LL (%)	**47**
Plastic Limit, PL (%)	**19**
Plasticity Index, PI (%)	**28**





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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BF/EH

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Description: Silty SAND, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	9633.7	8765.6
+3/8" Coarse fraction (g):	566.59	556.78
-3/8" Split fraction (g):	206.76	187.19
Hydrometer fraction (g):	64.70	58.97
First Split fraction:	0.936	

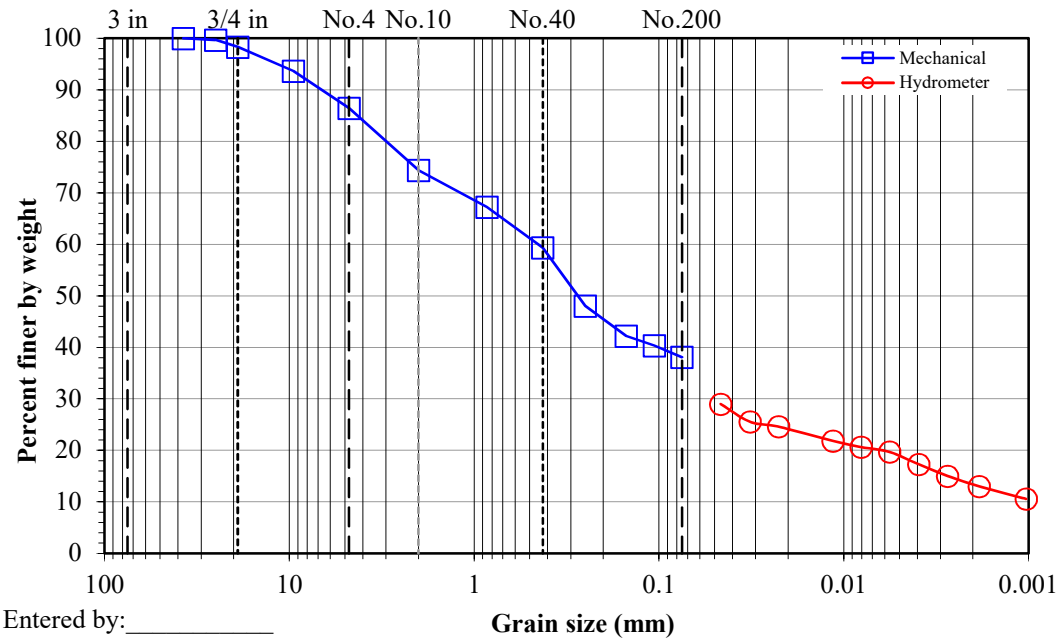
Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	695.22	329.16	26.95
Dry soil + tare (g):	685.34	309.59	25.23
Tare (g):	124.76	122.40	7.54
Water content (%):	1.76	10.45	9.72

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	74.37
Cylinder ID:	T6	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	100.0
1"	32.12	25	99.6
3/4"	148.62	19	98.3
3/8"	556.78	9.5	93.6
No.4	14.43	4.75	86.4
No.10	38.53	2	74.4
No.20	52.79	0.85	67.2
No.40	68.53	0.425	59.4
No.60	91.12	0.25	48.1
No.100	102.86	0.15	42.2
No.140	106.57	0.106	40.3
No.200	111.05	0.075	38.1

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.4	28.25	0.0463	28.96
	2	21.4	25.5	0.0321	25.53
	4	21.4	24.75	0.0226	24.60
	15	21.5	22.5	0.0115	21.84
	30	21.6	21.5	0.0080	20.63
	60	21.6	20.75	0.0057	19.70
	120	21.8	18.75	0.0039	17.29
	240	21.6	17	0.0027	15.02
	511	22	15.25	0.0019	13.02
<=1st Split	1590	22.1	13.25	0.0010	10.57
<=Split hyd.					

Gravel (%): 13.6
Sand (%): 48.3
Fines (%): 38.1



Entered by:_____
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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: JP/EH

Boring No.:
Sample: B1TP-1
Depth: 15-25'
Description: Sandy lean CLAY, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	9630.7	8851.1
+3/8" Coarse fraction (g):	294.56	288.18
-3/8" Split fraction (g):	298.58	273.85
Hydrometer fraction (g):	64.69	59.43
First Split fraction:	0.967	

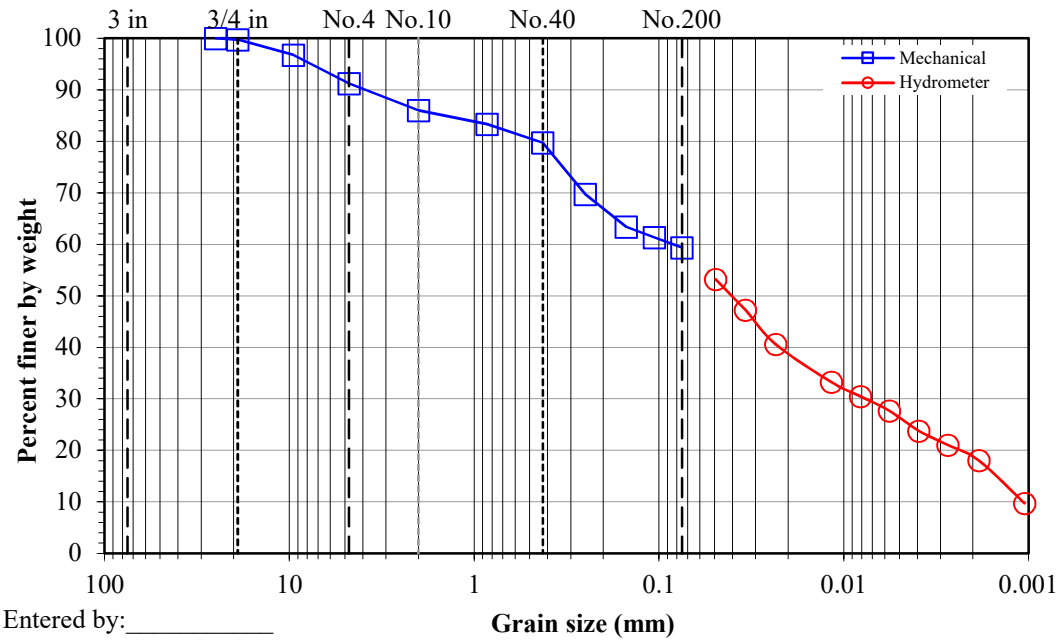
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	100.0	
3/4"	25.41	19	99.7	
3/8"	288.18	9.5	96.7	<=1st Split
No.4	15.72	4.75	91.2	
No.10	30.47	2	86.0	<=Split hyd.
No.20	37.93	0.85	83.3	
No.40	48.24	0.425	79.7	
No.60	76.41	0.25	69.8	
No.100	94.41	0.15	63.4	
No.140	100.31	0.106	61.3	
No.200	105.83	0.075	59.4	

Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	485.54	478.29	18.00
Dry soil + tare (g):	478.75	453.56	17.11
Tare (g):	172.19	179.71	7.06
Water content (%):	2.21	9.03	8.86

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.8	Assumed	
Bulb No.	6	Hyd. fraction:	85.98
Cylinder ID:	T3	Dispersion device:	Air-jet

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.4	43	0.0494	53.21
2	21.4	38.75	0.0341	47.25
4	21.4	34	0.0234	40.60
15	21.4	28.75	0.0117	33.24
30	21.5	26.75	0.0081	30.49
60	21.5	24.75	0.0057	27.69
120	21.4	22	0.0039	23.78
240	21.5	20	0.0027	21.03
500	21.8	17.75	0.0019	18.03
1414	21.3	12	0.0011	9.72

Gravel (%): 8.8
Sand (%): 31.8
Fines (%): 59.4



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BF/EH

Boring No.:
Sample: B1TP-2
Depth: 0-10'
Description: Silty SAND, brown

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	221.32	209.67
Hydrometer fraction (g):	59.42	56.44

Water content data		S.F.	Hyd.(-No.10)
Moist soil + tare (g):	-	372.46	17.86
Dry soil + tare (g):	-	360.81	17.32
Tare (g):	-	151.14	7.10
Water content (%):		5.56	5.28

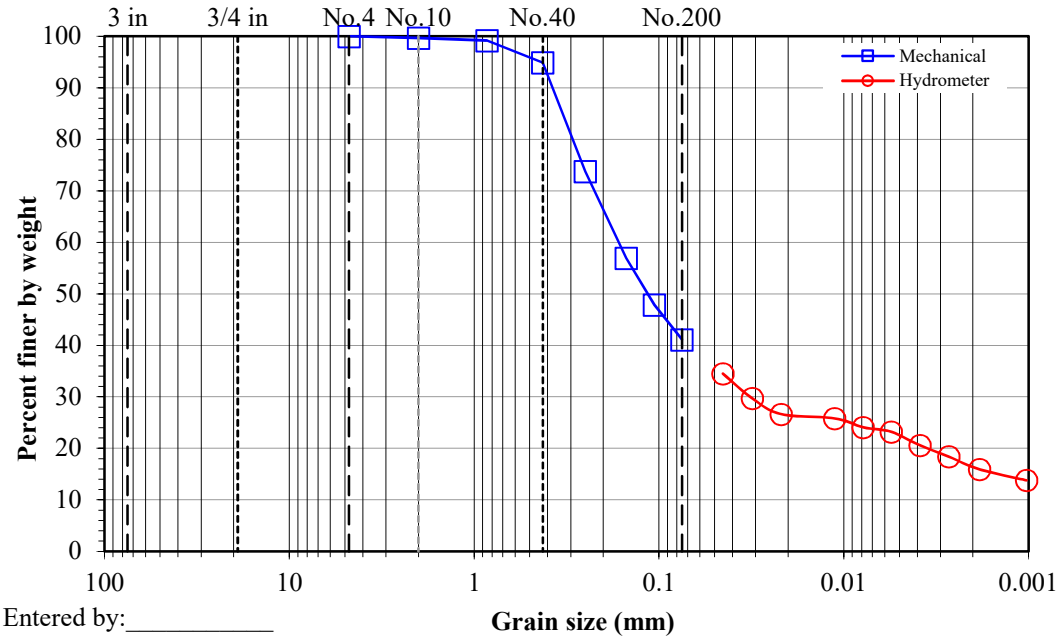
Hydrometer data
Hyd. split: No.10
Gs: 2.7 Assumed
Bulb No.: 6 Hyd. fraction: 99.64
Cylinder ID: N30 Dispersion device: Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	-
No.4		4.75	100.0
No.10	0.76	2	99.6
No.20	1.80	0.85	99.1
No.40	10.74	0.425	94.9
No.60	55.07	0.25	73.7
No.100	90.26	0.15	57.0
No.140	109.33	0.106	47.9
No.200	123.47	0.075	41.1

<=Split hyd.

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.5	24.75	0.0451	34.49
2	21.5	22	0.0312	29.69
4	21.5	20.25	0.0218	26.64
15	21.6	19.75	0.0112	25.83
30	21.6	18.75	0.0079	24.08
60	21.6	18.25	0.0055	23.21
120	21.6	16.75	0.0039	20.59
240	21.6	15.5	0.0027	18.41
506	21.8	14	0.0018	15.91
1590	21.9	12.75	0.0010	13.79

Gravel (%): 0.0
Sand (%): 58.9
Fines (%): 41.1



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BF/EH

Boring No.:
Sample: B1TP-2
Depth: 10-20'
Description: Silty SAND, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	No.10	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	221.70	214.45
No.10 Coarse fraction (g):	0.57	0.56
-No.10 Split fraction (g):	62.94	60.88
Hydrometer fraction (g):	62.94	60.88
First Split fraction:	0.997	

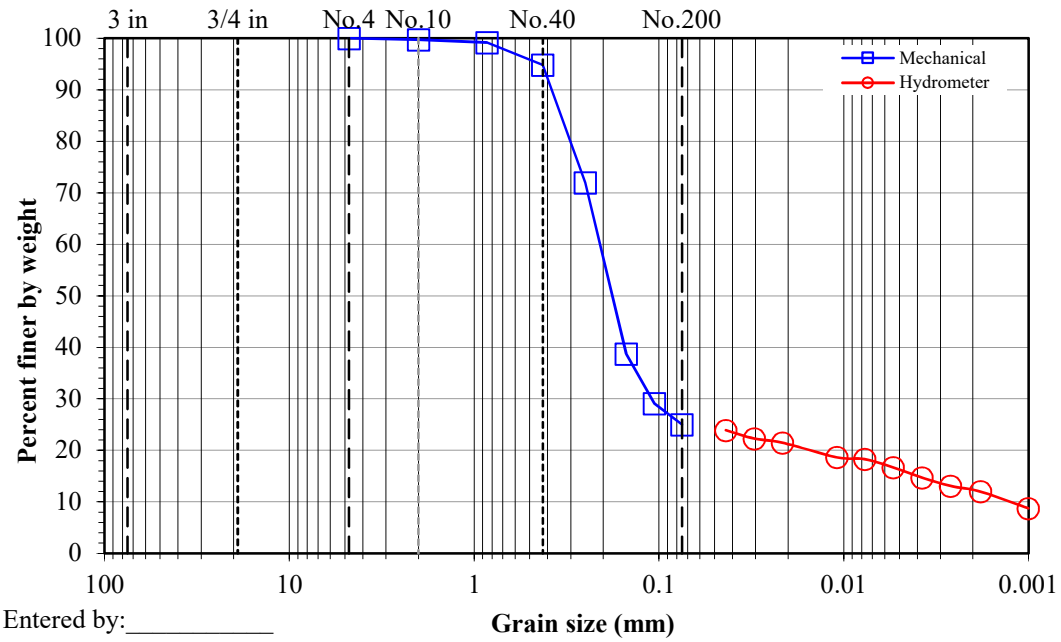
Water content data	C.F.1(+No.10)	S.F.1(-No.10)	Hyd.(-No.10)
Moist soil + tare (g):	344.36	19.84	19.84
Dry soil + tare (g):	339.29	19.42	19.42
Tare (g):	122.66	7.01	7.01
Water content (%):	2.34	3.38	3.38

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	99.74
Cylinder ID:	T5	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	-	
3/8"		9.5	-	
No.4		4.75	100.0	
No.10	0.56	2	99.7	<=1st Split
No.20	0.35	0.85	99.2	
No.40	3.00	0.425	94.8	
No.60	16.95	0.25	72.0	
No.100	37.23	0.15	38.7	
No.140	43.12	0.106	29.1	
No.200	45.61	0.075	25.0	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	21.5	19.75	0.0434	23.91
2	21.5	18.75	0.0305	22.29
4	21.5	18.25	0.0215	21.48
15	21.5	16.5	0.0109	18.64
30	21.6	16.25	0.0077	18.30
60	21.6	15.25	0.0054	16.68
120	21.7	14	0.0038	14.71
240	21.7	13	0.0026	13.09
501	21.9	12.25	0.0018	11.99
1590	21.9	10.25	0.0010	8.75

Gravel (%): 0.0
Sand (%): 75.0
Fines (%): 25.0



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BSS/EH

Boring No.:
Sample: B1TP-2
Depth: 20-25'
Description: Sandy lean CLAY, brown

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	305.97	279.27
Hydrometer fraction (g):	64.95	59.57

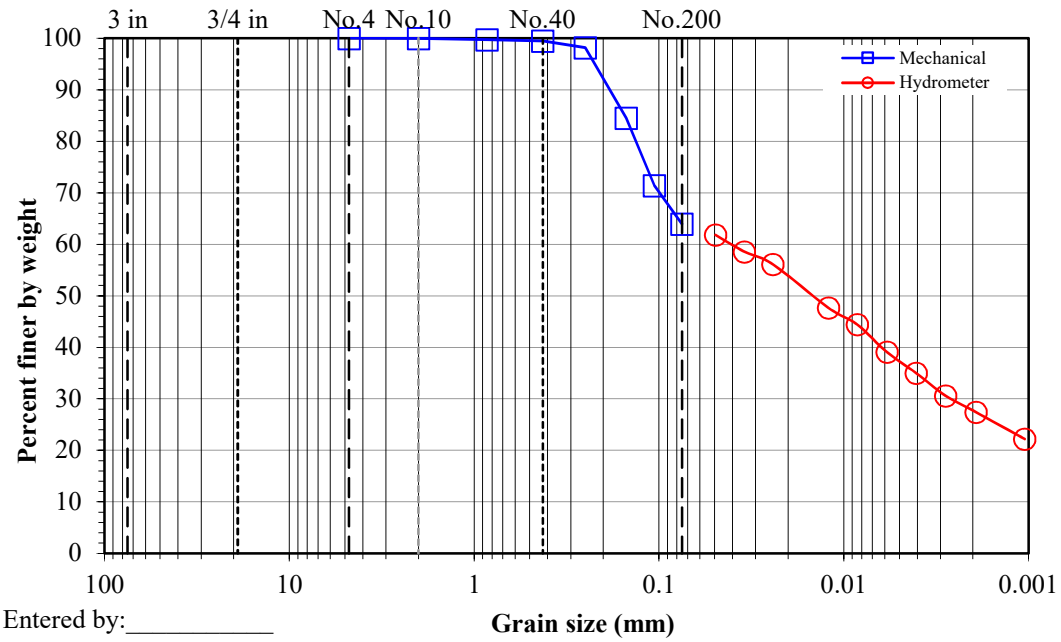
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	-
No.4		4.75	100.0
No.10	0.14	2	99.9
No.20	0.73	0.85	99.7
No.40	1.41	0.425	99.5
No.60	5.06	0.25	98.2
No.100	43.21	0.15	84.5
No.140	79.89	0.106	71.4
No.200	100.67	0.075	64.0

Water content data		S.F.	Hyd.(-No.10)
Moist soil + tare (g):		459.30	17.55
Dry soil + tare (g):		432.60	16.68
Tare (g):		153.33	7.05
Water content (%):		9.56	9.03

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.8	Assumed	
Bulb No.	6	Hyd. fraction:	99.95
Cylinder ID:	11	Dispersion device:	Air-jet

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.6	43	0.0494	61.82
	2	21.6	41	0.0346	58.57
	4	21.6	39.5	0.0242	56.13
	15	21.7	34.25	0.0121	47.66
	30	21.7	32.25	0.0084	44.41
	60	21.6	29	0.0058	39.07
	120	21.6	26.5	0.0041	35.01
	240	21.7	23.75	0.0028	30.60
	498	21.8	21.75	0.0019	27.41
	1587	21.9	18.5	0.0010	22.18
<=Split hyd.					

Gravel (%): 0.0
Sand (%): 36.0
Fines (%): 64.0



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BF/EH

Boring No.:
Sample: B1TP-3
Depth: 0-10'
Description: Sandy SILT, brown

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	184.65	166.57
Hydrometer fraction (g):	66.04	59.92

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	100.0
No.4	0.27	4.75	99.8
No.10	0.61	2	99.6
No.20	0.87	0.85	99.5
No.40	1.61	0.425	99.0
No.60	6.18	0.25	96.3
No.100	38.13	0.15	77.1
No.140	56.65	0.106	66.0
No.200	69.00	0.075	58.6

Water content data

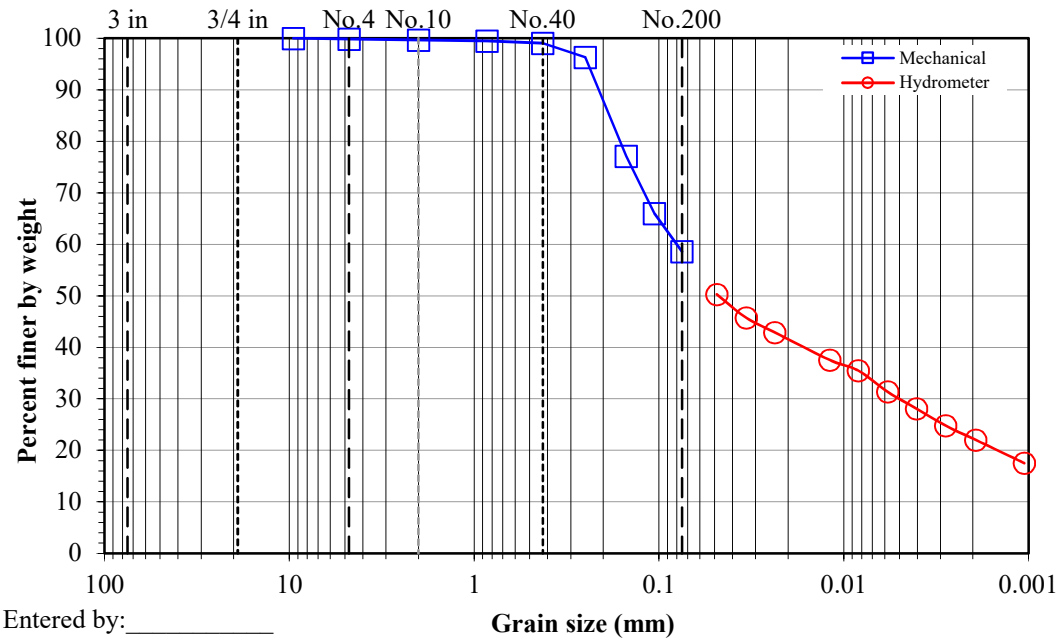
	S.F.	Hyd.(-No.10)
Moist soil + tare (g):	306.54	20.61
Dry soil + tare (g):	288.46	19.35
Tare (g):	121.89	7.02
Water content (%):	10.85	10.22

Hydrometer data

Hyd. split: No.10
Gs: 2.7 Assumed
Bulb No. 6 Hyd. fraction: 99.63
Cylinder ID: N18 Dispersion device: Air-jet

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.7	35.5	0.0486	50.28
	2	21.7	32.75	0.0338	45.76
	4	21.7	31	0.0236	42.88
	15	21.7	27.75	0.0119	37.54
	30	21.7	26.5	0.0083	35.48
	60	21.7	24	0.0058	31.37
	120	21.7	22	0.0040	28.08
	240	21.7	20	0.0028	24.80
	493	21.9	18.25	0.0019	22.04
	1583	21.9	15.5	0.0011	17.51
<=Split hyd.					

Gravel (%): 0.2
Sand (%): 41.3
Fines (%): 58.6



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BSS/EH

Boring No.:
Sample: B1TP-3
Depth: 10-20'
Description: Lean CLAY, brownish grey

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	379.51	350.56
Hydrometer fraction (g):	63.43	58.92

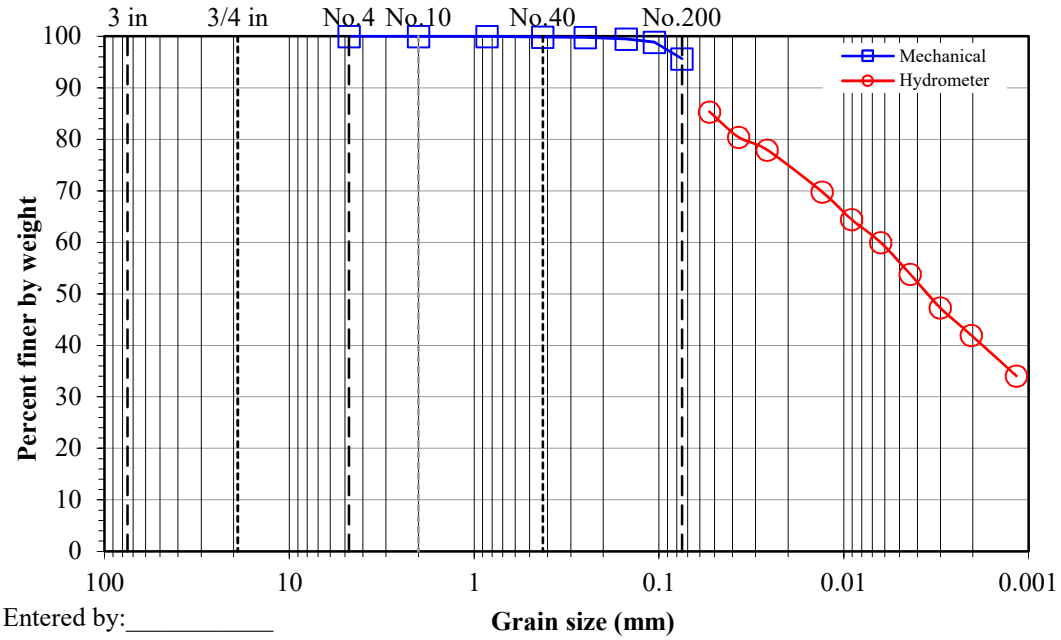
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	-
No.4		4.75	100.0
No.10	0.09	2	100.0
No.20	0.16	0.85	100.0
No.40	0.42	0.425	99.9
No.60	0.84	0.25	99.8
No.100	1.87	0.15	99.5
No.140	4.01	0.106	98.9
No.200	15.34	0.075	95.6

Water content data	S.F.	Hyd.(-No.10)
Moist soil + tare (g):	501.99	25.48
Dry soil + tare (g):	473.04	24.20
Tare (g):	122.48	7.46
Water content (%):	8.26	7.65

Hydrometer data
Hyd. split: No.10
Gs: 2.8 Assumed
Bulb No.: 6 Hyd. fraction: 99.97
Cylinder ID: N33 Dispersion device: Air-jet

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.3	57	0.0533	85.34
	2	21.3	54	0.0371	80.41
	4	21.3	52.5	0.0260	77.95
	15	21.4	47.5	0.0131	69.79
	30	21.4	44.25	0.0091	64.45
	60	21.5	41.5	0.0063	59.99
	120	21.5	37.75	0.0044	53.83
	240	21.6	33.75	0.0030	47.31
	500	21.6	30.5	0.0020	41.97
	1440	21.4	25.75	0.0012	34.05
<=Split hyd.					

Gravel (%): 0.0
Sand (%): 4.4
Fines (%): 95.6



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BSS/EH

Boring No.:
Sample: B1TP-3
Depth: 20-30'
Description: Lean CLAY, brownish grey

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	No	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	454.10	418.96
Hydrometer fraction (g):	62.92	58.55

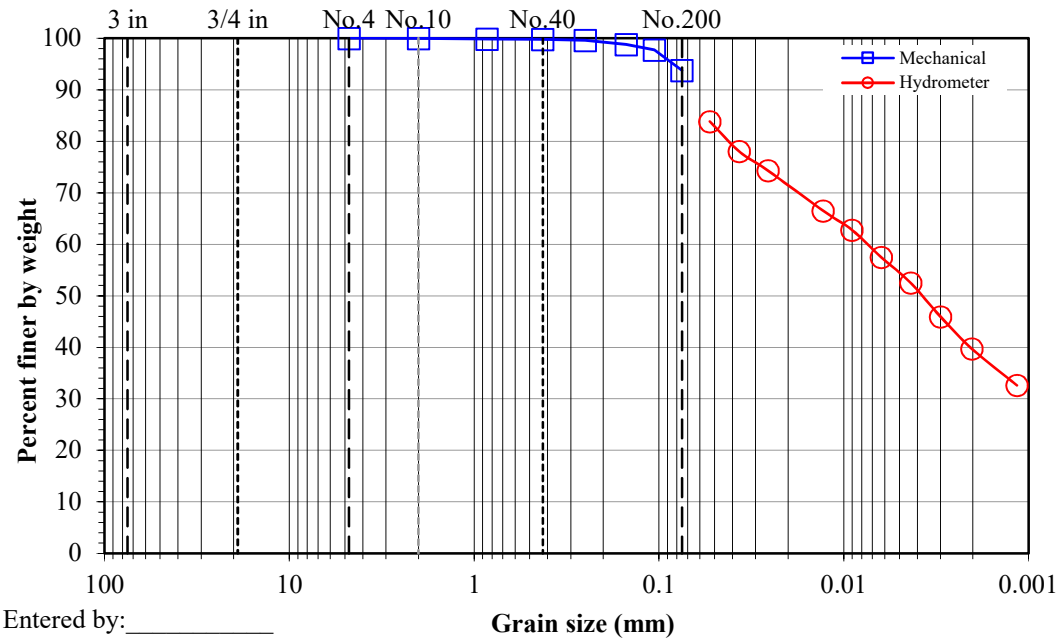
Water content data		S.F.	Hyd.(-No.10)
Moist soil + tare (g):		593.85	23.73
Dry soil + tare (g):		558.71	22.59
Tare (g):		139.75	7.31
Water content (%):		8.39	7.46

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.8	Assumed	
Bulb No.	6	Hyd. fraction:	99.98
Cylinder ID:	N10	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"	-	37.5	-
1"	-	25	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.09	2	100.0
No.20	0.52	0.85	99.9
No.40	0.87	0.425	99.8
No.60	1.67	0.25	99.6
No.100	4.93	0.15	98.8
No.140	9.44	0.106	97.7
No.200	26.20	0.075	93.7

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.3	55.75	0.0530	83.82
	2	21.3	52.25	0.0368	78.04
	4	21.3	50	0.0257	74.31
	15	21.4	45.25	0.0129	66.52
	30	21.4	43	0.0090	62.80
	60	21.5	39.75	0.0063	57.48
	120	21.5	36.75	0.0043	52.52
	240	21.6	32.75	0.0030	45.96
	500	21.5	29	0.0020	39.70
	1442	21.4	24.75	0.0012	32.62
<=Split hyd.					

Gravel (%): 0.0
Sand (%): 6.3
Fines (%): 93.7



Entered by:_____
Reviewed:_____

Classification of Soils for Engineering Purposes

(ASTM D2487)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/7/2020
By: BRR

Sample Info.									
	Boring No.								
	Sample:	B1TP-1	B1TP-1	B1TP-2	B1TP-2	B1TP-2	B1TP-3	B1TP-3	B1TP-3
	Depth:	10-15'	15-25'	0-10'	10-20'	20-25'	0-10'	10-20'	20-30'
Liquid Limit (%):		NP	25	NP	NP	23	NP	47	39
Plastic Limit (%):		NP	14	NP	NP	15	NP	19	18
Plastic Index (%):		NP	11	NP	NP	8	NP	28	21
Gravel (%):		13.6	8.8	0	0	0	0.2	0	0
Sand (%):		48.3	31.8	58.9	75	36	41.3	4.4	6.3
Fines (%):		38.1	59.4	41.1	25	64	58.6	95.6	93.7
D_{60} (mm):									
D_{30} (mm):									
D_{10} (mm):									
Cu:									
Cc:									
Group Symbol:		**SM**	**CL**	**SM**	**SM**	**CL**	**ML**	**CL**	**CL**
Group Name:		**Silty SAND**	**Sandy lean CLAY**	**Silty SAND**	**Silty SAND**	**Sandy lean CLAY**	**Sandy SILT**	**Lean CLAY**	**Lean CLAY**

Entered by:_____

Reviewed:_____

Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

(ASTM D2974)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 12/31/2019
By: BF/BSS/JAB

Sample Info.	Boring No.								
	Sample:	B1TP-1	B1TP-2	B1TP-3	B2TP-1	B2TP-2	B2TP-3	B3TP-1	
	Depth:	10-15'	10-20'	0-10'	20-25'	0-15'	12-15'	10-20'	
	Test Method:	C	C	C	C	C	C	C	
	Furnace temp. (°C)	440	440	440	440	440	440	440	
Moisture	Wet soil + tare (g)	680.76	630.70	611.32	614.17	599.84	552.15	569.66	
	Dry soil + tare (g)	653.03	624.18	585.74	578.80	580.49	525.90	536.95	
	Tare (g)	380.50	375.01	374.87	378.48	374.28	380.26	341.22	
Ash / Organic Info	Mass of crucible and oven-dried sample (g)	653.03	624.18	585.74	578.80	580.49	525.90	536.95	
	Mass of crucible and ash (g)	648.81	622.08	584.01	572.54	578.24	521.82	530.70	
	Mass of crucible (g)	380.50	375.01	374.87	378.48	374.28	380.26	341.22	
Moisture Content, w (%) [a]		**10.2**	**2.6**	**12.1**	**17.7**	**9.4**	**18.0**	**16.7**	
Ash Content (%)		**98.5**	**99.2**	**99.2**	**96.9**	**98.9**	**97.2**	**96.8**	
Organic Matter (%)		**1.5**	**0.8**	**0.8**	**3.1**	**1.1**	**2.8**	**3.2**	

[a] Moisture contents are by proportion of oven-dried mass (geotechnical convention).

Entered by:_____

Reviewed:_____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Sample Description: Silty SAND, brown
Engineering Classification: SM
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	144.85	
Dry soil + tare (g)	144.43	
Tare (g)	128.38	
Water content, w (%)	2.6	

Initial water temperature: 19.0 °C
Date test started: 12/27/2019
Time at beginning of test: 10:05

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	19.0	1	18.4	1	18.5
2	1	19.0	1	18.4	1	18.5

Dispersive classification: Grade 1-Nondispersive

Entered: _____
Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B1TP-2
Depth: 10-20'
Sample Description: Silty SAND, brown
Engineering Classification: SM
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	162.75	
Dry soil + tare (g)	162.17	
Tare (g)	127.70	
Water content, w (%)	1.7	

Initial water temperature: 19.0 °C
Date test started: 12/27/2019
Time at beginning of test: 10:07

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	2	19.0	2	18.4	2	18.0
2	2	18.9	3	18.4	3	18.0

Dispersive classification: Grade 3-Dispersive

Entered: _____
Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B1TP-3
Depth: 0-10'
Sample Description: Sandy SILT, brown
Engineering Classification: ML
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	156.54	
Dry soil + tare (g)	155.93	
Tare (g)	123.07	
Water content, w (%)	1.9	

Initial water temperature: 19.0 °C
Date test started: 12/27/2019
Time at beginning of test: 10:10

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	2	19.0	2	18.4	2	18.0
2	2	19.0	2	18.4	2	18.0

Dispersive classification: Grade 2-Intermediate

Entered: _____
Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B1TP-3
Depth: 20-30'
Sample Description: Lean CLAY, brown
Engineering Classification: CL
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	593.85	
Dry soil + tare (g)	558.71	
Tare (g)	139.75	
Water content, w (%)	8.4	

Initial water temperature: 18.9 °C
Date test started: 12/27/2019
Time at beginning of test: 10:13

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	18.9	1	18.4	1	18.1
2	1	18.9	1	18.4	1	18.1

Dispersive classification: Grade 1-Nondispersive

Entered: _____
Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 12/26/2019
By: BF

Sample: B1TP-1 & B1TP-2 & B1TP-3
Depth: 0-20'
Sample Description: Silty SAND, brown
Engineering Classification: SM
As-received water content (%): Not requested

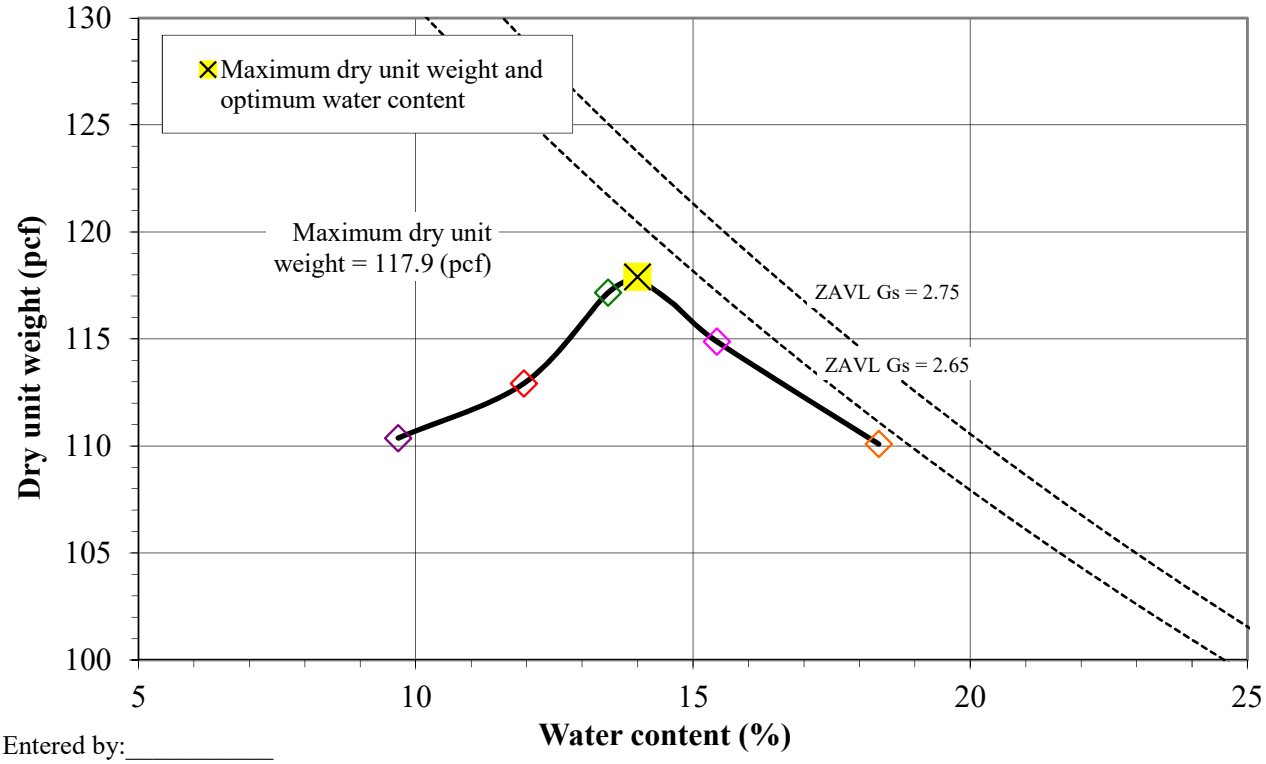
Method: ASTM D698 B
Mold Id. Inc 3
Mold volume (ft^3): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

Optimum water content (%): 14
Maximum dry unit weight (pcf): 117.9

Point Number	+2%	+4%	+6%	+8%	+10%			
Wt. Sample + Mold (g)	6046.3	6127.2	6225.5	6220.5	6185.5			
Wt. of Mold (g)	4220.9	4220.9	4220.9	4220.9	4220.9			
Wet Unit Wt., γ_m (pcf)	121.1	126.4	132.9	132.6	130.3			
Wet Soil + Tare (g)	1271.79	1030.93	1316.46	1342.64	1453.85			
Dry Soil + Tare (g)	1183.63	938.82	1180.06	1185.36	1261.84			
Tare (g)	273.28	168.10	167.11	165.99	215.39			
Water Content, w (%)	**9.7**	**12.0**	**13.5**	**15.4**	**18.3**			
Dry Unit Wt., γ_d (pcf)	**110.4**	**112.9**	**117.2**	**114.9**	**110.1**			

Comments:
Test specimen consisted of material from B1TP-1 @ 10-15', B1TP-2 @ 0-10', B1-TP2 @ 10-20', and B1TP-3 @ 0-10'.



Entered by:_____
Reviewed:_____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: BSS

Sample: B1TP-2 & B1TP-3
Depth: 10-30'
Sample Description: Lean CLAY, brown
Engineering Classification: CL
As-received water content (%): Not requested
Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

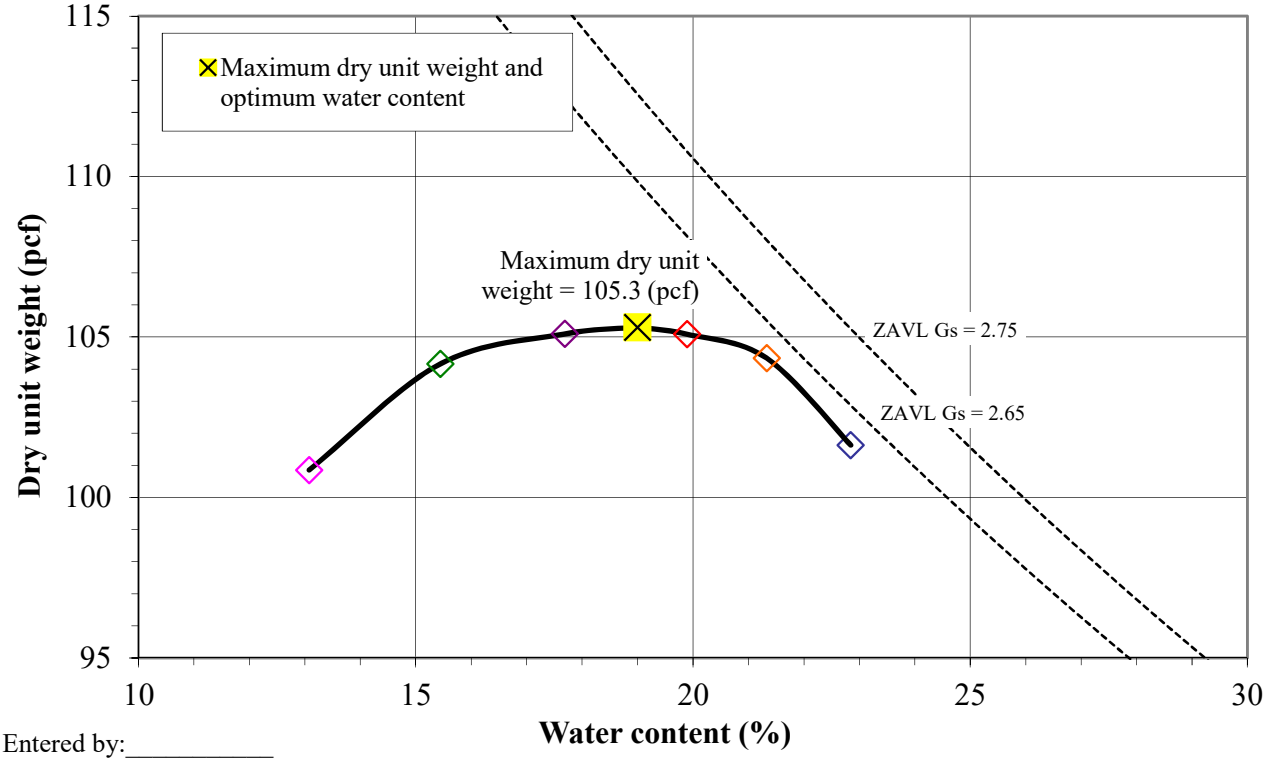
Method: ASTM D698 B
Mold Id. Inc 1
Mold volume (ft^3): 0.0333

Optimum water content (%): 19
Maximum dry unit weight (pcf): 105.3

Point Number	+8%	+10%	+6%	+4%	+12%	14%		
Wt. Sample + Mold (g)	6097.0	6131.8	6045.0	5951.4	6140.9	6114.5		
Wt. of Mold (g)	4229.7	4229.7	4229.7	4229.7	4229.7	4229.7		
Wet Unit Wt., γ_m (pcf)	123.7	126.0	120.2	114.0	126.6	124.8		
Wet Soil + Tare (g)	1224.49	1390.14	1141.17	1063.87	1248.59	1113.37		
Dry Soil + Tare (g)	1089.49	1211.00	1032.53	976.63	1083.68	947.60		
Tare (g)	326.42	310.61	328.95	309.51	310.52	221.97		
Water Content, w (%)	**17.7**	**19.9**	**15.4**	**13.1**	**21.3**	**22.8**		
Dry Unit Wt., γ_d (pcf)	**105.1**	**105.1**	**104.2**	**100.9**	**104.3**	**101.6**		

Comments:

Test specimen consisted of material from B1TP-2 @ 20-25', B1TP-3 @ 10-20', and B1TP-3 @ 20-30'. Due to insufficient sample quantity, points +6% and +14% contained previously compacted material.



Entered by:_____

Reviewed:_____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Clousres; Delta, UT
Date: 1/15/2020
By: EH

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Sample Description: Silty SAND, brown
Sample Type: Laboratory Compacted
Compaction Specifications: 90 (%) Dry unit weight
at 14 (%) w
Optimum water content (%) 14
Maximum dry unit weight (pcf) 117.9
Gs 2.7 Assumed
Cell No. 2
Station No. 3
Permeant liquid used De-aired tap water
Total backpressure (psi) 35
Effective horiz. consolidation stress (psi) 15
Effective vert. consolidation stress (psi) 15

	Initial (o)	Final (f)
Sample Height, H (in)	2.995	2.972
Sample Diameter, D (in)	2.412	2.364
Sample Length, L (cm)	7.607	7.548
Sample Area, A (cm^2)	29.479	28.318
Sample Volume, V (cm^3)	224.26	213.73
Wt. Rings + Wet Soil (g)	435.15	458.15
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	121.1	133.8
Wet Soil + Tare (g)	129.41	572.28
Dry Soil + Tare (g)	118.28	498.07
Tare (g)	37.61	123.49
Weight of solids, Ws (g)	382.39	382.39
Water Content, w (%)	13.80	19.81
Dry Unit Wt, γ_d (pcf)	106.4	111.7
Void ratio, e, for assumed Gs	0.58	0.53
Saturation (%), for assumed Gs	63.8	100 [a]
Average K[b] (cm/sec)	**3.6E-04**	

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

	Initial (o)	Final (f)
B value	0.60	0.98
External Burette (cm^3)	8.20	26.60
Cell Pressure (psi)	0.0	50.0

Backpressure bottom (psi) 35.0
Backpressure top (psi) 35.0
System volume coefficient (cm^3/psi) 0.158
System volume change (cm^3) 7.88
Net sample volume change (cm^3) -10.52
Bottom burette ground length, l_b (cm) 82.25
Top burette ground length, l_t (cm) 81.95
Burette area, a (cm^2) 0.197
Conversion, reading to cm head (cm/rd) 5.076

Start Date and Time: 1/13/20 15:16

Elapsed time (sec)	Bottom Burette (cm^3)	Top Burette (cm^3)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (ºC)	Visc. Ratio R_T	K^b (cm/sec)
15.0	3.80 4.04	6.16 5.92	12.28	9.84	3.9E-04	23.5 23.5	0.92	3.6E-04
15.0	4.04 4.23	5.92 5.72	9.84	7.86	3.9E-04	23.5 23.5	0.92	3.6E-04
15.0	4.23 4.39	5.72 5.56	7.86	6.24	4.0E-04	23.5 23.5	0.92	3.7E-04
15.0	4.39 4.52	5.56 5.44	6.24	4.97	4.0E-04	23.5 23.5	0.92	3.7E-04
25.0	4.52 4.67	5.44 5.28	4.97	3.40	4.0E-04	23.5 23.5	0.92	3.7E-04

Comments:
Test specimen was remolded (using only material from B1TP-1 at 10-15') to 90% of ASTM D698 B (which inlcuded combined material from B1TP-1 @ 10-15', B1TP-2 @ 0-10', B1-TP2 @ 10-20', and B1TP-3 @ 0-10') at optimum water content.

Entered by:_____
Reviewed:_____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Clousres; Delta, UT
Date: 1/15/2020
By: EH

Boring No.:
Sample: B1TP-2
Depth: 10-20'
Sample Description: Silty SAND, brown
Sample Type: Laboratory Compacted
Compaction Specifications: 95 (%) Dry unit weight
at 14 (%) w

	Initial (o)	Final (f)
Sample Height, H (in)	2.995	2.979
Sample Diameter, D (in)	2.412	2.380
Sample Length, L (cm)	7.607	7.567
Sample Area, A (cm^2)	29.479	28.696
Sample Volume, V (cm^3)	224.26	217.15
Wt. Rings + Wet Soil (g)	459.11	476.24
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	127.8	136.9
Wet Soil + Tare (g)	238.49	601.83
Dry Soil + Tare (g)	223.93	529.21
Tare (g)	118.62	127.39
Weight of solids, Ws (g)	403.34	403.34
Water Content, w (%)	13.83	18.07
Dry Unit Wt, γ_d (pcf)	112.3	116.0
Void ratio, e, for assumed Gs	0.50	0.49
Saturation (%), for assumed Gs	74.5	100 [a]
Average K[b] (cm/sec)	**2.1E-04**	

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

Optimum water content (%)	14
Maximum dry unit weight (pcf)	117.9
Gs	2.7 Assumed
Cell No.	1
Station No.	6
Permeant liquid used	De-aired tap water
Total backpressure (psi)	35
Effective horiz. consolidation stress (psi)	3
Effective vert. consolidation stress (psi)	3

	Initial (o)	Final (f)
B value	0.40	0.96
External Burette (cm^3)	12.70	25.50
Cell Pressure (psi)	0.0	38.0

Backpressure bottom (psi)	35.0
Backpressure top (psi)	35.0
System volume coefficient (cm^3/psi)	0.150
System volume change (cm^3)	5.69
Net sample volume change (cm^3)	-7.11
Bottom burette ground length, l_b (cm)	82.05
Top burette ground length, l_t (cm)	82
Burette area, a (cm^2)	0.197
Conversion, reading to cm head (cm/rd)	5.076

Start Date and Time: 1/13/20 11:45

Elapsed time (sec)	Bottom Burette (cm^3)	Top Burette (cm^3)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (ºC)	Visc. Ratio R_T	K^b (cm/sec)
30.0	3.92 4.19	6.11 5.85	11.17	8.48	2.4E-04	23.5 23.5	0.92	2.2E-04
30.0	4.19 4.39	5.85 5.66	8.48	6.52	2.3E-04	23.5 23.5	0.92	2.1E-04
30.0	4.39 4.54	5.66 5.52	6.52	5.02	2.3E-04	23.5 23.5	0.92	2.1E-04
30.0	4.54 4.66	5.52 5.42	5.02	3.91	2.2E-04	23.5 23.5	0.92	2.0E-04

Comments:
Test specimen was remolded (using only material from B1TP-2 at 10-20') to 95% of ASTM D698 B (which inlcuded combined material from B1TP-1 @ 10-15', B1TP-2 @ 0-10', B1-TP2 @ 10-20', and B1TP-3 @ 0-10') at optimum water content.

Entered by:_____
Reviewed:_____

Determination of the Soil Water Characteristic Curve for Desorption

Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: Stantec
No: M00287-022
Location: IPSCC CCR Unit Closures; Delta, UT
Date: 3/5/2020
By: DNB/JDF

Specific gravity, Gs: 2.650 Assumed

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Description: Silty SAND, brown
Sample type: Laboratory compacted
Dry unit weight 103.8 pcf
at 16 (%) w
Compaction specifications: 90% of ASTM D698B

		Test No.	1	2	3	4	5	6	7*	8*
		Tension (psi)	0.5	1.0	2.0	6.0	18.0	72.0	2915.26	22991.38
Sample A	Initial Condition	Sample height, H (in)	0.5010	0.5010	0.5010	0.5010	0.5010	0.5010	0.1873	0.1877
		Sample diameter, D (in)	1.880	1.880	1.880	1.880	1.880	1.880	1.4722	1.4715
		Sample Volume (ft^3)	0.001	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	64.05	64.05	64.05	64.05	64.05	64.05	34.127	33.817
		Wt. rings/cup (g)	20.69	20.69	20.69	20.69	20.69	20.69	24.594	24.575
		Moist soil, Ws (g)	43.36	43.36	43.36	43.36	43.36	43.36	9.533	9.242
		Dry soil (g)	37.93	37.93	37.93	37.93	37.93	37.93	8.731	8.668
		Moist unit wt., γ_m (pcf)	118.79	118.79	118.79	118.79	118.79	118.79	113.91	110.32
		Wet soil + tare (g)	107.89	107.89	107.89	107.89	107.89	107.89	34.127	33.817
		Dry soil + tare (g)	99.06	99.06	99.06	99.06	99.06	99.06	33.325	33.243
		Tare (g)	37.40	37.40	37.40	37.40	37.40	37.40	24.594	24.575
		Moisture Content, w (%)	14.3	14.3	14.3	14.3	14.3	14.3	9.19	6.62
		Dry Unit Wt., γ_d (pcf)	103.91	103.91	103.91	103.91	103.91	103.91	104.32	103.47
	Final Condition	Wet soil + ring/cup (g)	64.76	64.35	64.07	63.80	63.62	61.14	33.828	33.424
		Dry soil + ring/cup (g)	58.62	58.62	58.62	58.62	58.62	58.62	33.325	33.243
		Ring/cup (g)	20.69	20.69	20.69	20.69	20.69	20.69	24.594	24.575
		Dry soil (g)	37.93	37.93	37.93	37.93	37.93	37.93	8.731	8.668
		Moisture Content, w (%)	16.18	15.10	14.38	13.65	13.19	6.64	5.76	2.09
		Volumetric Water Content, θ	0.269	0.251	0.239	0.227	0.220	0.111	0.096	0.035
Sample B	Initial Condition	Sample height, H (in)	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000		
		Sample diameter, D (in)	1.887	1.887	1.887	1.887	1.887	1.887		
		Sample Volume (ft^3)	0.001	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	64.08	64.08	64.08	64.08	64.08	64.08		
		Wt. rings/cup (g)	20.48	20.48	20.48	20.48	20.48	20.48		
		Moist unit wt., γ_m (pcf)	118.80	118.80	118.80	118.80	118.80	118.80		
		Wet soil + tare (g)	107.89	107.89	107.89	107.89	107.89	107.89		
		Dry soil + tare (g)	99.06	99.06	99.06	99.06	99.06	99.06		
		Tare (g)	37.40	37.40	37.40	37.40	37.40	37.40		
		Moisture Content, w (%)	14.3	14.3	14.3	14.3	14.3	14.3		
		Dry Unit Wt., γ_d (pcf)	103.92	103.92	103.92	103.92	103.92	103.92		
	Final Condition	Wet soil + ring/cup (g)	64.82	64.43	64.18	63.90	63.62	63.25		
		Dry soil + ring/cup (g)	58.62	58.62	58.62	58.62	58.62	58.62		
		Ring/cup (g)	20.48	20.48	20.48	20.48	20.48	20.48		
		Dry soil (g)	38.14	38.14	38.14	38.14	38.14	38.14		
		Moisture Content, w (%)	16.26	15.24	14.59	13.85	13.11	12.14		
		Volumetric Water Content, θ	0.271	0.254	0.243	0.231	0.218	0.202		
		Average Volumetric Moisture:	**0.270**	**0.253**	**0.241**	**0.229**	**0.219**	**0.156**	**0.096**	**0.035**

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

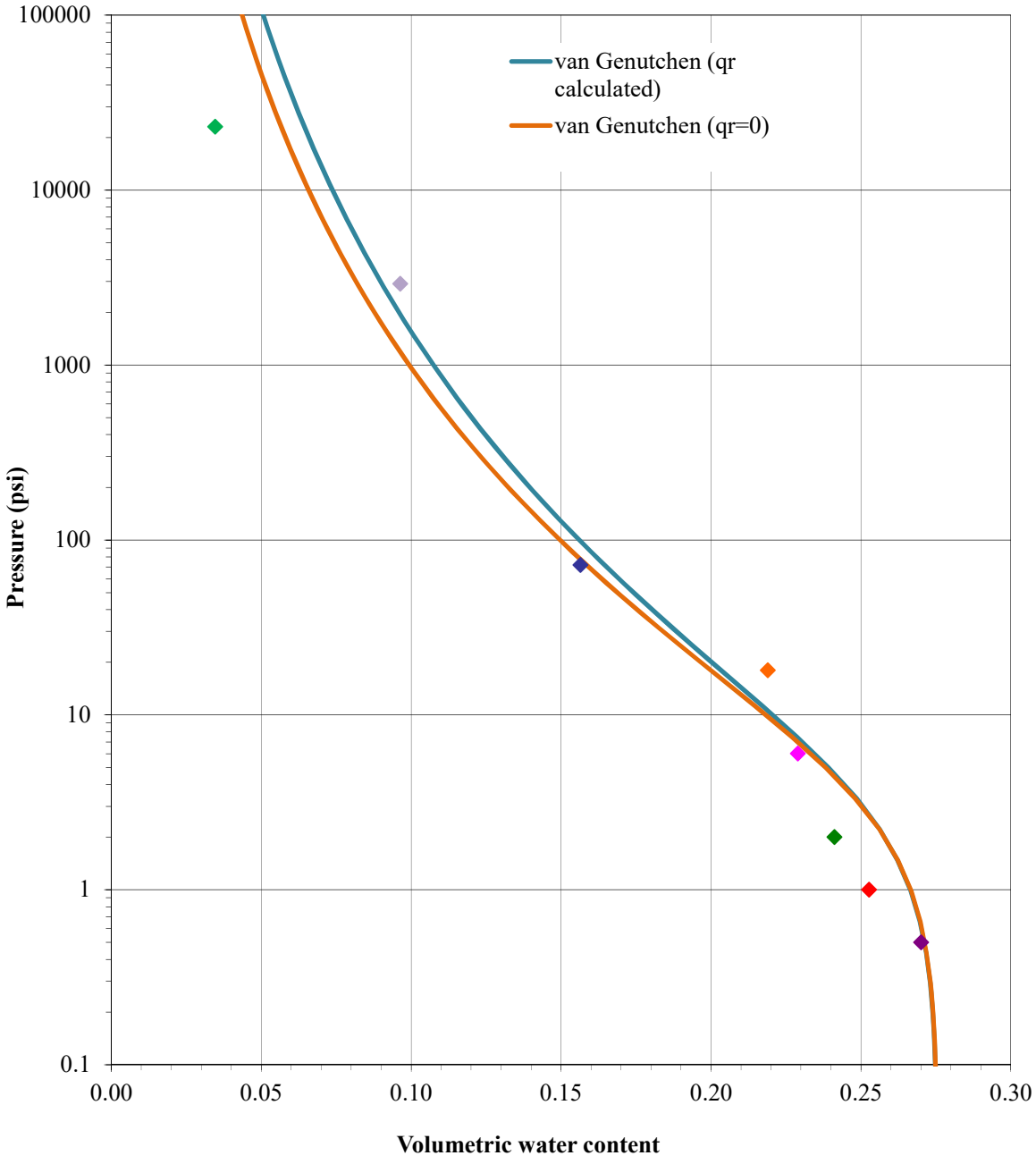
Entered by:_____
Reviewed:_____

Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: Stantec
No: M00287-022
Location: IPSCC CCR Unit Closures; Delta, UT
Date: 3/5/2020

Boring No.:
Sample: B1TP-1
Depth: 10-15'
Description: Silty SAND, brown



van Genuchten (1980) fitting parameters (using SWRC fit, Seki, K. (2007)); h in *psi:*

θ_r calculated		Setting $\theta_r = 0$		
θ_s	0.2755	θ_s	0.2755	$S_e = \left[\frac{1}{1+(\alpha h)^n}\right]^m$
θ_r	9.938E-06	θ_r	0	
α	0.3215	α	0.2987	
n	1.1632	n	1.1790	$(m = 1 - 1/n)$
m	0.1403	m	0.1518	
R^2	0.9648	R^2	0.9686	$\theta = \theta_r + (\theta_s - \theta_r)S_e$

Determination of the Soil Water Characteristic Curve for Desorption

Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: Stantec
No: M00287-022
Location: IPSCC CCR Unit Closures; Delta, UT
Date: 3/4/2020
By: DNB/JDF

Specific gravity, Gs: 2.650 Assumed

Boring No.:
Sample: B1TP-1
Depth: 15-25'
Description: Sandy lean CLAY, brown
Sample type: Laboratory compacted
Dry unit weight 93.1 pcf
at 19 (%) w
Compaction specifications: 90% of ASTM D698B

		Test No.	1	2	3	4	5	6	7*	8*
		Tension (psi)	0.5	1.0	2.0	6.0	18.0	72.0	3354.72	22508.41
Sample A	Initial Condition	Sample height, H (in)	0.5010	0.5010	0.5010	0.5010	0.5010	0.5010	0.1890	0.1882
		Sample diameter, D (in)	1.882	1.882	1.882	1.882	1.882	1.882	1.4718	1.4722
		Sample Volume (ft^3)	0.001	0.001	0.001	0.001	0.001	0.001	0.0002	0.0002
		Wt. rings/cup + wet soil (g)	61.18	61.18	61.18	61.18	61.18	61.18	33.709	33.004
		Wt. rings/cup (g)	20.56	20.56	20.56	20.56	20.56	20.56	24.764	24.367
		Moist soil, Ws (g)	40.62	40.62	40.62	40.62	40.62	40.62	8.945	8.637
		Dry soil (g)	34.06	34.06	34.06	34.06	34.06	34.06	7.900	7.842
		Moist unit wt., γ_m (pcf)	111.03	111.03	111.03	111.03	111.03	111.03	105.98	102.71
		Wet soil + tare (g)	146.19	146.19	146.19	146.19	146.19	146.19	33.709	33.004
		Dry soil + tare (g)	128.62	128.62	128.62	128.62	128.62	128.62	32.664	32.209
		Tare (g)	37.42	37.42	37.42	37.42	37.42	37.42	24.764	24.367
		Moisture Content, w (%)	19.3	19.3	19.3	19.3	19.3	19.3	13.23	10.14
		Dry Unit Wt., γ_d (pcf)	93.10	93.10	93.10	93.10	93.10	93.10	93.60	93.25
	Final Condition	Wet soil + ring/cup (g)	63.05	62.69	62.29	61.66	61.13	60.37	33.266	32.394
		Dry soil + ring/cup (g)	54.62	54.62	54.62	54.62	54.62	54.62	32.664	32.209
		Ring/cup (g)	20.56	20.56	20.56	20.56	20.56	20.56	24.764	24.367
		Dry soil (g)	34.06	34.06	34.06	34.06	34.06	34.06	7.900	7.842
		Moisture Content, w (%)	24.74	23.68	22.51	20.66	19.12	16.89	7.62	2.36
		Volumetric Water Content, θ	0.369	0.353	0.336	0.308	0.285	0.252	0.114	0.035
Sample B	Initial Condition	Sample height, H (in)	0.4980	0.4980	0.4980	0.4980	0.4980	0.4980		
		Sample diameter, D (in)	1.881	1.881	1.881	1.881	1.881	1.881		
		Sample Volume (ft^3)	0.001	0.001	0.001	0.001	0.001	0.001		
		Wt. rings/cup + wet soil (g)	61.05	61.05	61.05	61.05	61.05	61.05		
		Wt. rings/cup (g)	20.54	20.54	20.54	20.54	20.54	20.54		
		Moist unit wt., γ_m (pcf)	111.52	111.52	111.52	111.52	111.52	111.52		
		Wet soil + tare (g)	146.19	146.19	146.19	146.19	146.19	146.19		
		Dry soil + tare (g)	128.62	128.62	128.62	128.62	128.62	128.62		
		Tare (g)	37.42	37.42	37.42	37.42	37.42	37.42		
		Moisture Content, w (%)	19.3	19.3	19.3	19.3	19.3	19.3		
		Dry Unit Wt., γ_d (pcf)	93.51	93.51	93.51	93.51	93.51	93.51		
	Final Condition	Wet soil + ring/cup (g)	62.74	62.41	62.02	61.45	61.17	60.44		
		Dry soil + ring/cup (g)	54.51	54.51	54.51	54.51	54.51	54.51		
		Ring/cup (g)	20.54	20.54	20.54	20.54	20.54	20.54		
		Dry soil (g)	33.97	33.97	33.97	33.97	33.97	33.97		
		Moisture Content, w (%)	24.24	23.26	22.11	20.43	19.60	17.47		
		Volumetric Water Content, θ	0.363	0.349	0.331	0.306	0.294	0.262		
		Average Volumetric Moisture:	**0.366**	**0.351**	**0.334**	**0.307**	**0.290**	**0.257**	**0.114**	**0.035**

Comments:
*Points 7 and 8 were performed on a Chilled Mirror Hygrometer

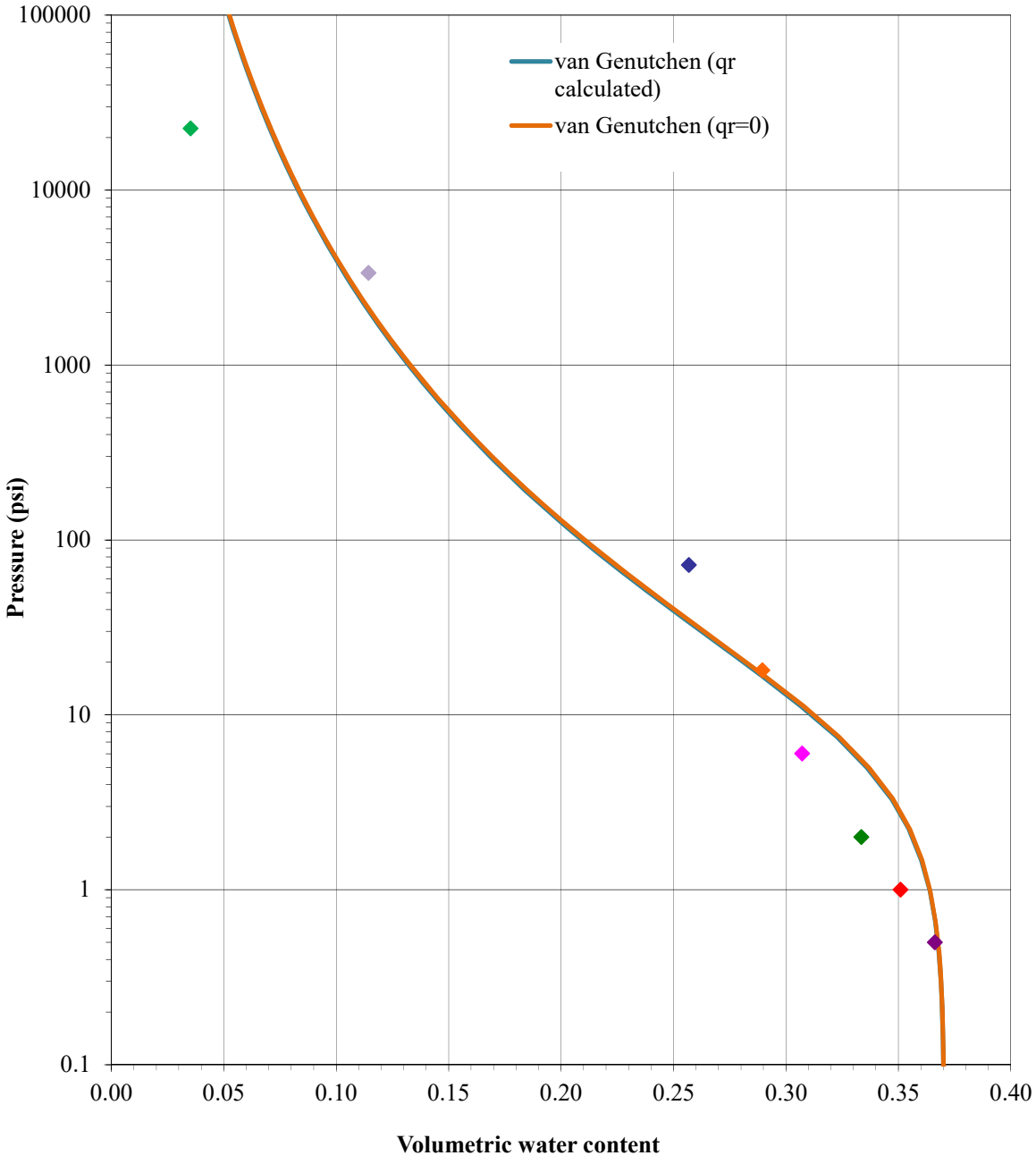
Entered by:_____
Reviewed:_____

Determination of the Soil Water Characteristic Curve for Desorption Using Pressure Extractor

(In general accordance with ASTM D6836)

Project: Stantec
No: M00287-022
Location: IPSCC CCR Unit Closures; Delta, UT
Date: 3/4/2020

Boring No.:
Sample: B1TP-1
Depth: 15-25'
Description: Sandy lean CLAY, brown



van Genuchten (1980) fitting parameters (using SWRC fit, Seki, K. (2007)); h in *psi:*				
θ_r calculated		Setting $\theta_r = 0$		
θ_s	0.3705	θ_s	0.3705	$S_e = \left[\frac{1}{1+(\alpha h)^n}\right]^m$
θ_r	4.115E-06	θ_r	0	
α	0.1639	α	0.1598	
n	1.2021	n	1.2020	$(m = 1 - 1/n)$
m	0.1681	m	0.1681	
R^2	0.9627	R^2	0.9627	$\theta = \theta_r + (\theta_s - \theta_r)S_e$

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-1
Depth: 0-10'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/4"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

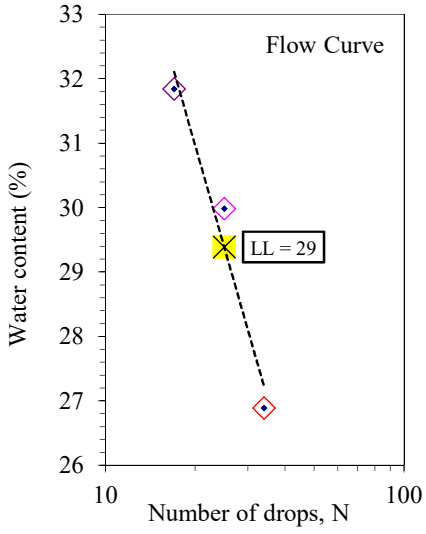
Plastic Limit

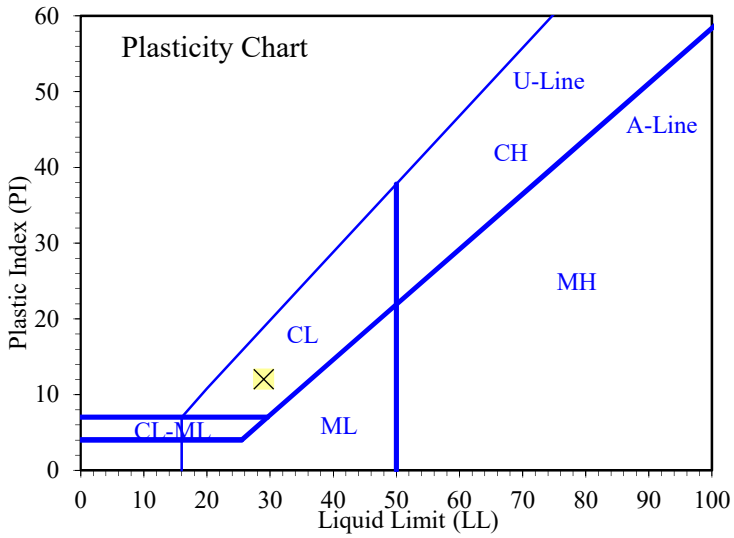
Determination No	1	2				
Wet Soil + Tare (g)	14.37	14.62				
Dry Soil + Tare (g)	13.28	13.51				
Water Loss (g)	1.09	1.11				
Tare (g)	7.08	7.11				
Dry Soil (g)	6.20	6.40				
Water Content, w (%)	17.58	17.34				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	25	17			
Wet Soil + Tare (g)	14.56	15.45	16.23			
Dry Soil + Tare (g)	13.03	13.66	14.10			
Water Loss (g)	1.53	1.79	2.13			
Tare (g)	7.34	7.69	7.41			
Dry Soil (g)	5.69	5.97	6.69			
Water Content, w (%)	26.89	29.98	31.84			
One-Point LL (%)		30				

Liquid Limit, LL (%)	**29**
Plastic Limit, PL (%)	**17**
Plasticity Index, PI (%)	**12**





Entered by:_____
Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-1
Depth: 10-20'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/8"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

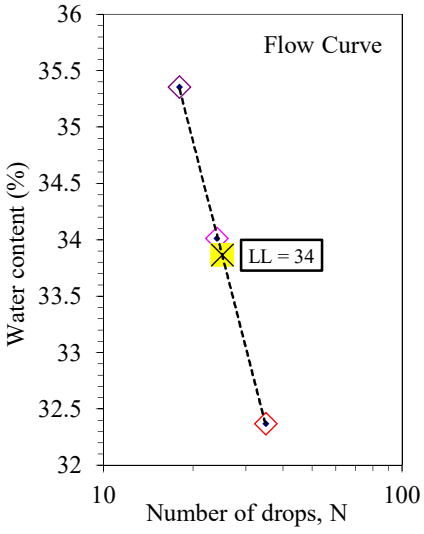
Plastic Limit

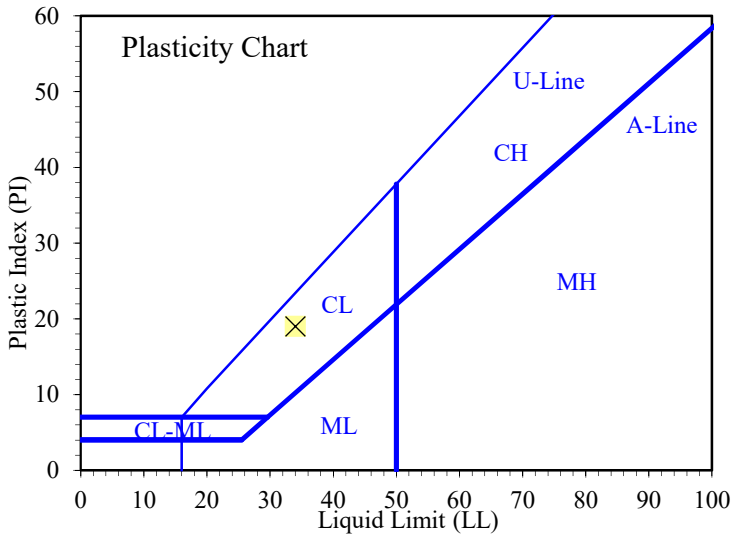
Determination No	1	2				
Wet Soil + Tare (g)	14.56	14.71				
Dry Soil + Tare (g)	13.56	13.73				
Water Loss (g)	1.00	0.98				
Tare (g)	7.03	7.11				
Dry Soil (g)	6.53	6.62				
Water Content, w (%)	15.31	14.80				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	24	18			
Wet Soil + Tare (g)	15.70	16.50	15.24			
Dry Soil + Tare (g)	13.69	14.33	13.20			
Water Loss (g)	2.01	2.17	2.04			
Tare (g)	7.48	7.95	7.43			
Dry Soil (g)	6.21	6.38	5.77			
Water Content, w (%)	32.37	34.01	35.36			
One-Point LL (%)		34				

Liquid Limit, LL (%)	**34**
Plastic Limit, PL (%)	**15**
Plasticity Index, PI (%)	**19**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-2
Depth: 0-15'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/8"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

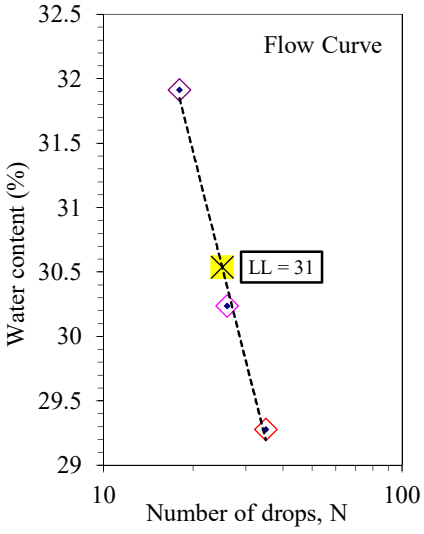
Plastic Limit

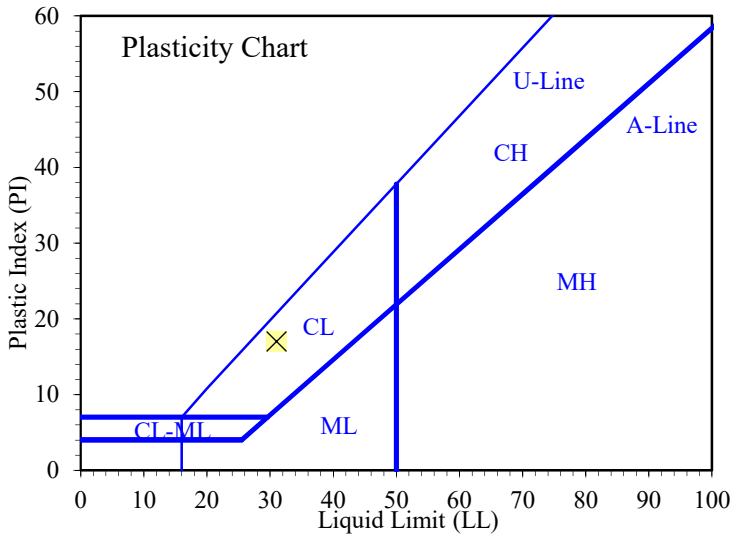
Determination No	1	2				
Wet Soil + Tare (g)	13.77	13.08				
Dry Soil + Tare (g)	12.94	12.34				
Water Loss (g)	0.83	0.74				
Tare (g)	7.05	7.03				
Dry Soil (g)	5.89	5.31				
Water Content, w (%)	14.09	13.94				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	26	18			
Wet Soil + Tare (g)	15.47	14.82	16.03			
Dry Soil + Tare (g)	13.57	13.03	13.86			
Water Loss (g)	1.90	1.79	2.17			
Tare (g)	7.08	7.11	7.06			
Dry Soil (g)	6.49	5.92	6.80			
Water Content, w (%)	29.28	30.24	31.91			
One-Point LL (%)		30				

Liquid Limit, LL (%)	**31**
Plastic Limit, PL (%)	**14**
Plasticity Index, PI (%)	**17**





Entered by:_____
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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-2
Depth: 15-25'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/8"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

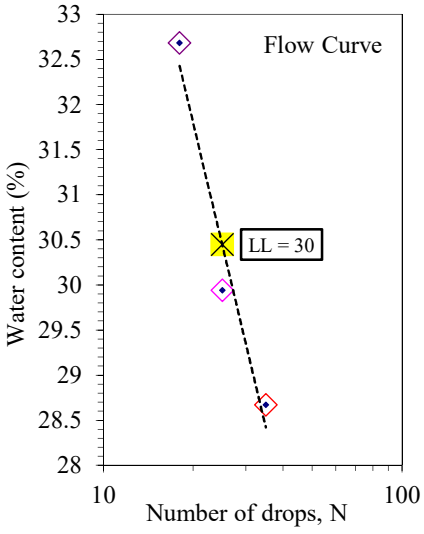
Plastic Limit

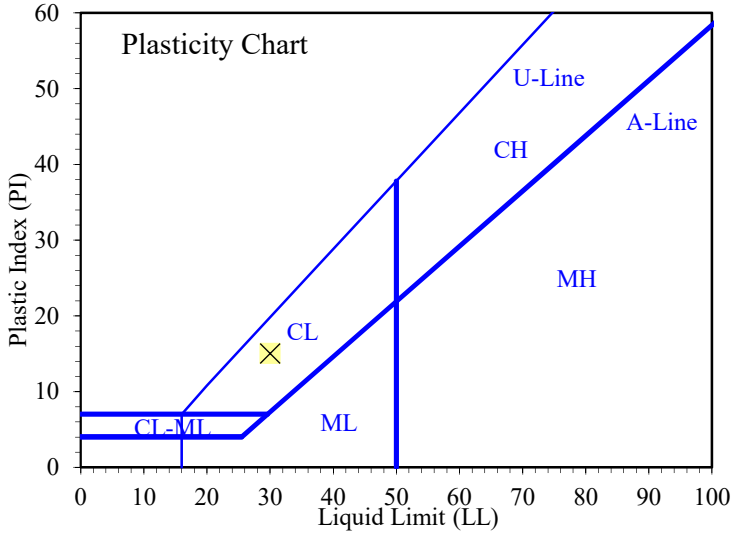
Determination No	1	2				
Wet Soil + Tare (g)	13.81	14.54				
Dry Soil + Tare (g)	12.93	13.56				
Water Loss (g)	0.88	0.98				
Tare (g)	7.03	7.13				
Dry Soil (g)	5.90	6.43				
Water Content, w (%)	14.92	15.24				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	25	18			
Wet Soil + Tare (g)	14.98	16.02	14.94			
Dry Soil + Tare (g)	13.30	14.02	13.10			
Water Loss (g)	1.68	2.00	1.84			
Tare (g)	7.44	7.34	7.47			
Dry Soil (g)	5.86	6.68	5.63			
Water Content, w (%)	28.67	29.94	32.68			
One-Point LL (%)		30				

Liquid Limit, LL (%)	**30**
Plastic Limit, PL (%)	**15**
Plasticity Index, PI (%)	**15**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-3
Depth: 0-15'
Description: SILT, brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/8"
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

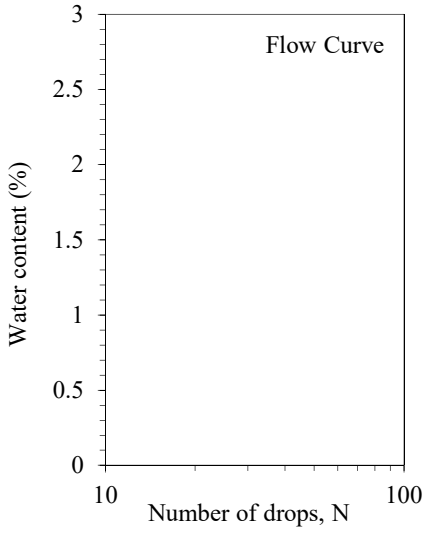
Plastic Limit

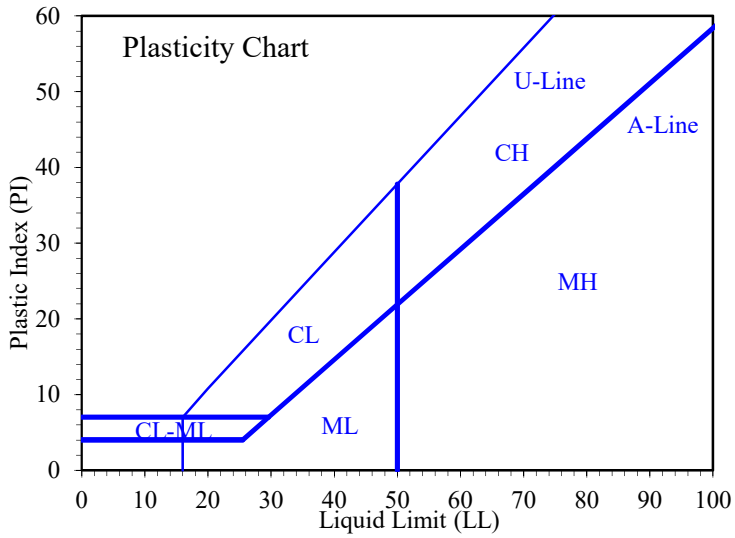
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.:
Sample: B3TP-3
Depth: 15-30'
Description: Lean CLAY, brown

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: No.4
Estimated percent retained on No.40: See Particle Size Distribution
As-received water content (%): Not requested

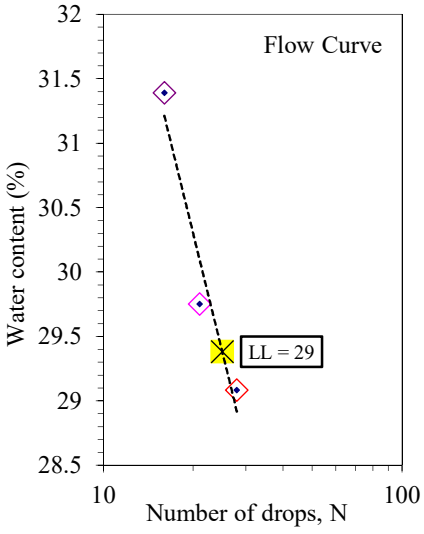
Plastic Limit

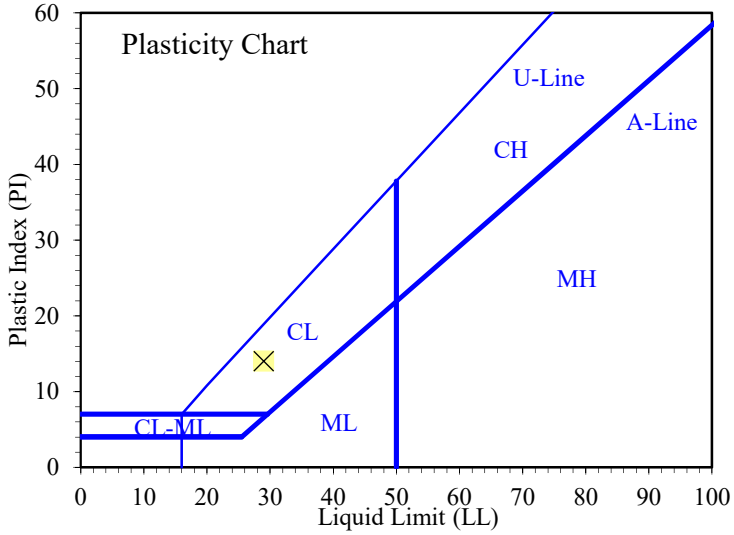
Determination No	1	2				
Wet Soil + Tare (g)	13.22	13.61				
Dry Soil + Tare (g)	12.41	12.75				
Water Loss (g)	0.81	0.86				
Tare (g)	7.12	7.07				
Dry Soil (g)	5.29	5.68				
Water Content, w (%)	15.31	15.14				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	28	21	16			
Wet Soil + Tare (g)	13.54	13.77	17.19			
Dry Soil + Tare (g)	12.08	12.22	14.93			
Water Loss (g)	1.46	1.55	2.26			
Tare (g)	7.06	7.01	7.73			
Dry Soil (g)	5.02	5.21	7.20			
Water Content, w (%)	29.08	29.75	31.39			
One-Point LL (%)	29	29				

Liquid Limit, LL (%)	**29**
Plastic Limit, PL (%)	**15**
Plasticity Index, PI (%)	**14**





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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: JAB/EH/BRR

Boring No.:
Sample: B3TP-1
Depth: 0-10'
Description: Clayey SAND, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	9915.5	9258.2
+3/8" Coarse fraction (g):	139.95	137.45
-3/8" Split fraction (g):	368.30	343.63
Hydrometer fraction (g):	65.30	58.84
First Split fraction:	0.985	

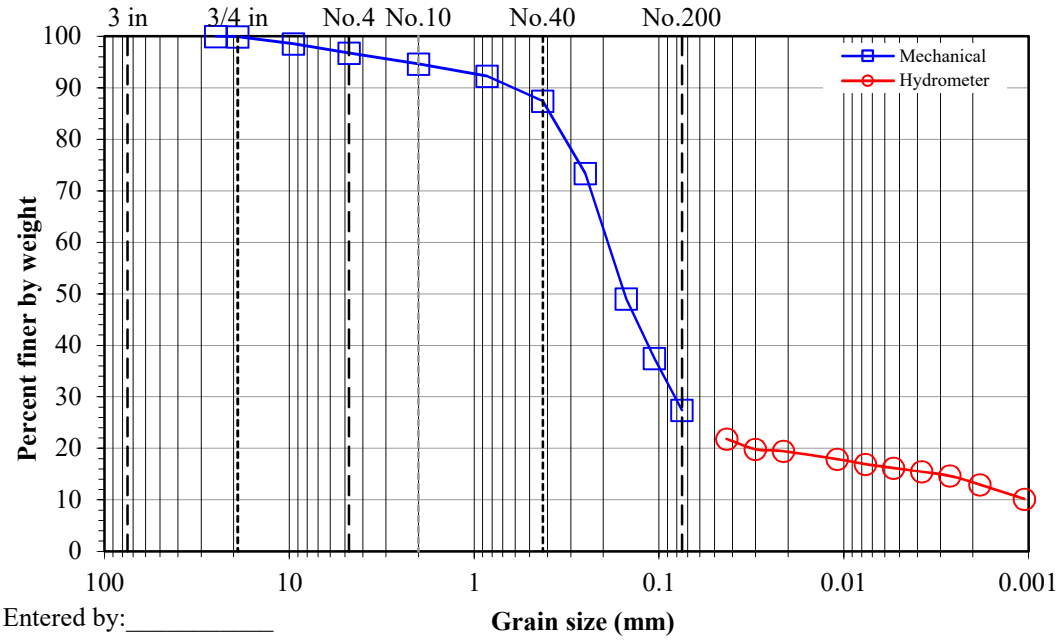
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	100.0
3/4"	5.88	19	99.9
3/8"	137.45	9.5	98.5
No.4	6.25	4.75	96.7
No.10	13.50	2	94.6
No.20	21.74	0.85	92.3
No.40	38.63	0.425	87.4
No.60	87.59	0.25	73.4
No.100	172.67	0.15	49.0
No.140	212.92	0.106	37.5
No.200	247.98	0.075	27.4

Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	264.47	497.11	30.00
Dry soil + tare (g):	261.94	472.44	27.73
Tare (g):	123.06	128.81	7.06
Water content (%):	1.82	7.18	10.98

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	94.65
Cylinder ID:	T5	Dispersion device:	Air-jet

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	22.1	18.5	0.0430	21.83
	2	22.1	17.25	0.0301	19.84
	4	22.1	17	0.0212	19.44
	15	22.2	16	0.0109	17.91
	30	21.9	15.5	0.0077	16.94
	60	22	15	0.0054	16.20
	120	22.1	14.5	0.0038	15.47
	240	22.1	14	0.0027	14.67
	500	21.9	13	0.0018	12.97
<=1st Split	1465	21.9	11.25	0.0011	10.18
<=Split hyd.					

Gravel (%): 3.3
Sand (%): 69.3
Fines (%): 27.4



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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: JAB/EH/BRR

Boring No.:
Sample: B3TP-1
Depth: 10-20'
Description: Lean CLAY with sand, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	9285.1	7989.9
+3/8" Coarse fraction (g):	18.33	17.92
-3/8" Split fraction (g):	308.83	265.68
Hydrometer fraction (g):	65.18	57.28
First Split fraction:	0.998	

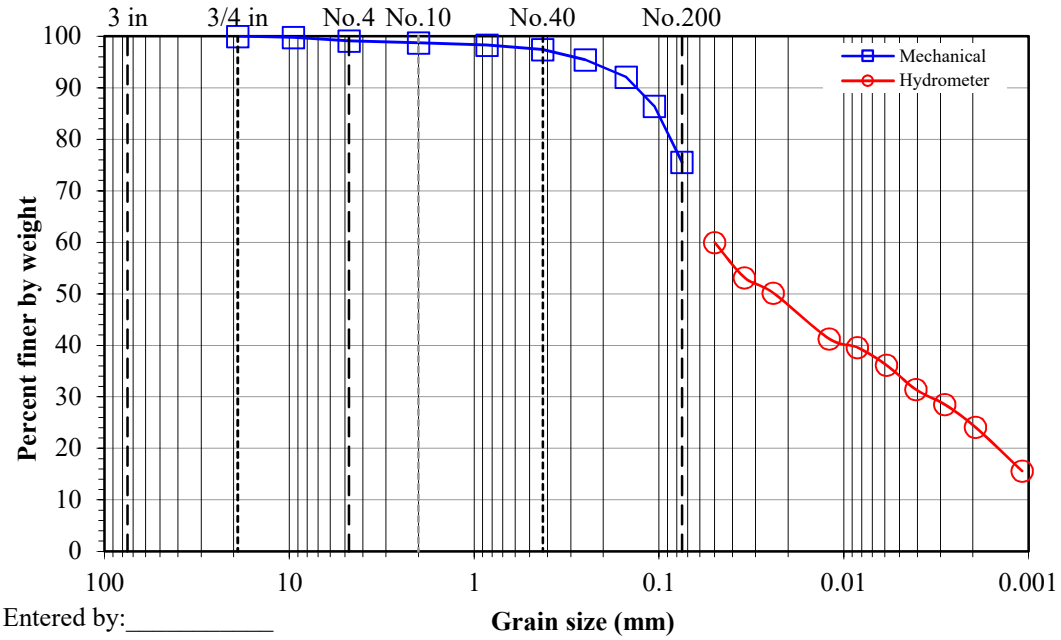
Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	147.79	435.66	25.99
Dry soil + tare (g):	147.33	392.51	23.75
Tare (g):	127.04	126.83	7.50
Water content (%):	2.27	16.24	13.78

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	98.76
Cylinder ID:	N3	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	100.0
3/8"	17.92	9.5	99.8
No.4	1.82	4.75	99.1
No.10	2.71	2	98.8
No.20	3.99	0.85	98.3
No.40	6.25	0.425	97.4
No.60	11.55	0.25	95.4
No.100	20.49	0.15	92.1
No.140	35.48	0.106	86.5
No.200	64.53	0.075	75.5

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	22	40	0.0500	59.99
	2	22	36	0.0345	53.17
	4	22	34.25	0.0241	50.18
	15	22.1	29	0.0120	41.30
	30	22.1	28	0.0084	39.59
	60	22.1	26	0.0059	36.18
	120	22	23.25	0.0041	31.43
	240	22.1	21.5	0.0028	28.51
	494	21.9	19	0.0019	24.12
<=1st Split	1458	21.9	14	0.0011	15.60
<=Split hyd.					

Gravel (%): 0.9
Sand (%): 23.6
Fines (%): 75.5



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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: JAB/EH/BRR

Boring No.:
Sample: B3TP-2
Depth: 0-15'
Description: Sandy lean CLAY, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	8606.1	7443.4
+3/8" Coarse fraction (g):	4.08	3.99
-3/8" Split fraction (g):	245.05	211.93
Hydrometer fraction (g):	65.51	57.75
First Split fraction:	0.999	

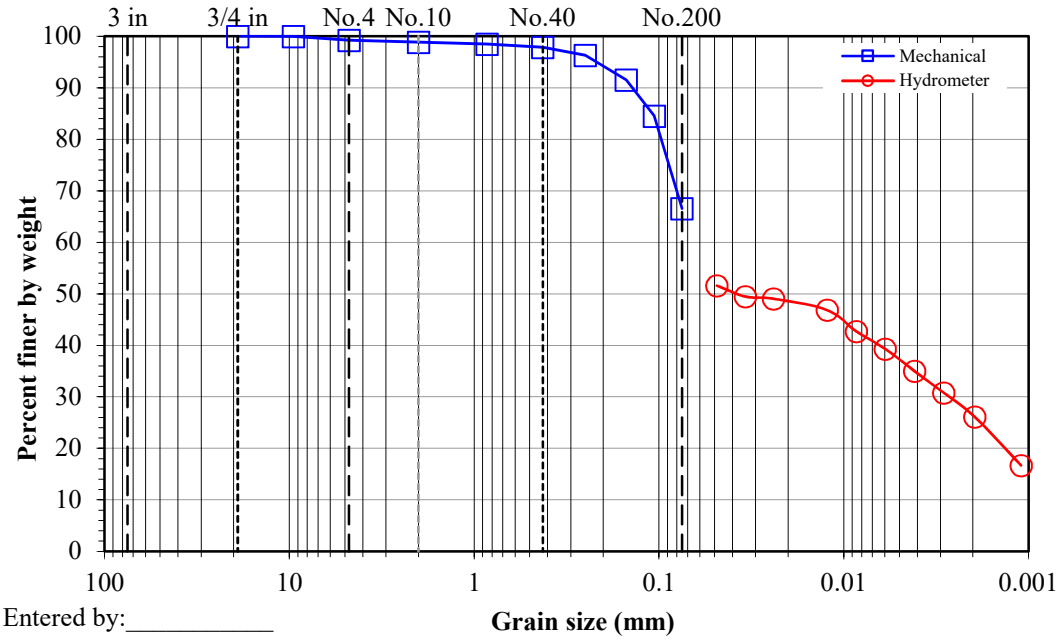
Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	132.04	373.55	35.45
Dry soil + tare (g):	131.95	340.43	32.09
Tare (g):	127.91	128.50	7.10
Water content (%):	2.23	15.63	13.45

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	98.84
Cylinder ID:	N10	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	100.0
3/8"	3.99	9.5	99.9
No.4	1.58	4.75	99.2
No.10	2.34	2	98.8
No.20	3.08	0.85	98.5
No.40	4.48	0.425	97.8
No.60	7.69	0.25	96.3
No.100	17.86	0.15	91.5
No.140	32.70	0.106	84.5
No.200	70.82	0.075	66.5

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	22.1	35.25	0.0486	51.58
	2	22.1	34	0.0341	49.46
	4	22.1	33.75	0.0240	49.04
	15	22	32.5	0.0123	46.86
	30	22.1	30	0.0086	42.69
	60	22.1	28	0.0060	39.31
	120	22	25.5	0.0041	35.02
	240	22	23	0.0029	30.78
	497	22	20.25	0.0020	26.13
<=1st Split	1450	21.1	15	0.0011	16.70
<=Split hyd.					

Gravel (%): 0.8
Sand (%): 32.7
Fines (%): 66.5



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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/9/2020
By: JAB/EH/BRR

Boring No.:
Sample: B3TP-2
Depth: 15-25'
Description: Sandy lean CLAY, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928	
Split:	Yes	
First Split sieve:	3/8"	
Second split:	No	
	Moist	Dry
Total sample wt. (g):	8940.3	7903.2
+3/8" Coarse fraction (g):	56.99	54.10
-3/8" Split fraction (g):	261.81	231.33
Hydrometer fraction (g):	61.80	55.36
First Split fraction:	0.993	

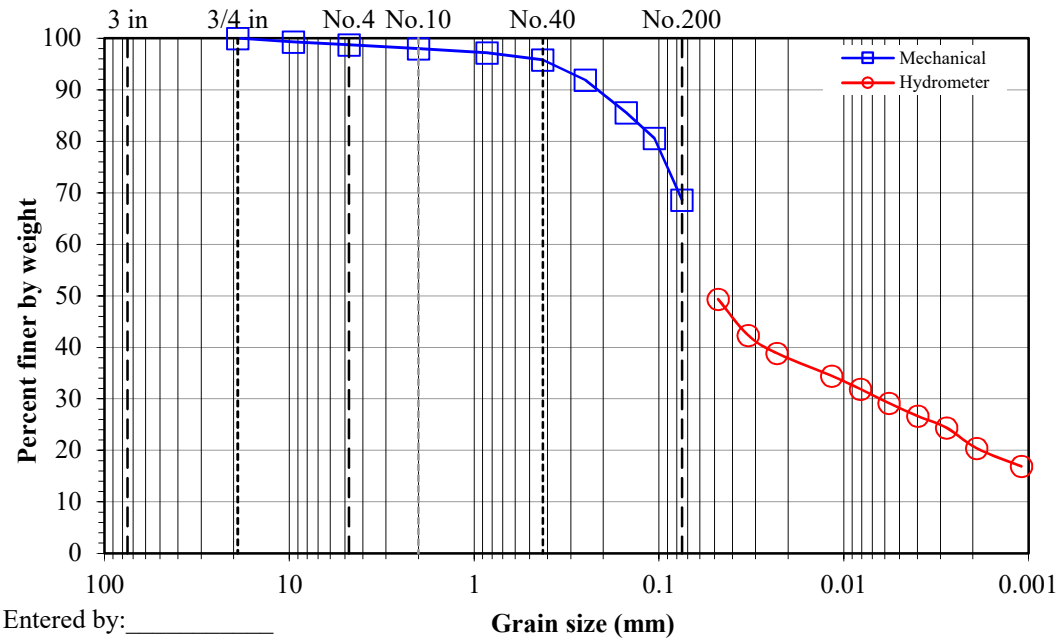
Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	192.03	389.49	28.99
Dry soil + tare (g):	188.63	359.01	26.74
Tare (g):	125.02	127.68	7.41
Water content (%):	5.35	13.18	11.64

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	98.00
Cylinder ID:	T3	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	100.0	
3/8"	54.10	9.5	99.3	<=1st Split
No.4	1.37	4.75	98.7	
No.10	3.07	2	98.0	<=Split hyd.
No.20	4.94	0.85	97.2	
No.40	8.21	0.425	95.8	
No.60	17.25	0.25	91.9	
No.100	32.03	0.15	85.6	
No.140	43.64	0.106	80.6	
No.200	71.52	0.075	68.6	

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	22	33	0.0478	49.34
2	22	29	0.0329	42.34
4	22	27	0.0229	38.84
15	22	24.5	0.0116	34.46
30	22.1	23	0.0081	31.90
60	21.9	21.5	0.0057	29.15
120	22.1	20	0.0040	26.65
240	22	18.75	0.0028	24.40
492	21.9	16.5	0.0019	20.40
1443	21.9	14.5	0.0011	16.90

Gravel (%): 1.3
Sand (%): 30.1
Fines (%): 68.6



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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JAB/BRR/EH

Boring No.:
Sample: B3TP-3
Depth: 0-15'
Description: Silty SAND, brown

ASTM Standard(s)	ASTM D6913 and ASTM D7928
Split:	Yes
First Split sieve:	3/8"
Second split:	No

	Moist	Dry
Total sample wt. (g):	9290.9	8833.5
+3/8" Coarse fraction (g):	47.94	46.11
-3/8" Split fraction (g):	212.21	201.75
Hydrometer fraction (g):	83.68	80.77
First Split fraction:	0.995	

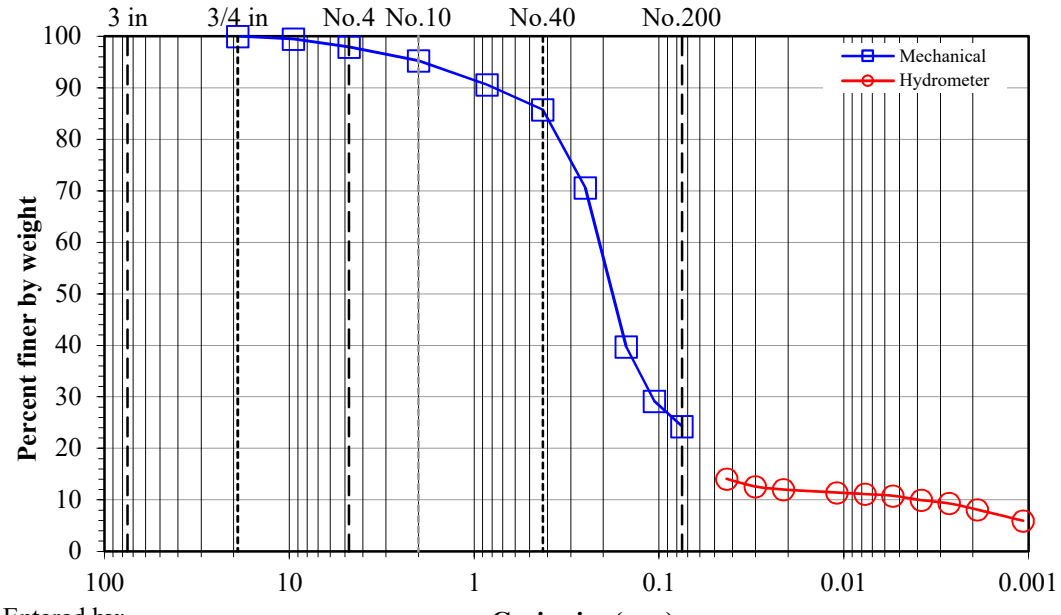
Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
6"		150	-	
4"		100	-	
3"		75	-	
1.5"		37.5	-	
1"		25	-	
3/4"		19	100.0	
3/8"	46.11	9.5	99.5	<=1st Split
No.4	3.18	4.75	97.9	
No.10	8.56	2	95.3	<=Split hyd.
No.20	18.00	0.85	90.6	
No.40	27.85	0.425	85.7	
No.60	58.55	0.25	70.6	
No.100	121.17	0.15	39.7	
No.140	142.63	0.106	29.2	
No.200	152.51	0.075	24.3	

Water content data	C.F.1(+3/8")	S.F.1(-3/8")	Hyd.(-No.10)
Moist soil + tare (g):	171.32	339.33	49.45
Dry soil + tare (g):	169.45	328.87	48.17
Tare (g):	122.41	127.12	12.64
Water content (%):	3.98	5.18	3.60

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.65	Assumed	
Bulb No.	6	Hyd. fraction:	95.26
Cylinder ID:	N16	Dispersion device:	Air-jet

Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
1	22	16.75	0.0430	14.08
2	22	15.5	0.0301	12.60
4	22	15	0.0212	12.01
15	22	14.5	0.0109	11.42
30	22	14.25	0.0077	11.13
60	21.9	14	0.0054	10.79
120	22	13.25	0.0038	9.95
239	21.9	12.75	0.0027	9.32
474	21.8	11.75	0.0019	8.10
1430	21.6	10	0.0011	5.95

Gravel (%): 2.1
Sand (%): 73.6
Fines (%): 24.3



Entered by:_____
Reviewed:_____

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(In general accordance with ASTM D6913 and ASTM D7928)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP/JAB/EH/BRR

Boring No.:
Sample: B3TP-3
Depth: 15-30'
Description: Lean CLAY with sand, brown

ASTM Standard(s): ASTM D6913 and ASTM D7928
Split: No
Second split: No

	Moist	Dry
Total sample wt. (g):	260.92	217.49
Hydrometer fraction (g):	65.96	56.18

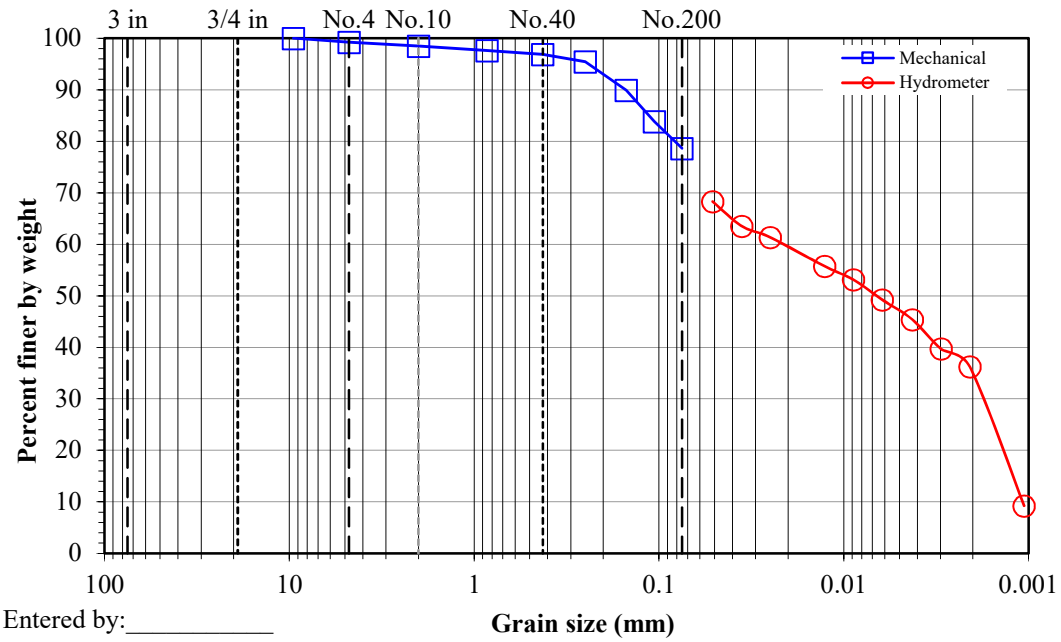
Water content data		S.F.	Hyd.(-No.10)
Moist soil + tare (g):		384.53	47.86
Dry soil + tare (g):		341.10	42.64
Tare (g):		123.61	12.66
Water content (%):		19.97	17.41

Hydrometer data			
Hyd. split:	No.10		
Gs:	2.7	Assumed	
Bulb No.	6	Hyd. fraction:	98.48
Cylinder ID:	N18	Dispersion device:	Air-jet

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
6"		150	-
4"		100	-
3"		75	-
1.5"		37.5	-
1"		25	-
3/4"		19	-
3/8"		9.5	100.0
No.4	1.74	4.75	99.2
No.10	3.31	2	98.5
No.20	5.15	0.85	97.6
No.40	6.80	0.425	96.9
No.60	9.89	0.25	95.5
No.100	21.91	0.15	89.9
No.140	35.12	0.106	83.9
No.200	46.50	0.075	78.6

	Elapsed time (min)	Temp. (°C)	Hydrometer Reading	Grain Size (mm)	% Soil in Suspension
	1	21.9	44.25	0.0512	68.30
	2	21.9	41.5	0.0357	63.53
	4	21.9	40.25	0.0250	61.36
	15	21.9	37	0.0127	55.73
	30	21.9	35.5	0.0089	53.13
	60	21.9	33.25	0.0062	49.23
	123	22	31	0.0043	45.39
	240	21.9	27.75	0.0030	39.70
	478	21.9	25.75	0.0021	36.23
<=Split hyd.	1434	21.7	10.25	0.0011	9.24

Gravel (%): 0.8
Sand (%): 20.6
Fines (%): 78.6



Entered by:_____
Reviewed:_____

Classification of Soils for Engineering Purposes

(ASTM D2487)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: BRR

Sample Info.									
	Boring No.								
	Sample:	B3TP-1	B3TP-1	B3TP-2	B3TP-2	B3TP-3	B3TP-3		
	Depth:	0-10'	10-20'	0-15'	15-25'	0-15'	15-30'		
Liquid Limit (%):		29	34	31	30	NP	29		
Plastic Limit (%):		17	15	14	15	NP	15		
Plastic Index (%):		12	19	17	15	NP	14		
Gravel (%):		3.3	0.9	0.8	1.3	2.1	0.8		
Sand (%):		69.3	23.6	32.7	30.1	73.6	20.6		
Fines (%):		27.4	75.5	66.5	68.6	24.3	78.6		
D_{60} (mm):									
D_{30} (mm):									
D_{10} (mm):									
Cu:									
Cc:									
Group Symbol:		**SC**	**CL**	**CL**	**CL**	**SM**	**CL**		
Group Name:		**Clayey SAND**	**Lean CLAY with sand**	**Sandy lean CLAY**	**Sandy lean CLAY**	**Silty SAND**	**Lean CLAY with sand**		

Entered by:_____

Reviewed:_____

Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

(ASTM D2974)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 12/31/2019
By: BF/BSS/JAB

Sample Info.	Boring No.								
	Sample:	B1TP-1	B1TP-2	B1TP-3	B2TP-1	B2TP-2	B2TP-3	B3TP-1	
	Depth:	10-15'	10-20'	0-10'	20-25'	0-15'	12-15'	10-20'	
	Test Method:	C	C	C	C	C	C	C	
	Furnace temp. (°C)	440	440	440	440	440	440	440	
Moisture	Wet soil + tare (g)	680.76	630.70	611.32	614.17	599.84	552.15	569.66	
	Dry soil + tare (g)	653.03	624.18	585.74	578.80	580.49	525.90	536.95	
	Tare (g)	380.50	375.01	374.87	378.48	374.28	380.26	341.22	
Ash / Organic Info	Mass of crucible and oven-dried sample (g)	653.03	624.18	585.74	578.80	580.49	525.90	536.95	
	Mass of crucible and ash (g)	648.81	622.08	584.01	572.54	578.24	521.82	530.70	
	Mass of crucible (g)	380.50	375.01	374.87	378.48	374.28	380.26	341.22	
Moisture Content, w (%) [a]		**10.2**	**2.6**	**12.1**	**17.7**	**9.4**	**18.0**	**16.7**	
Ash Content (%)		**98.5**	**99.2**	**99.2**	**96.9**	**98.9**	**97.2**	**96.8**	
Organic Matter (%)		**1.5**	**0.8**	**0.8**	**3.1**	**1.1**	**2.8**	**3.2**	

[a] Moisture contents are by proportion of oven-dried mass (geotechnical convention).

Entered by:_____
Reviewed:_____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B3TP-1
Depth: 10-20'
Sample Description: Lean CLAY with sand, brown
Engineering Classification: CL
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	142.03	
Dry soil + tare (g)	139.46	
Tare (g)	123.63	
Water content, w (%)	16.2	

Initial water temperature: 19.0 °C
Date test started: 12/27/2019
Time at beginning of test: 10:22

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	19.0	1	18.4	1	18.0
2	1	19.0	1	18.4	1	18.0

Dispersive classification: Grade 1-Nondispersive

Entered: _____
Reviewed: _____

DETERMINING DISPERSIVE CHARACTERISTICS OF CLAYEY SOILS BY THE CRUMB TEST

(ASTM D6572)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: JP

Boring No.:
Sample: B3TP-2
Depth: 15-25'
Sample Description: Sandy lean CLAY, brown
Engineering Classification: CL
Specimen Type: Natural irregularly shaped crumb

Specific Gravity, Gs:	2.65	Assumed
Curing Time:	0	minutes
Water used:	Distilled	
Water content:	Air-dried	
Wet soil + tare (g)	178.14	
Dry soil + tare (g)	169.56	
Tare (g)	114.72	
Water content, w (%)	15.6	

Initial water temperature: 18.9 °C
Date test started: 12/27/2019
Time at beginning of test: 10:24

Specimen Number	2 minutes		1 hour		6 hours	
	Grade	Temp. (°C)	Grade	Temp. (°C)	Grade	Temp. (°C)
1	1	18.9	1	18.3	1	18.0
2	1	18.9	1	18.3	1	18.0

Dispersive classification: Grade 1-Nondispersive

Entered: _____
Reviewed: _____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Closures; Delta, UT
Date: 1/10/2020
By: BSS

Sample: B3TP-1 & B3TP-2 & B3TP-3
Depth: 10-30'
Sample Description: Sandy lean CLAY, brown
Engineering Classification: CL
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 3
Mold volume (ft^3): 0.0332

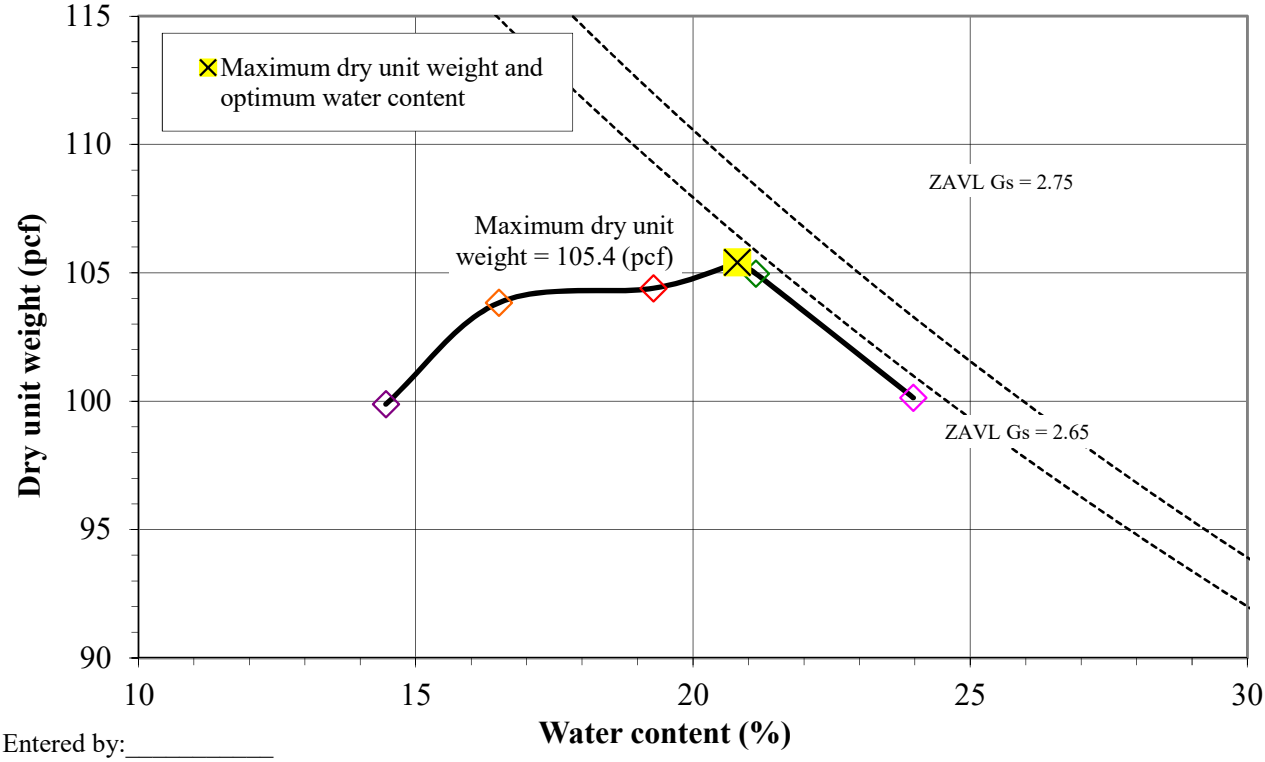
Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

Optimum water content (%): 20.8
Maximum dry unit weight (pcf): 105.4

Point Number	-2%	+2%	+4%	+6%	As Is			
Wt. Sample + Mold (g)	5945.2	6099.0	6138.5	6093.1	6045.3			
Wt. of Mold (g)	4221.2	4221.2	4221.2	4221.2	4221.2			
Wet Unit Wt., γ_m (pcf)	114.3	124.5	127.2	124.1	121.0			
Wet Soil + Tare (g)	971.48	1138.75	1103.65	1005.38	941.90			
Dry Soil + Tare (g)	890.21	990.52	948.61	852.61	840.16			
Tare (g)	328.25	221.93	215.02	215.35	223.51			
Water Content, w (%)	14.5	19.3	21.1	24.0	16.5			
Dry Unit Wt., γ_d (pcf)	99.9	104.4	105.0	100.1	103.8			

Comments:

Test specimen consisted of material from B3TP-1 @ 10-20', B3TP-2 @ 15-25', and B3TP-3 @ 15-30'. Due to insufficient sample quantity, points +4%, +6%, and As Is contained previously compacted material .



Entered by:_____

Reviewed:_____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

Project: Stantec
No: M00287-022
Location: IPSC CCR Unit Clousres; Delta, UT
Date: 1/15/2020
By: EH

Boring No.:
Sample: B3TP-1, B3-TP-2, & B3TP-3
Depth: 10-30'
Sample Description: Sandy lean CLAY, brown
Sample Type: Laboratory Compacted
Compaction Specifications: 95 (%) Dry unit weight
at 20.8 (%) w
Optimum water content (%) 20.8
Maximum dry unit weight (pcf) 105.4
Gs 2.7 Assumed
Cell No. 2
Station No. 3
Permeant liquid used De-aired tap water
Total backpressure (psi) 35
Effective horiz. consolidation stress (psi) 3
Effective vert. consolidation stress (psi) 3

	Initial (o)	Final (f)
Sample Height, H (in)	2.994	2.988
Sample Diameter, D (in)	2.413	2.400
Sample Length, L (cm)	7.605	7.589
Sample Area, A (cm^2)	29.503	29.195
Sample Volume, V (cm^3)	224.37	221.55
Wt. Rings + Wet Soil (g)	435.45	452.38
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	121.2	127.5
Wet Soil + Tare (g)	292.31	578.61
Dry Soil + Tare (g)	263.64	486.29
Tare (g)	127.12	127.15
Weight of solids, Ws (g)	359.87	359.87
Water Content, w (%)	21.00	25.71
Dry Unit Wt, γ_d (pcf)	100.1	101.4
Void ratio, e, for assumed Gs	0.68	0.69
Saturation (%), for assumed Gs	83.0	100 [a]
Average K[b] (cm/sec)	**1.5E-05**	

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20ºC

	Initial (o)	Final (f)
B value	0.58	0.96
External Burette (cm^3)	14.90	23.70
Cell Pressure (psi)	0.0	38.0

Backpressure bottom (psi) 35.0
Backpressure top (psi) 35.0
System volume coefficient (cm^3/psi) 0.158
System volume change (cm^3) 5.99
Net sample volume change (cm^3) -2.81
Bottom burette ground length, l_b (cm) 82.25
Top burette ground length, l_t (cm) 81.95
Burette area, a (cm^2) 0.197
Conversion, reading to cm head (cm/rd) 5.076

Start Date and Time: 1/14/20 16:34

Elapsed time (sec)	Bottom Burette (cm^3)	Top Burette (cm^3)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (ºC)	Visc. Ratio R_T	K[b] (cm/sec)
30.0	1.21 1.27	8.66 8.59	38.14	37.46	1.5E-05	23.5 23.5	0.92	1.4E-05
30.0	1.27 1.34	8.59 8.52	37.46	36.75	1.6E-05	23.5 23.5	0.92	1.5E-05
30.0	1.34 1.41	8.52 8.45	36.75	36.06	1.6E-05	23.5 23.5	0.92	1.5E-05
30.0	1.41 1.47	8.45 8.38	36.06	35.38	1.6E-05	23.5 23.5	0.92	1.5E-05
30.0	1.47 1.55	8.38 8.31	35.38	34.61	1.9E-05	23.5 23.5	0.92	1.7E-05

Comments:
Test specimen was remolded to 95% of ASTM D698 B (which inlcuded combined material from B3TP-1 @ 10-20', B3TP-2 @ 15-25', and B3TP-3 @ 15-30') at optimum water content. Test specimen comprised of combined material.

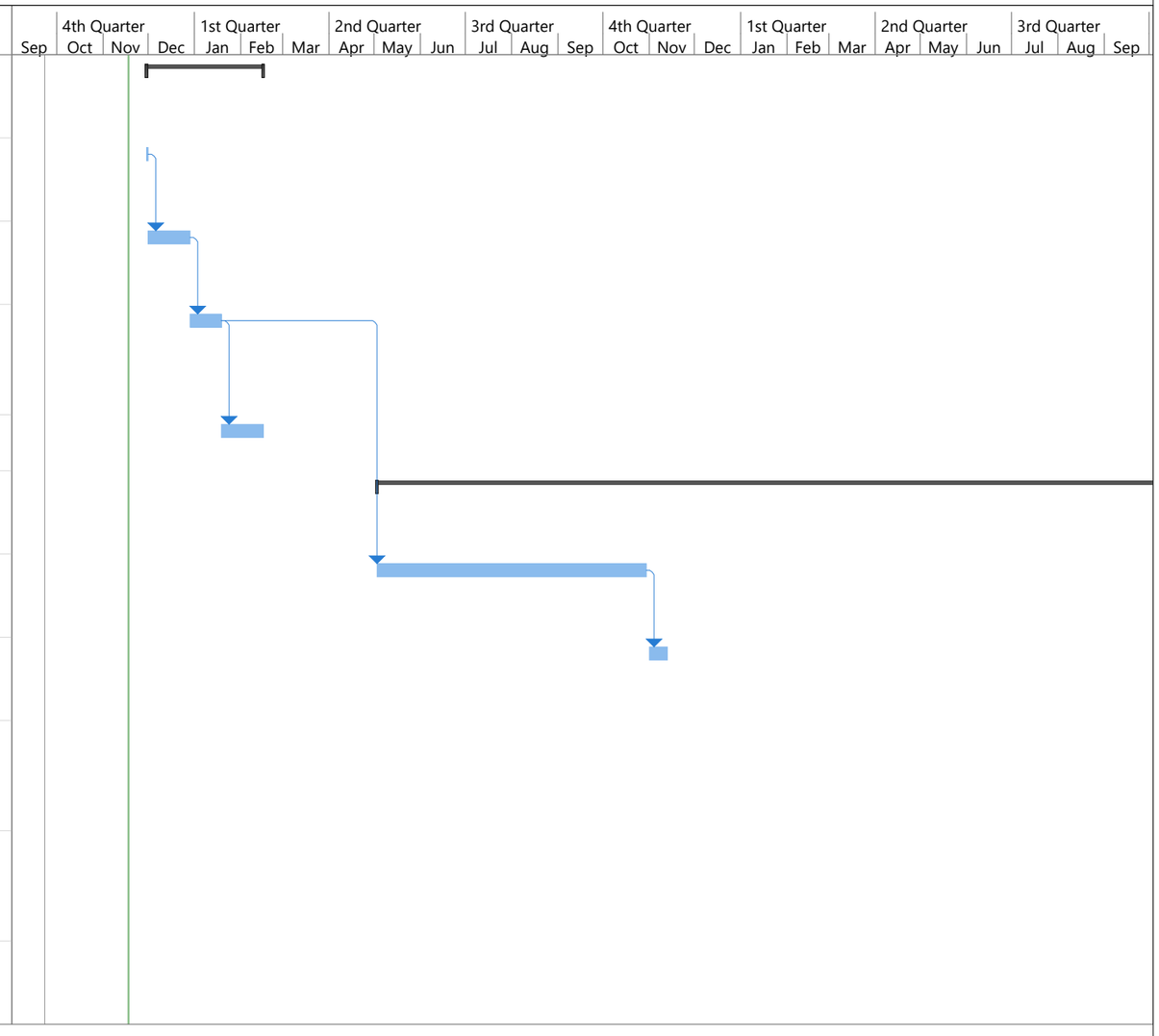
Entered by:_____
Reviewed:_____

Appendix E

Closure Schedule

CB Landfill Closure Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		**Closure Plan**	**56 days?**	**Mon 11/30/20**	**Mon 2/15/21**		
2		Submit CB Landfill Closure Plan to UDEQ	1 day?	Mon 11/30/20	Mon 11/30/20		
3		UDEQ Review	20 days	Tue 12/1/20	Mon 12/28/20	2	
4		Revise and Submit CB Landfill Closure Plan per UDEQ Review	15 days	Tue 12/29/20	Mon 1/18/21	3	
5		UDEQ Approval of Closure Plan	20 days	Tue 1/19/21	Mon 2/15/21	4	
6		**CB Landfill Closure**	**1445 days**	**Mon 5/3/21**	**Fri 11/13/26**		
7		Cover Installation on Eastern Portion of Landfill	130 days	Mon 5/3/21	Fri 10/29/21	4	
8		Seeding of Eastern Portion of Landfill Cover	10 days	Mon 11/1/21	Fri 11/12/21	7	
9		Cover Installation on Western Portion of Landfill (first season)	88 days	Tue 7/1/25	Thu 10/30/25		
10		Cover Installation on Western Portion of Landfill (second season)	30 days	Mon 5/4/26	Fri 6/12/26	9	
11		Seeding of Western Portion of Landfill Cover	10 days	Mon 11/2/26	Fri 11/13/26	9	



Project: CB Landfill Closure Sch
Date: Wed 11/18/20

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

CB Landfill Closure Schedule

Project: CB Landfill Closure Sch
Date: Wed 11/18/20

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	