

---

To:	Roy Blickwedel	From:	Cameron Fritz, EIT Jason Cumbers, PE
	General Electric		Stantec, Fort Collins, Colorado
File:	St. Anthony Mine 233001076	Date:	August 9, 2018

---

**Reference: St. Anthony Mine Geotechnical Investigation 2018**

## Introduction and Background

This memo presents information collected during the geotechnical drilling and field sampling specific to the waste rock piles and proposed borrow areas at the St. Anthony Mine Site ("Site"). Field notes, boring logs, and laboratory testing results are included in the attachments. Information presented will be used to supplement a previous field investigation conducted by MWH, described in the *Materials Characterization Report, Saint Anthony Mine Site* (MWH, 2007), and to advance the design of the closeout plan.

The St. Anthony Mine was an open pit and underground shaft uranium mine located on the Cebolleta Land Grant in Cibola County, New Mexico, approximately 40 miles west of Albuquerque and 4.6 miles southeast of Seboyeta. The Site is in a remote, sparsely populated area with difficult access. United Nuclear Corporation (UNC) operated the St. Anthony Mine from 1975 to 1981, pursuant to a mineral lease with the Cebolleta Land Grant, the current surface and mineral rights owner. The original lease covered approximately 2,560 acres. This lease was obtained on February 10, 1964 and was surrendered by a Release of Mineral Lease dated October 24, 1988. UNC has access to the Site through access agreements with the Cebolleta Land Grant and an adjacent landowner.

The Site includes underground workings comprising one mine shaft and several vent shafts that are now sealed at the surface, two open pits (one containing groundwater), seven piles of non-economic mine materials (now revegetated), numerous smaller piles of non-economical mine materials, and three topsoil and/or overburden piles. No perennial streams occur within the Site, but an arroyo (Meyer Gulch) passes through the Site. The two open pits at the Site are located in Sections 19 and 30, Township 11 North, Range 4 West, and the entrance to the underground mine is located in Section 24, Township 11 North, Range 5 West. Area disturbed during mining encompasses approximately 430 acres and includes roads, building and shaft pads, and former settling ponds along with the open pits and non-economic mine material piles.

## Site Geology

As described in the *St. Anthony Mine Site Closeout Plan* (MWH, 2010), the Site is located on the Colorado Plateau physiographic province, broadly characterized by plateaus of stratified sedimentary rock overlying tectonically stable Precambrian basement. The relatively high relief and dramatic topography of the Colorado Plateau formed as canyons were incised within thick sedimentary sequences. Within the southeastern portion of the Colorado Plateau lies the San Juan Basin, a structural depression encompassing most of northwestern New Mexico and adjoining parts of Colorado and Utah. The strata of the San Juan Basin dip gently to the north (approximately 2 degrees), although small faults and folds alter the dip of the strata locally. The San Juan Basin is truncated on its southeastern margin by the Jemez lineament, a northeasterly trending structural boundary between the Colorado Plateau to the northwest and the Rio Grande Rift to the south and east. The Site is within the Grants uranium district that lies on this transitional margin amidst many prominent Late Cenozoic volcanic fields that demarcate the Jemez lineament and the southeast margin of the San Juan Basin.

**Reference: St. Anthony Mine Geotechnical Investigation 2018**

Sediments in the Grants area were deposited in various continental environments. During late Permian time, the area now defined by the San Juan basin was an active seaway connecting the central New Mexico Sea with the Paradox basin in Utah. During this time, the Glorieta sandstone and San Andreas limestone were deposited. The region was subsequently uplifted in Laramide time and fluvial, lacustrine, and aolian sediments of the respective Chinle Formation, San Rafael Group, and Morrison Formation were deposited. Upper Cretaceous strata consist of marine shorezone sandstones, marine shales, and various continental deposits. In ascending order, these are represented by the Dakota Sandstone, Mancos Shale, and the Mesaverde Group.

Stratigraphy of interest at the Site includes the Mancos Formation (Late Cretaceous), the Dakota Formation (Early and Late Cretaceous) and the Morrison Formation (Late Jurassic). The surficial geologic unit at the Site is the Mancos Formation consisting of three sandstone units and interbedded shale units with a maximum thickness of 465 feet. The upper sandstone caps Gavilan Mesa to the south of the pits. The Dakota Formation sandstone is 6 to 20 feet thick in the Site area. The Morrison Formation is approximately 600 feet thick and is comprised of the Jackpile Member (sandstone), the Brushy Basin Member (interlayered mudstone and sandstone), the Westwater Canyon Member (sandstone), and the Recapture member (interbedded claystone and sandstone).

Uranium production at the Site was from the Jackpile Member with each pit penetrating approximately 75 feet into this unit. The Jackpile sandstone varies in thickness in the Site area from 80 to 120 feet and is representative of deposition in a braided stream environment.

### **Geotechnical Investigation**

Field work for the current St. Anthony geotechnical investigation took place during March and April 2018 following client approval of the *St. Anthony Supplemental Investigations Work Plan* (Stantec, 2018). Field activities included drilling and soil sampling of select non-economic waste rock piles and potential borrow areas around the Site. The objective of the field investigation was to collect subsurface information to characterize soil and rock in the piles and evaluate the suitability of potential borrow sources as cover materials. This information was necessary to develop a material balance, grading plan, and cover design for reclamation of the Site.

Activities were conducted in accordance with the work plan and applicable SOPs. Some minor changes to drilling locations were implemented due to field conditions. Additionally, some proposed boreholes were not drilled due to safety, access, or other concerns as determined by the Field Engineer. Details of activities conducted and any variations from the Work Plan are described in the following sections.

Fifty-one boreholes were completed using the hollow-stem auger drilling technique (see Table 1 and Figure A1 for a complete list and plan view, respectively, of the borings): 12 in the Lobo Tract borrow area, 5 in the Borrow South area, 4 in the Borrow West area, 2 in the Topsoil North pile, 6 in the Topsoil/Overburden (T/O) pile, 4 in the Topsoil South pile, 6 in Shale Piles 1 and 2, 6 in Pile 3, and 6 in Pile 4. Drilling was performed by Cascade Drilling, LP ("Cascade") using a CME LAR 75 track-mounted drill rig and a CME 85 truck-mounted drill rig. The track-mounted rig was used during initial drilling. Due to mechanical failure of the track-mounted rig, the truck-mounted rig was used to complete the work. Boreholes completed by the track-mounted rig included the L1 boreholes in the Lobo Tract borrow area, four of the T/O pile boreholes (T/O-2, T/O-4 through 6), and a portion of one additional borehole (T/O-3) where the mechanical failure occurred.

Soil borings in the borrow areas (Lobo Tract, Borrow South, and Borrow West) were advanced either to anticipated excavation depths (generally 20-40 feet below ground surface (bgs)) or until encountering bedrock.

**Reference: St. Anthony Mine Geotechnical Investigation 2018**

Borings in the topsoil piles (T/O, Topsoil North, and Topsoil South) were advanced to native, undisturbed alluvial soils or bedrock to evaluate depths to the base of each pile. Drilling in Piles 1, 2, and 3 was also intended to locate the base of the piles; however, safety concerns related to the unexpected detection of hydrogen sulfide (H<sub>2</sub>S) and methane within the boreholes resulted in final drilled depths less than those originally proposed for most boreholes. Pile 4 drilling depths originally were proposed to coincide with the anticipated excavation depths (approximately 70 feet bgs) based on a preliminary material balance, but due to the continued detection of subsurface gases the boreholes were advanced to depths of only 10 to 40 feet bgs. Drilling was stopped at these locations on Piles 1 through 4 upon measuring gas concentrations at, or greater than, the permissible exposure limits (PEL) (e.g., 1.0 ppm H<sub>2</sub>S and 5.0% by volume of the lower explosive limit (LEL) of methane) as outlined in Stantec's Site-Specific Health and Safety Plan (HASP). Following drilling at each boring, the drilling crew backfilled the hole with drill cuttings to the original ground surface. Stantec then placed a wooden stake and surveyed the borehole location with a handheld GPS unit.

Five of the originally proposed borehole locations outlined in the Work Plan were not drilled. Borehole location BS-4 in the Borrow South area contained exposed bedrock at the ground surface, with no suitable borrow material (i.e., alluvial soils) apparent in the immediate area, and therefore was abandoned. Borehole location TN-3 in the Topsoil North area was located in close proximity to unstable slopes and the highwall of the main pit (Pit 1), and was not drilled due to drill rig access and safety concerns. Work on Pile 4 was stopped prior to drilling boreholes P4-1, P4-2, and P4-4 due to safety concerns regarding gas emissions at nearby boreholes (described above).

The Borrow West area (just south of Pit 1) was not originally included as a potential borrow source and no boreholes were proposed in this area prior to drilling operations at the Site. However, on-site observations of this area supported its potential as a source of additional borrow material, with the close proximity to Site facilities also indicative of potential cost savings in material transport during construction. As a result, four boreholes were proposed and completed in the Borrow West area during the final days of field work at the Site.

The total depth drilled during the investigation was 1,374 feet, including 429 feet of continuous core sampling using a five-foot-long, 4.25-inch inner diameter (I.D.) core barrel. Standard penetration test (SPT) sampling was performed at each five-foot interval (unless otherwise directed by the Field Engineer) using a 24-inch-long, 2.0-inch outer diameter (O.D.) Modified California (MC) sampler containing three 6-inch brass liners. Samplers were driven 18 inches by an automatic, 140-pound hammer falling 30 inches, with blow counts recorded for each successive 6-inch increment. Brass liner samples were logged, capped with plastic end caps, and stored at the staging area before being transported to Daniel B. Stephens & Associates, Inc. (DB Stephens), a geotechnical testing laboratory in Albuquerque. The recovered soil cores were logged, placed in labeled core boxes and photographed. Core boxes were temporarily stored at the staging area near the Site entrance and later transported to the UNC Mill Site office area at the Northeast Church Rock Site (near Gallup, NM). Borehole logs and core photographs are provided in Attachments B and C. Daily reports detailing the drilling activities are included in Attachment D.

Additional samples were collected from boreholes in Piles 1, 2, 4, and the Borrow West area for analytical testing of Radium-226, Uranium, Thorium-230, and Gross-Alpha concentrations. Prior to sampling, the MC sampler and liners were decontaminated using a cleaning solution (mixed on-site) to remove any remaining material from previous sampling drives. Samples were collected as bulk bag samples of material extracted from the MC brass liner samples, with sampling depths chosen to supplement results from the 2007 characterization and provide a more complete assessment of the general radiological contamination profile in each area. Samples from Piles 1, 2, and 4 were selected for analytical testing because these piles are expected to be used

Reference: **St. Anthony Mine Geotechnical Investigation 2018**

as backfill sources for Pit 1. Borrow West area samples were also tested to confirm this potential cover material did not contain elevated levels of radiological contamination. ALS Environmental laboratory in Fort Collins, CO performed the analytical testing of the samples.

**Table 1. Summary of Proposed and Completed Boreholes**

	Area	Borehole ID	Proposed Depth (ft bgs)	Actual Depth (ft bgs)	Continuous Core
1	Lobo Tract (W of arroyo)	L1-1	20	20	X
2	Lobo Tract (W of arroyo)	L1-2	20	20	
3	Lobo Tract (W of arroyo)	L1-3	20	20	
4	Lobo Tract (W of arroyo)	L1-4	20	20	
5	Lobo Tract (W of arroyo)	L1-5	20	20	X
6	Lobo Tract (E of arroyo)	L2-1	20	20	
7	Lobo Tract (E of arroyo)	L2-2	20	15	
8	Lobo Tract (E of arroyo)	L2-3	20	15	
9	Lobo Tract (E of arroyo)	L2-4	20	20	X
10	Lobo Tract (E of arroyo)	L2-5	20	20	
11	Lobo Tract (E of arroyo)	L2-6	20	20	X
12	Lobo Tract (E of arroyo)	L2-7	20	20	
13	Borrow Area South	BS-1	20	15	
14	Borrow Area South	BS-2	20	20	
15	Borrow Area South	BS-3	20	15	X
16	Borrow Area South	BS-4*	20	N/A	
17	Borrow Area South	BS-5	20	5	X
18	Borrow Area South	BS-6	20	20	X
19	Topsoil North	TN-1	15	15	
20	Topsoil North	TN-2	25	30	
21	Topsoil North	TN-3*	15	N/A	
22	Topsoil/Overburden	T/O-1	75	70	
23	Topsoil/Overburden	T/O-2	25	25	
24	Topsoil/Overburden	T/O-3	75	80	X
25	Topsoil/Overburden	T/O-4	45	35	
26	Topsoil/Overburden	T/O-5	30	29	X
27	Topsoil/Overburden	T/O-6	20	15	
28	Topsoil South	TS-1	60	35	
29	Topsoil South	TS-2	60	35	X
30	Topsoil South	TS-3	60	30	
31	Topsoil South	TS-4	25	25	

Reference: **St. Anthony Mine Geotechnical Investigation 2018**

	Area	Borehole ID	Proposed Depth (ft bgs)	Actual Depth (ft bgs)	Continuous Core
32	Pile 1	P1-1	60	20	X
33	Pile 1	P1-1A	60	35	X
34	Pile 1	P1-2	120	65	
35	Pile 1	P1-3	40	40	
36	Pile 2	P2-1	120	30	
37	Pile 2	P2-2	60	20	
38	Pile 3	P3-1	25	15	
39	Pile 3	P3-2	50	45	X
40	Pile 3	P3-3	100	40	
41	Pile 3	P3-4	100	40	
42	Pile 3	P3-5	75	15	
43	Pile 3	P3-6	75	55	
44	Pile 4	P4-1*	70	N/A	
45	Pile 4	P4-2*	70	N/A	
46	Pile 4	P4-3	70	15	
47	Pile 4	P4-4*	70	N/A	
48	Pile 4	P4-5	70	20	
49	Pile 4	P4-6	70	10	
50	Pile 4	P4-7	70	30	X
51	Pile 4	P4-8	70	20	
52	Pile 4	P4-9	70	40	
53	Borrow Area West	BW-1†	40	35	X
54	Borrow Area West	BW-2†	20	20	
55	Borrow Area West	BW-3†	20	15	
56	Borrow Area West	BW-4†	20	20	

bgs = below ground surface, ft = feet

\* Indicates borehole was not drilled due to safety, access, or other concerns.

† Indicates borehole was not included in original proposed (work plan) drilling locations.

## Laboratory Testing

DB Stephens in Albuquerque, NM performed geotechnical laboratory testing of the soil samples. Laboratory testing of the brass liner samples included sieve analysis with hydrometer, Atterberg limits, moisture and density, and triaxial shear (consolidated undrained) of select samples. Laboratory testing of the bulk auger cutting samples included standard Proctor compaction. Analytical testing performed by ALS Environmental included testing for Radium-226 (Ra-226), Uranium, Thorium-230, and Gross-Alpha concentrations of select samples. Geotechnical and analytical test results are summarized in Tables E-1 through E-6 in Attachment E. Laboratory testing reports are included in Attachment F (DB Stephens) and Attachment G (ALS).

**Reference:** St. Anthony Mine Geotechnical Investigation 2018

## Soil Classification and Material Descriptions

Material encountered at the Site generally can be classified into two broad categories: (1) native alluvial soils, and (2) disturbed waste materials placed in piles following excavation from the two pits. The latter comprised mixtures of soil and rock with substantial variation between piles and, in some cases, considerable disparity within a given pile. The alluvial soils were generally more consistent both spatially and with depth throughout the borrow areas. Detailed descriptions of the materials found in each specific area are provided in the following sections.

### Borrow Sources

The Lobo Tract borrow area contained alluvial deposits of silt, sand and clay. Most of the material encountered contained greater than 50 percent fine-grained soils and was dominated by silt-sized particles with varying levels of clay and sand. Sandy silt (ML) and silty sand (SM) were the most common classifications given for these materials, although several deposits of lean clay (CL) were also encountered. Silt-sized particles generally encompassed more than one-third of the particle size distributions for materials encountered in the Lobo Tract, including those classified as sand or clay. The material was slightly moist with moisture contents ranging from about 4 percent to 8 percent by weight, except for some areas with greater clay content containing moisture contents between approximately 10 and 15 percent. Silts and sands were medium dense to dense, except for some small pockets of loose and poorly-graded sand, and clayey materials ranged from very stiff to very hard. Clay was mostly encountered in lower elevation areas near the arroyo in the center of the alluvial "valley" and was often found in the upper 10 to 15 feet of the alluvium with silt and sand-dominated materials below. In areas near the edge of the borrow area, and closer to the sandstone mesas that surround the area, materials were sandy with less clay and lower moisture contents. Along the easternmost extents of the borrow area, bedrock was encountered at a depth of approximately 10 feet owing to the closer proximity of these boreholes (e.g., L2-2, L2-3, and L2-4) to the sandstone outcroppings.

The Topsoil North pile was relatively homogenous throughout its area and profile compared to the Lobo Tract, though the pile did contain similar alluvial soils. Material in this pile was classified as a slightly moist silty sand (SM) with few to little clay, and was loose to medium dense with similar blow counts recorded for most of the sampling intervals.

Located just off the southern edge of Pit 1, the Borrow West area contained similar soils (SM) as the Topsoil North pile but with slightly increased variability. Two main types of SM topsoil were identified, one being nearly the same as the Topsoil North pile material and the other having a slightly higher clay content with a coarse fraction less than 50 percent. The latter was identifiable based on darker brown coloring and slightly increased moisture compared to the former, and was found at depths greater than approximately 10 to 15 feet. This stratification was consistent with an observable color change with depth in the exposed topsoil along the western Pit 1 highwall.

Material in the Borrow South area was more comparable to the Lobo Tract soils than to the Topsoil North and Borrow West soils, with greater silt content relative to sand content and classified as ML. Soil encountered in this borrow area was slightly moist and loose to medium dense. Due to the area's proximity to a rock outcropping, weathered sandstone bedrock was encountered in each Borrow South borehole except BS-6. Depth to bedrock ranged from 5 to 20 feet, with the exception of the BS-4 location which, as previously discussed, was not drilled due to exposed bedrock at the ground surface.

**Reference: St. Anthony Mine Geotechnical Investigation 2018**

The T/O and Topsoil South piles contained similar mixtures of topsoil and waste rock from the pit excavations. The piles were highly heterogeneous with no explicit stratigraphy of soil and/or rock. Although the piles were covered in a thin layer of alluvium characteristic of the topsoil throughout the Site, the interior of each pile comprised a highly variable mixture of weathered bedrock (gray/brown sandstone and black/gray shale) and sandy silt. Most material was dominated by fine-grained silt and clay particles, except for some portions of the Topsoil South pile in which a silty sand was encountered. Fines were classified as either CL or ML. Soils were slightly moist with occasional moist areas and were generally medium dense to dense.

### **Waste Piles**

Shale Piles 1 and 2 contained mixtures of weathered sandstone and shale. All material encountered was colored gray to black, though scattered iron and sulfur staining (red, orange, and yellow) also was observed. Samples were slightly moist to moist, with the wettest areas comprising mostly shale and black, possibly organic material. Most material contained a coarse fraction greater than 50 percent, including up to 20 percent gravel in samples from Pile 1. Some cobbles or boulders were encountered while drilling in Pile 1, resulting in damage to several augers. Samples from Pile 2 contained trace amounts of gravel, with higher sand, silt, and clay contents relative to Pile 1. Pile 2 samples also exhibited higher densities and moisture contents, possibly due to greater clay and/or organics content. Fines in Pile 1 were classified as ML, whereas fines in select Pile 2 samples were classified as CL. The northwestern portion of Pile 1 (near borehole location P1-3) contained numerous large, sandstone boulders, as indicated by frequent grinding on rock by the augers followed by sudden drops through large void spaces. Brass liner samples also contained mostly broken rock pieces.

Pile 3 material was largely composed of poorly-graded and fine- to medium-grained sand with trace amounts of gravel and sandstone pieces scattered throughout the profile. The majority of samples contained greater than 60 percent sand-sized particles, including amounts greater than 90 percent at depths of 30 to 40 feet in borehole P3-4. Some sand was characteristic of the Jackpile sandstone formation due to primarily gray and white coloring with areas of green and purple. Other areas contained brown or gray weathered sandstone and shale, frequently with traces of orange or yellow oxidation. Poorly-graded sands were generally moist and loose, whereas materials with improved gradation were medium-dense and slightly moist. Overall, moisture content appeared to increase with depth towards the center of the pile. Fine-grained soils usually comprised less than 30 to 40 percent of the material and were classified as ML. Minimal clay content or evidence of plasticity was observed.

Although borehole depths in Pile 4 were relatively shallow compared to the total depth of the pile, considerable variability was observed in the sampled material. Some variability was evident based on visual assessment of the surface of the pile, as material ranged from brown topsoil in the northern and southern extents of the pile, to gray and white sand and gravel (i.e., weathered and broken sandstone) in the central areas. Dark gray/black, weathered shale also was evident in the numerous drainage rivulets cutting across the pile surface. In the northern area of the pile at higher elevations, topsoil extended no more than approximately 5 to 10 feet bgs before grading into sand and broken rock mixtures. Lower elevations toward the central portion of the pile contained mixtures of sand, gravel, and highly weathered shale, ranging from light gray to black in color. Some areas contained almost exclusively broken sandstone pieces, whereas others contained poorly-graded sand similar to that encountered in Pile 3, but with higher gravel content. The latter presented traces of green and purple coloration characteristic of the Jackpile sandstone formation and was especially prevalent near borehole P4-5. Higher moisture content was noted in these sands compared to other sand and rock mixtures in the pile, which was consistent with the conditions observed in Pile 3 material. Sandy silt topsoil was the driest material observed in the pile, with moisture contents similar to those observed in the native borrow areas. Several of the

**Reference:** St. Anthony Mine Geotechnical Investigation 2018

boreholes (P4-3, P4-5, P4-6, and P4-8) appeared to extend into zones of higher shale content prior to being stopped due to elevated gas concentration levels.

### **Analytical Testing Results**

Seventeen soil samples were subjected to analytical testing for metals concentrations, including six from Shale Piles 1 and 2, five from Pile 4, and six from the Borrow West area. Overall, soil concentrations of Ra-226 in samples collected during the 2018 investigation ranged from 0.73 to 29.5 pCi/g. The lowest values were reported for the Borrow West area in which all samples contained concentrations below 1.15 pCi/g, similar to background and borrow area readings reported by MWH (2007). Values in Piles 1 and 2 generally were near background levels (0.91 to 3.85 pCi/g), except for one isolated sample (from borehole P1-2, 20 feet bgs) with a concentration of 16.1 pCi/g. In Pile 4, the highest soil concentrations were measured in borehole P4-5 and ranged from 18.6 to 29.5 pCi/g. All other samples from Pile 4 contained concentrations below 3.14 pCi/g. The results listed in Table E-6 were used in conjunction with analytical testing results from MWH (2007) to evaluate radon activity levels throughout the Site, including areas that were not sampled for analytical testing during the 2018 investigation.

### **Groundwater**

Groundwater was not encountered in any boreholes during drilling operations, mainly because the drilling was performed either in waste piles located above the native ground surface or in native borrow areas with relatively deep groundwater levels compared to the shallow (generally 15 to 20 feet) borehole depths. According to the *Stage I Abatement Plan Investigation Report* (INTERA, 2006), the minimum depth to groundwater was more than 50 feet (in the vicinity of the arroyo) based on data collected during August, September, and December of 2004 from six monitoring wells located throughout the Site.

### **Summary and Conclusions**

A total of 51 boreholes were drilled in waste piles and native borrow areas in and near the Site for this investigation. Several borings in the piles were not completed and many others only partially completed due to the presence of potentially harmful gases. However, Stantec expects the information to be sufficient for the intended purposes of the investigation, including the use of data for the reclamation design and closeout plan. Soil samples were collected using Modified California sampling methods as part of standard penetration tests and were delivered to testing laboratories for geotechnical and analytical testing. Results included index properties, gradations, compaction properties, and strength parameters from geotechnical testing, as well as metals concentrations from analytical testing.

Each borrow area was found to contain similar alluvial materials with varying combinations of silt, sand, and clay. Based on results for particle-size gradations and Ra-226 soil concentrations, these soils appear acceptable for use as cover material during Site reclamation. However, careful consideration of slopes will be necessary due to the material's susceptibility to erosion, as indicated by its relatively high fines content and by the numerous drainage gullies and rivulets observed on pile surfaces and in other areas with relatively high slope angles. The proximity of the Borrow West area to Pit 1 will be beneficial as material from this area will be easily accessible for potential use as cover material following the anticipated backfilling of Pit 1. The Borrow South area, although significantly smaller in area than Borrow West, is in relatively close proximity to Site facilities and will provide convenient access to cover materials. The Lobo Tract borrow area is located farther from Site facilities but is expected to provide a considerable contingency volume of cover material as needed during closeout. Portions of the borrow areas nearest to rock outcroppings and cliff bands generally exhibited



**Reference: St. Anthony Mine Geotechnical Investigation 2018**

shallower deposits of alluvium above the bedrock, with deeper deposits and greater potential borrow volumes in areas further from the cliffs (e.g., closer to the arroyo in the Lobo Tract and the center of the valley in which the Borrow West area is located).

Variable mixtures of topsoil and weathered rock overburden were encountered in the piles throughout the Site. The T/O and Topsoil South piles contained significantly less topsoil and more rock than was anticipated, suggesting that these piles may be more suitable as fill material for backfilling the pits than for use as cover material. Piles 1 through 4 also will likely be used as pit backfill material. Based on analytical testing results from this investigation and MWH (2007), Stantec anticipates materials from Piles 1 through 4 and T/O (i.e., materials with relatively low Ra-226 activities) will be deposited at upper elevations (near the cover) or lower elevations in the pit, below the expected groundwater rebound elevation (5966 feet above sea level (fasl)). For materials containing more elevated Ra-226 activities (e.g., west disturbance area, crusher/stockpile, and piles 5-7; see MWH, 2007), efforts will be made to place these materials near, or above elevation, 5966 fasl to reduce the future potential for contact with the groundwater. Relatively low-activity material (e.g., T/O pile) could be used as subsoil for cover material to enhance plant growth and provide additional buffer against the surface release of radon. Any residual pile material not used as backfill is expected to require additional cover material from borrow areas to facilitate revegetation, while also being regraded to reduce erosion of the topsoil.

Due to the presence of potentially harmful gases encountered during drilling, Stantec recommends additional safety precautions be taken during future earthwork at the Site. Special considerations during construction may include the use of personal H<sub>2</sub>S detectors by personnel near the earthwork, as well as the use of a 4-gas meter to routinely monitor the work area for elevated gas concentrations. Additional personal protective equipment (PPE) and/or engineering controls may be required under certain circumstances and conditions should be reevaluated prior to the start of earthwork.

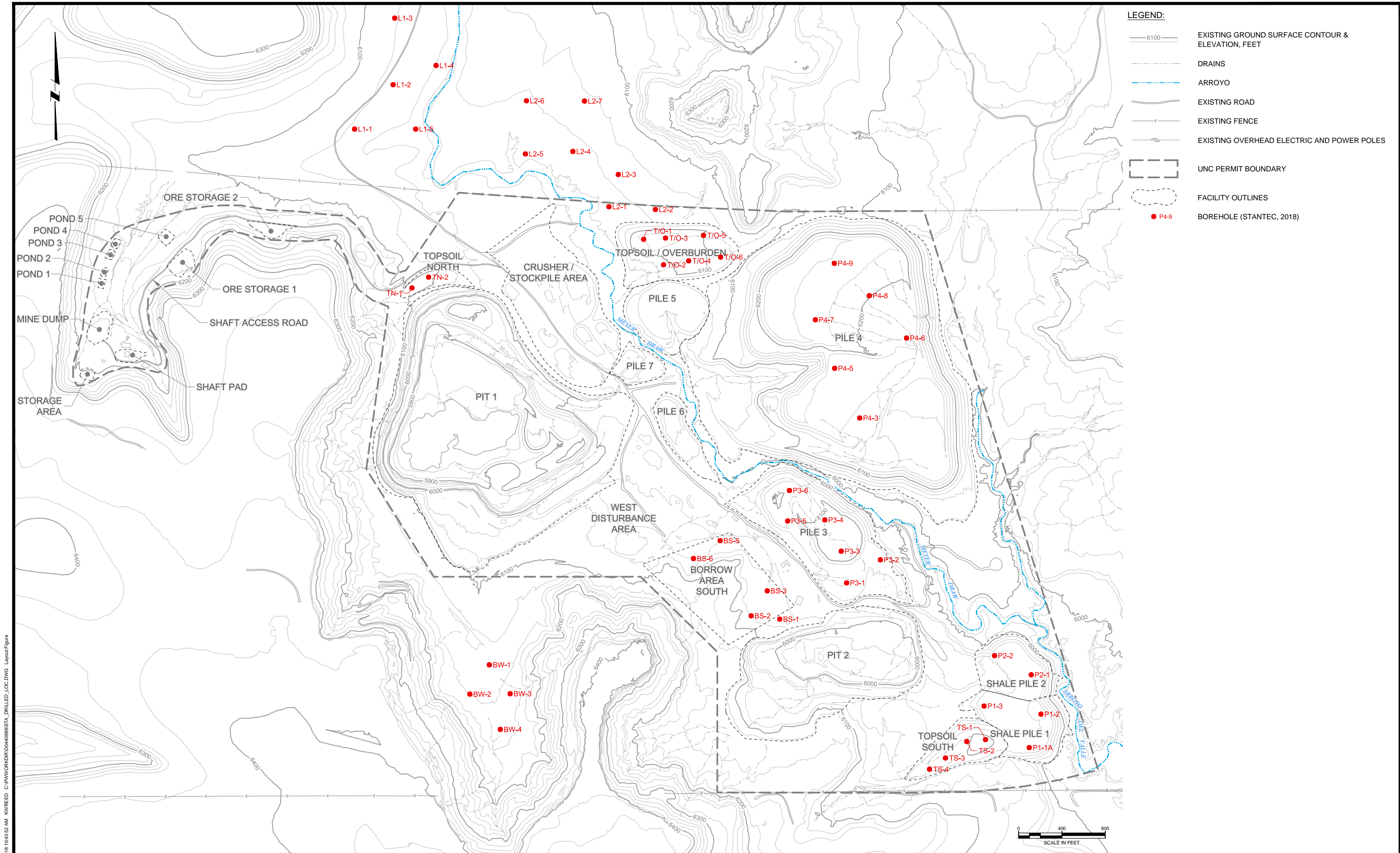
- Attachments:** Attachment A – Figure A1. 2018 Geotechnical Investigation Borehole Locations  
Attachment B – Borehole Logs  
Attachment C – Photos  
Attachment D – Daily Field Reports  
Attachment E – Table E-1. Laboratory Results – Initial Properties  
Table E-2. Laboratory Results – Particle-size Analyses  
Table E-3. Laboratory Results – Atterberg Limits  
Table E-4. Laboratory Results – Proctor Compaction  
Table E-5. Laboratory Results – Triaxial Shear  
Table E-6. Laboratory Results – Analytical Testing  
Attachment F – Geotechnical Laboratory Testing Report  
Attachment G – Analytical Laboratory Testing Reports

**Reference:** St. Anthony Mine Geotechnical Investigation 2018

## References

- INTERA, 2006. *Stage I Abatement Plan Investigation Report*. INTERA. October 26.
- MWH, 2007. *Materials Characterization Report: Saint Anthony Mine Site*. MWH. October 26.
- MWH, 2010. *St. Anthony Mine Site Closeout Plan*. MWH. July 2010.
- Stantec, 2018. *St. Anthony Supplemental Investigations Work Plan*. Stantec. February 23.

# **Attachment A. 2018 Geotechnical Investigation Borehole Locations**



Wednesday, August 01, 2018 10:49:52 AM KVVREED C:\P\WORK\DR\440889\STA\_DRILLED\_LOC.DWG Layout:Figure

- DRAWING REFERENCES:**
- All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
  - Elevation: Feet
  - On site: Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
  - Supplemental Off Site: USGS DEM 10m
  - Topography and Section Lines: rgs-stm.edu, 08/04/2014
  - Parcels and Cuijales Land Grant: Cibola County, cibolacountynm.com, 02/15/18
  - Permit Boundary: (100860001.dwg)

DESIGNED K REED  
 CHECKED C FRITZ  
 APPROVED J CUMBERS



UNITED NUCLEAR CORPORATION AND ST. ANTHONY MINE  
 CIBOLA COUNTY, NEW MEXICO

2018 GEOTECHNICAL INVESTIGATION  
 BOREHOLE LOCATIONS

FIGURE  
 A1  
 233001076  
 JULY 2018

# **Attachment B. Borehole Logs**



Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: **BS-1**  
Sheet **1** of **1**

Drilling Company: Cascade Drilling  
Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena  
Field Representative (day / night):

Drilling Rig: **CMIE 85**  
Drilling Method: Hollow Stem Auger  
Core Diameter: **N/A**

Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz

Start Date: **4/1/18**  
Finish Date: **4/1/18**  
Total Depth: **15.67**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand with little clay (SM), medium dense, weakly cemented, light brown, slightly moist			
5.67	5'A	13			SM	Same as above			
6.67	5'B	10							
7.67									
10.00	10'A	9			SM	Increased carbonate content, same material, slightly darker brown			
11.00	10'B	12							
12.00									
15.67	15' Bag	30	2"		SS	Sandstone bedrock (SS), highly to completely weathered, orange & yellow chemical			
						<b>EOB @ 15.67'</b>			

GRAVELS		SANDS		SILTS AND CLAYS		CONSISTENCY		GRAIN SIZE	
GRAVELS	GRAVELS	SANDS	SANDS	SILTS AND CLAYS	SILTS AND CLAYS	CONSISTENCY	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE
Well-sorted gravels, gravel-sand mixtures, little or no fines	Poorly-sorted gravels, gravel-sand mixtures, little or no fines	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Very soft	Very loose	Very loose	Very loose
Silty gravels, poorly-sorted gravel-sand-silt mixtures	Clayey gravels, poorly-sorted gravel-sand-silt mixtures	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Soft	Loose	Loose	Loose
Clayey silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Medium stiff	Medium dense	Medium dense	Medium dense
Clayey silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Stiff	Dense	Dense	Dense
Clayey silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Very stiff	Very dense	Very dense	Very dense
Clayey silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Hard	Very dense	Very dense	Very dense
Clayey silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Well-sorted sands, gravelly sands, little or no fines	Poorly-sorted sands, gravelly sands, little or no fines	Inorganic silts, micaceous or dumoseous fine sand or silt	Inorganic silts, micaceous or dumoseous fine sand or silt	Very hard	Very dense	Very dense	Very dense



Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: BS-2

Sheet 1 of 2

Drilling Company: Cascade Drilling | Drilling Rig: CM685 | Bit Type: 4.25" I.D., 8" O.D. Auger | Start Date: 4/1/18
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguena | Drilling Method: Hollow Stem Auger | Logged by: C. Fritz | Finish Date: 4/1/18
Field Representative (day / night): | Core Diameter: N/A | Total Depth: 20.75'

Main log table with columns: Depth, Sample Number, Blow Count, Recovery (in), qu (tsf), Lithology / Symbol, Description, Graphic, Remarks, Well Details. Includes handwritten entries for silty sand (SM) at various depths (0-6', 10-12', 15-16').

Legend table for soil types including Gravels, Sands, Silts and Clays, and Highly Organic Soils. Includes soil consistency and grain size classification criteria.







Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: B5-3

Sheet 1 of 1

Drilling Company: Cascade Drilling

Drilling Rig: CM 85

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/1/18

Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/1/18

Field Representative (day / night):

Core Diameter: 4.25"

Total Depth: 15.4 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Loose silty sand (SM), trace clay, trace carbonates, few organics (roots), well-graded, trace sandstone.			
2									
4									
5.4	5'A	3			SM	Same as above			
5.8	5'B	4							
8									
10						Moderate cementation -> Few clay.			
10.9	10'B	9			SM	Medium dense silty sand, trace red discoloration, trace carbonates, trace sandstone, weakly cemented soil.			
12									
14						-> beginning transition. Bits of sandstone evident.			
15.4					SS	Weathered sandstone			
16						<u>EOB @ 15.4'</u>			
18									
20									

<b>GRAVELS</b> -50% coarse fraction passes #10 sieve with little or no fines	<b>GRAVELS</b> with little or no fines	Well-graded gravel, gravel-sand mixtures, little or no fines	<b>LOW</b> <b>LP</b>	<b>Term</b> very soft	Blows/ft (SPT) 1.41D	Blows/ft (modCAL) 2.01D	Blows/ft (modCAL) 2.51D	<b>GRAIN SIZE</b> Boulders Cobbles	<b>Term</b> very loose	<b>Size (mm)</b> -300	<b>Size (inches)</b> >12	<b>Percentage of gravel, sand, and fines may be stated in terms of plasticity as below</b>
<b>SANDS</b> -50% coarse fraction passes #40 sieve with little or no fines	<b>SANDS</b> with little or no fines	Well-graded sands, gravelly sands, little or no fines	<b>CONSISTENCY</b> Stiff	soft	2-4	2-4	2-4	Fine gravel Coarse gravel	loose	4-10	5-12	1-18
<b>SILTS AND CLAYS</b> liquid limit <50		Organic silts and clays of low plasticity	<b>CL</b>	medium stiff	4-8	4-8	4-8	Medium sand Coarse sand	dense	10-30	12-37	18-51
<b>SILTS AND CLAYS</b> liquid limit >50		Organic silts and clays of high plasticity	<b>CH</b>	very stiff	8-15	9-17	9-18	Fine sand Silty clay (fine)	very dense	>50	>80	>86
<b>HIGHLY ORGANIC SOILS</b>		PEAT, muck, swamp soils with high organic content	<b>PT</b>	hard	30-60	39-78	42-85					





Stantec

Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: BS-6

Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CME 85

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/1/18

Drillers (day / night): S. Lam, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/1/18

Field Representative (day / night):

Core Diameter: 4.25"

Total Depth: 21.5 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						SM Loose silty sand, slightly moist, light brown, organics in top 2 ft			
2			39						
4						→ trace coarse frags			
6	5'A 5'B	12 6	6			SM same as above			
8			41						
10	10'A 10'B	3 6	6			SM same as above			
12			41						
14									
16	15'A 15'B	7 5	7			SM Loose to medium dense (some), increasing carbonate content → areas of weak cementation			
18			47						
20									

GRAVELS		SANDS		SILTS AND CLAYS		HIGHLY ORGANIC SOILS	
GW	Well-graded gravel, gravel-sand mixtures, little or no fines	GW	Well-graded gravel, gravel-sand mixtures, little or no fines	OL	Organic silts and clays of low plasticity	OH	Organic silts and clays of high plasticity
GP	Poorly-graded gravel, gravel-sand mixtures, little or no fines	GP	Poorly-graded gravel, gravel-sand mixtures, little or no fines	OH	Organic silts and clays of high plasticity, fat clays	PT	Peat, spongy peat, spongy peat with high organic content
GM	Silty gravel, poorly-graded gravel-sand-clay mixtures	GM	Silty gravel, poorly-graded gravel-sand-clay mixtures				
GC	Clayey gravel, poorly-graded gravel-sand-clay mixtures	GC	Clayey gravel, poorly-graded gravel-sand-clay mixtures				
GW	Well-graded sands, gravelly sands, little or no fines	GW	Well-graded sands, gravelly sands, little or no fines				
GM	Medium sand	GM	Medium sand				
SM	Silty sand, poorly-graded sand-gravel-silt mixtures	SM	Silty sand, poorly-graded sand-gravel-silt mixtures				
SC	Clayey sand, poorly-graded sand-gravel-silt mixtures	SC	Clayey sand, poorly-graded sand-gravel-silt mixtures				
ML	Inorganic silts with very fine sand, silty or clayey fine sand, silts with slight plasticity	ML	Inorganic silts with very fine sand, silty or clayey fine sand, silts with slight plasticity				
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
ML	Nonplastic Low	ML	Nonplastic Low				
CH	High	CH	High				
OH	Well-graded = poorly sorted	OH	Poorly-graded = well sorted				
PT		PT					

Term	Blows/ft	Term	Blows/ft	Term	Field Test	Term	Field Test
very soft	0-2	very loose	0-4	Wet	Absence of moisture dry to touch	Wet	Crumbles or breaks with handling or slight finger pressure
soft	2-4	loose	4-10	Dry	Damp - does not wet palm	Medium	Crumbles or breaks with considerable finger pressure
medium stiff	4-8	medium dense	10-30	Moist	Visible Free Water	Strong	Will not crumble or break with finger pressure
stiff	8-15	dense	30-50				
very stiff	15-30	very dense	>50				
hard	30-60		>85				
very hard	>60		>85				

GRAIN SIZE	Terminology	Size (mm)	Size (inches)	Percentages of gravel, sand, and fine clay to be stated in terms indicating a range of percentages as below
Boulders	>300	>12		
Cobbles	75 to 300	3 to 12		
Coarse gravel	19 to 75	3/4 to 3		
Fine gravel	4.75 to 19	3/16 to 3/4		
Coarse sand	2.0 to 4.75	1/16 to 3/16		
Medium sand	0.425 to 2.0	1/64 to 1/16		
Fine sand	0.075 to 0.425	0.003 to 1/64		
Silt / clay (fines)	<0.075	<0.003		

GRAIN SIZE	Terminology	Size (mm)	Size (inches)	Percentages of gravel, sand, and fine clay to be stated in terms indicating a range of percentages as below
Boulders	>300	>12		
Cobbles	75 to 300	3 to 12		
Coarse gravel	19 to 75	3/4 to 3		
Fine gravel	4.75 to 19	3/16 to 3/4		
Coarse sand	2.0 to 4.75	1/16 to 3/16		
Medium sand	0.425 to 2.0	1/64 to 1/16		
Fine sand	0.075 to 0.425	0.003 to 1/64		
Silt / clay (fines)	<0.075	<0.003		



Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **BS-6**  
Sheet **2** of **2**

Drilling Company: Cascade Drilling  
Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera  
Field Representative (day / night):  
Drilling Rig:  
Drilling Method: Hollow Stem Auger  
Core Diameter: **4.25"**  
Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz  
Start Date: **see sheet 1**  
Finish Date:  
Total Depth:

20

22

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
	20'A	5			SM	Same as above			
	20'B	9							
						<u>EUB @ 21.5'</u>			

GRAVELS <50% coarse fraction passes #4 sieve	GRAVELS with silts or no fines	Well-graded gravels, gravel-sand mixtures, little or no fines	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Term	Blows/ft (mod CAL)			Term	Blows/ft (mod CAL)	Term	Size (mm)	Size (inches)	Percentages of gravel, sand, and fines may be stated in terms including a range of percentages as below
					(SPT) 1.4'ID	2.0'ID	2.5'ID						
very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12			
soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12			
medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3			
stiff	8-15	9-17	9-18	dense	30-50	37-80	51-86	Fine gravel	4.75 to 19	3/16 to 3/4		Term %	
very stiff	15-30	17-39	18-42	very dense	>50	>80	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16		Trace	
hard	30-60	39-78	42-85					Medium sand	0.425 to 2.0	1/64 to 1/16		Fine	
very hard	>60	>78	>85					Fine sand	0.075 to 0.425	0.003 to 1/64		Little	
								Silt / clay (fines)	<0.075	<0.003		Sandy	
												Muddy	50-100

SILTS AND CLAYS liquid limit <50	SILTS AND CLAYS liquid limit >50	Organic silts and clays of low plasticity	Inorganic silts, micaceous or chloraceous fine sand or silt	Inorganic clays of high plasticity, fat clays	Organic silts and clays of medium to high plasticity	Peat, turfs, swamp soils with high organic content	Term	Field Test	Term	Field Test	Term	Field Test
OH	None	Nonplastic	Low	Dry	Absence of moisture, dry to touch	Very loose	Crumbles or breaks with fingering or slight finger pressure	OH	None	Low	Dry	Absence of moisture, dry to touch
CI	None	Low	Low	Dry	Damp, does not wet palm	Loose	Crumbles or breaks with considerable finger pressure	CH	None	Low	Moist	Damp, does not wet palm
MI	None	Medium	Medium	Moist	Visible Free Water	Moderate	Will not crumble or break with finger pressure	OH	None	Low	Wet	Visible Free Water
CL	None	High	High	Wet		Strong		OH	None	Low	Wet	

HIGHLY ORGANIC SOILS: Peat, turfs, swamp soils with high organic content.



Drilling Company: Cascade Drilling

Drilling Rig:

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: see sheet

Drillers (day / night): S. Lam, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: 4.25"

Total Depth:

 20  
22  
24  
26  
28  
30  
32  
34  
36  
38  
40

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20' - 22'	20' A 20' B	18 9	48		SM	Same as above			
25' - 26'	25' A 25' B	5 6	6		SM	Same as above		5" recovery both liners (no density)	
30' - 32'	30' A 30' B	5 4	4		SM	Same as above			
34' - 35'						(Additional moisture from pouring water down hole to suppress gas)		CO > 500 ppm H <sub>2</sub> S = 5.0 ppm LEL = 21% (4' down hole)	
35'						E.O.B. @ 35'			

GRAVELS <50% coarse fraction passes #4 sieve	GRAVELS with 15% fines	Well-graded gravels, gravel-sand mixtures, little or no fines	GM	Term	Blows/ft*			Term	Blows/ft*	Term	Field Test	Term	Field Test	Term	Field Test
					(SPT) 1.4'ID	2.0'ID	(mod)CAL 2.5'ID								
SANDS <20% coarse fraction passes #4 sieve	SANDS with 15% fines	Well-graded sands, gravelly sands, little or no fines	SM	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	crumbly	crumbles or breaks with fingering or slight finger pressure	flow	crumbs or breaks with considerable finger pressure
SANDS with 15% fines	SANDS with 15% fines	Poorly-graded sands, gravelly sands, little or no fines	SP	medium stiff	4-8	4-8	4-8	loose	4-10	5-12	7-16	little	little	Some	Mostly
SANDS with 15% fines	SANDS with 15% fines	Clayey sands, poorly-graded sand-gravel mixtures	SC	stiff	8-15	9-17	9-18	medium dense	10-30	13-37	18-61	some	some	Some	Mostly
SANDS with 15% fines	SANDS with 15% fines	Clayey sands, poorly-graded sand-gravel mixtures	SC	very stiff	15-30	17-39	18-42	dense	30-50	37-60	51-86	very stiff	very stiff	very stiff	very stiff
SANDS with 15% fines	SANDS with 15% fines	Inorganic sandy fine sands, silty or clayey fine sands, with wet silt clay plasticity	ML	hard	30-60	39-78	42-65	very dense	>60	>60	>86	extremely hard	extremely hard	extremely hard	extremely hard
SANDS with 15% fines	SANDS with 15% fines	Inorganic silty fine sand, sandy silty clay, lean clay	CL	very hard	>60	>78	>85								

SILTS AND CLAYS liquid limit <50		SILTS AND CLAYS liquid limit >50		HIGHLY ORGANIC SOILS	
CL	CL	CH	CH	OH	PT
CL	CL	CH	CH	OH	PT
CL	CL	CH	CH	OH	PT



Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: BW-2

Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig:

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/18/18

Drillers (day/night): S. Lora, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/18/18

Field Representative (day/night):

Core Diameter: N/A

Total Depth: 21.5 +/-

Depth	Sample Number	Blow Count	Recovery (in)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	silty sand w/ little clay (SM), few carbonates (esp in weakly cemented clods), trace organics (roots, grasses), light brown, slightly moist, medium dense			
5.5	5' Bag	19	10		SM	Same as above		Analytical Sample (look from A, B, C liners)	
6			13						
10	10' A	16	10		SM	Same as above, trace clay			
15	15' A	6	7		SM	Same as above			
15.5	15' B	7	17						

<b>GRAVELS</b> -50% coarse fraction passes #4 sieve	<b>GRAVELS</b> -60% coarse fraction passes #4 sieve	Well-graded: gravels, gravel-sand mixtures, little or no fines Poorly-graded: gravels, gravel-sand mixtures, little or no fines	<b>GW</b> <b>GP</b>	<b>Term</b>	<b>Blows/ft</b> (SPT) 1'410 2'010 2'510	<b>Term</b>	<b>Blows/ft</b> (SPT) 1'410 2'010 2'510	<b>GRAIN SIZE</b> (Sands and Gravels)	<b>Term</b>	<b>Size (mm)</b>	<b>Size (inches)</b>	<b>Percentages of gravel, sand, and fines may be stated in terms including a range of percentages as below</b>	
<b>SANDS</b> -50% coarse fraction passes #4 sieve	<b>SANDS</b> -60% coarse fraction passes #4 sieve	Silty gravels, poorly-graded: gravel-sand-clay mixtures Well-graded: sands, silty sands, little or no fines Poorly-graded: sands, silty sands, little or no fines Clayey sands, poorly-graded: sand-gravel-silt mixtures Clayey sands, poorly-graded: sand-gravel-silt mixtures Inorganic silty-sandy-clay sands, silty or clayey fine sands, silts with slight plasticity Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	<b>GM</b> <b>GC</b> <b>GM</b> <b>SM</b> <b>SC</b> <b>ML</b> <b>CL</b>	very soft soft medium stiff stiff very stiff hard very hard	0-2 2-4 4-8 8-15 15-30 30-60 >60	0-2 2-4 4-8 9-18 17-39 39-78 42-65 >65	very loose loose medium dense dense very dense		0-4 4-10 10-30 30-50 >50	0-5 5-12 12-37 37-50 >50	0-7 7-16 18-51 51-86 >86	>300 75 to 300 19 to 75 4.75 to 19 2.0 to 4.75 0.425 to 2.0 0.075 to 0.425 0.003 to 0.075	>12 3 to 12 3/4 to 3 3/16 to 3/4 1/16 to 3/16 1/64 to 1/16 0.003 to 1/64 <0.003
<b>SILTS AND CLAYS</b> liquid limit <50	<b>SILTS AND CLAYS</b> liquid limit >50	Organic silts and clays of low plasticity Inorganic silts, macaceous or dishonorous fine sand or silt Inorganic clays of high plasticity, fat clays Organic silts and clays of medium to high plasticity Peat, mucks, slumps silts with high organic content	<b>OL</b> <b>OH</b> <b>CH</b> <b>OH</b> <b>PT</b>	Note Well-graded = poorly sorted Poorly-graded = well sorted	Low Medium High	<b>Term</b> Dry Moist Wet	<b>Field Test</b> Absence of moisture dry to touch Damp, does not wet palm Visible Free Water	<b>Term</b> Weak Moderate Strong	<b>Field Test</b> Crumbles or breaks with hand or slight finger pressure Crumbles or breaks with considerable finger pressure Will not crumble or break with finger pressure	<b>Term</b> Very soft Soft Stiff Very stiff Hard Very hard	<b>Field Test</b> Does not flow water (time and effort) Does to water after entry (time and effort)		



Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: BW-2

Sheet 2 of 2

Drilling Company: Cascade Drilling	Drilling Rig:	Bit Type: 4.25" I.D., 8" O.D. Auger	Start Date: See Sheet 1
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguena	Drilling Method: Hollow Stem Auger	Logged by: C. Fritz	Finish Date:
Field Representative (day / night):	Core Diameter: N/A		Total Depth:

20

22

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
	20' Bag	11	24	32	SM	Dense silty sand (SM), few carbonates, brown + white w/ trace black shale pieces, slightly moist		Analytical sample (bulk from A, B, C liners)	
					EOB @ 20' 21.5'				

GRAVELS		SANDS		SILTS AND CLAYS		HIGHLY ORGANIC SOILS		GRAIN SIZE		SOIL TYPE MODIFIER		
GRAVELS with little or no fines	GRAVELS with 15% fines	SANDS with little or no fines	SANDS with 15% fines	SILTS AND CLAYS liquid limit <50	SILTS AND CLAYS liquid limit >50	PEAT, HUMUS, SLICKEN SOILS with high organic content	Nonplastic Low	Plastic Low	Term	Field Test	Term	Field Test
GW	GP	SW	SP	CL	ML	PT	Low	Low	Very loose	Absence of moisture, dry to touch	Weak	Crumbles or breaks with handling or a slight finger pressure
GM	GC	SM	SC	CL	ML	PT	Medium	Medium	loose	Damp, does not wet palm	Mild	Chunks or breaks with considerable finger pressure
GM	GC	SM	SC	CL	ML	PT	High	High	medium dense	Visible Free Water	Strong	Will not crumble or break with finger pressure







Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No.: BW-4

Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CHS 85

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/18/18

Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/18/18

Field Representative (day / night):

Core Diameter: N/A

Total Depth: 21.5 FT

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						SM Loose silty sand, light brown, slightly moist, some weakly cemented clods			
5	5' Bag	3	3	6		SM Same as above		Analytical Sample (A, B, C liners → bulk)	
10	10' A	4	4	6		SM Same as above, trace fine gravel			
15	15' Bag	10	11	7		SM Silty sand w/ trace clay, slightly darker brown than above, medium dense & weak cementation		Analytical Sample (Bulk from A, B, C liners)	

GRAVELS		SANDS		SILTS AND CLAYS		CONSISTENCY (Soils and Clays)	Blows/ft (SPT) 1'ID 2'ID 2.5'ID	Term	Blow/ft (modCAL) 1'ID 2'ID 2.5'ID	Term	Field Test	Term	Field Test
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	liquid limit <50	liquid limit >50								

HIGHLY ORGANIC SOILS		RELATIVITY	MOISTURE	TERM	FIELD TEST	TERM	FIELD TEST
Frail, tumid, swamp soils with high organic contents	Frail, tumid, swamp soils with high organic contents						







Client: GE - United Nuclear Corporation  
 Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: L1-1  
 Sheet 2 of 2

Drilling Company: Cascade Drilling

Drilling Rig:

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: See sheet 1

Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: 4.25"

Total Depth:

20

22

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20'	20'A 20'B	18 15			SM	SAME AS ABOVE			
22'						EOB @ 21.5'			

GRAVELS	GRAVELS with fine or no fines	Well-sorted gravels, gravel-sand mixtures, fine or no fines	GW	Term	Blows/ft <sup>2</sup>			Term	Blows/ft <sup>2</sup>			GRAIN SIZE	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
					(SPT) 1.4'ID	(FIELD) 2.0'ID	(FIELD) 2.5'ID		(SPT) 1.4'ID	(FIELD) 2.0'ID	(FIELD) 2.5'ID		
COARSE	40% coarse fraction passes #4 sieve	poorly-sorted gravels, gravel-sand mixtures, little or no fines	GM	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders >300	>12
MEDIUM	20% coarse fraction passes #10 sieve	clayey gravels, poorly-sorted, gravel-sand-clay mixtures	GC	soft	2-4	2-4	2-4	loose	4-10	5-12	7-18		75 to 300
FINE	10% coarse fraction passes #20 sieve	clayey gravels, poorly-sorted, gravel-sand-clay mixtures	GC	medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	15-51	30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey gravels, poorly-sorted, sand-gravel-silt mixtures	SM	stiff	8-15	9-17	9-18	very dense	>30	>37	>51	3 to 75	3/16 to 3/4
SANDS	40% coarse fraction passes #4 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC	very stiff	15-30	17-39	18-42		>50	>60	>86	75 to 300	3 to 12
MEDIUM	20% coarse fraction passes #10 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC	stiff	30-60	39-78	42-85					30 to 75	3/4 to 3
FINE	10% coarse fraction passes #20 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM	very hard	>60	>78	>85					30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
SANDS	40% coarse fraction passes #4 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC									30 to 75	3/4 to 3
MEDIUM	20% coarse fraction passes #10 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
FINE	10% coarse fraction passes #20 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
SANDS	40% coarse fraction passes #4 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC									30 to 75	3/4 to 3
MEDIUM	20% coarse fraction passes #10 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
FINE	10% coarse fraction passes #20 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
SANDS	40% coarse fraction passes #4 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC									30 to 75	3/4 to 3
MEDIUM	20% coarse fraction passes #10 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
FINE	10% coarse fraction passes #20 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
SANDS	40% coarse fraction passes #4 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SC									30 to 75	3/4 to 3
MEDIUM	20% coarse fraction passes #10 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
FINE	10% coarse fraction passes #20 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3
VERY FINE	5% coarse fraction passes #40 sieve	clayey sands, poorly-sorted, sand-gravel-silt mixtures	SM									30 to 75	3/4 to 3

SILTS AND CLAYS	SILTS AND CLAYS liquid limit < 50	Inorganic silts and clays of low plasticity	ML	Term	Blows/ft <sup>2</sup>	Term	Blows/ft <sup>2</sup>	GRAIN SIZE	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
CLAYEY SILTS	20% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>very soft</td> <td>0-2</td> <td>0-2</td> <td>0-2</td> <td></td> <td></td>	CL	very soft	0-2	0-2	0-2		
MEDIUM CLAYS	40% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>soft</td> <td>2-4</td> <td>2-4</td> <td>2-4</td> <td></td> <td></td>	CL	soft	2-4	2-4	2-4		
FINE CLAYS	60% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>medium stiff</td> <td>4-8</td> <td>4-8</td> <td>4-8</td> <td></td> <td></td>	CL	medium stiff	4-8	4-8	4-8		
STIFF CLAYS	70% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>stiff</td> <td>8-15</td> <td>9-17</td> <td>9-18</td> <td></td> <td></td>	CL	stiff	8-15	9-17	9-18		
VERY STIFF CLAYS	80% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>very stiff</td> <td>15-30</td> <td>17-39</td> <td>18-42</td> <td></td> <td></td>	CL	very stiff	15-30	17-39	18-42		
HARD CLAYS	> 90% fines	clayey silts, micaceous or diatomaceous fine sand or silt <td>CL</td> <td>very hard</td> <td>&gt;60</td> <td>&gt;78</td> <td>&gt;85</td> <td></td> <td></td>	CL	very hard	>60	>78	>85		
ORGANIC SILTS	10% organic	organic silts and clays of low plasticity <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						
MEDIUM ORGANIC SILTS	20% organic	organic silts, micaceous or diatomaceous fine sand or silt <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						
FINE ORGANIC SILTS	40% organic	organic silts, micaceous or diatomaceous fine sand or silt <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						
VERY FINE ORGANIC SILTS	60% organic	organic silts, micaceous or diatomaceous fine sand or silt <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						
ORGANIC CLAYS	80% organic	organic silts, micaceous or diatomaceous fine sand or silt <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						
VERY ORGANIC SILTS	> 90% organic	organic silts, micaceous or diatomaceous fine sand or silt <td>OL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	OL						



Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No.: 41-2

Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CLC LAR 75 Hi Rise

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 3/26/18

Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 3/26/18

Field Representative (day / night):

Core Diameter: N/A

Total Depth: 21.4 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					CL	Lean clay, <sup>(CL)</sup> medium dense, dry, light brown, trace calcium carbonate			
2			16						
4									
6	5'A 5'B	14 13 20			CL	Same as above			
8			19						
10	10'A 10'B	9 10 16			SM	Silty fine sand, tan/light brown, trace clay + gravel, slightly moist, medium dense			
12			20						
14									
16	15'A 15'B	9 17 22			SM	Silty sand, trace to few gravel, tan/light brown, slightly moist, weakly cemented, medium to dense			
18			16						
20									

GRAVELS	GRAVELS	Well-graded: gravel, gravel-sand mixtures, little or no fines	GW	Term	Blows/ft <sup>2</sup>	Blows/ft <sup>2</sup>	Term	Blows/ft <sup>2</sup>	Blows/ft <sup>2</sup>	GRAIN SIZE	Term	Size (mm)	Size (inches)	Percentage of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
+50% coarse fraction passes #4 sieve	GRAVELS	Poorly-graded: gravels, gravel-sand mixtures, little or no fines	GM	very soft	0-2	0-2	very loose	0-4	0.5	0-7	Boulders	>300	>12	
with <15% fines	GRAVELS	clay gravels, poorly-graded gravel-sand mixtures	GC	soft	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12	
	SANDS	Well-graded: sand, gravelly sands, little or no fines	SW	medium stiff	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3	
+50% coarse fraction passes #4 sieve	SANDS	Poorly-graded: sand, gravelly sands, little or no fines	SP	stiff	8-15	9-18	dense	30-50	37-50	51-98	Fine gravel	4.75 to 19	3/16 to 3/4	Term %
with <15% fines	SANDS	clay sands, poorly-graded sand-gravel mixtures	SC	very stiff	15-30	17-38	very dense	>50	>50	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16	Trace
	SANDS	clay sands, poorly-graded sand-gravel mixtures	SC	hard	30-80	39-78					Medium sand	0.425 to 2.0	1/64 to 1/16	<5
	SANDS	clay sands, poorly-graded sand-gravel mixtures	SC	very hard	>80	>85					Fine sand	0.075 to 0.425	0.003 to 1/64	Little
	SANDS	clay sands, poorly-graded sand-gravel mixtures	SC								Silt / clay (fine)	<0.075	<0.003	Some
	SANDS	clay sands, poorly-graded sand-gravel mixtures	SC											50-100

SOILS AND CLAYS	SOILS AND CLAYS	Organic silts and clays of low plasticity	OL	Term	Field Test	Term	Field Test	Term	Field Test	Term	Field Test
liquid limit <50	SOILS AND CLAYS	Organic silts and clays of medium to high plasticity	OH	Nonplastic	Field Test	Nonplastic	Field Test	Nonplastic	Field Test	Nonplastic	Field Test
	SOILS AND CLAYS	Organic silts and clays of high plasticity	CH	Low	Absence of marl, dry to touch	Low	Dense, does not wet palm	Low	Crumbles or breaks with no finger pressure	Low	Crumbles or breaks with considerable finger pressure
	SOILS AND CLAYS	Organic silts and clays of medium to high plasticity	OH	Medium	Moist	Medium	Moist	Medium	Crumbles or breaks with considerable finger pressure	Medium	Crumbles or breaks with considerable finger pressure
	SOILS AND CLAYS	Organic silts and clays of medium to high plasticity	OH	High	Wet	High	Wet	High	Crumbles or breaks with considerable finger pressure	High	Crumbles or breaks with considerable finger pressure
	SOILS AND CLAYS	Organic silts and clays of medium to high plasticity	OH	Very High	Very Wet	Very High	Very Wet	Very High	Crumbles or breaks with considerable finger pressure	Very High	Crumbles or breaks with considerable finger pressure





Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No. **LI-3**

Sheet **1** of **2**

Drilling Company: Cascade Drilling

Drilling Rig: **CHE LAR 75 Hydraulic**

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **3/27/18**

Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: **3/27/18**

Field Representative (day / night):

Core Diameter: **N/A**

Total Depth: **21.5 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						SM Silty sand (SM), few to little clay, light brown / tan, slightly moist, medium dense			
5' A	5'A	9				SM same as above		Slightly improved structure in samples compared to previous holes	
5' B	5'B	12							
10	10'A	5	7	10		SM same as above			
15	15'A	5	8			SM same as above			
15	15'B	12							

<b>GRAVELS</b> <50% coarse fraction passes #4 sieve	<b>GRAVELS</b> with fine or no fines	Well-graded gravels, gravel-sand mixtures, little or no fines	<b>GW</b>	Term	Blows/ft. (SPT) 1'4"ID 2'0"ID 2'5"ID	Term	Blows/ft. (SPT) 1'4"ID 2'0"ID 2'5"ID	Term	Field Test	Term	Field Test	Depth to first water (Time and date)
<b>SANDS</b> <50% passing fraction passes #4 sieve	<b>SANDS</b> with fine or no fines	Well-graded sands, gravely sands, little or no fines	<b>SW</b>									
<b>SANDS</b> <50% passing fraction passes #4 sieve	<b>SANDS</b> with fine or no fines	Front-graded sands, gravely sandy, little or no fines	<b>SP</b>	Low	Most	Damp, does not wet palm	Moderate	Crumbles or breaks with considerable finger pressure	Depth to water after drilling (Time and date)			
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Silty sands, poorly-graded, sand-gravel-silt mixtures	<b>SM</b>	Medium	Wet	Visible Free Water	Strong	Will not crumble or break with finger pressure				
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Clayey sands, poorly-graded, sand-gravel-silt mixtures	<b>SC</b>	High								
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Inorganic silty, very fine sands, silty or clayey fine sands, silts with slight plasticity	<b>ML</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Inorganic silty, fine to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	<b>CL</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Organic silts and clays of low plasticity	<b>OL</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Inorganic silts, micaceous or carbonaceous fine sand or silt	<b>MH</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Inorganic clays of high plasticity, fat clays	<b>CH</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Organic silts and clays of medium to high plasticity	<b>OH</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	<b>CL</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Organic clays of low to medium plasticity	<b>OH</b>									
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Peat, humus, seaweed soils with high organic content	<b>PT</b>									











Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No: **L1-5**

Sheet **1** of **2**

Drilling Company: Cascade Drilling

Drilling Rig: **CHL LAR 75 High**

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **3/26/18**

Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: **Hollow Stem Auger Torque**

Logged by: C. Fritz

Finish Date: **3/26/18**

Field Representative (day / night):

Core Diameter: **4.25"**

Total Depth: **21.5 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						SM Silty sand (SM) w/ trace calcium carbonate, hard, moderate cementation, slightly moist, brown			
1.9		17	37	80 1/4	SC	Clayey sand, dense, dry, light brown (SC)			
5.4	5' Bag				SC	Clayey sand (SC), slightly moist, very hard, moderate cementation, brown			
8.8	8' Bag				SC	same as above			
12.2	10' Bag				SM	Silty sand (SM), trace silt, light brown, weakly cemented, dry, poorly graded		Material in shoe only	
15.7	15' Bag								

GRAVELS		SANDS		SILTS AND CLAYS	
Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Well-graded sands, gravelly sands, little or no fines	SW	Highly plastic silts, micaceous or discontinuous fine sand or silt	SH
Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP	Medium sand	SM	Organic silts and clays of high plasticity, fat clays	OH
Silty gravels, poorly-graded, gravel-sand-silt mixtures	GM	Very silty sand	ST	Organic silts and clays of medium to high plasticity	OM
Clayey gravels, poorly-graded, gravel-sand-silt mixtures	GC	Very hard	SH	Peat, humus, swamp soils with high organic content	PT















Client: GE - United Nuclear Corporation

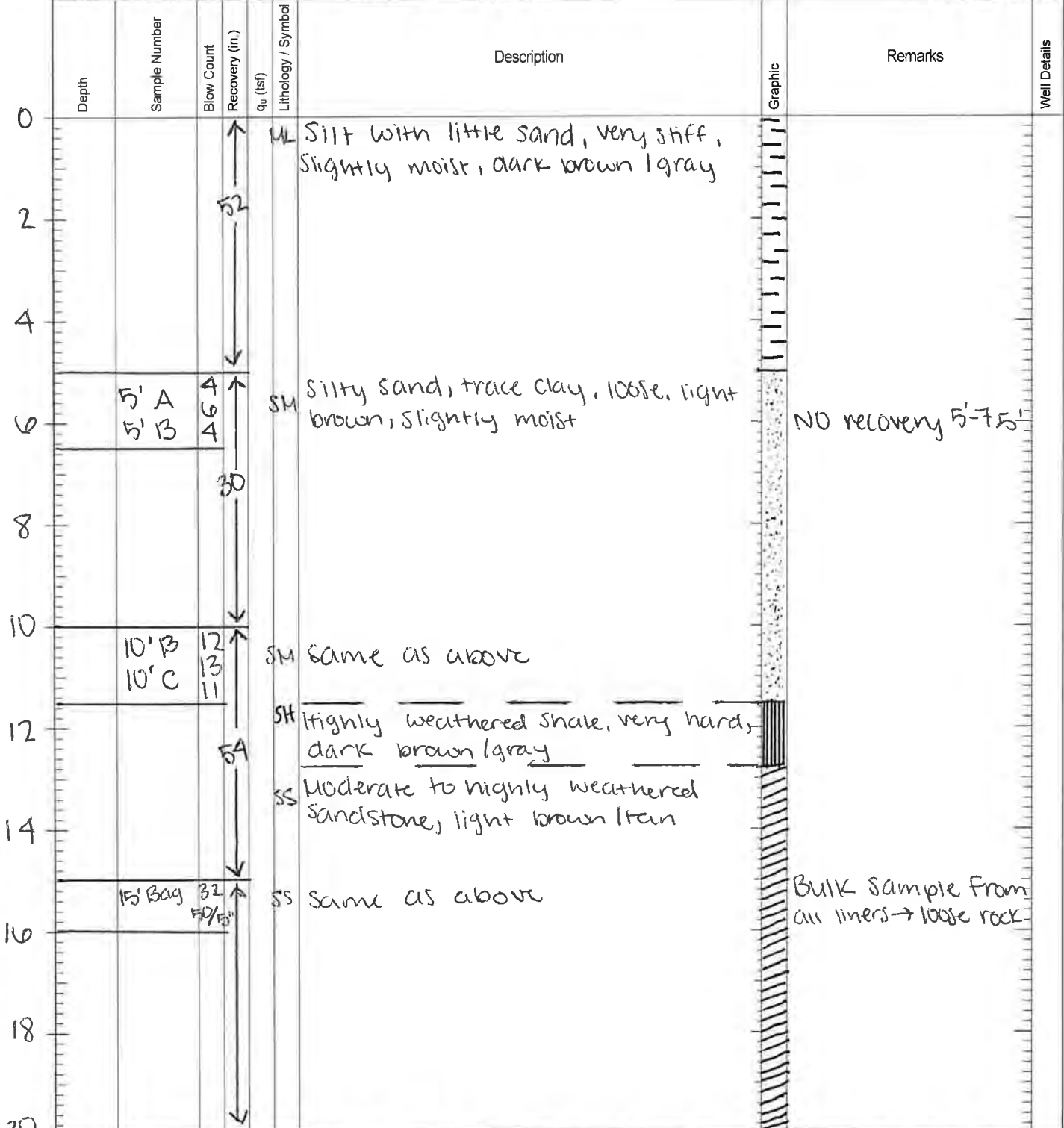
SOIL BORING LOG FORM

BOREHOLE No.: L2-A

Project Number: 233001076

Sheet 1 of 2

Drilling Company: Cascade Drilling	Drilling Rig: CME 85	Bit Type: 4.25" I.D., 8" O.D. Auger	Start Date: 3/31/18
Drillers (day/night): S. Lora, A. Rodriguez, J. Viguena	Drilling Method: Hollow Stem Auger	Logged by: C. Fritz	Finish Date: 3/31/18
Field Representative (day/night):	Core Diameter: 4.25"		Total Depth: 20.4 ft



GRAVELS +50% coarse fraction passes #4 sieve	GRAVELS with little or no fines +50% coarse fraction passes #4 sieve	Well-sorted gravels, gravel-sand mixtures, little or no fines Poorly-sorted gravels, gravel-sand mixtures, little or no fines	GW GP	Terminology very soft	Blows/ft 0-2	Terminology very loose	Blows/ft 0-4	Terminology Boulders	Size (mm)	Size (inches)	Percentage of gravel, sand, and fines may be stated in terms of percentages as below
SANDS +50% coarse fraction passes #4 sieve	SANDS with little or no fines +50% coarse fraction passes #4 sieve	Silty gravels, poorly-sorted gravel-sand-clay mixtures Clayey gravels, poorly-sorted gravel-sand-clay mixtures Well-sorted sands, gravely sands, little or no fines Poorly-sorted sands, gravely sands, little or no fines	GM GC GW GP GZ GC	Terminology soft medium stiff stiff very stiff very hard	Blows/ft 2-4 4-8 8-15 15-30 >60	Terminology loose medium dense dense very dense	Blows/ft 4-10 12-37 37-60 60-100 >85	Terminology Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	Size (mm) 75 to 300 19 to 75 4.75 to 19 2.0 to 4.75 0.425 to 2.0 0.075 to 0.425	Size (inches) 3 to 12 3/4 to 3 3/16 to 3/4 1/16 to 3/16 1/8 to 1/16 0.003 to 1/64 <0.003	Terminology Term Trace Few Little Some Mostly



Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **L2-A**  
Sheet **2** of **2**

Drilling Company: Cascade Drilling      Drilling Rig:      Bit Type: 4.25" I.D., 8" O.D. Auger      Start Date: **See sheet 1**  
 Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena      Drilling Method: Hollow Stem Auger      Logged by: C. Fritz      Finish Date:  
 Field Representative (day / night):      Core Diameter: **4.25"**      Total Depth:

20  
  
22

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
	<b>NR</b>	<b>0</b>	<b>0.5"</b>		<b>SS</b>	<b>Same as above</b>			
						<b>EOB @ 20.4'</b>			

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Term	Blows/in*			Term	Blows/in*			GRAIN SIZE	Term	Size (mm)	Size (inches)	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
					(SPT)	(HVICAL)	(HVICAL)		(SPT)	(HVICAL)	(HVICAL)					
<50% coarse fraction passes #4 sieve	GRAVELS	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12		
>50% coarse fraction passes #4 sieve	GRAVELS	Clayey gravels, poorly-graded, gravel-sand mixtures	GM	soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12		
<50% coarse fraction passes #4 sieve	SANDS	Well-graded sands, gravelly sands, little or no fines	GW	medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3		
>50% coarse fraction passes #4 sieve	SANDS	Poorly-graded sands, gravelly sands, little or no fines	SP	stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel	4.75 to 19	3/16 to 3/4	Term %	
	SANDS	Clayey sands, poorly-graded, sand-gravel mixtures	SM	very stiff	15-30	17-39	18-42	very dense	>50	>60	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16	Trace	
	SANDS	Clayey sands, poorly-graded, sand-gravel mixtures	SC	hard	30-60	38-78	42-85					Medium sand	0.425 to 2.0	1/64 to 1/16	Few	
	SANDS	Inorganic, silty, fine sand, silty or clayey fine sand, silts with slight plasticity	ML	very hard	>60	>78	>85					Fine sand	0.075 to 0.425	0.003 to 1/64	Little	
	SANDS	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL									Silt / clay (fines)	<0.075	<0.003	Some	
	SANDS	Organic silts and clays of low plasticity	OL												Mostly	
	SANDS	Inorganic silts, micaceous or silty, non-plastic, fine sand or silt	ML													
	SANDS	Organic clays of high plasticity, fat clays	CH													
	SANDS	Organic silts and clays of medium to high plasticity	OM													
	SANDS	Peat, humus, swamp soils with high organic content	PT													

FLASIBILITY	MOISTURE	FIELD TEST	TERMS	FIELD TEST
Low	Dry	Absence of moisture, dry to touch	Weak	Chumbles or breaks with hanging or slight finger pressure
Medium	Moist	Damp, does not wet palm	Moderate	Chumbles or breaks with considerable finger pressure
High	Wet	Visible Free Water	Strong	Will not crumble or break with finger pressure





Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: L2-5

Sheet 2 of 2

Drilling Company: Cascade Drilling

Drilling Rig:

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: See sheet 1

Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: N/A

Total Depth:

20

22

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20'A	14			SC	Clayey sand (SC), silty, few carbonates, slightly moist, brown, moderate cementation & medium dense.			
	20'B	14	22						
						EOB @ 21.5'			

GRAVELS		SANDS		SILTS AND CLAYS		CONSISTENCY		TERMS		FIELD TEST		COMPARISON	
<b>GRAVELS</b> with fine or no fines fraction passes #4 sieve	<b>GRAVELS</b> with fine or no fines fraction passes #4 sieve	<b>SANDS</b> with fine or no fines fraction passes #4 sieve	<b>SANDS</b> with fine or no fines fraction passes #4 sieve	<b>SILTS AND CLAYS</b> liquid limit <50	<b>SILTS AND CLAYS</b> liquid limit >50	<b>GW</b> Well-graded <b>GP</b> Poorly-graded <b>GM</b> Clayey <b>GC</b> Clayey <b>SW</b> Well-graded <b>SP</b> Poorly-graded <b>SM</b> Clayey <b>SC</b> Clayey <b>ML</b> Inorganic <b>CL</b> Organic <b>MH</b> Inorganic <b>CH</b> Organic <b>PT</b> Peat	<b>Term</b> very soft soft medium stiff stiff very stiff hard very hard	<b>Blows/ft*</b> (SPT) 1-410 2-070 2-510	<b>Term</b> very loose loose medium dense dense very dense	<b>Blows/ft*</b> (SPT) 1-410 2-070 2-510	<b>Field Test</b> Dry: Absence of moisture dry to touch Moist: Damp - does not wet palm Wet: Visible Free Water	<b>Term</b> Weak Moderate Strong	<b>Field Test</b> Cumbles or breaks with hand or light finger pressure Cumbles or breaks with considerable finger pressure Will not crumble or break with finger pressure
* = 140 pound hammer dropped 30 inches													



Client: GE - United Nuclear Corporation  
 Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: L2-6  
 Sheet 1 of 2

Drilling Company: Cascade Drilling Drilling Rig: CHE 85 Bit Type: 4.25" I.D., 8" O.D. Auger  
 Drillers (day / night): S. Lora, A. Rodriguez, J. Viguiera Drilling Method: Hollow Stem Auger Logged by: C. Fritz  
 Field Representative (day / night): Core Diameter: 4.25" Start Date: 3/31/18  
 Finish Date: 3/31/18 Total Depth: 21.5 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SC	clayey sand (SC), slightly moist, brown / grey, weak cementation, hard. few carbonates			
2			38						
6	5'B	17 24 17			SC	Same as above			
8			60						
10	10'A 10'B	11 26 15			SC	same as above			
12						Transitioning into Sandy mat'l			
14					SM	Silty Sand (SM), light brown, medium dense, slightly moist, weak to moderate cementation		No recovery 12.5' - 15'	
16	15'A 15'B	10 12 11				→ ~6" clay			
18									
20									

GRAVELS		SANDS		SILTS AND CLAYS	
Symbol	Description	Symbol	Description	Symbol	Description
GW	Well-sorted gravels, gravel-sand mixtures, little or no fines	SW	Well-sorted sands, gravelly sands, little or no fines	ML	Medium plastic silts and clays
GP	Poorly-sorted gravels, gravel-sand mixtures, little or no fines	SP	Poorly-sorted sands, gravelly sands, little or no fines	CL	Low plastic silts and clays
GM	Silty gravels, poorly-sorted gravel-sand-clay mixtures	SM	Silty sands, poorly-sorted sand-gravel mixtures	OH	Organic silts and clays of low plasticity
GC	Clayey gravels, poorly-sorted gravel-sand-clay mixtures	SC	Clayey sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
GM	Medium plastic silts and clays	SM	Medium plastic silty sands, silty or clayey fine sands, silts with high plasticity	OH	Organic silts and clays of low plasticity
SM	Silty sands, poorly-sorted sand-gravel mixtures	SC	Clayey sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
ML	Medium plastic silts and clays	SM	Silty sands, poorly-sorted sand-gravel mixtures	OH	Organic silts and clays of low plasticity
CL	Low plastic silts and clays	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
OH	Organic silts and clays of low plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	OH	Organic silts and clays of low plasticity
CH	Organic silts and clays of high plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
OH	Organic silts and clays of low plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
CH	Organic silts and clays of high plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
OH	Organic silts and clays of low plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity
CH	Organic silts and clays of high plasticity	SM	Silty sands, poorly-sorted sand-gravel mixtures	CH	Organic silts and clays of high plasticity



Stantec

Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: L2-6  
Sheet 2 of 2

Drilling Company: Cascade Drilling  
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera  
Field Representative (day / night):  
Drilling Rig:  
Drilling Method: Hollow Stem Auger  
Core Diameter: 4.25"  
Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz  
Start Date: See Sheet 1  
Finish Date:  
Total Depth:

20  
22

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
	20' A	9				SM silty sand			
	20' B	10							
						<u>EOB @ 21.5'</u>			

GRAVELS		SANDS		SILTS AND CLAYS		HIGHLY ORGANIC SOILS	
Well-sorted gravels, gravel-sand mixtures, little or no fines	GW	Well-sorted sands, gravelly sands, little or no fines	GW	Inorganic silts and clays of low plasticity	OL	Peat, humus, swamp soils with high organic content	PT
Poorly-sorted gravels, gravel-sand mixtures, little or no fines	GP	Poorly-sorted sands, gravelly sands, little or no fines	GP	Inorganic silts and clays of medium plasticity	ML		
Silty gravels, poorly-sorted gravel-sand mixtures	GM	Silty sands, poorly-sorted sand-gravel mixtures	SM	Inorganic silts and clays of high plasticity	CH		
Clayey gravels, poorly-sorted gravel-sand mixtures	GC	Clayey sands, poorly-sorted sand-gravel mixtures	SC	Organic silts and clays of medium to high plasticity	OH		
Well-sorted sands, gravelly sands, little or no fines	GW	Well-sorted silts and clays of low plasticity	OL				
Poorly-sorted sands, gravelly sands, little or no fines	GP	Nonplastic	NP				
Silty sands, poorly-sorted sand-gravel mixtures	SM	Low	Low				
Clayey sands, poorly-sorted sand-gravel mixtures	SC	Medium	Medium				
Inorganic silts and clays of low plasticity	OL	High	High				
Inorganic silts and clays of medium plasticity	ML						
Inorganic silts and clays of high plasticity	CH						
Organic silts and clays of medium to high plasticity	OH						
Peat, humus, swamp soils with high organic content	PT						

GRAIN SIZE	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE
Term	Size (mm)	Size (inches)	Percentage of gravel, sand, and fines may be listed in terms indicating a range of percentages as below
Boulders	>300	>12	
Cobbles	75 to 300	3 to 12	
Course gravel	19 to 75	3/4 to 3	
Fine gravel	4.75 to 19	3/16 to 3/4	
Course sand	2.0 to 4.75	1/16 to 3/16	
Medium sand	0.425 to 2.0	1/64 to 1/16	
Fine sand	0.075 to 0.425	0.003 to 1/64	
Silt / clay (fines)	<0.075	<0.003	



Stantec

Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: **L2-7**

Sheet **1** of **2**

Drilling Company: Cascade Drilling	Drilling Rig: <b>CHE 85</b>	Bit Type: 4.25" LD., 8" O.D Auger	Start Date: <b>3/31/18</b>
Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena	Drilling Method: Hollow Stem Auger	Logged by: C. Fritz	Finish Date: <b>3/31/18</b>
Field Representative (day / night):	Core Diameter: <b>N/A</b>		Total Depth: <b>21.5 ft</b>

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						SM Silty sand (SM), trace highly weathered sand stone & shale, trace plant roots, some weak cementation, medium dense			
5	5'A	9				SM Same as above			
6	5'B	13							
10	10'A	8				SM Same as above, less organics, trace carbonates			
15	15'A	11				SM Same as above, possibly greater clay content			
16		20							

GRAVELS		SANDS		SILTS AND CLAYS		CONSISTENCY		BLOWN/TERMS		GRAIN SIZE		PERCENTAGES		
Well-sorted gravels, gravel-sand mixtures, little or no fines	GP	Well-sorted sands, gravely sands, little or no fines	SW	Inorganic silts, very fine sand, silt or clayey fine sand, silts with slight plasticity	ML	Very soft	0-2	0-2	0-2	Very loose	0-4	0-5	0-7	Percentages of gravel, sand, and fines may be placed in terms indicating a range of percentages as below
Poorly-sorted gravels, gravel-sand mixtures, little or no fines	GM	Poorly-sorted sands, gravelly sands, little or no fines	SM	Organic silts, micaceous or diatomaceous fine sand or silt	OH	Soft	2-4	2-4	2-4	Loose	4-10	5-12	7-18	
Silty gravels, poorly-sorted gravel-sand-silt mixtures	GM	Clayey gravels, poorly-sorted gravel-sand-clay mixtures	GC	Inorganic silts of high plasticity, fat clays	CH	Medium stiff	4-8	4-8	4-8	Medium dense	10-30	12-37	18-51	Term %
Well-sorted sands, gravely sands, little or no fines	SW	Clayey sands, poorly-sorted sand-gravel mixtures	SC	Organic silts and clays of low plasticity	OL	Stiff	8-15	9-17	9-18	Dense	30-50	37-60	51-86	Trace
Poorly-sorted sands, gravely sands, little or no fines	SM	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL	Organic silts and clays of medium to high plasticity	OH	Very stiff	15-30	17-38	18-42	Very dense	>50	>60	>86	Few
Clayey sands, poorly-sorted sand-gravel mixtures	SC	Organic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL	Highly organic silts and clays with high organic content	PT	Hard	30-60	36-78	42-85	** 140 pound hammer dropped 30 inches	Soil type modulus			15-25
Inorganic silts, very fine sand, silt or clayey fine sand, silts with slight plasticity	ML	Organic silts, micaceous or diatomaceous fine sand or silt	OH			Very hard	>60	>78	>85		Soil type modulus			30-45
Organic silts, micaceous or diatomaceous fine sand or silt	OH										Soil type modulus			50-100







Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No: **PI - 1**  
Sheet **1** of **2**

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **4/3/18**

Drillers (day/night): S. Lora, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: **4/3/18**

Field Representative (day/night):

Core Diameter: **4.25 inch**

Total Depth: **20 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand (SM) with clay + gravel, light to dark gray/black, some orange staining			
2			37						
6	5'A 5'B	6 6			SM	Same as above, medium dense, slightly moist			
8			42			→ chunks weathered sandstone			
10	10'A	5 5 2			SM	Same as above			
12			36						
16	15'B	13 5			SM	Same as above			
18			30		SS	→ Mostly broken sandstone pieces, strong and moderately hard, gray w/ some orange, highly weathered			
20									

GRAVELS	GRAVELS	Well-sorted gravels, gravel-sand mixtures, little or no fines	GW
<50% coarse fraction passes #4 sieve	GRAVELS	Poorly-sorted gravels, gravel-sand mixtures, little or no fines	GP
	GRAVELS	Silty gravels, poorly-sorted, gravel-sand-clay mixtures	GM
	GRAVELS	Clayey gravels, poorly-sorted, gravel-sand-clay mixtures	GC
	GRAVELS	Well-sorted sands, gravelly sands, little or no fines	GW
	GRAVELS	Poorly-sorted sands, gravelly sands, little or no fines	GP
	GRAVELS	Silty sands, poorly-sorted, sand-gravel mixtures	SM
	GRAVELS	Clayey sands, poorly-sorted, sand-gravel-clay mixtures	SC
	GRAVELS	Inorganic silty/sandy fine sands, silty or clayey fine sands, silts with slight plasticity	ML
	GRAVELS	Inorganic silty/sandy fine sands, silty or clayey fine sands, silts with slight plasticity	ML
	GRAVELS	Organic silts and clays of low plasticity	OL
	GRAVELS	Inorganic silts, micaceous or diatomaceous fine sand or silt	MH
	GRAVELS	Organic silts and clays of medium to high plasticity	OH
	GRAVELS	Post-humus, swamp soils with high organic content	PT

GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	
very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12
soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12
medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3
stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel	4.75 to 19	3/16 to 3/4
very stiff	15-30	17-39	18-42	very dense	>50	>60	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16
hard	30-60	39-78	42-35					Medium sand	0.425 to 2.0	1/64 to 1/16
very hard	>60	>78	>85					Fine sand	0.075 to 0.425	0.003 to 1/64
								Silt/clay (fines)	<0.075	<0.003

















Client: GE - United Nuclear Corporation  
Project Number: 233001076

# SOIL BORING LOG FORM

BOREHOLE No: **PI-3**  
Sheet **1** of **3**

Drilling Company: Cascade Drilling  
Drillers (day/night): S. Lom, A. Rodriguez, J. Viguena  
Field Representative (day/night):

Drilling Rig: CME 85 Truck Rig  
Drilling Method: Hollow Stem Auger  
Core Diameter: **N/A**

Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz

Start Date: **4/3/18**  
Finish Date: **4/3/18**  
Total Depth: **41.5 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand & sandstone boulders		Large boulders on ground surface in vicinity	
5.5	5'A	31 38 39			SM	Very dense silty sand (SM). Possibly sandstone boulder, light brown/gray			
10.5	10'A	27 30			SM	Silty sand w/ few clay (SM), few broken rock pieces, dense to very dense, slightly moist, brown			
15.5	15'A	26			SM	Same as above			
16.0	15'B	17 10							

GRAVELS <50% coarse fraction passes #4 sieve	GRAVELS <50% coarse fraction passes #4 sieve	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Blows/ft			Term	Blows/ft	Term	Term	Size (mm)	Size (inches)	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
				(SPT)	(mod CAL)	(mod CAL)							
GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GP	1.4" ID	2.0" ID	2.5" ID	Term	Term	Term	Term	Term	Term	Term
SANDS	SANDS	Well-graded sands, gravelly sands, little or no fines	SW				very soft	very loose		Boulders	>300	>12	
SANDS	SANDS	Medium dense to dense sands, gravelly sands, little or no fines	SM				soft	loose		Cobbles	75 to 300	3 to 12	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SP				medium stiff	medium dense		Coarse gravel	18 to 75	3/4 to 3	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SH				stiff	dense		Fine gravel	4.75 to 19	3/16 to 3/4	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SH				very stiff	very dense		Coarse sand	2.0 to 4.75	1/16 to 3/16	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SH				hard			Medium sand	0.425 to 2.0	1/64 to 1/16	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SH				very hard			Fine sand	0.075 to 0.425	0.003 to 1/64	
SANDS	SANDS	Very dense sands, gravelly sands, little or no fines	SH							Silt & clay (fines)	<0.075	<0.003	







Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: PA-1  
Sheet 1 of 2

Drilling Company: Cascade Drilling  
Drillers (day/night): S. Lom, A. Rodriguez, J. Viguena  
Field Representative (day/night):

Drilling Rig: CME 85 Truck Rig  
Drilling Method: Hollow Stem Auger  
Core Diameter: N/A

Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz

Start Date: 4/14/18  
Finish Date: 4/14/18  
Total Depth: 30 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand (SM), little clay (weathered shale) + trace gravel, slightly moist, gray w/trace black + yellow/orange			
5.5	5'A	15			SM	Same as above, medium dense		VOC = 17.2 ppm	
6.5	5'B	15							
7.5	5'C	18							
10	10' Bag	10			SM	Same as above, but softer + more weathered		Analytical sample from A, B, + C liners	
10.5		8							
11		7							
15.5	15'A	4			SM	Same as above, loose			
16.5		6							
17.5		5							

GRAVELS		SANDS		SILTS AND CLAYS		FLUIDITY		MOISTURE		CONSISTENCY	
Well-graded gravels, gravel-sand mixtures, little or no fines	GP	Well-graded sands, gravelly sands, little or no fines	SW	Inorganic silts and clays of low plasticity	OL	Nonplastic	Term	Field Test	Field Test	Field Test	Field Test
Poorly-graded gravels, gravel-sand mixtures, little or no fines	GM	Poorly-graded sands, gravelly sands, little or no fines	SP	Inorganic silts and clays of medium to high plasticity	MH	Low	Dry	Absence of moisture, dry to touch	Crumbles or breaks with hand or slight finger pressure	Crumbles or breaks with hand or slight finger pressure	Crumbles or breaks with hand or slight finger pressure
Silty gravels, poorly-graded gravel-sand mixtures	GC	Silty sands, poorly-graded sand-silt mixtures	SM	Organic silts and clays of medium to high plasticity	CH	Medium	Moist	Damp, does not wet palm	Crumbles or breaks with considerable finger pressure	Crumbles or breaks with considerable finger pressure	Crumbles or breaks with considerable finger pressure
Clayey gravels, poorly-graded gravel-sand mixtures	GM	Clayey sands, poorly-graded sand-gravel mixtures	SC	Inorganic silts and clays of low plasticity	CL	High	Wet	Visible Free Water	Will not crumble or break with finger pressure	Will not crumble or break with finger pressure	Will not crumble or break with finger pressure





Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: p2 - 2

Sheet 1 of 1

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/15/18

Drillers (day/night): S. Lorn, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C, Fritz

Finish Date: 4/15/18

Field Representative (day/night):

Core Diameter: N/A

Total Depth: 20 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SC	Clayey sand (SC) w/some silt & trace gravel, some areas very black w/orgonics, brown in sandier spots			
2					SC	Same as above, medium dense, slightly moist to moist		H <sub>2</sub> S = 0 ppm, CO = 0, LEL = 0 *A liner has very black clayey material in bottom	
5.5	5'A	11							
6.5	5'B	8							
10	10' Bag	7			SC	Same as above, considerable weathered shale, brown + black w/trace orange, few salts in black clayey spots		Analytical sample (bulk from A, B, & C liners) H <sub>2</sub> S = 0, LEL = 0, CO > 500 ppm	
16		3	NA		SC	No recovery. L. body similar to above. Driller thought it was perhaps clayey material that shrank and fell out of sampler.		H <sub>2</sub> S = 0.4 ppm (outside hole) CO > 500 ppm	
20								@ 20': H <sub>2</sub> S = 4 ppm (outside hole) CO > 500 ppm, LEL = 28% NO sampling @ 20'	

EOB @ 20'

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Term	Blows/ft <sup>2</sup> (mod CAL)			Term	Blows/ft <sup>2</sup> (mod CAL)	GRAIN SIZE	Term	Field Test	Term	Field Test					
					(SPT)	1.4"ID	2.0"ID								2.5"ID	(SPT)	1.4"ID	2.0"ID	2.5"ID
>50% coarse fraction passes #4 sieve	GRAVELS	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	loose	4-10	5-12	7-18	Boulders	>300	>12	Percentages of gravel and fines may be stated in terms indicating a range of percentages as below
<50% coarse fraction passes #4 sieve	SANDS	Well-graded sands, gravelly sands, little or no fines	SW	soft	2-4	2-4	2-4	loose	10-30	12-37	18-51	medium dense	30-50	37-60	51-86	Cobbles	75 to 300	3 to 12	Term %
>50% coarse fraction passes #4 sieve	SANDS	Poorly-graded sands, gravelly sands, little or no fines	SP	medium stiff	4-8	4-8	4-8	dense	>50	>60	>86	very dense	>80	>86	Coarse gravel	19 to 75	3/4 to 3	Trace <5	
<50% coarse fraction passes #4 sieve	SANDS	Well-graded sands, gravelly sands, little or no fines	SW	stiff	8-15	9-17	9-18	very dense	>80	>86	>86	very dense	>80	>86	Fine gravel	4.75 to 19	3/16 to 3/4	Little 5-10	
>50% coarse fraction passes #4 sieve	SANDS	Poorly-graded sands, gravelly sands, little or no fines	SP	very stiff	15-30	17-38	18-42	very dense	>80	>86	>86	very dense	>80	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16	Some 15-25	
<50% coarse fraction passes #4 sieve	SANDS	Well-graded sands, gravelly sands, little or no fines	SW	hard	30-60	35-78	42-85	very dense	>80	>86	>86	very dense	>80	>86	Medium sand	0.425 to 2.0	1/64 to 1/16	Some 30-45	
>50% coarse fraction passes #4 sieve	SANDS	Poorly-graded sands, gravelly sands, little or no fines	SP	very hard	>80	>78	>85	very dense	>80	>86	>86	very dense	>80	>86	Fine sand	0.075 to 0.425	0.003 to 1/64	Mostly 50-100	
<50% coarse fraction passes #4 sieve	SANDS	Well-graded sands, gravelly sands, little or no fines	SW	very hard	>80	>78	>85	very dense	>80	>86	>86	very dense	>80	>86	Silt / clay (fines)	<0.075	<0.003		

Depth to final water (time and date)  
Depth to water after drilling (time and date)



Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: P3-1

Sheet 1 of 1

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/18/18

Drillers (day/night): S. Lom, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/18/18

Field Representative (day/night):

Core Diameter: N/A

Total Depth: 16.5 ft

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand (SM) with gravel, trace sandstone cobbles, light gray w/trace darker gray in more cemented spots, trace iron oxidation, trace green discoloration			
2					SM	Same as above, slightly moist, dense (though possibly just due to cobbles)		Hit void first 6" drive	
6	5' A	2							
	5' B	29							
		28							
10	10' A	4			SM	Same material as above, medium-grained sand, loose + moist, light brown + gray w/green		CO = 300 ppm	
	10' B	5							
		8							
15	15' A	5			SP	Top of sampler (C): poorly-graded medium sand, light gray/white with some green tinge		H <sub>2</sub> S = 0 ppm, LEL = 5%	
	15' B	7			SC	A liner + part of B liner: clayey sand (SC) + weathered shale, silty, dark gray/black w/light gray, orange + yellow oxidation		CO = 140 ppm (and still rising)	
		12							
						EOB @ 16.5'			

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW
<50% coarse fraction passes #4 sieve	GRAVELS with little or no fines	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP
	GRAVELS #4 sieve with <15% fines	Silty gravels, poorly-graded gravel-sand-silt mixtures	GM
		Clayey gravels, poorly-graded gravel-sand-clay mixtures	GC
		Well-graded sands, gravelly sands, little or no fines	SW
		Poorly-graded sands, gravelly sands, little or no fines	SP
		Silty sands, poorly-graded sand-gravel-silt mixtures	SM
		Clayey sands, poorly-graded sand-gravel-clay mixtures	SC
		Inorganic silty/sandy fine sands, silty or clayey fine sands, silts with slight plasticity	ML
		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL
		Organic silts and clays of low plasticity	OL
		Inorganic silts, inarticulate or diatomaceous fine sand or silt	MH
		Inorganic clays of high plasticity, fat clays	CH
		Organic silts and clays of medium to high plasticity	OH
		PEAT, humus, swamp soils with high organic content	PT

TERMS	PLASTICITY	MOISTURE	FIELD TEST	SOIL TYPE	DEPTH TO FIRST WATER
Very soft	Nonplastic	Very loose	Field Test	Weak	Depth to first water (time and date)
Soft	Low	Loose	Absence of moisture, dry to touch	Moderate	Depth to water after drilling (time and date)
Medium stiff	Medium	Dense	Damp, does not wet palm	Strong	
Stiff	High	Very dense	Visible Free Water		
Very stiff					
Hard					
Very hard					













Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **P3-3**

Sheet **2** of **3**

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **See Sheet 1**

Drillers (day / night): S. Lorn, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: **N/A**

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20'A 20'B	3 6 6			SM	Same as above, brown/tan with trace gray, black, & orange, trace gravel			
22									
24									
26	26'A 26'B	3 5 5			SM	Same as above, increased presence green material		H <sub>2</sub> S = 0ppm, CO = 0ppm	
28									
30	30'A 30'B	3 4 7			SM	Same as above, trace to few gravel		H <sub>2</sub> S = 0ppm, CO = 9ppm (material getting darker)	
32									
34									
36	35'A 35'B	3 4 3			SM	Same as above, few sandstone chunks		CO = 2ppm, H <sub>2</sub> S = 0ppm	
38									
40									

GRAVELS	GRAVELS with little or no fines fraction passing #4 sieve	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Blows/m*			Term	Blows/m*			Term	Term	Field Test	Term	Field Test	Term	Field Test	Term	Field Test								
				(SPT)	(modCAL)	(SPT)		(modCAL)	(SPT)	(modCAL)										(SPT)	(modCAL)	(SPT)	(modCAL)	(SPT)	(modCAL)	(SPT)	(modCAL)
SANDS	SANDS with little or no fines fraction passing #4 sieve	Well-graded sands, gravelly sands, little or no fines	SW	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	loose	4-10	5-12	7-18	medium dense	10-30	12-37	18-51	dense	30-50	37-60	51-86	very dense	>50	>60	>86
				soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	medium dense	10-30	12-37	18-51	dense	30-50	37-60	51-86	very dense	>50	>60	>86				
Note:				* = 140 pound hammer dropped 30 inches											Field Test												
Well-graded # poorly sorted															Absence of moisture, dry to touch												
Poorly-graded # well sorted															Damp, does not wet palm												
															Visible Free Water												







Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **p3-4**  
Sheet **2** of **3**

Drilling Company: Cascade Drilling  
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera  
Field Representative (day / night):  
Drilling Rig: CME 85 Truck Rig  
Drilling Method: Hollow Stem Auger  
Core Diameter: **NA**  
Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz  
Start Date: **See Sheet 1**  
Finish Date:  
Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20'A	10			SP-SM	Same as above, trace coarse gravel, medium dense			
	20'B	13							
22									
24									
26	25'A	50/5*			SP-SM	Same as above, fine to medium sand, trace coarse gravel		High blow counts likely due to cobbles	
28									
30	30'B	17			SP-SM	Same as above			
		15							
32									
34									
36	35'A	10			SP-SM	Same as above, brown w/dark gray, few shale (black), trace yellow, orange, & light gray			
	35'B	11							
38									
40									

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Term	Blows/ft* (modCAL)	Term	Blows/ft* (modCAL)	Term	Size (mm)	Size (inches)	Percentage of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP								
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Clayey gravels, poorly-graded gravel-sand-silt mixtures	GM	soh	2-4	loose	4-10	5-12	3 to 12		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Well-graded sands, gravelly sands, little or no fines	GW	medium stiff	4-8	medium dense	10-30	12-37	3/4 to 3		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Poorly-graded sands, gravelly sands, little or no fines	GP	stiff	8-15	dense	30-50	37-60	3/16 to 3/4		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Silty sands, poorly-graded sand-gravel-silt mixtures	SM	very stiff	15-30	very dense	>50	>60	1/16 to 3/16		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Clayey sands, poorly-graded sand-gravel-clay mixtures	SC	hard	30-60				1/64 to 1/16		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Inorganic silty/very-fine sands, silty or clayey fine sands, silts with slight plasticity	ML	very hard	>60				<0.003 to 1/64		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL						<0.003		
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Organic silts and clays of low plasticity	OL								
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Inorganic silts, micaceous or ductinaceous fine sand or silt	MH								
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Inorganic clays of high plasticity, fat clays	CH								
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Organic silts and clays of medium to high plasticity	OH								
<50% coarse fraction passes #4 sieve	<50% coarse fraction passes #4 sieve	Peat, turfs, swamp soils with high organic content	PT								

PREPARED BY: [Name] DATE: [Date]  
TERMS AND CONDITIONS: [Text]  
FIELD TEST: [Text]  
DEPTH TO FRESH WATER: [Text]



Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No.: P3-4  
Sheet 3 of 3

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: See Sheet 1

Drillers (day / night): S. Lam, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter:

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
40	40'A	7			ML	Sandy silt w/few clay (ML), moist, black + gray, hard to very hard		Encountered H <sub>2</sub> S while drilling from 40', stopped work.	
	40'B	48							
		38							
42						EOB @ 41.5'			
44									
46									
48									
50									

TERMINOLOGY	SYMBOL	CONSISTENCY	Blows/ft*			Blows/ft*			GRAIN SIZE	PERCENTAGES OF GRAVEL, SAND AND SILT MAY BE STATED IN TERMS INDICATING A RANGE OF PERCENTAGES AS BELOW
			(SPT) 1.4"ID	(SPT) 2.0"ID	(SPT) 2.5"ID	(SPT) 1.4"ID	(SPT) 2.0"ID	(SPT) 2.5"ID		
GRAVELS	GP	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders >300 >12
GRAVELS	GM	soft	2-4	2-4	2-4	loose	4-10	5-12	7-16	Cobbles 75 to 300 3 to 12
GRAVELS	GC	medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	19-51	Coarse gravel 19 to 75 3/4 to 3
SANDS	SP	stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel 4.75 to 19 3/16 to 3/4
SANDS	SM	very stiff	15-30	17-39	18-42	very dense	>50	>60	>86	Coarse sand 2.0 to 4.75 1/16 to 3/16
SANDS	SC	hard	30-60	39-78	42-85					Medium sand 0.425 to 2.0 1/64 to 1/16
SANDS	CL	very hard	>60	>78	>85					Fine sand 0.075 to 0.425 0.003 to 1/64
SANDS	OL									Silt / clay (fines) <0.075 <0.003
SILTS AND CLAYS	ML	Nonplastic				Field Test				Term Field Test
SILTS AND CLAYS	MH	Low				Dry	Absence of moisture, dry to touch			Weak Crumbles or breaks with hand or slight finger pressure
SILTS AND CLAYS	CH	Medium				Moist	Damp, does not wet palm			Moderate Crumbles or breaks with considerable finger pressure
SILTS AND CLAYS	OH	High				Wet	Visible Free Water			Strong Will not crumble or break with finger pressure
HIGHLY ORGANIC SOILS	PT									Depth to first water (time and date)







Client: GE - United Nuclear Corporation

Project Number: 233001076

# SOIL BORING LOG FORM

BOREHOLE No: P3-6

Sheet 1 of 3

Drilling Company: Cascade Drilling	Drilling Rig: CME 85 Truck Rig	Bit Type: 4.25" I.D., 8" O.D. Auger	Start Date: <u>4/14/18</u>
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera	Drilling Method: Hollow Stem Auger	Logged by: C. Fritz	Finish Date: <u>4/14/18</u>
Field Representative (day / night):	Core Diameter: <u>N/A</u>		Total Depth: <u>55 ft</u>

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand (SM), fine to medium-grained sand, trace gravel + sandstone chunks, light brown + gray, trace orange, slightly moist			
2					SM	Same as above, trace cobbles			
4					SM	Same as above, but mostly dark brown w/some light brown, gray, and orange, slightly moist, loose to medium dense			
6	5'A 5'B	10 50/4"						H <sub>2</sub> S = 0 ppm, CO = 0 ppm	
10	10'A 10'B	11 5 5						0 ppm gas readings ↓	
16	15'A 15'B	3 5 6							

<b>GRAVELS</b> with fine or no fines	<b>GRAVELS</b> with fine or no fines	Well-graded: gravels, gravel-sand mixtures, little or no fines	<b>GW</b> Poorly-graded: gravels, gravel-sand mixtures, little or no fines
<b>GRAVELS</b> with 15% fines	<b>GRAVELS</b> with 15% fines	Totally gravel, poorly-graded: gravel-sand mixtures	<b>GM</b> Clayey gravel, poorly-graded: gravel-sand-clay mixtures
<b>SANDS</b> with fine or no fines	<b>SANDS</b> with fine or no fines	Well-graded: sands, gravelly sands, little or no fines	<b>SP</b> Poorly-graded: sands, gravelly sands, little or no fines
<b>SANDS</b> with 15% fines	<b>SANDS</b> with 15% fines	Totally sandy, poorly-graded: sand-gravel mixtures	<b>SM</b> Clayey sands, poorly-graded: sand-gravel-clay mixtures
<b>SILTS AND CLAYS</b> liquid limit <50		Inorganic silty, very fine sands, silty or clayey fine sands, silts with slight plasticity	<b>ML</b> Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
<b>SILTS AND CLAYS</b> liquid limit >50		Organic silts and clays of low plasticity	<b>OL</b>
<b>HIGHLY ORGANIC SOILS</b>		Inorganic silts, mucous or diatomaceous fine sand or silt	<b>MH</b>
		Organic clays of high plasticity, fat clays	<b>CH</b>
		Organic silts and clays of medium to high plasticity	<b>OH</b>
		Peat, turfs, swamp soils with high organic content	<b>PT</b>







Client: GE - United Nuclear Corporation

Project Number: 233001076

# SOIL BORING LOG FORM

BOREHOLE No: **P4-3**

Sheet **1** of **1**

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **4/16/18**

Drillers (day / night): S. Lorn, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: **4/16/18**

Field Representative (day / night):

Core Diameter: **N/A**

Total Depth: **15 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Sand with silt (SM) and gravel (weathered sandstone + shale), gray, slightly moist to moist			
2									
4									
6	5' Bag	50/6"			SM	Same as above			
8									
10	10'A 10'B 10'C	20 12 14			SM	Sand with little to some silt (SM)			
12					CL	Silt and clay w/ organics + salts (CL), black, slightly moist, trace to few gray sand		Bottom of A liner has black clay	
14								4 ft down hole: H <sub>2</sub> S = 6.5 ppm, LEL = 17%, CO > 500 ppm	
16						EOB @ 15'		*Stopped work due to gas	
18									
20									

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW
<50% coarse fraction passes #4 sieve	with little or no fines	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP
GRAVELS	with #10 sieve	Silty gravels, poorly-graded gravel-sand-silt mixtures	GC
GRAVELS	with #40 sieve	Clayey gravels, poorly-graded gravel-sand-clay mixtures	GC
SANDS	with little or no fines	Well-graded sands, gravelly sands, little or no fines	SW
SANDS	with #10 sieve	Poorly-graded sands, gravelly sands, little or no fines	SP
SANDS	with #40 sieve	Silty sands, poorly-graded sand-gravel-silt mixtures	SM
SANDS	with #10 sieve	Clayey sands, poorly-graded sand-gravel-clay mixtures	SC
SANDS	with #40 sieve	Inorganic silty fine sands, silty or clayey fine sands, silts with slight plasticity	ML
SANDS	with #40 sieve	Inorganic clayey fine sands, silty or clayey fine sands, silts with slight plasticity	CL
SANDS	with #40 sieve	Inorganic silty clays of low plasticity	OL
SANDS	with #40 sieve	Inorganic silty, micaceous or dumetaceous fine sand or silt	MH
SANDS	with #40 sieve	Inorganic clays of high plasticity, fat clays	CH
SANDS	with #40 sieve	Organic silty sand clays or medium to high plasticity	OH
SANDS	with #40 sieve	Organic silty clays or medium to high plasticity	OH
SANDS	with #40 sieve	Peat, turfs, swamp soils with high organic content	PT

TERMINOLOGY	TERMINOLOGY	TERMINOLOGY	TERMINOLOGY
GRAIN SIZE	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE
GRAIN SIZE	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE
GRAIN SIZE	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE
GRAIN SIZE	GRAIN SIZE	GRAIN SIZE	GRAIN SIZE











Client: GE - United Nuclear Corporation

Project Number: 233001076

SOIL BORING LOG FORM

BOREHOLE No: P4-7  
Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 4/15/18

Drillers (day/night): S. Lom, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 4/15/18

Field Representative (day/night):

Core Diameter: 4.25 inch

Total Depth: 30 ft

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand topsoil, brown, slightly moist, few clay Broken + weathered sandstone w/silt (SM), few clay, brown + gray w/orange iron staining			
2			42						
4									
6	5'A	12				Same as above			
	5'B	6							
		15							
8			46						
10		2				→ ~6" gray weathered sandstone			
	10'A	0				→ tan + gray		Poor sample recovery	
		2				→ trace brown sand			
12			37						
14						→ trace brown sand			
16	15'B	1			SM	Moderately to completely weathered sandstone with little silt (SM), trace black shale, gray w/trace green + purple, some areas loose + sandy, others solid rock		H <sub>2</sub> S = 0 ppm, CO = 40 ppm LEL = 4% Poor CA sample recovery	
		2							
		4							
18			45						
20									

GRAVELS -50% coarse fraction passes #4 sieve	SANDS -50% coarse fraction passes #4 sieve	SILTS AND CLAYS liquid limit <50	SILTS AND CLAYS liquid limit >50	HIGHLY ORGANIC SOILS	Terminology (Soils and Clays)	Blows/ft*			Blows/ft*			Terminology (Soils and Clays)	Field Test	Terminology (Soils and Clays)	Field Test
						SPT		(mod CAL)	SPT		(mod CAL)				
						1.4" ID	2.0" ID	2.5" ID	1.4" ID	2.0" ID	2.5" ID				
Well-graded gravel, gravel-sand mixtures, silt or no fines	Well-graded sands, gravelly sands, silt or no fines	Inorganic silts, micaceous or diatomaceous fine sand or silt	Inorganic silts, micaceous or diatomaceous fine sand or silt	Peat: numus, swamp soils with high organic content	GP	2-4	4-8	9-16	GC	0-4	0-5	0-7	Very loose	Weak	Crumbles or breaks with hand or slight finger pressure
Poorly-graded gravel, gravel-sand mixtures, silt or no fines	Poorly-graded sands, gravelly sands, silt or no fines	Inorganic silts, very fine sands, silty or clayey fine sands, silts with slight plasticity	Inorganic silts, very fine sands, silty or clayey fine sands, silts with slight plasticity		GM	2-4	4-8	9-16	GS	4-10	5-12	7-18	Loose	Moderate	Crumbles or breaks with considerable finger pressure
Silty gravel, poorly-graded gravel-sand mixtures	Silty sands, poorly-graded sand-gravel mixtures	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		GC	4-8	9-16	18-42	GM	10-30	12-37	18-51	Medium dense	Strong	Will not crumble or break with finger pressure
Clayey gravel, poorly-graded gravel-sand-clay mixtures	Clayey sands, poorly-graded sand-gravel-clay mixtures				GC	8-15	9-17	18-42	GS	30-60	37-60	51-86	Dense		
Very stiff	Very stiff				GM	15-30	17-36	18-42	GS	>50	>60	>86	Very dense		
Hard	Hard				GM	30-60	39-78	42-85	GS						
Very hard	Very hard				GM	>60	>78	>85	GS	* 140 pound hammer dropped 30 inches					





Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No.: **PH-8**

Sheet **1** of **1**

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **4/15/18**

Drillers (day/night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: **4/15/18**

Field Representative (day/night):

Core Diameter: **N/A**

Total Depth: **20 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SC	Clayey sand (SC) w/silt + weathered shale, brown + dark gray/black, trace iron staining, slightly moist			
5	5'A	12			SC	Same as above, medium dense			
6	5'B	12							
6	5'C	14							
10	10'A	7			SM	Silty sand (SM) w/few to little clay + trace gravel (weathered sandstone pieces), black + gray, medium dense			
10	10'B	8							
10	10'B	9							
15	15'A	5			SM	Same as above, black w/some gray + orange			
15	15'B	6							
15	15'B	6							

EOB @ 20'

LEL = 99%, CO > 500 ppm  
H<sub>2</sub>S = 60 ppm (top of hole)  
\* Stepped work

TERMS	SPT	Blows/ft*			TERMS	SPT	Blows/ft*			GRAIN SIZE	PERCENTAGES OF GRAVEL, SAND AND SILT MAY BE STATED IN TERMS INDICATING A RANGE OF PERCENTAGES AS BELOW	
		1.4" ID	2.0" ID	2.5" ID			1.4" ID	2.0" ID	2.5" ID			
very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12	Trace	<5
soft	2-4	2-4	2-4	loose	4-10	5-12	7-19	Cobbles	75 to 300	3 to 12	Few	5-10
medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3	Some	30-45
stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel	4.75 to 19	3/16 to 3/4	Mostly	50-100
very stiff	15-30	17-39	16-42	very dense	>50	>60	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16		
hard	30-60	39-78	42-85					Medium sand	0.425 to 2.0	1/64 to 1/16		
very hard	>60	>78	>85					Fine sand	0.075 to 0.425	0.003 to 1/64		
								Silt / clay (fines)	<0.075	<0.003		

TERMS	FLUIDITY	MOISTURE	TERMS	FIELD TEST	TERMS	FIELD TEST
Nonplastic	Low	Dry	Weak	Field Test	Weak	Crumbles or breaks with hand or slight finger pressure
Plastic	Low	Moist	Moderate	Absence of moisture, dry to touch	Moderate	Crumbles or breaks with considerable finger pressure
Plastic	High	Wet	Strong	Damp, does not wet palm	Strong	Will not crumble or break with finger pressure
				Visible Free Water		



Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: PH-9  
Sheet 1 of 2

Drilling Company: Cascade Drilling  
Drillers (day/night): S. Lom, A. Rodriguez, J. Viguera  
Field Representative (day/night):

Drilling Rig: CME 85 Truck Rig  
Drilling Method: Hollow Stem Auger  
Core Diameter: N/A

Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz

Start Date: 4/15/18  
Finish Date: 4/15/18  
Total Depth: 40 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					SM	Silty sand (SM) (topsoil), trace gravel + shale pieces, light brown w/trace gray, slightly moist			
2									
4									
6	5'A 5'B	4 11 16			SM	Same as above, medium dense		VOCs = 35 ppm, H <sub>2</sub> S = 0, CO = 0, LEL = 0	
8									
10	10'A	14 15 11			SM	Same as above, little sandstone		Auger cuttings contain numerous rounded, alluvial rocks (~1" diameter)	
12									
14									
16	15' Bag	9 12 42			SM	Same as above, w/sandstone chunks		Bulk sample from A+B liners (accidentally emptied liners thinking it was analytical sample)	
18									
20									

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Consistency	Blows/ft*			Term	Blows/ft*			Term	Grain Size	Terminology	Field Test	Terminology	Field Test
					(SPT)	(mod CAL)	(mod CAL)		(SPT)	(mod CAL)	(mod CAL)						
<50% coarse fraction passes #4 sieve	GRAVELS with >15% fines	Silty gravels, poorly-graded gravel-sand mixtures	GP	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below		
<50% coarse fraction passes #4 sieve	SANDS with little or no fines	Well-graded sands, gravely sands, little or no fines	SW	soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12			
<50% coarse fraction passes #4 sieve	SANDS with >15% fines	Poorly-graded sands, plasticity limits, little or no fines	SP	medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3			
		Silty sands, poorly-graded sand-gravel mixtures	SM	stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel	4.75 to 19	3/16 to 3/4	Term		
		Clayey sands, poorly-graded sand-gravel mixtures	SC	very stiff	15-30	17-33	18-43	very dense	>50	>60	>86	Coarse sand	2.0 to 4.75	1/16 to 3/16	Trace	<5	
		Inorganic silts, very fine sands, silty or clayey fine sands, silts with slight plasticity	ML	hard	30-60	39-78	42-85					Medium sand	0.425 to 2.0	1/64 to 1/16	Few	5-10	
		Organic silts and clays of low plasticity	OL	very hard	>80	>78	>85					Fine sand	0.075 to 0.425	0.003 to 1/64	Little	15-25	
		Some silts and clays of low plasticity	CL									Silt / clay (fines)	<0.075	<0.003	Some	30-45	
		Some silts and clays of low plasticity	CL												Mostly	50-100	





Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **TN-1**

Sheet **1** of **1**

Drilling Company: Cascade Drilling

Drilling Rig: **CME 85**

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **4/1/18**

Drillers (day / night): S. Lam, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: **4/1/18**

Field Representative (day / night):

Core Diameter: **N/A**

Total Depth: **16.5 ft**

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						Silty sand, medium dense, slight moist, light brown			
5.5	5'A	10				same as above			
6	5'B	18							
10.5	10'A	5				↑ Fill Native sand, silty (SM), improved structure & rupture resistance, trace carbonates, slightly darker brown (increased organics)		More "soilly"	
11	10'B	11							
15.5	15'A	7				Silty sand, carbonates, intact pores visible within samples			
16.5						<u>EOB @ 16.5'</u>			

<b>GRAVELS</b> ->50% coarse fraction passes #4 sieve	<b>GRAVELS</b> ->50% coarse fraction passes #4 sieve	Well-graded gravels, gravel-sand mixtures, little or no fines Poorly-graded gravels, gravel-sand mixtures, little or no fines	<b>GW</b> GP	<b>Term</b> soft medium stiff stiff hard very hard	<b>Blow Count (SPT)</b> 1.4'ID 2.0'ID 2.5'ID 0-2 2-4 4-8 8-15 15-30 30-60 >60	<b>Blow Count (SPT)</b> 1.4'ID 2.0'ID 2.5'ID 0-4 4-10 10-30 30-50 >50 >85	<b>GRAIN SIZE</b> Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	<b>Term</b> Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	<b>Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below</b>  <b>SOIL TYPE</b> Terminology Terminology Terminology Terminology Terminology Terminology Terminology Terminology
<b>SANDS</b> ->50% coarse fraction passes #4 sieve	<b>SANDS</b> ->50% coarse fraction passes #4 sieve	Well-graded sands, gravelly sands, little or no fines Poorly-graded sands, gravelly sands, little or no fines Clayey sands, poorly-graded sand-gravel mixtures Inorganic silty very fine sands, silty or clayey fine sands, silts with slight plasticity Organic clays of low to medium plasticity, gravelly coars, sandy clays, silty clays, lean clays	<b>SW</b> SP SI SC ML MH CL	<b>Term</b> very soft soft medium stiff stiff very stiff hard very hard	<b>Blow Count (SPT)</b> 1.4'ID 2.0'ID 2.5'ID 0-2 2-4 4-8 8-15 15-30 30-60 >60	<b>Blow Count (SPT)</b> 1.4'ID 2.0'ID 2.5'ID 0-4 4-10 10-30 30-50 >50 >85	<b>GRAIN SIZE</b> Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	<b>Term</b> Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	<b>Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below</b>  <b>SOIL TYPE</b> Terminology Terminology Terminology Terminology Terminology Terminology Terminology Terminology
<b>SILTS AND CLAYS</b> liquid limit <=50	<b>SILTS AND CLAYS</b> liquid limit >=50	Organic silts and clays of low plasticity Inorganic silts, micaceous or dull-micaous fine sand or silt Inorganic clays of high plasticity, fat clays Organic silts and clays of medium to high plasticity Peat, humus, swamp soils with high organic content	<b>OH</b> MH CH OH PT	<b>Term</b> Nonplastic Low Medium High	<b>Field Test</b> Dry Moist Wet	<b>Field Test</b> Absence of moisture dry to touch Damp does not wet palm Viable Free Water	<b>Term</b> Weak Moderate Strong	<b>Field Test</b> Crumbles or breaks with handing or slight finger pressure Crumbles or breaks with considerable finger pressure Will not crumble or break with finger pressure	<b>Depth to first water (time and date)</b>  <b>Depth to water after drilling (time and date)</b>



Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: TN - 2  
Sheet 1 of 2

Drilling Company: Cascade Drilling      Drilling Rig: CME 85      Bit Type: 4.25" I.D., 8" O.D. Auger  
Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena      Drilling Method: Hollow Stem Auger      Logged by: C. Fritz  
Field Representative (day / night):      Core Diameter: 4.125"      Start Date: 4/1/18  
Finish Date: 4/1/18  
Total Depth: 31.5 ft

Depth	Sample Number	Blow Count	Recovery (in.)	$a_{60}$ (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0 - 5.5			39		SM	Loose to medium dense silty sand (SM), light brown, slightly moist			
5.5 - 6.5	5'A	5			SM	Same as above		Loose sand in partially full liners	
6.5 - 7.5	5'B	6			SM				
7.5 - 10.5			35		SM	Trace carbonates, increased cementation (still weak)			
10.5 - 11.5	10'A	6			SM				
11.5 - 12.5	10'B	9			SM				
12.5 - 15.5			30		SM	Same as above, trace sandstone pieces			
15.5 - 16.5	15'A	5			SM				
16.5 - 18.5	15'B	8			SM				
18.5 - 20.5			39		SM	Trace to few clay, darker Trace sandstone			

<b>GRAVELS</b> 50% coarse fraction passes #4 sieve	Well-graded gravel, gravel-sand mixtures, little or no fines	GW	Term	Blows/ft (SPT) 1410 2010 2510	Blows/ft (mod CAL) 1410 2010 2510	Term	Blows/ft (SPT) 1410 2010 2510	Blows/ft (mod CAL) 1410 2010 2510	Term	Field Test	Term	Field Test														
	Poorly-graded gravel, gravel-sand mixtures, little or no fines	GM											Very loose	0-4	0-5	0-7	Very loose	0-4	0-5	0-7	Very loose	Absence of moisture dry to touch				
<b>SANDS</b> 50% coarse fraction passes #4 sieve	Well-graded sand, gravelly sand, little or no fines	SW	Soft	2-4	2-4	2-4	Loose	4-10	5-12	7-16	Loose	4-10	5-12	7-16	Loose	4-10	5-12	7-16	Loose	4-10	5-12	7-16	Loose	4-10	5-12	7-16
	Poorly-graded sand, gravelly sand, little or no fines	SP	Medium stiff	4-8	4-8	4-8	Medium dense	10-30	12-37	18-51	Dense	30-50	37-60	51-96	Dense	30-50	37-60	51-96	Dense	30-50	37-60	51-96	Dense	30-50	37-60	51-96
<b>SILTS AND CLAYS</b> Liquid limit <50	Clayey silt, micaceous or diatomaceous fine sand or silt	ML	Very stiff	15-30	17-38	18-42	Very dense	>50	>60	>86	Very dense	>50	>60	>86	Very dense	>50	>60	>86	Very dense	>50	>60	>86	Very dense	>50	>60	>86
	Clayey sand, poorly-graded sand-gravel mixtures	SM	Very hard	30-60	39-78	42-65	Very hard	>60	>78	>85	Very hard	>60	>78	>85	Very hard	>60	>78	>85	Very hard	>60	>78	>85	Very hard	>60	>78	>85









Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No: T10-1

Sheet 2 of 4

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: See Sheet 1

Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: N/A

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20'A	11 15 15			ML	Silt, some moderately to slightly weathered shale (lean clay), dark brown/gray, slightly moist, very stiff silt, very hard shale			
22									
24									
26	25'A	10 9 10			CL	Lean clay (moderately to highly weathered shale)			
28									
30	30'A	9 14 15			CL	Same as above			
32									
34									
36	35'A 35'B	7 8 10			ML	Sandy silt, light brown, trace moderately weathered sandstone, slightly moist, stiff			
38									
40									

TERMINOLOGY	SYMBOL	DESCRIPTION	Blows/ft*			Blows/ft*			TERMINOLOGY	SYMBOL	DESCRIPTION	TERMINOLOGY	SYMBOL	DESCRIPTION
			(SPT)	(mod CAL)	(mod CAL)	(SPT)	(mod CAL)	(mod CAL)						
GRAVELS	GP	Well-graded gravels, gravel-sand mixtures, little or no fines	0-2	0-2	0-2	0-4	0-5	0-7	GRAVELS	GM	Medium sand	Very loose	VL	0-4
GRAVELS with 5-15% fines	GM	Gravelly sands, gravel-sand mixtures, little or no fines	2-4	2-4	2-4	4-10	5-12	7-16	GRAVELS with >15% fines	GC	Coarse sand	Loose	LS	4-10
SANDS	SW	Well-graded sands, gravelly sands, little or no fines	4-8	4-8	4-8	10-30	12-37	18-51	SANDS with 5-15% fines	SM	Medium sand	Medium dense	MD	10-30
SANDS with 15-35% fines	SP	Sandy silts, poorly-graded sand-gravel-silt mixtures	6-15	9-17	9-18	30-50	37-60	51-86	SANDS with >35% fines	SC	Clayey sand	Dense	DS	30-50
SILTS AND CLAYS	ML	Lean silts, silty clays, silty clay	30-60	39-78	42-85	>60	>60	>86	SILTS AND CLAYS	CL	Lean clay	Very dense	VD	>60
SILTS AND CLAYS	OH	Organic silts and clays of low plasticity							SILTS AND CLAYS	CH	Clayey silt	Extremely dense	ED	>85
SILTS AND CLAYS	SH	Lean silts and clays of high plasticity							SILTS AND CLAYS	PT	Peat			









Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING  
LOG FORM**

BOREHOLE No: T10-2  
Sheet 2 of 2

Drilling Company: Cascade Drilling	Drilling Rig: CME LAR 75 High Torque Track Rig	Bit Type: 4.25" I.D., 8" O.D. Auger	Start Date: <u>See Sheet 1</u>
Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera	Drilling Method: Hollow Stem Auger	Logged by: C. Fntz	Finish Date:
Field Representative (day / night):	Core Diameter: <u>N/A</u>		Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20'A	8			ML	Sandy silt (ML) (native), light brown, medium dense, slightly moist			
	20'B	16							
		30							
22									
24									
26	25'A	11			SS	Moderately to highly weathered sandstone bedrock, dark brown/gray			
		13							
		20							
28						EOB @ 26.5'			
30									

GRAVELS		SANDS		SILTS AND CLAYS		HIGHLY ORGANIC SOILS	
Terminology	Blows/ft*	Terminology	Blows/ft*	Terminology	Blows/ft*	Terminology	Blows/ft*
GRAVELS with little or no fines	0-2	SANDS with little or no fines	0-4	SILTS AND CLAYS liquid limit <50	>50	HIGHLY ORGANIC SOILS	>50
GRAVELS with >1% fines	2-4	SANDS with >1% fines	4-8	SILTS AND CLAYS liquid limit >50	8-15		8-15
	4-8		15-30		17-38		17-38
	8-15		30-60		38-78		38-78
	>15		>60		>78		>78

FLASTICITY	MOISTURE	CEMENTATION	GRAIN SIZE	DENSITY
Nonplastic Low Medium High	Field Test Absence of moisture, dry to touch Moist Damp, does not wet palm Visible Free Water	Weak Moderate Strong	Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)	Terminology Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (fines)





Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No.: T10 - 3  
Sheet 2 of 5

Drilling Company: Cascade Drilling  
Drillers (day / night): S. Lora, A. Rodriguez, J. Viguera  
Field Representative (day / night):  
Drilling Rig: CME LAR 75, CME 85 (below 35')  
Drilling Method: Hollow Stem Auger  
Core Diameter: 4.25 inch  
Bit Type: 4.25" I.D., 8" O.D. Auger  
Logged by: C. Fritz  
Start Date: See Sheet 1  
Finish Date:  
Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20' B	4	42		ML	Loose sandy silt w/ weathered shale (liners); cores show medium dense-dense sand w/moderate cementation			
	21' Bag	5							
22									
24									
26	25'A	8 7 9	42		ML	Sandy silt (ML), medium dense			
28									
30	30'A 30'B	7 10 14	49		SM	Silty sand (SM) and slightly to completely weathered shale, medium dense sand, very stiff shale, light brown (sand) & dark gray/black (shale), slightly moist			
32									
34									
36		11 13 17	48			→ mostly shale, moderate cementation, pockets of hard rock, trace iron oxide & carbonates		Used downhole (manual) hammer @ 35'. Began using CME 85 rig to drill beyond 35' bgs.	
38									
40									

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW
<50% coarse fraction passes #4 sieve	GRAVELS with <10% fines	Poorly-graded gravels, gravel-sand mixtures, little or no fines	GP
	GRAVELS with <10% fines	Silty gravels, poorly-graded gravel-sand mixtures	GS
		Clayey gravels, poorly-graded gravel-sand mixtures	GC
		Well-graded sands, gravelly sands, little or no fines	SW
		Poorly-graded sands, gravelly sands, little or no fines	SP
		Silty sands, poorly-graded sand-gravel mixtures	SM
		Clayey sands, poorly-graded sand-gravel mixtures	SC
		Inorganic silty fine sands, silty or clayey fine sands, silts with slight plasticity	ML
		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL
		Organic silts and clays of low plasticity	OL
		Inorganic silts, micaceous or diatomaceous fine sand or silt	MH
		Inorganic clays of high plasticity, fat clays	CH
		Organic silts and clays of medium to high plasticity	OH
		Organic silts and clays of low plasticity	OT
		Peat, humus, swamp soils with high organic content	PT











Client: GE - United Nuclear Corporation

Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: T10-4

Sheet 1 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CME LAR 75 High Torque Track Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: 3/29/18

Drillers (day/night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date: 3/29/18

Field Representative (day/night):

Core Diameter: N/A

Total Depth: 36.5 Ft

Depth	Sample Number	Blow Count	Recovery (in.)	$q_u$ (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0					ML	Sandy silt topsoil (ML)			
5	5'A	11			ML	Weathered shale (broken + flakey pieces) in sandy silt matrix (ML), gray, slightly moist, very stiff, trace carbonates			
6	5'B	11							
10	10'A	8			ML	Same as above			
11	10'B	19							
15	15'A	12			ML	Same as above, slightly less shale			
16	15'B	13							

Soil Type	Terminology	Terminology	Terminology	Blows/ft			Blows/ft*			Terminology	Terminology	Terminology	Terminology	Terminology
				(SPT)	(modCAL)	(modCAL)	(SPT)	(modCAL)	(modCAL)					
GRAVELS	<50% coarse with little or no fines	GW	GP	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
GRAVELS	with 5-15% fines	GM	GC	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12	
GRAVELS	with 15-30% fines	GC	GC	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel	19 to 75	3/4 to 3	Term
SANDS	Well-graded sands, gravelly sands, little or no fines	SW	SP	8-15	9-17	9-18	stiff	>50	>60	>86	Fine gravel	4.75 to 19	3/16 to 3/4	%
SANDS	with little or no fines	SP	SP	15-30	17-39	18-42	very stiff	>80	>78	>85	Coarse sand	2.0 to 4.75	1/16 to 3/16	Trace
SANDS	with 5-15% fines	SM	SM	30-60	39-78	42-85	hard	* = 140 pound hammer dropped 30 inches			Medium sand	0.425 to 2.0	1/64 to 1/16	Few
SANDS	with 15-30% fines	SC	SC	>60	>78	>85	very hard				Fine sand	0.075 to 0.425	0.003 to 1/64	15-25
SANDS	with 30-50% fines	ML	CL							Silt/clay (lines)	<0.075	<0.003	30-45	
SANDS	with 50% or more fines	ML	CL										Mostly	50-100
SILTS AND CLAYS	liquid limit <50	OL	OH											
SILTS AND CLAYS	liquid limit >50	OH	PT											



Client: GE - United Nuclear Corporation

Project Number: 233001076

# SOIL BORING LOG FORM

BOREHOLE No: T/O-4

Sheet 2 of 2

Drilling Company: Cascade Drilling

Drilling Rig: CME LAR 75 High Torque Track Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: See Sheet 1

Drillers (day / night): S. Lom, A. Rodriguez, J. Viguera

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: N/A

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20' B	14			ML	Sandy silt (ML), little shale (moderately weathered pieces), mostly light brown with darker shale, weak cementation, trace carbonates (less than above)			
		14							
		16							
22									
24									
26	25' B	10			ML	Same as above, increased shale presence		Mostly sand in C (topmost) liner, mixtures in A + B	
		11							
		20							
28									
30	30' B	10			SM	Silty sand (SM) (native), medium dense, trace to few carbonates, slightly moist, light brown		Improved soil structure, more uniform material w/less shale + rock inter-mixed	
		10							
		16							
32									
34									
36	35' B	11			SS	Weathered sandstone bedrock, very stiff, dark gray		Rock in A liner @ 36'	
		16							
		24							
38									
40									

EOB @ 36.5'

GRAVELS	GRAVELS	Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Term	Blows/ft <sup>3</sup>	Blows/ft <sup>3</sup>	Term	Blows/ft <sup>3</sup>	Blows/ft <sup>3</sup>	Term	Size (mm)	Size (inches)	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below
with fine or up to 5% fines	with fine or up to 5% fines	with fine or up to 5% fines	GP	very soft	0-2	0-2	very loose	0-4	0-5	0-7	>300	>12	Term %
with 5-15% fines	with 5-15% fines	with 5-15% fines	GM	soft	2-4	2-4	loose	4-10	5-12	7-18	75 to 300	3 to 12	Trace
with 15-30% fines	with 15-30% fines	with 15-30% fines	GC	medium stiff	4-8	4-8	medium dense	10-30	12-37	18-51	19 to 75	3/4 to 3	Few
with 30-50% fines	with 30-50% fines	with 30-50% fines	GM	stiff	8-15	9-17	dense	30-50	37-60	51-86	4.75 to 19	3/16 to 3/4	5-10
with 50-75% fines	with 50-75% fines	with 50-75% fines	SM	very stiff	15-30	17-39	very dense	>50	>80	>86	2.0 to 4.75	1/16 to 3/16	15-25
with 75-100% fines	with 75-100% fines	with 75-100% fines	SC	hard	30-60	30-78					0.425 to 2.0	1/64 to 1/16	Some
			CL	very hard	>60	>78					0.075 to 0.425	0.003 to 1/64	Mostly
			OL								<0.075	<0.003	50-100







Client: GE - United Nuclear Corporation  
 Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: T10-6  
 Sheet 1 of 1

Drilling Company: Cascade Drilling  
 Drillers (day / night): S. Lora, A. Rodriguez, J. Viguena  
 Field Representative (day / night):  
 Drilling Rig: CME LAR 75 High Torque Track Rig  
 Drilling Method: Hollow Stem Auger  
 Core Diameter: N/A  
 Bit Type: 4.25" I.D., 8" O.D. Auger  
 Logged by: C. Fritz  
 Start Date: 3/29/18  
 Finish Date: 3/29/18  
 Total Depth: 15.33 ft

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>s</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
0						ML Silt with sand (ML), little clay (weathered shale), slightly moist, gray/brown, very stiff			
2									
4									
6	5'A	14 16 19				ML Same as above			
8									
10	10'A	7 8 10				↑ Fill ML Sandy silt, little clay (ML), native, light brown, slightly moist, stiff			
12									
14						SS Sandstone bedrock, light brown, very dense			
16						EOB @ 15.33'			
18									
20									

GRAVELS <50% coarse fraction passes #4 sieve SANDS <50% coarse fraction passes #4 sieve SILTS AND CLAYS liquid limit <50 SILTS AND CLAYS liquid limit >50 HIGHLY ORGANIC SOILS	GRAVELS with little or no fines GRAVELS with 10% fines SANDS with little or no fines SANDS with 10% fines SILTS AND CLAYS with liquid limit <50 SILTS AND CLAYS with liquid limit >50 HIGHLY ORGANIC SOILS	Well-graded gravels, gravel-sand mixtures, little or no fines Poorly-graded gravels, gravel-sand mixtures, little or no fines Silty gravels, poorly-graded gravel-sand-silt mixtures Clayey gravels, poorly-graded gravel-sand-clay mixtures Well-graded sands, gravelly sands, little or no fines Poorly-graded sands, gravelly sands, little or no fines Silty sands, poorly-graded sand-gravel-silt mixtures Clayey sands, poorly-graded sand-gravel-clay mixtures Inorganic silts-very-fine sands, silty or clayey fine sands, silts with slight plasticity Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays Organic silts and clays of low plasticity Inorganic silts, incohesive or diatomaceous fine sand or silt Inorganic clays of high plasticity, fat clays Organic silts and clays of medium to high plasticity Peat, humus, swamp soils with high organic content	GW GP GM GC GC SW SM SC CL OL CH CH OH PT	Term very soft soft medium stiff very stiff hard very hard Blow count (SPT) 1'4"ID 0-2 2-4 4-8 8-15 15-30 >30 Blow count (mod CAL) 2'0"ID 0-2 2-4 4-8 9-18 17-39 39-78 >78 Blow count (mod CAL) 2'5"ID 0-2 2-4 4-8 9-18 18-42 42-85 >85 * = 140 pound hammer dropped 30 inches	Term very loose loose medium dense dense very dense Field Test Absence of moisture, dry to touch Damp, does not wet palm Viable Free Water	Term Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (lines)	Term Field Test Crumbles or breaks with handing or slight finger pressure Crumbles or breaks with considerable finger pressure Will not crumble or break with finger pressure	Percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages as below Term % Trace <5 Little 5-10 Some 15-25 Most 30-45 Mostly 50-100	Depth to first water (time and date) Depth to water after drilling (time and date)					
										CONSISTENCY (Silt and Clays) Note: Well-graded = poorly sorted Poorly-graded = well-sorted	PLASTICITY Nonplastic Low Dry Medium Moist High	MOISTURE Term Dry Moist Wet	DENSITY Term Loose Moderate Strong	GRAIN SIZE Term Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (lines)
										GRAIN SIZE Term Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Silt / clay (lines)				











Client: GE - United Nuclear Corporation  
Project Number: 233001076

**SOIL BORING LOG FORM**

BOREHOLE No: **75-2**  
Sheet **2** of **2**

Drilling Company: Cascade Drilling

Drilling Rig: CME 85 Truck Rig

Bit Type: 4.25" I.D., 8" O.D. Auger

Start Date: **See Sheet 1**

Drillers (day / night): S. Lom, A. Rodriguez, J. Viguena

Drilling Method: Hollow Stem Auger

Logged by: C. Fritz

Finish Date:

Field Representative (day / night):

Core Diameter: **4.25 inch**

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details	
20	20' B	11	60		SS	Same as above Highly weathered sandstone, gray, some fines (darker patches, possibly weathered shale), weakly cemented, considerable iron staining, breaks easily along horizontal planes		Topsoil in C (top) liner, rock in mid-B & A		
	20' C	30								
		50								
22										
24										
26	25' A	18	56		SS	Same as above				
		29								
		19								
28										
30	30' A	8	14		SS	Same as above				
	30' B	7								
		6								
32										
34		20			SS	Same as above		Initially had auger refusal @ 33'. Drove sampler then were able to continue to 35'. No samples collected due to broken rock.		
		23								
		87								
36		12			SS	Same as above				
		15								
		10								
38	<b>EOB @ 36.5'</b>									
40										

TERMINOLOGY	DESCRIPTION	CONSISTENCY	Blows/ft*			Blows/ft*			GRAIN SIZE	PERCENTAGES OF GRAVEL, SAND AND SILT MAY BE STATED IN TERMS INDICATING A RANGE OF PERCENTAGES AS BELOW				
			(SPT) 1.4'ID	(modCAL) 2.0'ID	2.5'ID	(SPT) 1.4'ID	(modCAL) 2.0'ID	2.5'ID						
GRAVELS	<50% coarse fraction passes #4 sieve	Well-graded: gravels, gravel-sand mixtures, little or no fines Poorly-graded: gravels, gravel-sand mixtures, little or no fines	very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders >300	>12	Term	%
SANDS	<50% coarse fraction passes #4 sieve	Well-graded: sands, gravelly sands, little or no fines Poorly-graded: sands, gravelly sands, little or no fines	soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles 75 to 300	3 to 12	Trace	<5
SILTS AND CLAYS	liquid limit <50	Inorganic silts and clays of low plasticity Organic silts and clays of low plasticity	medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Coarse gravel 19 to 75	3/4 to 3	Few	5-10
SILTS AND CLAYS	liquid limit >50	Inorganic silts, micaceous or diatomaceous fine sand or silt Inorganic clays of high plasticity, fat clays Organic silts and clays of medium to high plasticity	stiff	9-15	9-17	9-18	dense	30-50	37-60	51-86	Fine gravel 4.75 to 19	3/16 to 3/4	Little	15-25
HIGHLY ORGANIC SOILS		Peat, humus, swamp soils with high organic content	very stiff	15-30	17-39	18-42	very dense	>50	>60	>85	Coarse sand 2.0 to 4.75	1/16 to 3/16	Some	50-45
			hard	30-60	35-78	42-85					Fine sand 0.075 to 0.425	0.003 to 1/64	Mostly	50-100
			very hard	>60	>78	>85					Silt / clay (fines) <0.075	<0.003		





Client: GE - United Nuclear Corporation

Project Number: 233001076

### SOIL BORING LOG FORM

BOREHOLE No.: TS-3

Sheet 2 of 2

Drilling Company: Cascade Drilling

Drillers (day/night): S. Lom, A. Rodriguez, J. Viguera

Drilling Rig: CME 85 Truck Rig

Drilling Method: Hollow Stem Auger

Bit Type: 4.25" I.D., 8" O.D. Auger

Logged by: C. Fritz

Start Date: See Sheet 1

Finish Date:

Field Representative (day/night):

Core Diameter: N/A

Total Depth:

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description	Graphic	Remarks	Well Details
20	20' A	18			SS	Weathered sandstone, light gray w/red + orange oxidation		Native @ ~20'	
	20' B	19 14							
22									
24									
26	25' A	13 24 23			SS	Same as above, but darker gray/black. Still coarse-grained but possible shale influence (?)			
28									
30	30' A	10 14 20			SS	Sandstone, highly weathered, gray			
32						EOB @ 31.5'			
34									
36									
38									
40									

GRAVELS	SANDS	SILTS AND CLAYS	HIGHLY ORGANIC SOILS	Consistency	Blows/ft			Blows/ft			Term	Field Test	Consistency	Field Test	Depth to first water (time and date)
					(SPT)	(medCAL)	(2.5'ID)	(SPT)	(medCAL)	(2.5'ID)					
Very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7	Boulders	>300	>12	Term	Field Test	Wet	Crumbles or breaks with hand or slight finger pressure	Depth to first water (time and date)
soft	2-4	2-4	2-4	loose	4-10	5-12	7-18	Cobbles	75 to 300	3 to 12	Moderate	Crumbles or breaks with considerable finger pressure	Wet	Crumbles or breaks with hand or slight finger pressure	Depth to first water (time and date)
medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51	Fine gravel	4.75 to 19	3/16 to 3/4	Strong	Will not crumble or break with finger pressure	Wet	Crumbles or breaks with hand or slight finger pressure	Depth to first water (time and date)
stiff	8-15	9-17	9-18	dense	30-50	37-60	51-86	Coarse sand	2.0 to 4.75	1/16 to 3/16					
very stiff	15-30	17-39	18-42	very dense	>50	>60	>86	Medium sand	0.425 to 2.0	1/64 to 1/16					
hard	30-60	39-78	42-85					Fine sand	0.075 to 0.425	0.003 to 1/64					
very hard	>60	>78	>85					Silt / clay (fines)	<0.075	<0.003					







# **Attachment C. Photos**



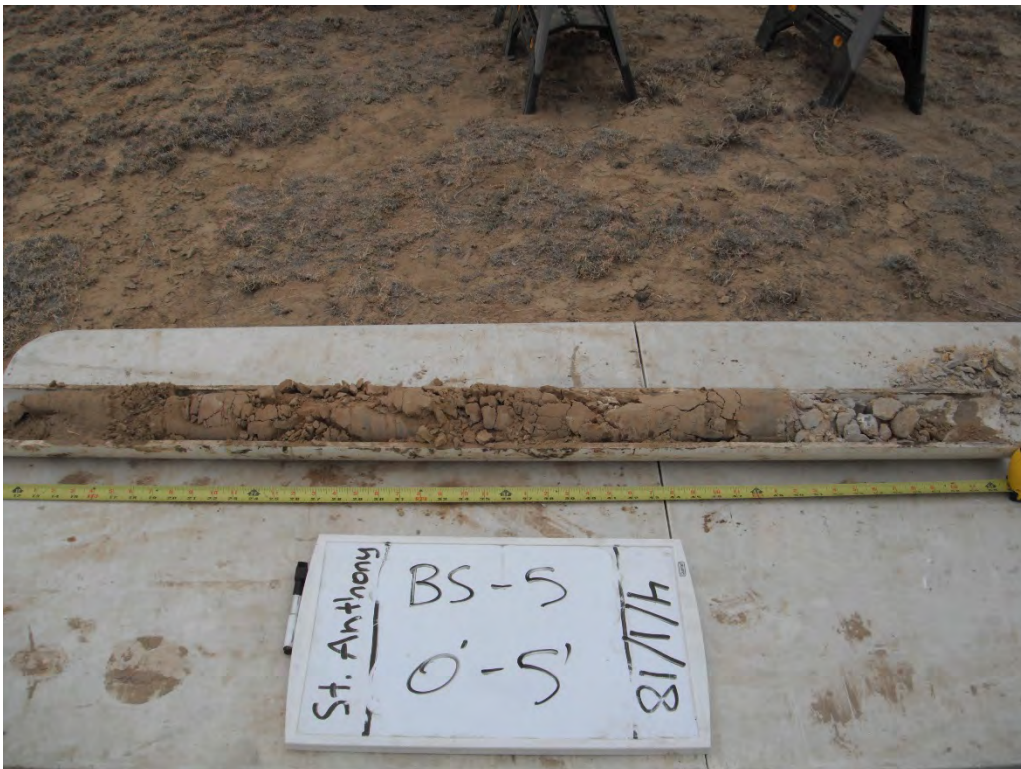
Photograph 1. BS-3: 0' (left) to 5' (right) bgs



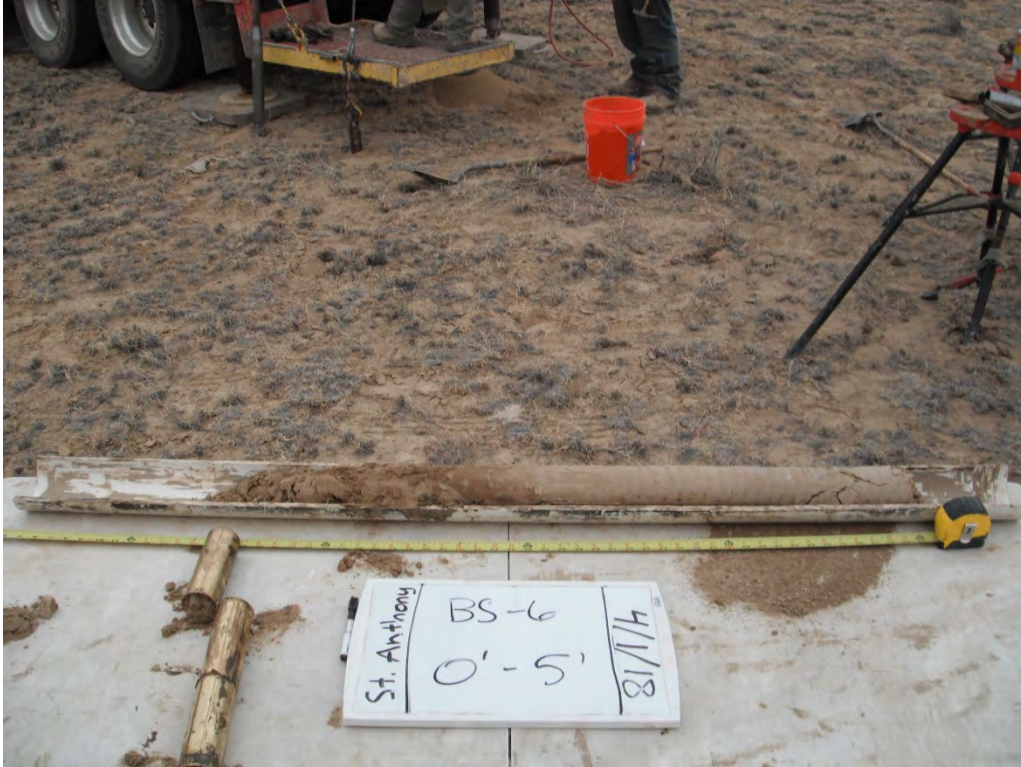
Photograph 2. BS-3: 5' (left) to 10' (right) bgs



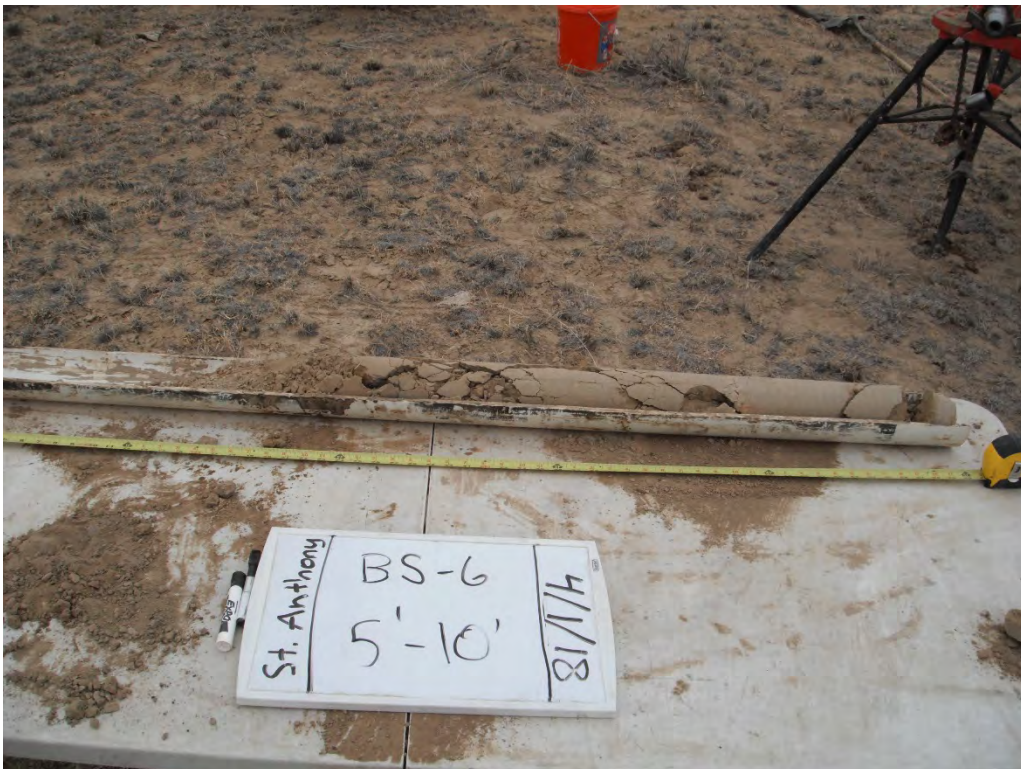
Photograph 3. BS-3: 10' (left) to 15' (right) bgs



Photograph 4. BS-5: 0' (left) to 5' (right) bgs



Photograph 5. BS-6: 0' (left) to 5' (right) bgs



Photograph 6. BS-6: 5' (left) to 10' (right) bgs



Photograph 7. BS-6: 10' (left) to 15' (right) bgs



Photograph 8. BW-1: 0' (top left) to 10' (bottom right) bgs



Photograph 9. BW-1: 10' (top left) to 20' (bottom right) bgs



Photograph 10. BW-1: 20' (top left) to 30' (bottom right) bgs



Photograph 11. L1-1 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 12. L1-5 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 13. L2-4 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 14. L2-6 (all cores): 0' (bottom left) to 20' (top right) bgs





Photograph 15. P1-1 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 16. P1-1A (all cores): 20'-30' (bottom two boxes) & 30'-35' (top box) bgs



Photograph 17. P3-2: 0' (left) to 5' (right) bgs



Photograph 18. P3-2: 5' (left) to 10' (right) bgs



Photograph 19. P3-2: 10' (left) to 15' (right) bgs



Photograph 20. P3-2: 15' (left) to 20' (right) bgs



Photograph 21. P3-2: 17.5' (bottom left) to 45' (top right) bgs



Photograph 22. P4-7: 0' (left) to 5' (right) bgs



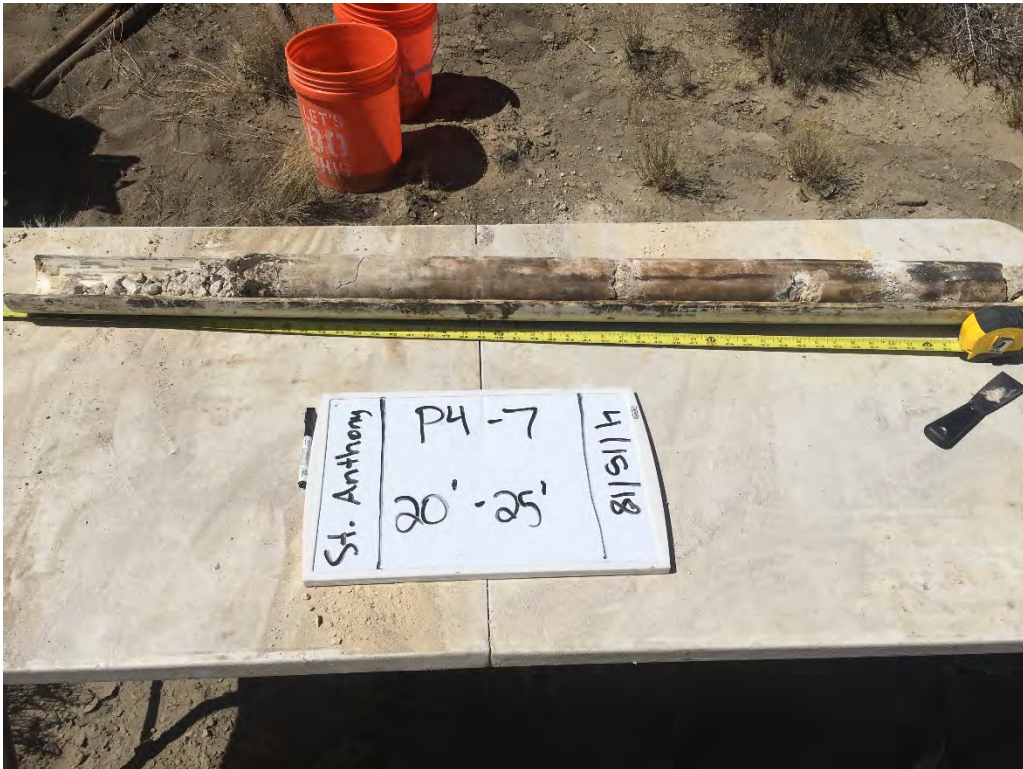
Photograph 23. P4-7: 5' (left) to 10' (right) bgs



Photograph 24. P4-7: 10' (left) to 15' (right) bgs



Photograph 25. P4-7: 15' (left) to 20' (right) bgs



Photograph 26. P4-7: 20' (left) to 25' (right) bgs



Photograph 27. P4-7: 25' (left) to 30' (right) bgs



Photograph 28. TN-2 (all cores): 0' (bottom left) to 30' (top right) bgs



Photograph 29. T/O-3: 0' (top right box) to 35' (bottom left box) bgs



Photograph 30. T/O-3: 35' (top left) to 80' (bottom right) bgs





Photograph 31. T/O-5 (all cores): 0' (bottom left) to 29' (top right) bgs



Photograph 32. TS-2 (all cores): 0' (bottom left) to 30' (top right) bgs

# **Attachment D. Daily Field Reports**



# Daily Field Report

Date Mon, 3/26/2018

PROJECT: St. Anthony Mine

JOB NO: 233001076

CLIENT: United Nuclear Corporation

CONTRACTOR: Cascade Drilling

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input checked="" type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Arnold	Cascade	Drilling Supervisor	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME LAR 75 track rig w/hollow stem auger	Cascade	

**Safety:**  
No incidents reported

**Activities Summary:**  
First day of St. Anthony work. I met the drilling crew and Rob at the gas station next to the Sky City Casino. We then met Breanna Van (Stantec) and followed her to the Site. We arrived at 8am and met with Nat and Victor Patel (AVM) for rad and site safety training. After finishing training at 10:30, we moved to the first drilling location in the Lobo Tract borrow area, L1-1, and began to set up the rig. All boreholes in this borrow area will be only 20' deep.

After completing L1-1, we moved to L1-5 location. This location was completed at 3:20, we then moved to L1-2 and completed drilling to 20' at 4:30. After frisking trucks and persons for radiation, all individuals were cleared to leave and were off-site by 5:15pm.

Total depth drilled: 60 ft  
Total depth cored: 40 ft  
Total CA brass liner samples collected: 17

By: C. Fritz Title: Field Engineer

Date Tue, 3/27/2018

 PROJECT: St. Anthony Mine

 JOB NO: 233001076

 CLIENT: United Nuclear Corporation

 CONTRACTOR: Cascade Drilling

 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input checked="" type="checkbox"/> Over-cast	<input checked="" type="checkbox"/> Rain	<input checked="" type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input checked="" type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Arnold	Cascade	Drilling Supervisor	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME LAR 75 track rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to site at 7:10am and had safety tailgate. After our meeting the drillers worked to get the flatbed and support trucks back onto the road before additional rain came and made it too muddy and difficult. The rig was then moved to L1-4 location, and drilling began at 8:30. After drilling to 20' at 9:15, the rig was moved to L1-3. The drillers then went to retrieve the flatbed truck to prepare for loading up the rig to move areas after the next hole. Drilling was completed at 11:00 after drilling to 20' and the rig was loaded up onto the flatbed to move across the arroyo to the L2 holes. However, upon arrival at the L2-1 location, we discovered a cattle fence that blocked access to the borehole locations on the east side of the arroyo. As a result we moved on to the nearby topsoil/overburden pile. Rob and I staked out borehole locations on the pile while the drillers set up at T/O-3.

Drilling began at 1:10 at T/O-3 and continued until 2:30, at which point a thunderstorm moved into the area and we had to stop work due to lightning. After a 1-hr delay, work resumed and continued until encountering auger refusal (and a 50-for-bounce modified CA test) at 29'.

At 4:30, the rig was moved to T/O-3 location and set up such that drilling can start first thing tomorrow. After frisking all persons and trucks for radiation levels, all parties left site at 5pm.

Total depth drilled: 69 ft

Total depth cored: 29 ft

Total CA brass liner samples collected: 21

 By: C. Fritz Title: Field Engineer

Date Wed, 3/28/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Arnold	Cascade	Drilling Supervisor	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME LAR 75 track rig w/hollow stem auger	Cascade	

### Safety:

No incidents reported

### Activities Summary:

Arrived to the rig at 7:15am and had safety tailgate. After our meeting and warming up the rig, drilling began at T/O-3 and 8:20. Drilling continued until 10:15 before encountering mechanical issues with the rig. The transmission partially broke down, resulting in 2<sup>nd</sup> and 4<sup>th</sup> gears being the only functional gears. While Arnold went to make a phone call to determine a course of action to fix the rig, the rest of us drove to the top of pile 4 to evaluate the possibility of using a full-size truck rig to access and drill the upcoming locations. Soap said his truck rig would be much faster for drilling the holes throughout the site, and should be able to access all of the locations, other than the 3 northernmost holes on pile 4, which appeared to be blocked by erosion channels that were too deep to drive (or even track) over. We'll need to discuss with Ricky Spitz how to access these locations.

After returning to the rig at 11:45, Arnold was there already and said he would be taking Jose back to Arizona to retrieve the full-size truck rig. They left the site, with the intention to return with the truck tomorrow morning. Soap noted he would have brought the truck rig from the start had he known the true nature of the terrain on site, however he was told a track rig would be required. We discussed and agreed that a pre-job site visit would have solved many of the problems we encountered today, as the track rig was clearly not the best option for this job.

At noon, I drove back up to pile 4 to find cell phone service and call Jason Cumbers (Stantec) to discuss the day's events. We decided we would go ahead with bringing in the new rig and would discuss additional costs at a later date with Cascade.

Drilling resumed at T/O-3 at 12:30, though speed and power were limited due to the lack of a fully functional transmission. After sampling at 35', Soap stopped drilling because the rig lacked enough power to drill deeper without the risk of the auger getting stuck. We then walked around the remaining T/O holes to determine how to proceed with the track rig. It was decided to leave T/O-3 at 35' and finish it when the truck rig arrives, and in the

meantime to move to T/O-2. This hole is estimated to involve only 25' of drilling and thus will be doable with the track rig. Also, this location would not be accessible with the truck rig. Drilling started at 2:15 and was completed at 3:30 after drilling into shale bedrock at 25'. All parties left the site at 4:30pm.

Total depth drilled: 60 ft

Total depth cored: 35 ft

Total CA brass liner samples collected: 12

By: C. Fritz Title: Field Engineer

Date Thu, 3/29/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME LAR 75 track rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to the front gate at 7am, had safety tailgate at 7:45 after bathroom breaks. At 8:15, the rig was moved from T/O-2 to T/O-4 location and drilling was started. This hole was finished at 11:15 after drilling to 35'. Some extra time was involved due to stopping at 30' and 35' to examine surrounding terrain and our soil samples to determine if we had reached native soil at the bottom of the pile.

The rig was then moved to T/O-6 and drilling started at 11:45. This hole was completed after encountering native soil at only 10' depth, and sandstone bedrock at 15'. At this location, the pile is likely located atop a sandstone shelf similar to those in the surrounding area.

Soap and Anthony then left the site to go back to the casino for lunch and to contact Joey, who at the time was driving the truck rig from Phoenix to the site, for an ETA on his arrival with the rig. In the meantime, Rob and I drove up to scout pile 4 locations again to re-evaluate access for the truck rig. We were able to find a route that should allow the rig to reach all borehole locations atop the pile. We then went to evaluate access to the Topsoil North pile, and widened an opening in the road berm that should allow the rig to pass through and access the pile.

Soap and Anthony returned at 2:15 and we all proceeded to go evaluate most of the remaining borehole locations at piles 1, 2, and 3, as well as the Topsoil South pile. We returned to the rig at 3:15 and Joey still had not arrived, so Soap and Anthony loaded the track rig onto the flatbed and prepared it for transport back to Albuquerque, where the transmission will be worked on.

At 4:30, Joey finally arrived with the truck rig. All three drillers then began work setting it up and making mechanical adjustments to prepare it for drilling tomorrow. The finished up and left the site at 5:50 after being frisked for radiological contamination. I left the site soon after at 6pm.

Total depth drilled: 50 ft  
Total depth cored: 0 ft  
Total CA brass liner samples collected: 12

By: C. Fritz Title: Field Engineer



Date Fri, 3/30/2018

 PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to gate at 7am, and to rig at 7:15 to have our safety tailgate meeting. The drillers checked on the loaded-up LAR track rig to make sure it was secure, then began prepping the CME 85 truck rig for drilling. At 8am, drilling resumed at T/O-3 at 35 ft after the rig was aligned with the existing hole and connected to the augers (still in the hole). Shortly thereafter, Joey left to drive the track rig back to Albuquerque. T/O-3 was finished at 2pm after drilling to 80 ft. The actual depth of contact with native remains fully unknown, Rob and I discussed for some time and came to different conclusions. He noted native material at about 55 ft. The logs and photos will have to be revisited to make a determination.

Around 2:45, Bryan Nydoske (Cascade PM) arrived to the site with Joey and we all had lunch together to discuss the work thus far. At 3:15, drilling began at the nearby T/O-1 location and Bryan left the site. T/O-1 was completed after drilling to 70 ft at 6pm. All individuals left the site by 6:15pm.

Total depth drilled: 115 ft  
 Total depth cored: 45 ft  
 Total CA brass liner samples collected:

 By: C. Fritz Title: Field Engineer

Date Sat, 3/31/2018

 PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived on-site at 7am, had safety tailgate at the rig at 7:20. After our meeting, the drillers started packing up equipment to move areas, and pulled augers out of T/O-1. At 8:20, we moved into the Lobo Tract borrow area (east of the arroyo) and began drilling L2-1 at 9am. This hole was finished after drilling through 20' of native soil, before moving on to L2-2. In this hole, bedrock was encountered at only 10' and drilling stopped at 15'. The same conditions were encountered at the following hole (L2-3). After a 30 minute lunch break from 11:20-11:50, drilling began at L2-5, and was completed after 20'. The rig was then moved to L2-7. After 5 minutes of drilling, a mechanical issue with the autohammer resulted in 40 mins of down time from 12:50-1:30pm. L2-7 then was completed after 20' of drilling. The drillers then took a 30 minute break due to warm weather.

At 2:30, the first hole with coring was begun at L2-6, and finished after 20' of coring and sampling. The rig was then moved to the other corehole for this area, L2-4. At 4:30, L2-4 was completed after 20' of coring and sampling. We then moved over to the topsoil north pile and scouted the drilling locations in this area with the drillers. It was determined that borehole TN-3 would not be accessible with the rig due to dangerous slopes on both sides of the narrow pile. As a result, only 2 boreholes likely will be drilled in this pile tomorrow.

The drillers left the site at 5:30pm, and Rob and I followed shortly thereafter once we had finished unloading core samples near the site entrance and covering with a tarp.

Total depth drilled: 130 ft  
 Total depth cored: 40 ft  
 Total CA brass liner samples collected: 38

 By: C. Fritz Title: Field Engineer

Date Sun, 4/1/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived on-site at 7am, began warming up rig at 7:15 and had our safety tailgate meeting. The drillers then refueled the rig and drilling and coring began at 8am at TN-2 in the topsoil north pile. TN-2 was completed after drilling 30' and encountering native soil. The rig was then moved to TN-1 in the same pile, and 15' of drilling was completed at 10:15am.

At 10:30, we moved across the site to the Borrow South area. Drilling began at BS-1 at 11, and continued until bedrock was encountered at 15'. The rig was then moved to BS-2, which was drilled until encountering bedrock in the CA sampler just past 20'. After moving to BS-3, 15' of coring was completed before hitting bedrock. After completing BS-3, we decided not to drill at location BS-4 due to exposed bedrock at the surface in the general vicinity, which was of no interest to us in terms of potential borrow material. Therefore, we moved on to BS-5. However, this location also had shallow bedrock, resulting in only 5' of soil coring. BS-6 exhibited improved borrow materials, with 20' of coring completed and no bedrock encountered.

After completing the final borrow south borehole at 3:15, the rig was moved to the south topsoil pile and set up at location TS-4. Drilling began at 4pm and was completed at 4:45 after drilling to 25'. The rig was then moved to TS-3 and drilling was completed to 15' before experiencing mechanical issues with the autohammer at 5:15. After 30 mins of work on the hammer, the drillers said they needed to salvage a part from the LAR track rig's autohammer, which was still on site. We decided to do this in the morning, and left the site at 5:45.

Total depth drilled: 160 ft  
 Total depth cored: 70 ft  
 Total CA brass liner samples collected: 52

By: C. Fritz Title: Field Engineer

Date Mon, 4/2/2018

 PROJECT: St. Anthony Mine

 JOB NO: 233001076

 CLIENT: United Nuclear Corporation

 CONTRACTOR: Cascade Drilling

 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived on-site at 7am, the drillers then went to salvage the hammer part from the LAR rig's hammer while I unloaded cores and buckets of samples near the site entrance where the other samples were already stored. The drillers then worked on attaching the part from 7:30-8:30 before resuming drilling at TS-3 at 15' depth. At 10am, drilling was completed at 30' depth, and the rig was moved to TS-2. This location was cored to 35' depth. Significant amounts of rock were encountered at this location beginning around 20', though it was difficult to determine whether the rock was native or fill due to the broken nature of it, as well as relatively low blow counts for such rocky material. The abrasiveness of the material resulted in high temperatures within the hole and steam. We took a break from 11:45-12:15 to allow the tooling to cool before finishing the hole.

Drilling then began at TS-1 at 1:20 after moving the original location to the top of the pile near the road that comes up from pile 1. The original location was on too steep of a slope to jack up the rig. This hole was drilled to 35', again hitting rocky material at shallower depths than anticipated. It appears that the pile is located atop a rock shelf, with topsoil material piled off the north side of the shelf, about 60 ft down to the native ground surface below.

At 3:15, the rig was moved to location P1-3 and towered up. However, drilling was not started at this location due to an increase in wind speeds at this time. It was determined that the wind was too strong to safely work (hard hats were being blown off), and all individuals subsequently left the site at 3:45 after being frisked for radiation.

Total depth drilled: 125 ft

Total depth cored: 35 ft

Total CA brass liner samples collected: 30

 By: C. Fritz

 Title: Field Engineer

Date Tue, 4/3/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to site at 7:10am, began warming up rig and had tailgate meeting. At 8am, began drilling P1-3. Encountered numerous boulders with voids in between, resulted in lots of grinding and wear on the augers. Around 10am, Victor Patel (AVM) arrived with the air sampler to attach to Sop to measure air quality in the drillers' working area. At this time, the drillers went to make a phone call to managers to discuss the need for upcoming maintenance on the augers due to damage resulting from abrasive material in the TS pile and current hole. Resumed drilling at 40' at 11:15, but after progressing 1 ft further we decided to stop drilling the hole due to continued grinding on rock. Sop explained Cascade's desire to stop work for this 10-day rotation one day early so they could return to the shop and perform maintenance on the augers. He said if we were to continue we would risk breaking augers beyond repair and possibly losing equipment down hole, which would result in high replacement costs at Stantec's expense. I then called my supervisor to discuss this option and we agreed to stop after today.

At 12:15, moved the rig to location P1-1 and began coring. After drilling to 20' depth, drillers attempted to lower the sampling rod but encountered a bend in the lowermost auger that prevented the sampling rod from reaching the bottom. Apparently, the auger had shifted off to the side after hitting a large boulder. Sop pulled all 4 augers from the hole and noted cracks and warped blades. It was decided we could not proceed without causing significant damage to additional augers. At 1:45pm, the drillers left the site to return to Cascade's Peoria workshop. I left the site at 2:45 after organizing samples and loading up buckets to take to testing lab in Albuquerque.

Total depth drilled: 60 ft  
 Total depth cored: 20 ft  
 Total CA brass liner samples collected: 12

By: C. Fritz Title: Field Engineer

Date Mon, 4/9/2018

PROJECT: St. Anthony Mine

JOB NO: 233001076

CLIENT: United Nuclear Corporation

CONTRACTOR: Cascade Drilling

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

At 12pm, at a depth of 60' while drilling boring P1-2 in shale pile 1, a very loud bang came from the hole. I was standing next to the rig at the time and would describe it as a deafening (I didn't have earplugs in at that moment), percussive boom from underground. Rob was standing about 50 feet away behind his truck and could feel the impact of it. We immediately stopped work and gathered away from the rig. After waiting about 30-40 minutes to let things settle (and air out in case there was any gas of some sort), the driller slowly drilled down a couple more feet and continued to hear a couple of small pops from inside the hole. We then shut down the rig without continuing further and I went to call Stantec and Cascade supervisors.

Cascade operations manager requested that we immediately stop work (which we already had) and leave the area as a precaution until we could get more information and figure out what we were dealing with. With the augers still in the hole, we then left the site. Later in the day, I had a conference call with Cascade management, health and safety, and the drilling crew to discuss the events. It was decided that their ops manager would meet me and the drillers in the morning with a gas meter to see if there were any detectable gases in the borehole.

**Activities Summary:**

Arrived to site at 7am, collected materials from staging area near entrance, then began warming up rig where it had been left on 4/3 on shale pile 1 and had tailgate meeting at 7:30. At 8am, the rig was moved about 5' over from location P1-1 and drilling commenced at P1-1A, with the intention to avoid the rock that bent the auger in P1-1. Stopped from 8:15-8:45 while helpers refueled rig and Sop went to retrieve materials from support truck. Drilling then resumed, with coring from the surface down to 20' without collected SPT samples. P1-1A was completed after drilling to 35' and encountering native bedrock. We then moved to location P1-2, towered up at 10:30, and began drilling at 10:45. At 12pm, while drilling from 55-60', the safety incident described above occurred. All parties left site at 2pm after I made the initial phone calls to inform Cascade and Stantec supervisors of the incident.

Total depth drilled: 100 ft  
 Total depth cored: 35 ft  
 Total CA brass liner samples collected: 14



# *Daily Field Report*

By: C. Fritz Title: Field Engineer

Date Tue, 4/10/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Bryan Nydoske	Cascade	Operations Manager	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment			
Item	Company	Op Hrs	
CME 85 drill rig w/hollow stem auger	Cascade		

**Safety:**

No incidents reported

**Activities Summary:**

At 7:15am, I met the drilling crew off-site to wait for Bryan to meet us before proceeding to the rig to address yesterday's HSSE incident. At 8am, after arriving to location P1-2, Bryan led a safety meeting prior to approaching the borehole. We discussed the methods that would be employed to safely address the situation, including measuring gas levels and removing tooling from the hole. At this time, Bryan noted that he did not have a radiation dosimetry badge on his person and requested a variance from the health and safety plan, which stated the requirements for on-site personnel having said badges. I provided verbal affirmation that he could be on the site today, without a badge, to address the current safety situation. At 9am, after calibrating the gas meter with fresh air readings, Bryan approached the hole while the rest of us stayed back about 150'. He placed the tip of the gas meter just inside the top of the auger opening and measured 4.6 ppm hydrogen sulfide gas and 346 ppm carbon monoxide gas. We all then left the site and gathered at a location with cell phone service to discuss the findings with Cascade health and safety. I also called my supervisor and Stantec health and safety to discuss. It was decided that the drillers would return to Albuquerque with Bryan to prepare engineering controls that will be used to proceed with tooling removal from P1-2.

At 11am, Rob and Bryan left while the drillers and I returned to the rig to set up an exclusion zone around the borehole. We then left the site at 11:45am. Later in the day I had a conference call with Cascade to discuss methods for tooling removal. It was decided that drilling mud would be mixed and placed down-hole to reduce the chance of igniting gases. We will also record gas readings after removal of each 5' auger segment to ensure gas is not pulled up into the working area during removal.

Total depth drilled: 0 ft  
 Total depth cored: 0 ft  
 Total CA brass liner samples collected: 0

By: C. Fritz Title: Field Engineer



Date Wed, 4/11/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input checked="" type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Began day on standby while waiting for Stantec health and safety to approve the updated health and safety plan, which will address procedures related to the gases encountered at P1-2. At 10am, I received the updated version of the HASP and we drove to the site. At 11am, we had a safety meeting to discuss procedures for tooling removal from the borehole. Work began at 12:45, with drilling mud being mixed and placed down the hole. Immediately after pumping the mud into the hole, a spike in H2S and CO was detected at top of the hole (3ppm H2S and 200 ppm CO). We then waited 10 mins to air out the hole before proceeding. Sop then pulled the AWJ sampling rods in 30' increments, with gas readings between increments. He then began pulling up augers in 5' increments, again with gas readings between each increment. At 2pm, with 25' of auger still in the hole, H2S spiked to 5ppm. We took a 20 min break until the gas meter stopping beeping (indicative of elevated readings). At 2:30, backfilling of the hole with cuttings was completed and the drillers began packing up to move to the next location. The drillers then took the mud mixer and other equipment back to the staging area.

At 3:30, the rig was moved to location P3-2 and coring began at 4pm. Auger refusal was encountered at 45', consistent with expected depth to native bedrock based on assessment of surrounding geology. After packing up rig and work area to move to next location, all parties left the site by 6:15pm.

Total depth drilled: 45 ft  
 Total depth cored: 45 ft  
 Total CA brass liner samples collected: 12

By: C. Fritz Title: Field Engineer

Date Thu, 4/12/2018

 PROJECT: St. Anthony Mine

 JOB NO: 233001076

 CLIENT: United Nuclear Corporation

 CONTRACTOR: Cascade Drilling

 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to site at 7:10am, began refueling rig after drillers arrived at 7:30. At 8am, the rig was moved from location P3-2 to P3-4, and drilling began at 8:30. Around 9:30, after drilling to 40', black material similar to what was seen at P1-2 just prior to the explosion was noted in the auger cuttings. It was very black and appeared to have significant organics. Rob suggested that we stop and take a gas reading in the hole as a pre caution. After connecting a small hose to the gas meter and taking a reading about 4' down the hole, H2S and CO were measured at 22 ppm and 500 ppm, respectively. Also, the LEL reading was at 62% of the lower explosive limit for methane. We immediately stopped and moved away from the borehole. At 10am, we left the site to make phone calls to supervisors. Cascade health and safety told their drillers to use the same methods to pull out of the hole as previously employed at P1-2. My supervisor and I discussed the possibility of continuing in the same pile using drilling mud to suppress gas and explosion potential, however, the Cascade operations manager noted that mud could not be circulated using a hollow stem auger rig and that mud rotary may be a better option for this site. I told him that I could not make the final call of whether to bring in a different rig, and that he would have to speak with Stantec management about that possibility and its associated costs.

We then returned to the rig, where the gas meter was still reading from 4' down the hole. The meter at that time read 32 ppm H2S, 499 ppm CO, and 99% LEL. There also was a noticeable rotten-egg smell down wind of the hole. By this time, winds were picking up significantly and were stronger than Cascade's 35 mph limit for safe drilling. Because of the wind and the elevated gas readings, we decided to stop work for the day and return tomorrow to pull tooling from the hole. All parties left site at 12:30pm.

Total depth drilled: 40 ft

Total depth cored: 0 ft

Total CA brass liner samples collected: 13

 By: C. Fritz

 Title: Field Engineer



# Daily Field Report

Date Fri, 4/13/2018

PROJECT: St. Anthony Mine

JOB NO: 233001076

CLIENT: United Nuclear Corporation

CONTRACTOR: Cascade Drilling

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input checked="" type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input checked="" type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.		
Humidity	<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Jesse Dillon	Cedar Creek	Ecologist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**  
No incidents reported

**Activities Summary:**  
Arrived on-site at 7:10am, had safety tailgate at 7:30 to discuss removal of tooling from P3-4 and possibility of stopping work again if more dangerous gas levels are encountered. At 7:45, drillers began taking readings with the gas meter. Did not detect H2S anywhere outside borehole, though levels up to 2 ppm were measured after extending the measurement tube as deep as 20' down the hole. CO reached as high as 400 ppm, but LEL remained below 8%. Ectraction of tooling began at 8am with gas readings recorded after each 5' increment, and backfilling of the hole with cuttings was completed at 9:15. The rig was moved to the next location (P3-3) at 9:40, however, the wind was too strong (>35 mph sustained) to continue with any drilling. All parties left site at 10:15am.

Total depth drilled: 0 ft  
Total depth cored: 0 ft  
Total CA brass liner samples collected: 0

By: C. Fritz Title: Field Engineer

Date Sat, 4/14/2018

 PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Rob Murphy	Cedar Creek	Soil Scientist	
Jesse Dillon	Cedar Creek	Ecologist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived to site at 7am, had safety tailgate at 7:20 while rig was warming up. Drilling began at location P3-3 at 8am, and was completed upon measuring 2 ppm H2S, 499 ppm CO, and 12% LEL in the hole after drilling to 40'. The rig was then moved to location P3-6 and drilling began at 9:45. At 55' depth, the auger cuttings became much blacker. Gas readings of 4 ppm H2S, >500 ppm CO, and 15% LEL were recorded at the top of the hole. Work was then stopped for 30 mins to allow the hole to air out. Extraction of tooling then was completed from 11:30-12pm. At 12:30, the rig was moved to P3-5 and drilling began. The auger hit a boulder at the surface, so the rig was moved over several feet and drilling began again at 1pm after fixing the drill bit. Black material with elevated gas readings was encountered at only 15', thus ending drilling at this location.

The rig was then moved back to pile 2 to attempt shallow borings, with the intent to collect samples before hitting the problematic black, organic material at greater depths. Elevated gas levels were measured after drilling 30', we took a break to air out the hole before extracting tooling. At 5:30, extraction was completed, the hole was backfilled, and all parties left the site.

Total depth drilled: 140 ft  
 Total depth cored: 0 ft  
 Total CA brass liner samples collected: 48

 By: C. Fritz Title: Field Engineer



# Daily Field Report

Date Sun, 4/15/2018

PROJECT: St. Anthony Mine

JOB NO: 233001076

CLIENT: United Nuclear Corporation

CONTRACTOR: Cascade Drilling

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Jesse Dillon	Cedar Creek	Ecologist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

### Safety:

No incidents reported

### Activities Summary:

Arrived on-site at 7am, had safety tailgate at the rig at 7:30. Drilling began at location P2-2 at 8am and continued until encountering elevated gas levels at 20' depth. Drilling did not continue past this depth, tooling was extracted and the hole backfilled, and we began the move to pile 4 at 9:30. Because of the difficult access to several of the pile 4 holes, Jesse and I had to scout a route that the rig could navigate. Drilling and coring then began at location P4-7 at 10:45am. An hour later, elevated H2S and LEL were measured after coring to 30' depth. Work was then stopped for about 30 mins to let the hole air out. Tooling was then extracted and the rig was moved to location P4-9 at 12:45. After drilling to 40' depth at P4-9, the drillers experienced a sudden puff of gas from the hole and work was stopped. Elevated gas levels were measured at the top of the borehole. After waiting for the hole to air out, tooling was pulled and the rig was moved to location P4-8. Drilling began at 3:40pm. Shortly thereafter, elevated gas levels were recorded at 20' depth. At 4:30, all parties left the site to allow the hole to air out overnight before extracting tooling.

Total depth drilled: 110 ft  
 Total depth cored: 30 ft  
 Total CA brass liner samples collected: 23

By: C. Fritz Title: Field Engineer

Date Mon, 4/16/2018

 PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input checked="" type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

**Onsite Personnel**

Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Jesse Dillon	Cedar Creek	Ecologist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

**Equipment**

Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived on-site at 7:15am and unloaded samples at staging area near entrance. Had safety meeting at 7:45 while rig was warming up. At 8:15, drillers began pulling augers from P4-8. We then moved to P4-6 and soon encountered elevated gas levels at 10' depth. The augers were immediately pulled out in one segment and the hole was backfilled. Cuttings had started to turn dark gray/black at about 7' depth. Some bubbling was observed in the water poured over the top of the backfilled hole. The rig was then moved at 9:30 to P4-5 and drilling began at 9:45. Gas was encountered at 20' depth, augers were extracted, and the hole was backfilled. At 11:30 the rig was moved to P4-3 and drilling began. Gas was encountered at 15' depth, took 30 min break to air out hole. At 12:45, augers were pulled and the hole was backfilled. At 1:15, after moving to P4-4 location, Joey was not feeling well and was acting slightly lethargic. Excessive exposure to CO was suspected since Joey had been measuring gas levels with his face near the top of the borehole. Sop and Anthony also did not feel right and noted they were much more tired and had less energy than they normally should, even given the warm temperatures and amount of work performed to that point. Because of this, we decided to stop work and left the site at 1:30. All drillers later said they felt much better shortly after leaving the work area.

 Total depth drilled: 45 ft  
 Total depth cored: 0 ft  
 Total CA brass liner samples collected: 11

 By: C. Fritz Title: Field Engineer

Date Tue, 4/17/2018

PROJECT: St. Anthony Mine  
 JOB NO: 233001076  
 CLIENT: United Nuclear Corporation  
 CONTRACTOR: Cascade Drilling  
 PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Jesse Dillon	Cedar Creek	Ecologist	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Vigueria	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

At 7am, met drillers at location near site with cell phone service. We had a brief conference call with Cascade and Stantec supervisors and decided to abandon drilling on pile 4, and return to pile 3 to complete one unfinished hole. We then arrived to the site at 7:45, I met with other Stantec personnel who had recently arrived on-site to discuss drilling an additional hole to obtain samples for their purposes. However, after retrieving the rig from pile 4, no accessible drilling location was found in the immediate vicinity of where they had wanted to obtain samples. By this time (9am) the wind had increased and was blowing dust off the nearby piles containing material with elevated radiation levels. The on-site radiation safety officer (with subcontractor AVM) recommended stopping work, as all other on-site personnel (there to collect radiological samples from test pits) were planning on leaving due to the winds. Wind speeds above 35 mph were expected soon as well, meaning drilling could not proceed. As a result, I informed the drillers we would not be drilling today and they left the site.

Because radiological sampling was not being conducted for the rest of the day, I was able to have Mark Spitz (backhoe operator) use his equipment to create access for the drill rig onto the section of pile 3 where the last remaining borehole was located. While Mark worked on the access, Jesse and I went to examine a potential borrow area near the large pit to determine if additional drilling may be warranted to investigate the area. Jesse then left at 10am, and I returned to where Stantec and AVM personnel were staged to wait for two individuals to return from conducting separate sampling in the arroyo. At 10:45, all individuals besides myself left the site after being frisked for radiological contaminants. I then left at 11:15 after doing inventory of samples in the staging area in preparation for delivering samples to the testing lab in Albuquerque.

Total depth drilled: 0 ft  
 Total depth cored: 0 ft  
 Total CA brass liner samples collected: 0

By: C. Fritz Title: Field Engineer

Date Wed, 4/18/2018

PROJECT: St. Anthony Mine

JOB NO: 233001076

CLIENT: United Nuclear Corporation

CONTRACTOR: Cascade Drilling

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow	
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100	<input type="checkbox"/> >100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.		
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1		

Onsite Personnel			
Name	Company	Position	Remarks
Cameron Fritz	Stantec	Field Engineer	
Sopotyn Lorn	Cascade	Driller	
Anthony Martinez	Cascade	Helper	
Joey Viguera	Cascade	Helper	

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

**Safety:**

No incidents reported

**Activities Summary:**

Arrived on-site at 7am. We then went to survey the new access to pile 3, as well as access to newly proposed locations in the west borrow area near the large pit. At 7:45, we had a safety meeting while the rig warmed up at location P3-1. Drilling then began, with the additional use of a blower fan the drillers retrieved from Albuquerque yesterday. This fan will be more effective at removing gases from the borehole, and depositing them away from the working area such that the effects felt by the drillers yesterday will not be an issue again. At 8:30, after drilling to 15' depth, CO and LEL began to slowly increase at the top of the borehole. Work was then stopped so we could monitor the gas levels, which continued to increase inside the hole. Although H2S was not detected, CO and LEL increased to as high as 140 ppm and 5%, respectively. We decided not to continue drilling the hole, as we expected levels to further increase if we kept drilling deeper. Upon removing the sampler from the hole, black shale was evident in the tip of the sampler from ~16' depth.

The rig was then moved to location BW-1 in the west borrow area and coring began at 9:15. At 10:30, elevated H2S, CO, and LEL were detected in the borehole after drilling to 35' depth. Because this location was in a clean, undisturbed borrow area, it was believed that we had drilled through the potential borrow material (alluvium) and into the native shale at a depth consistent with where the shale layer is visible in the walls of the open pit just to the north, at which point gas levels began to increase. Tooling was then extracted and the rig moved to location BW-4. Drilling was completed at 20' depth without any gas issues, as we did not drill deep enough to encounter materials other than the alluvium. We then completed drilling at locations BW-3 (hit bedrock at 15') and BW-2 (drilled to 20') without incident.

After completing the final borehole of the drilling program, the drillers went to prepare the rig and support vehicles for demobilization back to the Cascade shop. While they did that, I did sample inventory and collected buckets to bring to the geotechnical testing lab in Albuquerque. After the drillers had already left the site, I left at 5pm along with the remaining on-site Stantec and AVM personnel.



Total depth drilled: 105 ft  
Total depth cored: 35 ft  
Total CA brass liner samples collected: 26

By: C. Fritz Title: Field Engineer

# **Attachment E. Laboratory Results**

**Table E-1. Laboratory Results – Initial Properties**

Sample ID	Gravimetric Moisture Content (% <sub>w</sub> , g/g)	Volumetric Moisture Content (% <sub>v</sub> , ft <sup>3</sup> /ft <sup>3</sup> )	Dry Bulk Density (pcf)	Wet Bulk Density (pcf)	Calculated Porosity (%)
L1-1 (10'A)	6.3	8.7	86.6	92.1	47.6
L1-2 (20'B)	10.2	17.8	109.4	120.5	33.9
L1-3 (5'A)	4.2	6.3	93.7	97.6	43.4
L1-4 (5'B)	7.5	10.6	88.2	94.8	46.7
L2-1 (5'B)	4.1	7.0	105.4	109.7	36.3
L2-1 (15'A)	5.0	8.7	108.6	114.0	34.4
L2-3 (5'A)	3.8	6.1	100.5	104.3	39.3
L2-5 (5'B)	11.8	19.8	104.8	117.2	36.6
L2-6 (10'B)	14.4	21.9	97.3	111.4	41.3
T/O-1 (20'A)	11.4	19.5	106.6	118.8	35.6
T/O-1 (45'B)	7.2	10.9	94.5	101.3	42.9
T/O-2 (15'A)	11.3	18.5	101.6	113.1	38.6
T/O-3 (15'B)	9.9	18.4	116.6	128.1	29.5
T/O-3 (40'B)	6.8	10.9	100.5	107.3	39.3
T/O-4 (5'A)	8.9	16.4	115.8	126.1	30.0
T/O-5 (20'A)	6.3	9.4	94.2	100.1	43.1
T/O-6 (5'A)	6.9	12.0	108.9	116.5	34.1
TN-2 (20'A)	6.0	7.8	81.5	86.3	50.8
BS-1 (10'A)	8.4	12.3	91.2	98.9	44.9
BS-6 (20'A)	7.0	9.5	84.7	90.6	48.8
TS-1 (5'A)	7.8	14.4	114.4	123.4	30.8
TS-2 (15'A)	8.9	14.3	99.9	108.8	39.6

TS-3 (10'A)	6.0	9.6	100.4	106.4	39.3
TS-4 (10'A)	7.0	13.8	123.4	132.0	25.4
P1-1 (15'B)	10.0	13.4	84.2	92.6	49.1
P1-1A (30'A)	3.9	4.8	76.6	79.7	53.7
P1-2 (50'A)	4.3	6.9	99.7	104.0	39.7
P2-1 (5'A)	13.2	24.6	115.8	131.2	30.0
P2-1 (25'B)	15.4	25.6	104.1	120.1	37.1
P3-1 (5'A)	7.3	13.6	116.4	124.8	29.7
P3-1 (15'A)	9.4	8.8	58.3	63.8	64.8
P3-2 (10'A)	6.6	11.1	105.5	112.4	36.2
P3-2 (20'A)	11.3	18.8	104.1	115.8	37.1
P3-3 (20'A)	8.1	13.7	105.5	114.1	36.2
P3-3 (40'A)	14.7	26.3	112.0	128.4	32.3
P3-4 (10'A)	9.3	14.4	96.2	105.2	41.8
P3-4 (30'A)	6.0	9.1	95.2	100.9	42.4
P3-4 (40'A)	7.1	13.3	117.0	125.3	29.3
P3-5 (10'A)	8.3	15.5	115.8	125.4	30.0
P3-6 (5'A)	4.8	7.8	101.8	106.7	38.4
P3-6 (20'A)	9.3	16.1	107.9	117.9	34.8
P3-6 (50'A)	6.0	10.7	110.8	117.4	33.1
P4-5 (20'A)	7.3	12.6	108.6	116.4	34.4
P4-6 (10'A)	10.0	15.9	99.0	108.9	40.2
P4-7 (5'A)	9.8	14.6	93.1	102.2	43.7
P4-7 (25'B)	6.2	11.0	110.1	117.0	33.5
P4-8 (15'B)	13.0	21.0	101.1	114.2	38.9

P4-9 (5'A)	4.4	8.3	116.7	121.9	29.4
P4-9 (35'B)	13.5	22.4	103.7	117.7	37.3
BW-1 (30'A)	9.3	13.0	87.2	95.3	47.3
BW-2 (10'A)	5.9	8.9	94.7	100.3	42.8
BW-3 (5'A)	3.8	6.1	101.0	104.8	38.9

**Table E-2. Laboratory results – Particle Size Analyses**

Sample ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	
L1-1 (10'A)	0.0	33.2	43.1	23.7	2.2E-05	0.046	0.061	2773	33	(Est)
L1-2 (20'B)	0.1	2.3	68.1	29.5	2.8E-05	0.0092	0.015	536	12	(Est)
L1-3 (5'A)	0.0	46.5	40.8	12.7	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	(Est)
L1-5 (20'B)	0.0	49.7	37.7	12.6	0.0011	0.074	0.093	85	17	(Est)
L2-1 (5'A)	0.0	32.5	49.0	18.5	0.00040	0.045	0.060	150	9.4	(Est)
L2-2 (5'A)	0.0	46.3	37.5	16.2	0.00019	0.067	0.085	447	60	(Est)
L2-3 (5'A)	0.0	51.2	36.8	12.1	0.00094	0.076	0.089	95	26	(Est)
L2-4 (10'B)	0.0	28.8	50.0	21.2	3.9E-05	0.045	0.057	1462	65	(Est)
L2-5 (5'A)	0.0	2.8	48.6	48.6	4.4E-05	0.0022	0.0047	107	0.50	(Est)
L2-6 (5'A)	0.0	14.8	55.2	29.9	0.00031	0.013	0.030	97	0.43	(Est)
L2-7 (10'A)	0.0	40.1	48.2	11.7	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	(Est)
T/O-1 (20'A)	0.2	3.2	66.0	30.6	0.00030	0.0088	0.016	53	0.75	(Est)
T/O-1 (45'B)	0.0	47.9	31.0	21.1	5.1E-05	0.070	0.099	1941	51	(Est)
T/O-2 (5'A)	0.0	23.0	71.5	5.5	0.0025	0.010	0.022	8.8	0.15	

T/O-3 (40'A)	0.0	51.5	34.4	14.1	0.00083	0.078	0.10	120	20	(Est)
T/O-3 (70'B)	0.5	8.7	73.8	17.1	0.00032	0.034	0.045	141	8.4	(Est)
T/O-4 (20'B)	0.0	24.8	57.7	17.5	0.00059	0.034	0.050	85	4.1	(Est)
T/O-5 (10'B)	0.0	10.1	75.3	14.6	0.0011	0.028	0.039	35	2.3	(Est)
T/O-6 (5'A)	0.0	24.3	59.7	16.0	0.00066	0.043	0.054	82	9.1	(Est)
TN-1 (5'A)	0.4	50.9	33.3	15.4	0.00074	0.077	0.097	131	17	(Est)
TN-2 (20'A)	0.0	51.9	34.4	13.8	0.00077	0.079	0.10	130	18	(Est)
BS-1 (10'A)	0.0	40.8	36.1	23.0	0.00029	0.052	0.076	262	4.4	(Est)
BS-2 (15'A)	0.0	43.0	51.6	5.3	0.0039	0.061	0.082	21	0.61	
BS-6 (20'A)	0.0	26.3	55.8	17.9	0.00018	0.054	0.062	344	43	(Est)
TS-1 (20'A)	0.0	18.2	65.1	16.7	0.0010	0.035	0.048	48	2.0	(Est)
TS-2 (10'A)	0.0	53.9	35.3	10.8	0.0019	0.087	0.12	63	3.0	
TS-3 (10'A)	0.0	16.1	68.6	15.2	0.00086	0.043	0.051	59	3.9	(Est)
TS-4 (5'A)	0.7	63.1	22.7	13.5	0.0011	0.11	0.13	118	20	(Est)
P1-1 (5'A)	18.8	49.8	20.8	10.6	0.0012	0.13	0.17	142	23	(Est)
P1-2 (30'B)	20.3	43.0	24.9	11.8	0.0010	0.11	0.16	160	21	(Est)

P2-1 (25'A)	0.3	54.0	30.7	15.1	0.00071	0.087	0.12	169	11	(Est)
P2-2 (5'B)	5.1	53.2	27.1	14.6	0.00078	0.089	0.11	141	28	(Est)
P3-1 (5'A)	19.7	64.9	15.3		NA	0.23	0.33	NA	NA	(Est)
P3-2 (15'B)	0.0	78.8	21.2		NA	0.20	0.25	NA	NA	(Est)
P3-2 (35'B)	1.1	68.2	30.7		NA	0.15	0.19	NA	NA	(Est)
P3-3 (5'A)	0.3	67.7	31.9		NA	0.15	0.19	NA	NA	(Est)
P3-3 (40'B)	1.4	56.3	42.3		NA	0.085	0.099	NA	NA	(Est)
P3-4 (20'A)	0.0	92.7	7.3		0.11	0.25	0.29	2.6	0.91	
P3-4 (30'A)	0.0	92.3	7.7		0.10	0.19	0.22	2.2	0.89	
P3-4 (40'A)	0.0	48.1	44.2	7.7	0.0029	0.072	0.087	30	7.7	
P3-5 (10'A)	0.0	68.6	27.8	3.6	0.020	0.099	0.12	6.0	2.2	
P3-6 (20'A)	0.0	85.2	14.8		NA	0.20	0.24	NA	NA	(Est)
P3-6 (50'A)	7.2	76.4	16.4		NA	0.23	0.30	NA	NA	(Est)
P4-5 (20'A)	24.9	61.0	14.1		NA	0.30	0.39	NA	NA	(Est)
P4-6 (10'A)	0.0	48.0	41.0	11.0	0.0012	0.072	0.084	70	23	(Est)
P4-7 (5'A)	7.2	43.9	49.0		NA	0.077	0.095	NA	NA	(Est)



P4-7 (25'B)	0.0	77.0	17.5	5.5	0.0052	0.28	0.34	65	9.6	
P4-8 (15'B)	0.5	51.9	35.5	12.1	0.0011	0.085	0.13	118	5.1	(Est)
P4-9 (35'B)	15.7	26.6	46.4	11.4	6.7E-06	0.061	0.087	1.3E+04	1160	(Est)
BW-1 (20'A)	0.0	45.4	34.9	19.7	0.0012	0.047	0.083	69	1.2	(Est)
BW-2 (10'A)	0.0	44.1	38.1	17.8	0.00035	0.062	0.084	240	18	(Est)
BW-3 (5'A)	0.0	53.1	35.9	11.0	0.0011	0.080	0.099	90	23	(Est)

$d_{50}$  = Median particle diameter

(Est) = Reported values for  $d_{10}$ ,  $C_u$ , and  $C_c$  are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

**Table E-3. Laboratory Results – Atterberg Limits**

<b>Sample ID</b>	<b>Liquid Limit</b>	<b>Plastic Limit</b>	<b>Plasticity Index</b>	<b>Classification</b>
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)	---	---	---	ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)	---	---	---	ML
P1-1 (10'A)	---	---	---	ML
P1-2 (15'A)	---	---	---	ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)	---	---	---	ML
P3-3 (40'A)	---	---	---	ML
P3-4 (40'B)	---	---	---	ML
P3-5 (10'B)	---	---	---	ML
P3-6 (50'A)	---	---	---	ML
P4-8 (15'A)	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

**Table E-4. Laboratory Results – Proctor Compaction**

Sample ID	Measured		Oversize Corrected	
	Optimum Moisture Content, (% g/g)	Maximum Dry Bulk Density (pcf)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (pcf)
L1 Auger Cuttings (1 & 2)	14.6	112.7	---	---
L2 Auger Cuttings (1 & 2)	14.1	113.1	---	---
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	114.1	---	---
Topsoil North Cuttings (1 & 2)	12.6	118.1	---	---
Borrow South Cuttings (1 & 2)	13.0	115.1	---	---
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	112.7	12.3	120.0
Borrow West Auger Cuttings (1 & 2)	12.7	116.8	---	---
P1-2 Auger Cuttings	12.8	113.8	---	---
P3 Auger Cuttings (1 & 2)	9.9	122.4	9.2	124.6
P4 Auger Cuttings (1 & 2)	11.1	121.1	9.0	127.7

--- = Oversize correction is unnecessary because coarse fraction is <5% of composite mass

**Table E-5. Laboratory Results – Triaxial Shear**

Sample ID	Effective Consolidation Stress (psf)	Effective Minor Stress at Failure (psf)	Effective Major Stress at Failure (psf)	Pore-Water Pressure at Failure (psf)	Total Minor Stress at Failure (psf)	Total Major Stress at Failure (psf)	% Strain at Failure*	Cohesion, c' (psf)	Friction Angle, $\phi'$ (°)
L2-1 (15'A) CU Stage 1 (6.0 psi)	861.0	367.1	1,212.6	10,803.2	11,170.3	12,015.8	2.12		
L2-1 (15'A) CU Stage 2 (12.0 psi)	1,734.8	724.2	2,597.1	11,313.4	12,037.6	13,910.5	2.96	0	35
L2-1 (15'A) CU Stage 3 (24.0 psi)	3,460.9	1,376.8	5,152.1	12,396.6	13,773.4	17,548.8	7.73		
L2-5 (5'B) CU Stage 1 (2.0 psi)	283.9	105.9	753.1	11,796.0	11,901.9	12,549.1	1.88		
L2-5 (5'B) CU Stage 2 (4.0 psi)	577.7	290.7	1,347.1	11,885.8	12,176.5	13,232.9	0.97	129.6	35.8
L2-5 (5'B) CU Stage 3 (8.0 psi)	1,151.2	471.6	2,222.1	12,303.9	12,775.5	14,526.0	1.13		
L2-6 (10'B) CU Stage 1 (3.5 psi)	501.3	305.2	501.2	11,945.9	12,251.1	12,447.1	0.69		
L2-6 (10'B) CU Stage 2 (7.1 psi)	1,016.3	456.6	1,483.0	12,308.7	12,765.4	13,791.8	3.02	0	32.3
L2-6 (10'B) CU Stage 3 (14.0 psi)	2,016.8	871.0	3,224.1	12,914.0	13,784.9	16,138.1	11.74		

\*Noted percent strain used as failure criterion.

**Table E-6. Laboratory Results – Analytical Testing**

Borehole ID	Sample Depth (ft)	Ra-226 (pCi/g)	Uranium (µg/kg)	Thorium-230 (pCi/g)	Gross Alpha (pCi/g)
P1-2	20	11.5 +/- 1.5	36,000	16.6 +/- 2.6	48.2 +/- 9.6
P1-2	20 (duplicate)	16.1 +/- 2.0	36,300	-	-
P1-2	40	1.25 +/- 0.30	3,700	1.11 +/- 0.23	5.3 +/- 2.1
P1-2	60	1.31 +/- 0.28	530	0.99 +/- 0.22	3.7 +/- 1.7
P2-1	10	3.85 +/- 0.58	1,000	4.11 +/- 0.69	10.5 +/- 3.2
P2-1	20	1.25 +/- 0.31	2,000	1.15 +/- 0.23	2.1 +/- 1.5
P2-1	20 (duplicate)	-	-	1.05 +/- 0.21	4.9 +/- 2.1
P2-2	10	0.91 +/- 0.21	1,000	0.89 +/- 0.19	2.7 +/- 1.5
P4-3	5	2.15 +/- 0.41	1,600	1.60 +/- 0.29	6.8 +/- 1.6
P4-5	5	29.5 +/- 3.6	29,000	19.5 +/- 3.1	65 +/- 11
P4-5	15	18.6 +/- 2.3	24,000	15.4 +/- 2.4	67 +/- 11
P4-9	20	3.14 +/- 0.48	5,300	2.51 +/- 0.42	7.0 +/- 1.5
P4-9	30	1.26 +/- 0.27	580	0.93 +/- 0.20	4.8 +/- 2.1
BW-1	10	0.76 +/- 0.22	480	0.90 +/- 0.20	6.0 +/- 2.5
BW-4	5	1.15 +/- 0.27	550	1.20 +/- 0.24	5.0 +/- 2.3
BW-4	15	0.81 +/- 0.25	610	0.90 +/- 0.20	6.6 +/- 2.5
BW-3	10	0.83 +/- 0.20	510	0.85 +/- 0.19	3.3 +/- 1.9
BW-2	5	0.73 +/- 0.22	520	0.78 +/- 0.18	5.4 +/- 2.2
BW-2	20	0.82 +/- 0.23	460	0.64 +/- 0.17	2.2 +/- 1.6

# **Attachment F. Geotechnical Laboratory Testing Report**

# Laboratory Report for Stantec

St. Anthony Geotech Investigation

PO# 233001076-DBS

June 20, 2018  
Revised July 2, 2018



*Daniel B. Stephens & Associates, Inc.*

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



June 20, 2018, Revised July 2, 2018

Cameron Fritz  
Stantec Consulting Services Inc.  
3325 South Timberline Road Suite 150  
Fort Collins, CO 80525-2903  
(970) 482-5922

Re: DBS&A Laboratory Report for the Stantec St. Anthony Geotech Investigation, PO# 233001076-DBS Project

Dear Mr. Fritz:

Enclosed is the report for the Stantec St. Anthony Geotech Investigation, PO# 233001076-DBS project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.  
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines  
Laboratory Manager

Enclosure

*Daniel B. Stephens & Associates, Inc.*  
*Soil Testing & Research Laboratory*

4400 Alameda Blvd. NE, Suite C  
Albuquerque, NM 87113

505-889-7752  
FAX 505-889-0258



## **Summaries**



### Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction			
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C		
SA-GM 1B															X									
SA-GM 1T															X									
SA-GM 2B															X									
SA-GM 2T															X									
SA-GM 3B															X									
SA-GM 3T															X									
SA-GM 4B															X									
SA-GM 5B															X									
SA-GM 5T															X									
SA-GM 6B															X									
SA-GM 6T															X									
SA-GM 7B															X									
SA-GM 8B															X									
SA-GM 8T															X									
L1 Auger Cuttings (1 & 2)																								X

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial





### Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction							
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C						
L1-5 (8' Bag)																												
L1-5 (20'B)																X	X											
L2-1 (5'A)																X	X											
L2-1 (5'B)	X	X																										
L2-1 (15'A)	X	X														X	X					X						
L2-2 (5'A)																X	X											
L2-2 (5'B)																										X		
L2-3 (5'A)	X	X														X	X											
L2-3 (5'B)																												
L2-4 (10'B)																X	X											
L2-5 (5'A)																X	X											
L2-5 (5'B)	X	X																				X						
L2-6 (5'A)																X	X									X		
L2-6 (10'B)	X	X																				X						
L2-7 (10'A)																X	X											

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction					
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C				
T/O-1 (20'A)	X	X														X	X									
T/O-1 (25'A)																									X	
T/O-1 (45'B)	X	X														X	X									
T/O-2 (5'A)																X	X									
T/O-2 (10'A)																									X	
T/O-2 (15'A)	X	X																								
T/O-3 (15'B)	X	X																								
T/O-3 (40'A)																X	X									
T/O-3 (40'B)	X	X																								
T/O-3 (60'A)																									X	
T/O-3 (70'B)																X	X									
T/O-4 (5'A)	X	X																								
T/O-4 (20'B)																X	X									
T/O-5 (10'B)																X	X									
T/O-5 (20'A)	X	X																								

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



### Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction						
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C					
T/O-6 (5'A)	X	X														X	X										
TN-1 (5'A)																X	X										
TN-2 (20'A)	X	X														X	X										
TN-2 (20'B)																											
BS-1 (10'A)	X	X														X	X										
BS-1 (10'B)																											
BS-2 (15'A)																X	X										
BS-6 (20'A)	X	X														X	X										
BS-6 (20'B)																											
TS-1 (5'A)	X	X																									
TS-1 (20'A)																X	X										
TS-2 (10'A)																X	X										
TS-2 (15'A)	X	X																									
TS-3 (10'A)	X	X														X	X										
TS-3 (10'B)																											

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



### Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction					
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C				
TS-4 (5'A)															X	X										
TS-4 (10'A)	X	X																								
P1-1 (5'A)															X	X										
P1-1 (10'A)																								X		
P1-1 (15'B)	X	X																								
P1-1A (30'A)	X	X																								
P1-2 (15'A)																								X		
P1-2 (30'B)															X	X										
P1-2 (50'A)	X	X																								
P2-1 (5'A)	X	X																								
P2-1 (25'A)															X	X										
P2-1 (25'B)	X	X																								
P2-2 (5'A)																								X		
P2-2 (5'B)															X	X										
P3-1 (5'A)	X	X													X											

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction							
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C						
P3-1 (5'B)																												
P3-1 (15'A)	X	X																									X	
P3-2 (10'A)	X	X																										
P3-2 (15'B)																	X											
P3-2 (20'A)	X	X																										
P3-2 (35'B)																	X											
P3-3 (5'A)																	X											
P3-3 (20'A)	X	X																										
P3-3 (40'A)	X	X																									X	
P3-3 (40'B)																	X											
P3-4 (10'A)	X	X																										
P3-4 (20'A)																	X											
P3-4 (30'A)	X	X															X											
P3-4 (40'A)	X	X															X	X										
P3-4 (40'B)																											X	

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial





### Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction					
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C				
P3-5 (10'A)	X	X													X	X										
P3-5 (10'B)																									X	
P3-6 (5'A)	X	X																								
P3-6 (20'A)	X	X													X											
P3-6 (50'A)	X	X													X											
P4-3 (10'B)																									X	
P4-5 (20'A)	X	X													X											
P4-6 (10'A)	X	X													X	X										
P4-6 (10'B)																										
P4-7 (5'A)	X	X													X											
P4-7 (5'B)																										
P4-7 (25'B)	X	X													X	X										
P4-8 (15'A)																									X	
P4-8 (15'B)	X	X													X	X										
P4-9 (5'A)	X	X																								

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		CU <sup>6</sup>	Atterberg Limits	Proctor Compaction						
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C					
P4-9 (35'B)	X	X														X	X										
BW-1 (20'A)																X	X										
BW-1 (30'A)	X	X																									
BW-2 (10'A)	X	X														X	X										
BW-2 (10'B)																											
BW-3 (5'A)	X	X														X	X										
BW-4 (20'A)																											
BW-4 (20'B)																											

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>6</sup> CU = Consolidated Undrained Triaxial



## Notes

### **Report Revision July 2, 2018:**

This revised report includes all results previously submitted in the report dated June 20, 2018, as well as initial properties test data for sample L2-1 (5'A) and particle size analysis test data for sample L2-1 (15'A). Other than the addition of these test results, no changes were made to the previously submitted data.

### **Sample Receipt:**

Three hundred ninety five samples were hand delivered between April 4, 2018 and May 4, 2018. Ten samples were received, each as loose material in two full 5-gallon buckets sealed with a lid. Fourteen samples were received each as loose material, double-bagged in 1/4 full 1-gallon Ziploc bag. The remaining three hundred seventy one samples were received each in a 2" x 6" brass sleeve sealed with end caps.

### **Sample Preparation and Testing Notes:**

One hundred fifteen samples were tested. Forty nine samples were subjected to initial properties testing. Sixty seven samples were subjected to particle size analysis, forty two of which included hydrometer analysis. Fifteen samples were subjected to Atterberg limits testing. Ten of the samples were subjected to standard proctor compaction testing. And, three samples were selected for 3-stage consolidated undrained triaxial shear testing.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the use of an assumed specific gravity value of 2.65.

### **Consolidated Undrained Triaxial Shear Testing:**

Each of the staged consolidated undrained (CU) triaxial shear tests were performed using a single sample. The test samples were extruded from the sampling sleeves and the ends were trimmed using a blade. Each three-stage CU triaxial shear test was performed using test parameters and effective confining stresses specified by the client.

The first stage was performed by consolidating the sample at the lowest specified effective stress and then shearing to 3% strain, unless there was a clear peak or leveling off of the deviator stress prior to the 3% strain, in which case the Stage 1 test was halted. Upon completion, the specimen was unloaded and returned to the starting pre-compression load. The effective stress was increased to the next highest confining stress for the second stage, and was once again consolidated and sheared to 3% strain unless there was a clear peak or leveling off of the deviator stress prior to the 3% strain, in which case the Stage 2 test was halted. Upon completion, the specimen was unloaded and returned to the starting pre-compression load. The effective stress was then increased to the highest requested confining stress for the third and final stage, and the sample was consolidated and sheared to 15% strain. In all cases 'failure' was interpreted as the peak deviator stress achieved for each stage.

The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
L1-1 (10'A)	6.3	8.7	---	---	1.39	1.47	47.6
L1-2 (20'B)	10.2	17.8	---	---	1.75	1.93	33.9
L1-3 (5'A)	4.2	6.3	---	---	1.50	1.56	43.4
L1-4 (5'B)	7.5	10.6	---	---	1.41	1.52	46.7
L2-1 (5'B)	4.1	7.0	---	---	1.69	1.76	36.3
L2-3 (5'A)	3.8	6.1	---	---	1.61	1.67	39.3
T/O-1 (20'A)	11.4	19.5	---	---	1.71	1.90	35.6
T/O-1 (45'B)	7.2	10.9	---	---	1.51	1.62	42.9
T/O-2 (15'A)	11.3	18.5	---	---	1.63	1.81	38.6
T/O-3 (15'B)	9.9	18.4	---	---	1.87	2.05	29.5
T/O-3 (40'B)	6.8	10.9	---	---	1.61	1.72	39.3
T/O-4 (5'A)	8.9	16.4	---	---	1.86	2.02	30.0

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
T/O-5 (20'A)	6.3	9.4	---	---	1.51	1.60	43.1
T/O-6 (5'A)	6.9	12.0	---	---	1.75	1.87	34.1
TN-2 (20'A)	6.0	7.8	---	---	1.30	1.38	50.8
BS-1 (10'A)	8.4	12.3	---	---	1.46	1.58	44.9
BS-6 (20'A)	7.0	9.5	---	---	1.36	1.45	48.8
TS-1 (5'A)	7.8	14.4	---	---	1.83	1.98	30.8
TS-2 (15'A)	8.9	14.3	---	---	1.60	1.74	39.6
TS-3 (10'A)	6.0	9.6	---	---	1.61	1.70	39.3
TS-4 (10'A)	7.0	13.8	---	---	1.98	2.11	25.4
P1-1 (15'B)	10.0	13.4	---	---	1.35	1.48	49.1
P1-1A (30'A)	3.9	4.8	---	---	1.23	1.28	53.7
P1-2 (50'A)	4.3	6.9	---	---	1.60	1.67	39.7

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
P2-1 (5'A)	13.2	24.6	---	---	1.86	2.10	30.0
P2-1 (25'B)	15.4	25.6	---	---	1.67	1.92	37.1
P3-1 (5'A)	7.3	13.6	---	---	1.86	2.00	29.7
P3-1 (15'A)	9.4	8.8	---	---	0.93	1.02	64.8
P3-2 (10'A)	6.6	11.1	---	---	1.69	1.80	36.2
P3-2 (20'A)	11.3	18.8	---	---	1.67	1.86	37.1
P3-3 (20'A)	8.1	13.7	---	---	1.69	1.83	36.2
P3-3 (40'A)	14.7	26.3	---	---	1.79	2.06	32.3
P3-4 (10'A)	9.3	14.4	---	---	1.54	1.69	41.8
P3-4 (30'A)	6.0	9.1	---	---	1.53	1.62	42.4
P3-4 (40'A)	7.1	13.3	---	---	1.87	2.01	29.3
P3-5 (10'A)	8.3	15.5	---	---	1.85	2.01	30.0

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
P3-6 (5'A)	4.8	7.8	---	---	1.63	1.71	38.4
P3-6 (20'A)	9.3	16.1	---	---	1.73	1.89	34.8
P3-6 (50'A)	6.0	10.7	---	---	1.77	1.88	33.1
P4-5 (20'A)	7.3	12.6	---	---	1.74	1.87	34.4
P4-6 (10'A)	10.0	15.9	---	---	1.59	1.74	40.2
P4-7 (5'A)	9.8	14.6	---	---	1.49	1.64	43.7
P4-7 (25'B)	6.2	11.0	---	---	1.76	1.87	33.5
P4-8 (15'B)	13.0	21.0	---	---	1.62	1.83	38.9
P4-9 (5'A)	4.4	8.3	---	---	1.87	1.95	29.4
P4-9 (35'B)	13.5	22.4	---	---	1.66	1.89	37.3
BW-1 (30'A)	9.3	13.0	---	---	1.40	1.53	47.3
BW-2 (10'A)	5.9	8.9	---	---	1.52	1.61	42.8

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
BW-3 (5'A)	3.8	6.1	---	---	1.62	1.68	38.9

NA = Not analyzed

--- = This sample was not remolded





### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
SA-GM 1B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 1T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 2B	NA	NA	0.071	NA	NA	WS	NA	NA	(Est)
SA-GM 2T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 3B	NA	0.18	0.25	NA	NA	WS	NA	NA	(Est)
SA-GM 3T	NA	0.18	0.37	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 4B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 5B	NA	0.21	0.28	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 5T	0.16	0.38	0.43	2.7	1.3	WS	NA	Sand	
SA-GM 6B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 6T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
SA-GM 7B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 8B	NA	0.12	0.16	NA	NA	WS	NA	NA	(Est)
SA-GM 8T	NA	0.37	0.52	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
L1-1 (10'A)	2.2E-05	0.046	0.061	2773	33	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L1-2 (20'B)	2.8E-05	0.0092	0.015	536	12	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
L1-3 (5'A)	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L1-5 (20'B)	0.0011	0.074	0.093	85	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-1 (5'A)	0.00040	0.045	0.060	150	9.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-1 (15'A)	0.00024	0.056	0.065	271	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-2 (5'A)	0.00019	0.067	0.085	447	60	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-3 (5'A)	0.00094	0.076	0.089	95	26	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
L2-4 (10'B)	3.9E-05	0.045	0.057	1462	65	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-5 (5'A)	4.4E-05	0.0022	0.0047	107	0.50	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay	(Est)
L2-6 (5'A)	0.00031	0.013	0.030	97	0.43	WS/H	Lean clay (CL)	Clay Loam	(Est)
L2-7 (10'A)	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-1 (20'A)	0.00030	0.0088	0.016	53	0.75	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
T/O-1 (45'B)	5.1E-05	0.070	0.099	1941	51	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
T/O-2 (5'A)	0.0025	0.010	0.022	8.8	0.15	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	
T/O-3 (40'A)	0.00083	0.078	0.10	120	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-3 (70'B)	0.00032	0.034	0.045	141	8.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-4 (20'B)	0.00059	0.034	0.050	85	4.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-5 (10'B)	0.0011	0.028	0.039	35	2.3	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
T/O-6 (5'A)	0.00066	0.043	0.054	82	9.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TN-1 (5'A)	0.00074	0.077	0.097	131	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
TN-2 (20'A)	0.00077	0.079	0.10	130	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
BS-1 (10'A)	0.00029	0.052	0.076	262	4.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam (Est)
BS-2 (15'A)	0.0039	0.061	0.082	21	0.61	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam
BS-6 (20'A)	0.00018	0.054	0.062	344	43	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
TS-1 (20'A)	0.0010	0.035	0.048	48	2.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TS-2 (10'A)	0.0019	0.087	0.12	63	3.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam
TS-3 (10'A)	0.00086	0.043	0.051	59	3.9	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TS-4 (5'A)	0.0011	0.11	0.13	118	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P1-1 (5'A)	0.0012	0.13	0.17	142	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup> (Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
P1-2 (30'B)	0.0010	0.11	0.16	160	21	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam † (Est)
P2-1 (25'A)	0.00071	0.087	0.12	169	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P2-2 (5'B)	0.00078	0.089	0.11	141	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P3-1 (5'A)	NA	0.23	0.33	NA	NA	WS	NA	NA † (Est)
P3-2 (15'B)	NA	0.20	0.25	NA	NA	WS	NA	NA (Est)
P3-2 (35'B)	NA	0.15	0.19	NA	NA	WS	NA	NA (Est)
P3-3 (5'A)	NA	0.15	0.19	NA	NA	WS	NA	NA (Est)
P3-3 (40'B)	NA	0.085	0.099	NA	NA	WS	NA	NA (Est)
P3-4 (20'A)	0.11	0.25	0.29	2.6	0.91	WS	NA	Sand
P3-4 (30'A)	0.10	0.19	0.22	2.2	0.89	WS	NA	Sand
P3-4 (40'A)	0.0029	0.072	0.087	30	7.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
P3-5 (10'A)	0.020	0.099	0.12	6.0	2.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand
P3-6 (20'A)	NA	0.20	0.24	NA	NA	WS	NA	NA (Est)
P3-6 (50'A)	NA	0.23	0.30	NA	NA	WS	NA	NA (Est)
P4-5 (20'A)	NA	0.30	0.39	NA	NA	WS	NA	NA <sup>†</sup> (Est)
P4-6 (10'A)	0.0012	0.072	0.084	70	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P4-7 (5'A)	NA	0.077	0.095	NA	NA	WS	NA	NA (Est)
P4-7 (25'B)	0.0052	0.28	0.34	65	9.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand
P4-8 (15'B)	0.0011	0.085	0.13	118	5.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P4-9 (35'B)	6.7E-06	0.061	0.087	1.3E+04	1160	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam <sup>†</sup> (Est)
BW-1 (20'A)	0.0012	0.047	0.083	69	1.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
BW-2 (10'A)	0.00035	0.062	0.084	240	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
BW-3 (5'A)	0.0011	0.080	0.099	90	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
SA-GM 1B	0.0	15.0	85.0		**
SA-GM 1T	0.1	34.3	65.6		**
SA-GM 2B	0.0	39.4	60.6		**
SA-GM 2T	0.0	24.4	75.6		**
SA-GM 3B	0.0	69.0	31.0		**
SA-GM 3T	15.1	48.0	36.9		**
SA-GM 4B	0.0	64.2	35.8		**
SA-GM 5B	14.6	61.8	23.6		**
SA-GM 5T	0.1	94.9	5.1		**
SA-GM 6B	0.0	20.4	79.6		**
SA-GM 6T	0.0	17.6	82.4		**
SA-GM 7B	0.0	62.6	37.4		**
SA-GM 8B	0.0	61.1	38.9		**
SA-GM 8T	13.4	70.7	15.8		**
L1-1 (10'A)	0.0	33.2	43.1	23.7	
L1-2 (20'B)	0.1	2.3	68.1	29.5	

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L1-3 (5'A)	0.0	46.5	40.8	12.7
L1-5 (20'B)	0.0	49.7	37.7	12.6
L2-1 (5'A)	0.0	32.5	49.0	18.5
L2-1 (15'A)	0.0	31.5	50.5	18.0
L2-2 (5'A)	0.0	46.3	37.5	16.2
L2-3 (5'A)	0.0	51.2	36.8	12.1
L2-4 (10'B)	0.0	28.8	50.0	21.2
L2-5 (5'A)	0.0	2.8	48.6	48.6
L2-6 (5'A)	0.0	14.8	55.2	29.9
L2-7 (10'A)	0.0	40.1	48.2	11.7
T/O-1 (20'A)	0.2	3.2	66.0	30.6
T/O-1 (45'B)	0.0	47.9	31.0	21.1
T/O-2 (5'A)	0.0	23.0	71.5	5.5
T/O-3 (40'A)	0.0	51.5	34.4	14.1
T/O-3 (70'B)	0.5	8.7	73.8	17.1
T/O-4 (20'B)	0.0	24.8	57.7	17.5

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.





**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
T/O-5 (10'B)	0.0	10.1	75.3	14.6
T/O-6 (5'A)	0.0	24.3	59.7	16.0
TN-1 (5'A)	0.4	50.9	33.3	15.4
TN-2 (20'A)	0.0	51.9	34.4	13.8
BS-1 (10'A)	0.0	40.8	36.1	23.0
BS-2 (15'A)	0.0	43.0	51.6	5.3
BS-6 (20'A)	0.0	26.3	55.8	17.9
TS-1 (20'A)	0.0	18.2	65.1	16.7
TS-2 (10'A)	0.0	53.9	35.3	10.8
TS-3 (10'A)	0.0	16.1	68.6	15.2
TS-4 (5'A)	0.7	63.1	22.7	13.5
P1-1 (5'A)	18.8	49.8	20.8	10.6
P1-2 (30'B)	20.3	43.0	24.9	11.8
P2-1 (25'A)	0.3	54.0	30.7	15.1
P2-2 (5'B)	5.1	53.2	27.1	14.6
P3-1 (5'A)	19.7	64.9	15.3	**
P3-2 (15'B)	0.0	78.8	21.2	**

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm. 27



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
P3-2 (35'B)	1.1	68.2		30.7	**
P3-3 (5'A)	0.3	67.7		31.9	**
P3-3 (40'B)	1.4	56.3		42.3	**
P3-4 (20'A)	0.0	92.7		7.3	**
P3-4 (30'A)	0.0	92.3		7.7	**
P3-4 (40'A)	0.0	48.1	44.2	7.7	
P3-5 (10'A)	0.0	68.6	27.8	3.6	
P3-6 (20'A)	0.0	85.2		14.8	**
P3-6 (50'A)	7.2	76.4		16.4	**
P4-5 (20'A)	24.9	61.0		14.1	**
P4-6 (10'A)	0.0	48.0	41.0	11.0	
P4-7 (5'A)	7.2	43.9		49.0	**
P4-7 (25'B)	0.0	77.0	17.5	5.5	
P4-8 (15'B)	0.5	51.9	35.5	12.1	
P4-9 (35'B)	15.7	26.6	46.4	11.4	
BW-1 (20'A)	0.0	45.4	34.9	19.7	
BW-2 (10'A)	0.0	44.1	38.1	17.8	
BW-3 (5'A)	0.0	53.1	35.9	11.0	

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)	---	---	---	ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)	---	---	---	ML
P1-1 (10'A)	---	---	---	ML
P1-2 (15'A)	---	---	---	ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)	---	---	---	ML
P3-3 (40'A)	---	---	---	ML
P3-4 (40'B)	---	---	---	ML
P3-5 (10'B)	---	---	---	ML
P3-6 (50'A)	---	---	---	ML
P4-8 (15'A)	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
L1 Auger Cuttings (1 & 2)	14.6	1.81	---	---
L2 Auger Cuttings (1 & 2)	14.1	1.81	---	---
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	1.83	---	---
Topsoil North Cuttings (1 & 2)	12.6	1.89	---	---
Borrow South Cuttings (1 & 2)	13.0	1.84	---	---
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	1.81	12.3	1.92
Borrow West Auger Cuttings (1 & 2)	12.7	1.87	---	---
P1-2 Auger Cuttings	12.8	1.82	---	---
P3 Auger Cuttings (1 & 2)	9.9	1.96	9.2	2.00
P4 Auger Cuttings (1 & 2)	11.1	1.94	9.0	2.05

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



**Summary of Consolidated Undrained (CU) Triaxial Shear Testing**

Sample Number	Effective Consolidation Stress (psi)	Effective Minor Stress at Failure (psi)	Effective Major Stress at Failure (psi)	Pore-Water Pressure at Failure (psi)	Total Minor Stress at Failure (psi)	Total Major Stress at Failure (psi)	% Strain at Failure*
L2-1 (15'A) CU Stage 1 (6.0 psi)	6.0	2.5	8.4	75.0	77.6	83.4	2.12
L2-1 (15'A) CU Stage 2 (12.0 psi)	12.0	5.0	18.0	78.6	83.6	96.6	2.96
L2-1 (15'A) CU Stage 3 (24.0 psi)	24.0	9.6	35.8	86.1	95.6	121.9	7.73
L2-5 (5'B) CU Stage 1 (2.0 psi)	2.0	0.7	5.2	81.9	82.7	87.1	1.88
L2-5 (5'B) CU Stage 2 (4.0 psi)	4.0	2.0	9.4	82.5	84.6	91.9	0.97
L2-5 (5'B) CU Stage 3 (8.0 psi)	8.0	3.3	15.4	85.4	88.7	100.9	1.13
L2-6 (10'B) CU Stage 1 (3.5 psi)	3.5	2.1	3.5	83.0	85.1	86.4	0.69
L2-6 (10'B) CU Stage 2 (7.1 psi)	7.1	3.2	10.3	85.5	88.6	95.8	3.02
L2-6 (10'B) CU Stage 3 (14.0 psi)	14.0	6.0	22.4	89.7	95.7	112.1	11.74

\*Noted percent strain used as failure criterion.



**Summary of Consolidated Undrained Estimated Effective Friction Angle and Cohesion**

Sample Number	c' Cohesion (psi)	$\phi'$ Friction Angle (°)
L2-1 (15'A) CU	0	35
L2-5 (5'B) CU	0.9	35.8
L2-6 (10'B) CU	0	32.3

---

<sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

## **Initial Properties**



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
L1-1 (10'A)	6.3	8.7	---	---	1.39	1.47	47.6
L1-2 (20'B)	10.2	17.8	---	---	1.75	1.93	33.9
L1-3 (5'A)	4.2	6.3	---	---	1.50	1.56	43.4
L1-4 (5'B)	7.5	10.6	---	---	1.41	1.52	46.7
L2-1 (5'B)	4.1	7.0	---	---	1.69	1.76	36.3
L2-3 (5'A)	3.8	6.1	---	---	1.61	1.67	39.3
T/O-1 (20'A)	11.4	19.5	---	---	1.71	1.90	35.6
T/O-1 (45'B)	7.2	10.9	---	---	1.51	1.62	42.9
T/O-2 (15'A)	11.3	18.5	---	---	1.63	1.81	38.6
T/O-3 (15'B)	9.9	18.4	---	---	1.87	2.05	29.5
T/O-3 (40'B)	6.8	10.9	---	---	1.61	1.72	39.3
T/O-4 (5'A)	8.9	16.4	---	---	1.86	2.02	30.0

NA = Not analyzed

--- = This sample was not remolded





**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
T/O-5 (20'A)	6.3	9.4	---	---	1.51	1.60	43.1
T/O-6 (5'A)	6.9	12.0	---	---	1.75	1.87	34.1
TN-2 (20'A)	6.0	7.8	---	---	1.30	1.38	50.8
BS-1 (10'A)	8.4	12.3	---	---	1.46	1.58	44.9
BS-6 (20'A)	7.0	9.5	---	---	1.36	1.45	48.8
TS-1 (5'A)	7.8	14.4	---	---	1.83	1.98	30.8
TS-2 (15'A)	8.9	14.3	---	---	1.60	1.74	39.6
TS-3 (10'A)	6.0	9.6	---	---	1.61	1.70	39.3
TS-4 (10'A)	7.0	13.8	---	---	1.98	2.11	25.4
P1-1 (15'B)	10.0	13.4	---	---	1.35	1.48	49.1
P1-1A (30'A)	3.9	4.8	---	---	1.23	1.28	53.7
P1-2 (50'A)	4.3	6.9	---	---	1.60	1.67	39.7

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
P2-1 (5'A)	13.2	24.6	---	---	1.86	2.10	30.0
P2-1 (25'B)	15.4	25.6	---	---	1.67	1.92	37.1
P3-1 (5'A)	7.3	13.6	---	---	1.86	2.00	29.7
P3-1 (15'A)	9.4	8.8	---	---	0.93	1.02	64.8
P3-2 (10'A)	6.6	11.1	---	---	1.69	1.80	36.2
P3-2 (20'A)	11.3	18.8	---	---	1.67	1.86	37.1
P3-3 (20'A)	8.1	13.7	---	---	1.69	1.83	36.2
P3-3 (40'A)	14.7	26.3	---	---	1.79	2.06	32.3
P3-4 (10'A)	9.3	14.4	---	---	1.54	1.69	41.8
P3-4 (30'A)	6.0	9.1	---	---	1.53	1.62	42.4
P3-4 (40'A)	7.1	13.3	---	---	1.87	2.01	29.3
P3-5 (10'A)	8.3	15.5	---	---	1.85	2.01	30.0

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
P3-6 (5'A)	4.8	7.8	---	---	1.63	1.71	38.4
P3-6 (20'A)	9.3	16.1	---	---	1.73	1.89	34.8
P3-6 (50'A)	6.0	10.7	---	---	1.77	1.88	33.1
P4-5 (20'A)	7.3	12.6	---	---	1.74	1.87	34.4
P4-6 (10'A)	10.0	15.9	---	---	1.59	1.74	40.2
P4-7 (5'A)	9.8	14.6	---	---	1.49	1.64	43.7
P4-7 (25'B)	6.2	11.0	---	---	1.76	1.87	33.5
P4-8 (15'B)	13.0	21.0	---	---	1.62	1.83	38.9
P4-9 (5'A)	4.4	8.3	---	---	1.87	1.95	29.4
P4-9 (35'B)	13.5	22.4	---	---	1.66	1.89	37.3
BW-1 (30'A)	9.3	13.0	---	---	1.40	1.53	47.3
BW-2 (10'A)	5.9	8.9	---	---	1.52	1.61	42.8

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
BW-3 (5'A)	3.8	6.1	---	---	1.62	1.68	38.9

NA = Not analyzed

--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	584.09	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	294.41	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	272.52	
Sample volume (cm <sup>3</sup> ):	196.40	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	6.3
Volumetric Moisture Content (% vol):	8.7
Dry bulk density (g/cm <sup>3</sup> ):	1.39
Wet bulk density (g/cm <sup>3</sup> ):	1.47
Calculated Porosity (% vol):	47.6
Percent Saturation:	18.3

---

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: L1-2 (20'B)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L1-3 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	736.63	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	283.35	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	434.95	
Sample volume (cm <sup>3</sup> ):	289.93	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	4.2
Volumetric Moisture Content (% vol):	6.3
Dry bulk density (g/cm <sup>3</sup> ):	1.50
Wet bulk density (g/cm <sup>3</sup> ):	1.56
Calculated Porosity (% vol):	43.4
Percent Saturation:	14.6

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L1-4 (5'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	720.27	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	295.01	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	395.59	
Sample volume (cm <sup>3</sup> ):	279.95	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	7.5
Volumetric Moisture Content (% vol):	10.6
Dry bulk density (g/cm <sup>3</sup> ):	1.41
Wet bulk density (g/cm <sup>3</sup> ):	1.52
Calculated Porosity (% vol):	46.7
Percent Saturation:	22.7

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded





### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (5'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	25-Jun-18	---
Field weight* of sample (g):	43.78	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	6.50	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	35.80	
Sample volume (cm <sup>3</sup> ):	21.20	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	4.1
Volumetric Moisture Content (% vol):	7.0
Dry bulk density (g/cm <sup>3</sup> ):	1.69
Wet bulk density (g/cm <sup>3</sup> ):	1.76
Calculated Porosity (% vol):	36.3
Percent Saturation:	19.2

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: L2-3 (5'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: T/O-1 (20'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	771.59	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	268.53	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	451.54	
Sample volume (cm <sup>3</sup> ):	264.39	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	11.4
Volumetric Moisture Content (% vol):	19.5
Dry bulk density (g/cm <sup>3</sup> ):	1.71
Wet bulk density (g/cm <sup>3</sup> ):	1.90
Calculated Porosity (% vol):	35.6
Percent Saturation:	54.8

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: T/O-1 (45'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	757.08	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	284.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	440.68	
Sample volume (cm <sup>3</sup> ):	291.25	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	7.2
Volumetric Moisture Content (% vol):	10.9
Dry bulk density (g/cm <sup>3</sup> ):	1.51
Wet bulk density (g/cm <sup>3</sup> ):	1.62
Calculated Porosity (% vol):	42.9
Percent Saturation:	25.5

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: T/O-2 (15'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: T/O-3 (15'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	772.95	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	268.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	459.12	
Sample volume (cm <sup>3</sup> ):	245.75	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.9
Volumetric Moisture Content (% vol):	18.4
Dry bulk density (g/cm <sup>3</sup> ):	1.87
Wet bulk density (g/cm <sup>3</sup> ):	2.05
Calculated Porosity (% vol):	29.5
Percent Saturation:	62.5

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: T/O-3 (40'B)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm³), and Assumed particle density (g/cm³).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm³), Wet bulk density (g/cm³), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: T/O-4 (5'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded





Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: T/O-5 (20'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: T/O-6 (5'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TN-2 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	577.54	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	284.28	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	276.75	
Sample volume (cm <sup>3</sup> ):	212.09	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	6.0
Volumetric Moisture Content (% vol):	7.8
Dry bulk density (g/cm <sup>3</sup> ):	1.30
Wet bulk density (g/cm <sup>3</sup> ):	1.38
Calculated Porosity (% vol):	50.8
Percent Saturation:	15.3

---

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

**Comments:**

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: BS-1 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	730.69	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	268.40	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	426.30	
Sample volume (cm <sup>3</sup> ):	291.88	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	8.4
Volumetric Moisture Content (% vol):	12.3
Dry bulk density (g/cm <sup>3</sup> ):	1.46
Wet bulk density (g/cm <sup>3</sup> ):	1.58
Calculated Porosity (% vol):	44.9
Percent Saturation:	27.5

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-6 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	660.78	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	263.67	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	371.11	
Sample volume (cm <sup>3</sup> ):	273.57	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	7.0
Volumetric Moisture Content (% vol):	9.5
Dry bulk density (g/cm <sup>3</sup> ):	1.36
Wet bulk density (g/cm <sup>3</sup> ):	1.45
Calculated Porosity (% vol):	48.8
Percent Saturation:	19.5

---

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: TS-1 (5'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: TS-2 (15'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: TS-3 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	790.32	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	292.26	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	470.01	
Sample volume (cm <sup>3</sup> ):	292.17	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	6.0
Volumetric Moisture Content (% vol):	9.6
Dry bulk density (g/cm <sup>3</sup> ):	1.61
Wet bulk density (g/cm <sup>3</sup> ):	1.70
Calculated Porosity (% vol):	39.3
Percent Saturation:	24.4

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded





Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: TS-4 (10'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-1 (15'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	686.24	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	297.38	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	353.60	
Sample volume (cm <sup>3</sup> ):	262.30	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	10.0
Volumetric Moisture Content (% vol):	13.4
Dry bulk density (g/cm <sup>3</sup> ):	1.35
Wet bulk density (g/cm <sup>3</sup> ):	1.48
Calculated Porosity (% vol):	49.1
Percent Saturation:	27.4

---

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines

**Comments:**

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P1-1A (30'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	553.07	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	269.55	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	272.79	
Sample volume (cm <sup>3</sup> ):	222.18	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	3.9
Volumetric Moisture Content (% vol):	4.8
Dry bulk density (g/cm <sup>3</sup> ):	1.23
Wet bulk density (g/cm <sup>3</sup> ):	1.28
Calculated Porosity (% vol):	53.7
Percent Saturation:	9.0

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P1-2 (50'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm³), and Assumed particle density (g/cm³).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm³), Wet bulk density (g/cm³), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P2-1 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	862.56	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	269.31	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	523.86	
Sample volume (cm <sup>3</sup> ):	282.39	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	13.2
Volumetric Moisture Content (% vol):	24.6
Dry bulk density (g/cm <sup>3</sup> ):	1.86
Wet bulk density (g/cm <sup>3</sup> ):	2.10
Calculated Porosity (% vol):	30.0
Percent Saturation:	81.9

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P2-1 (25'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	22-May-18	---
Field weight* of sample (g):	739.39	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	209.29	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	459.48	
Sample volume (cm <sup>3</sup> ):	275.50	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	15.4
Volumetric Moisture Content (% vol):	25.6
Dry bulk density (g/cm <sup>3</sup> ):	1.67
Wet bulk density (g/cm <sup>3</sup> ):	1.92
Calculated Porosity (% vol):	37.1
Percent Saturation:	69.2

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-1 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	16-May-18	---
Field weight* of sample (g):	789.58	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	208.68	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	541.45	
Sample volume (cm <sup>3</sup> ):	290.47	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	7.3
Volumetric Moisture Content (% vol):	13.6
Dry bulk density (g/cm <sup>3</sup> ):	1.86
Wet bulk density (g/cm <sup>3</sup> ):	2.00
Calculated Porosity (% vol):	29.7
Percent Saturation:	45.8

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-1 (15'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	15-May-18	---
Field weight* of sample (g):	555.60	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	258.76	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	271.23	
Sample volume (cm <sup>3</sup> ):	290.68	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.4
Volumetric Moisture Content (% vol):	8.8
Dry bulk density (g/cm <sup>3</sup> ):	0.93
Wet bulk density (g/cm <sup>3</sup> ):	1.02
Calculated Porosity (% vol):	64.8
Percent Saturation:	13.6

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded





### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-2 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	792.24	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	298.95	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	462.96	
Sample volume (cm <sup>3</sup> ):	273.96	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	6.6
Volumetric Moisture Content (% vol):	11.1
Dry bulk density (g/cm <sup>3</sup> ):	1.69
Wet bulk density (g/cm <sup>3</sup> ):	1.80
Calculated Porosity (% vol):	36.2
Percent Saturation:	30.6

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P3-2 (20'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P3-3 (20'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-3 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	16-May-18	---
Field weight* of sample (g):	813.73	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	213.53	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	523.50	
Sample volume (cm <sup>3</sup> ):	291.74	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	14.7
Volumetric Moisture Content (% vol):	26.3
Dry bulk density (g/cm <sup>3</sup> ):	1.79
Wet bulk density (g/cm <sup>3</sup> ):	2.06
Calculated Porosity (% vol):	32.3
Percent Saturation:	81.4

---

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-4 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	15-May-18	---
Field weight* of sample (g):	706.80	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	213.41	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	451.37	
Sample volume (cm <sup>3</sup> ):	292.80	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.3
Volumetric Moisture Content (% vol):	14.4
Dry bulk density (g/cm <sup>3</sup> ):	1.54
Wet bulk density (g/cm <sup>3</sup> ):	1.69
Calculated Porosity (% vol):	41.8
Percent Saturation:	34.3

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P3-4 (30'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: E. Bastien
Data entered by: C. Krous
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P3-4 (40'A)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Parameter, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-5 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	867.36	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	292.86	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	530.27	
Sample volume (cm <sup>3</sup> ):	285.93	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	8.3
Volumetric Moisture Content (% vol):	15.5
Dry bulk density (g/cm <sup>3</sup> ):	1.85
Wet bulk density (g/cm <sup>3</sup> ):	2.01
Calculated Porosity (% vol):	30.0
Percent Saturation:	51.5

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded





### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-6 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	22-May-18	---
Field weight* of sample (g):	660.32	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	263.20	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	378.94	
Sample volume (cm <sup>3</sup> ):	232.31	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	4.8
Volumetric Moisture Content (% vol):	7.8
Dry bulk density (g/cm <sup>3</sup> ):	1.63
Wet bulk density (g/cm <sup>3</sup> ):	1.71
Calculated Porosity (% vol):	38.4
Percent Saturation:	20.4

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-6 (20'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	15-May-18	---
Field weight* of sample (g):	764.00	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	212.68	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	504.36	
Sample volume (cm <sup>3</sup> ):	291.86	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.3
Volumetric Moisture Content (% vol):	16.1
Dry bulk density (g/cm <sup>3</sup> ):	1.73
Wet bulk density (g/cm <sup>3</sup> ):	1.89
Calculated Porosity (% vol):	34.8
Percent Saturation:	46.2

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-6 (50'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	758.56	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	210.96	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	516.43	
Sample volume (cm <sup>3</sup> ):	291.09	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	6.0
Volumetric Moisture Content (% vol):	10.7
Dry bulk density (g/cm <sup>3</sup> ):	1.77
Wet bulk density (g/cm <sup>3</sup> ):	1.88
Calculated Porosity (% vol):	33.1
Percent Saturation:	32.4

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P4-5 (20'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	16-May-18	---
Field weight* of sample (g):	710.57	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	210.11	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	466.53	
Sample volume (cm <sup>3</sup> ):	268.31	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	7.3
Volumetric Moisture Content (% vol):	12.6
Dry bulk density (g/cm <sup>3</sup> ):	1.74
Wet bulk density (g/cm <sup>3</sup> ):	1.87
Calculated Porosity (% vol):	34.4
Percent Saturation:	36.8

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P4-6 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	795.13	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	286.81	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	462.06	
Sample volume (cm <sup>3</sup> ):	291.36	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	10.0
Volumetric Moisture Content (% vol):	15.9
Dry bulk density (g/cm <sup>3</sup> ):	1.59
Wet bulk density (g/cm <sup>3</sup> ):	1.74
Calculated Porosity (% vol):	40.2
Percent Saturation:	39.5

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P4-7 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	16-May-18	---
Field weight* of sample (g):	638.50	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	207.42	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	392.69	
Sample volume (cm <sup>3</sup> ):	263.40	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.8
Volumetric Moisture Content (% vol):	14.6
Dry bulk density (g/cm <sup>3</sup> ):	1.49
Wet bulk density (g/cm <sup>3</sup> ):	1.64
Calculated Porosity (% vol):	43.7
Percent Saturation:	33.3

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P4-7 (25'B)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P4-8 (15'B)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded





### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P4-9 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	792.93	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	267.28	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	503.41	
Sample volume (cm <sup>3</sup> ):	269.21	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	4.4
Volumetric Moisture Content (% vol):	8.3
Dry bulk density (g/cm <sup>3</sup> ):	1.87
Wet bulk density (g/cm <sup>3</sup> ):	1.95
Calculated Porosity (% vol):	29.4
Percent Saturation:	28.1

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc
Job Number: DB18.1151.00
Sample Number: P4-9 (35'B)
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm³), and Assumed particle density (g/cm³).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm³), Wet bulk density (g/cm³), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: BW-1 (30'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	23-May-18	---
Field weight* of sample (g):	714.17	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	284.25	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	393.38	
Sample volume (cm <sup>3</sup> ):	281.54	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	9.3
Volumetric Moisture Content (% vol):	13.0
Dry bulk density (g/cm <sup>3</sup> ):	1.40
Wet bulk density (g/cm <sup>3</sup> ):	1.53
Calculated Porosity (% vol):	47.3
Percent Saturation:	27.5

---

Laboratory analysis by: A. Bland  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: BW-2 (10'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	751.25	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	283.91	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	441.31	
Sample volume (cm <sup>3</sup> ):	290.92	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	5.9
Volumetric Moisture Content (% vol):	8.9
Dry bulk density (g/cm <sup>3</sup> ):	1.52
Wet bulk density (g/cm <sup>3</sup> ):	1.61
Calculated Porosity (% vol):	42.8
Percent Saturation:	20.9

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: BW-3 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

	<u>As Received</u>	<u>Remolded</u>
Test Date:	10-May-18	---
Field weight* of sample (g):	756.43	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	268.23	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	470.38	
Sample volume (cm <sup>3</sup> ):	290.70	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	3.8
Volumetric Moisture Content (% vol):	6.1
Dry bulk density (g/cm <sup>3</sup> ):	1.62
Wet bulk density (g/cm <sup>3</sup> ):	1.68
Calculated Porosity (% vol):	38.9
Percent Saturation:	15.7

---

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines

Comments:

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded

# Particle Size Analysis



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
SA-GM 1B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 1T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 2B	NA	NA	0.071	NA	NA	WS	NA	NA	(Est)
SA-GM 2T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 3B	NA	0.18	0.25	NA	NA	WS	NA	NA	(Est)
SA-GM 3T	NA	0.18	0.37	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 4B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 5B	NA	0.21	0.28	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 5T	0.16	0.38	0.43	2.7	1.3	WS	NA	Sand	
SA-GM 6B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 6T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
SA-GM 7B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 8B	NA	0.12	0.16	NA	NA	WS	NA	NA	(Est)
SA-GM 8T	NA	0.37	0.52	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
L1-1 (10'A)	2.2E-05	0.046	0.061	2773	33	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L1-2 (20'B)	2.8E-05	0.0092	0.015	536	12	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
L1-3 (5'A)	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L1-5 (20'B)	0.0011	0.074	0.093	85	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-1 (5'A)	0.00040	0.045	0.060	150	9.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-1 (15'A)	0.00024	0.056	0.065	271	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-2 (5'A)	0.00019	0.067	0.085	447	60	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-3 (5'A)	0.00094	0.076	0.089	95	26	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material





**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
L2-4 (10'B)	3.9E-05	0.045	0.057	1462	65	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-5 (5'A)	4.4E-05	0.0022	0.0047	107	0.50	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay	(Est)
L2-6 (5'A)	0.00031	0.013	0.030	97	0.43	WS/H	Lean clay (CL)	Clay Loam	(Est)
L2-7 (10'A)	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-1 (20'A)	0.00030	0.0088	0.016	53	0.75	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
T/O-1 (45'B)	5.1E-05	0.070	0.099	1941	51	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
T/O-2 (5'A)	0.0025	0.010	0.022	8.8	0.15	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	
T/O-3 (40'A)	0.00083	0.078	0.10	120	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-3 (70'B)	0.00032	0.034	0.045	141	8.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-4 (20'B)	0.00059	0.034	0.050	85	4.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-5 (10'B)	0.0011	0.028	0.039	35	2.3	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
T/O-6 (5'A)	0.00066	0.043	0.054	82	9.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TN-1 (5'A)	0.00074	0.077	0.097	131	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
TN-2 (20'A)	0.00077	0.079	0.10	130	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
BS-1 (10'A)	0.00029	0.052	0.076	262	4.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam (Est)
BS-2 (15'A)	0.0039	0.061	0.082	21	0.61	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam
BS-6 (20'A)	0.00018	0.054	0.062	344	43	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
TS-1 (20'A)	0.0010	0.035	0.048	48	2.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TS-2 (10'A)	0.0019	0.087	0.12	63	3.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam
TS-3 (10'A)	0.00086	0.043	0.051	59	3.9	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
TS-4 (5'A)	0.0011	0.11	0.13	118	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P1-1 (5'A)	0.0012	0.13	0.17	142	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup> (Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
P1-2 (30'B)	0.0010	0.11	0.16	160	21	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam † (Est)
P2-1 (25'A)	0.00071	0.087	0.12	169	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P2-2 (5'B)	0.00078	0.089	0.11	141	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P3-1 (5'A)	NA	0.23	0.33	NA	NA	WS	NA	NA † (Est)
P3-2 (15'B)	NA	0.20	0.25	NA	NA	WS	NA	NA (Est)
P3-2 (35'B)	NA	0.15	0.19	NA	NA	WS	NA	NA (Est)
P3-3 (5'A)	NA	0.15	0.19	NA	NA	WS	NA	NA (Est)
P3-3 (40'B)	NA	0.085	0.099	NA	NA	WS	NA	NA (Est)
P3-4 (20'A)	0.11	0.25	0.29	2.6	0.91	WS	NA	Sand
P3-4 (30'A)	0.10	0.19	0.22	2.2	0.89	WS	NA	Sand
P3-4 (40'A)	0.0029	0.072	0.087	30	7.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
P3-5 (10'A)	0.020	0.099	0.12	6.0	2.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand
P3-6 (20'A)	NA	0.20	0.24	NA	NA	WS	NA	NA (Est)
P3-6 (50'A)	NA	0.23	0.30	NA	NA	WS	NA	NA (Est)
P4-5 (20'A)	NA	0.30	0.39	NA	NA	WS	NA	NA <sup>†</sup> (Est)
P4-6 (10'A)	0.0012	0.072	0.084	70	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P4-7 (5'A)	NA	0.077	0.095	NA	NA	WS	NA	NA (Est)
P4-7 (25'B)	0.0052	0.28	0.34	65	9.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand
P4-8 (15'B)	0.0011	0.085	0.13	118	5.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
P4-9 (35'B)	6.7E-06	0.061	0.087	1.3E+04	1160	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam <sup>†</sup> (Est)
BW-1 (20'A)	0.0012	0.047	0.083	69	1.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam (Est)
BW-2 (10'A)	0.00035	0.062	0.084	240	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)
BW-3 (5'A)	0.0011	0.080	0.099	90	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam (Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
SA-GM 1B	0.0	15.0	85.0		**
SA-GM 1T	0.1	34.3	65.6		**
SA-GM 2B	0.0	39.4	60.6		**
SA-GM 2T	0.0	24.4	75.6		**
SA-GM 3B	0.0	69.0	31.0		**
SA-GM 3T	15.1	48.0	36.9		**
SA-GM 4B	0.0	64.2	35.8		**
SA-GM 5B	14.6	61.8	23.6		**
SA-GM 5T	0.1	94.9	5.1		**
SA-GM 6B	0.0	20.4	79.6		**
SA-GM 6T	0.0	17.6	82.4		**
SA-GM 7B	0.0	62.6	37.4		**
SA-GM 8B	0.0	61.1	38.9		**
SA-GM 8T	13.4	70.7	15.8		**
L1-1 (10'A)	0.0	33.2	43.1	23.7	
L1-2 (20'B)	0.1	2.3	68.1	29.5	

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L1-3 (5'A)	0.0	46.5	40.8	12.7
L1-5 (20'B)	0.0	49.7	37.7	12.6
L2-1 (5'A)	0.0	32.5	49.0	18.5
L2-1 (15'A)	0.0	31.5	50.5	18.0
L2-2 (5'A)	0.0	46.3	37.5	16.2
L2-3 (5'A)	0.0	51.2	36.8	12.1
L2-4 (10'B)	0.0	28.8	50.0	21.2
L2-5 (5'A)	0.0	2.8	48.6	48.6
L2-6 (5'A)	0.0	14.8	55.2	29.9
L2-7 (10'A)	0.0	40.1	48.2	11.7
T/O-1 (20'A)	0.2	3.2	66.0	30.6
T/O-1 (45'B)	0.0	47.9	31.0	21.1
T/O-2 (5'A)	0.0	23.0	71.5	5.5
T/O-3 (40'A)	0.0	51.5	34.4	14.1
T/O-3 (70'B)	0.5	8.7	73.8	17.1
T/O-4 (20'B)	0.0	24.8	57.7	17.5

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
T/O-5 (10'B)	0.0	10.1	75.3	14.6
T/O-6 (5'A)	0.0	24.3	59.7	16.0
TN-1 (5'A)	0.4	50.9	33.3	15.4
TN-2 (20'A)	0.0	51.9	34.4	13.8
BS-1 (10'A)	0.0	40.8	36.1	23.0
BS-2 (15'A)	0.0	43.0	51.6	5.3
BS-6 (20'A)	0.0	26.3	55.8	17.9
TS-1 (20'A)	0.0	18.2	65.1	16.7
TS-2 (10'A)	0.0	53.9	35.3	10.8
TS-3 (10'A)	0.0	16.1	68.6	15.2
TS-4 (5'A)	0.7	63.1	22.7	13.5
P1-1 (5'A)	18.8	49.8	20.8	10.6
P1-2 (30'B)	20.3	43.0	24.9	11.8
P2-1 (25'A)	0.3	54.0	30.7	15.1
P2-2 (5'B)	5.1	53.2	27.1	14.6
P3-1 (5'A)	19.7	64.9	15.3	**
P3-2 (15'B)	0.0	78.8	21.2	**

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm. 97



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
P3-2 (35'B)	1.1	68.2	30.7		**
P3-3 (5'A)	0.3	67.7	31.9		**
P3-3 (40'B)	1.4	56.3	42.3		**
P3-4 (20'A)	0.0	92.7	7.3		**
P3-4 (30'A)	0.0	92.3	7.7		**
P3-4 (40'A)	0.0	48.1	44.2	7.7	
P3-5 (10'A)	0.0	68.6	27.8	3.6	
P3-6 (20'A)	0.0	85.2	14.8		**
P3-6 (50'A)	7.2	76.4	16.4		**
P4-5 (20'A)	24.9	61.0	14.1		**
P4-6 (10'A)	0.0	48.0	41.0	11.0	
P4-7 (5'A)	7.2	43.9	49.0		**
P4-7 (25'B)	0.0	77.0	17.5	5.5	
P4-8 (15'B)	0.5	51.9	35.5	12.1	
P4-9 (35'B)	15.7	26.6	46.4	11.4	
BW-1 (20'A)	0.0	45.4	34.9	19.7	
BW-2 (10'A)	0.0	44.1	38.1	17.8	
BW-3 (5'A)	0.0	53.1	35.9	11.0	

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

\*\*Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 402.69
Job Number: DB18.1151.00	Weight Passing #10 (g): 402.69
Sample Number: SA-GM 1B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 83.95
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 83.95
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	402.69	100.00
	2"	50	0.00	0.00	402.69	100.00
	1.5"	38.1	0.00	0.00	402.69	100.00
	1"	25	0.00	0.00	402.69	100.00
	3/4"	19.0	0.00	0.00	402.69	100.00
	3/8"	9.5	0.00	0.00	402.69	100.00
	4	4.75	0.00	0.00	402.69	100.00
	10	2.00	0.00	0.00	402.69	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.08	0.08	83.87	99.90
	40	0.425	0.32	0.40	83.55	99.52
	60	0.250	0.27	0.67	83.28	99.20
	140	0.106	4.87	5.54	78.41	93.40
	200	0.075	7.02	12.56	71.39	85.04
	dry pan			1.72	14.28	69.67
wet pan				69.67	0.00	

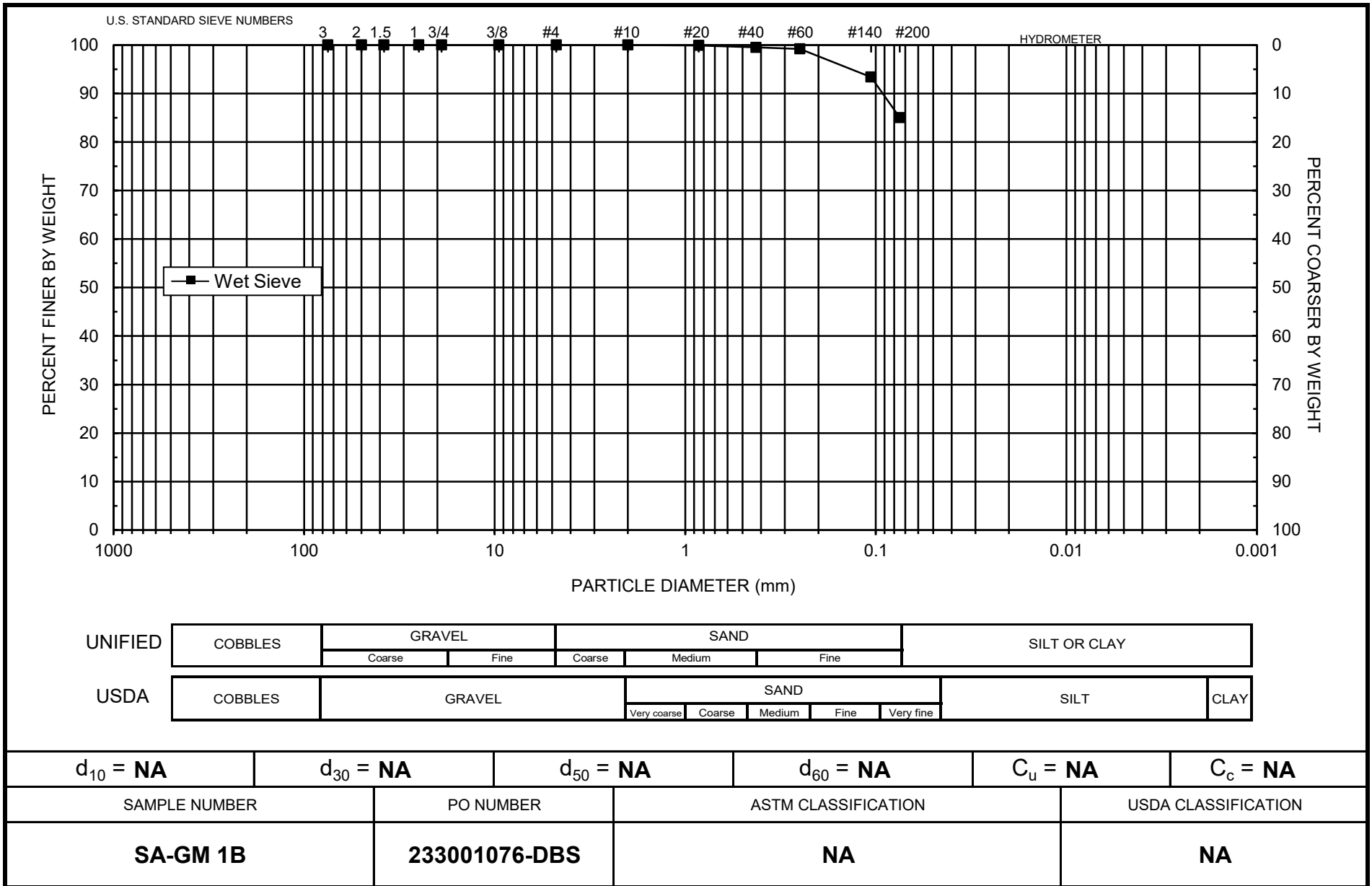
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): NA  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): NA

Median Particle Diameter--d<sub>50</sub> (mm): NA  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 394.50
Job Number: DB18.1151.00	Weight Passing #10 (g): 393.94
Sample Number: SA-GM 1T	Weight Retained #10 (g): 0.56
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 55.40
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 55.48
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	394.50	100.00
	2"	50	0.00	0.00	394.50	100.00
	1.5"	38.1	0.00	0.00	394.50	100.00
	1"	25	0.00	0.00	394.50	100.00
	3/4"	19.0	0.00	0.00	394.50	100.00
	3/8"	9.5	0.00	0.00	394.50	100.00
	4	4.75	0.23	0.23	394.27	99.94
	10	2.00	0.33	0.56	393.94	99.86
-10	(Based on calculated sieve wt.)					
	20	0.85	1.93	2.01	53.47	96.38
	40	0.425	1.51	3.52	51.96	93.66
	60	0.250	1.32	4.84	50.64	91.28
	140	0.106	7.96	12.80	42.68	76.93
	200	0.075	6.29	19.09	36.39	65.59
	dry pan			1.81	20.90	34.58
wet pan				34.58	0.00	

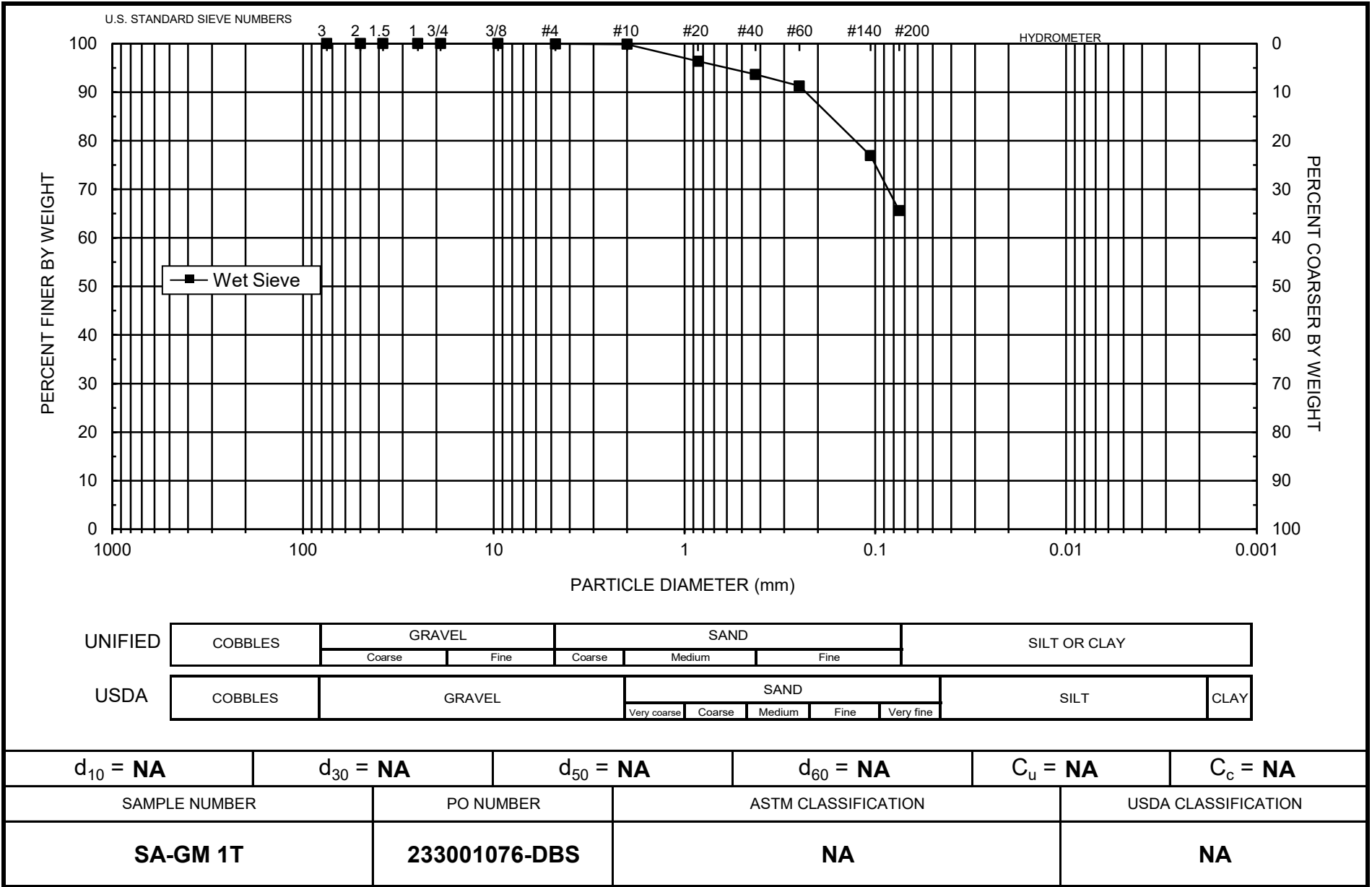
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): NA  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): NA  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 632.00
Job Number: DB18.1151.00	Weight Passing #10 (g): 632.00
Sample Number: SA-GM 2B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 53.48
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 53.48
Test Date: 25-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	632.00	100.00
	2"	50	0.00	0.00	632.00	100.00
	1.5"	38.1	0.00	0.00	632.00	100.00
	1"	25	0.00	0.00	632.00	100.00
	3/4"	19.0	0.00	0.00	632.00	100.00
	3/8"	9.5	0.00	0.00	632.00	100.00
	4	4.75	0.00	0.00	632.00	100.00
	10	2.00	0.00	0.00	632.00	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.14	0.14	53.34	99.74
	40	0.425	1.32	1.46	52.02	97.27
	60	0.250	5.06	6.52	46.96	87.81
	140	0.106	12.46	18.98	34.50	64.51
	200	0.075	2.11	21.09	32.39	60.56
	dry pan			0.21	21.30	32.18
wet pan				32.18	0.00	

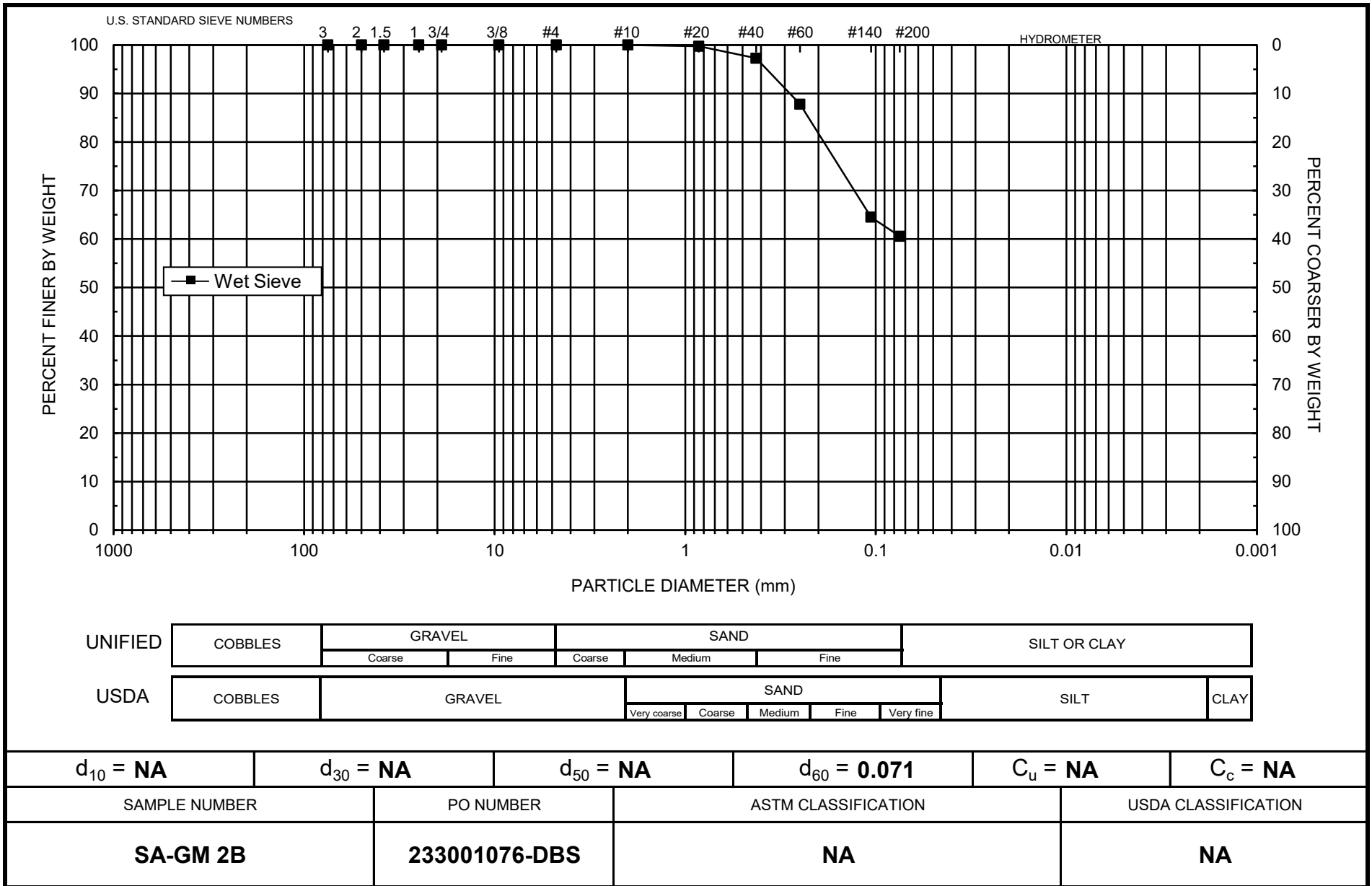
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.071  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.22

Median Particle Diameter--d<sub>50</sub> (mm): NA  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: SA-GM 2T  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 544.47  
 Weight Passing #10 (g): 544.47  
 Weight Retained #10 (g): 0.00  
 Wt. of -10 Sieve Sample (g): 60.16  
 Calculated Weight of Sieve Sample (g): 60.16  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	544.47	100.00
	2"	50	0.00	0.00	544.47	100.00
	1.5"	38.1	0.00	0.00	544.47	100.00
	1"	25	0.00	0.00	544.47	100.00
	3/4"	19.0	0.00	0.00	544.47	100.00
	3/8"	9.5	0.00	0.00	544.47	100.00
	4	4.75	0.00	0.00	544.47	100.00
	10	2.00	0.00	0.00	544.47	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.13	0.13	60.03	99.78
	40	0.425	0.36	0.49	59.67	99.19
	60	0.250	1.16	1.65	58.51	97.26
	140	0.106	8.90	10.55	49.61	82.46
	200	0.075	4.11	14.66	45.50	75.63
	dry pan			0.38	15.04	45.12
wet pan				45.12	0.00	

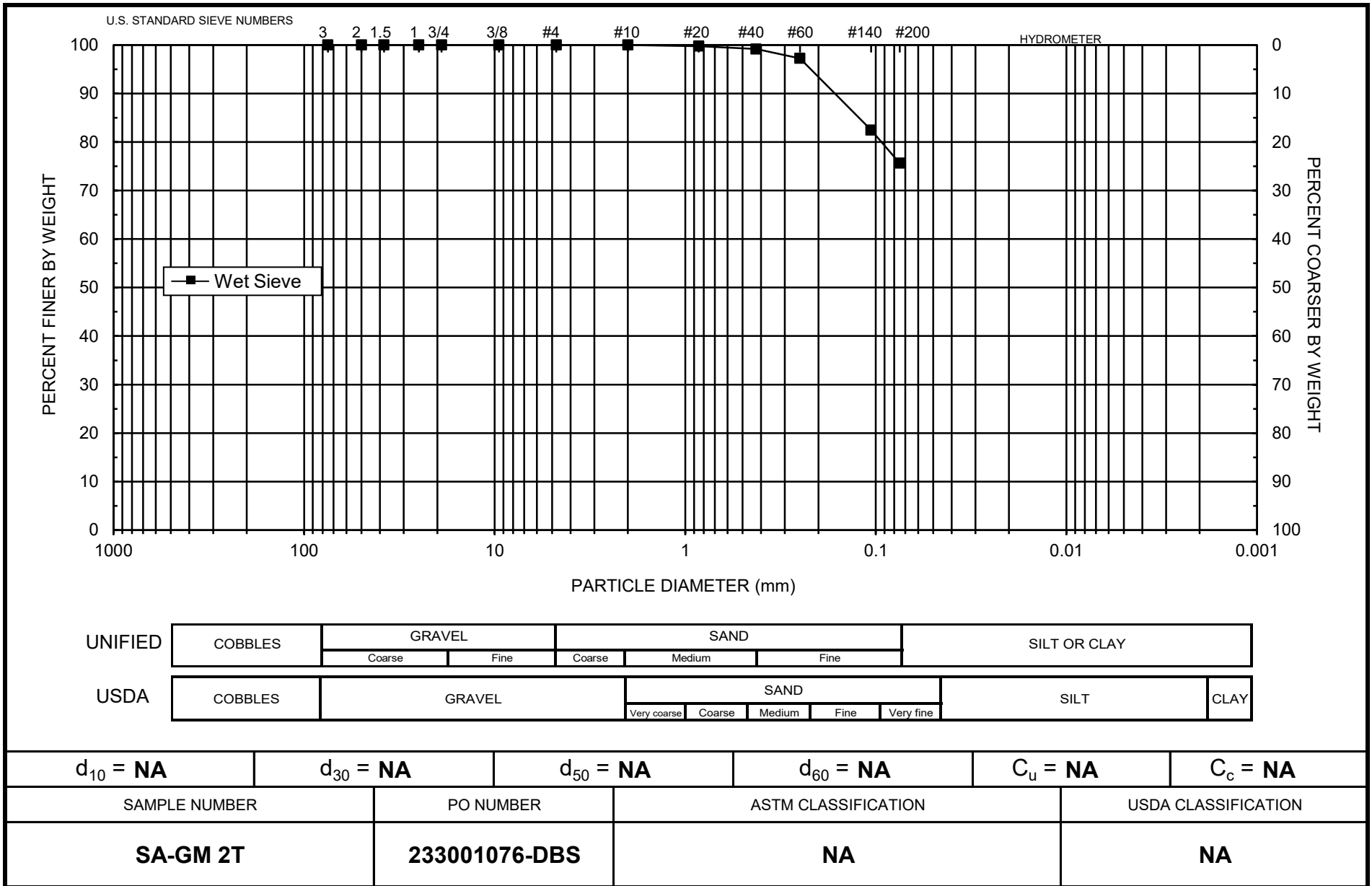
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
 d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): NA  
 d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.12

Median Particle Diameter--d<sub>50</sub> (mm): NA  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
 USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 509.48
Job Number: DB18.1151.00	Weight Passing #10 (g): 509.48
Sample Number: SA-GM 3B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 90.13
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 90.13
Test Date: 23-May-18	Shape: Rounded
	Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	509.48	100.00
	2"	50	0.00	0.00	509.48	100.00
	1.5"	38.1	0.00	0.00	509.48	100.00
	1"	25	0.00	0.00	509.48	100.00
	3/4"	19.0	0.00	0.00	509.48	100.00
	3/8"	9.5	0.00	0.00	509.48	100.00
	4	4.75	0.00	0.00	509.48	100.00
	10	2.00	0.00	0.00	509.48	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.24	0.24	89.89	99.73
	40	0.425	8.88	9.12	81.01	89.88
	60	0.250	26.63	35.75	54.38	60.34
	140	0.106	22.88	58.63	31.50	34.95
	200	0.075	3.56	62.19	27.94	31.00
	dry pan		0.70	62.89	27.24	
	wet pan			27.24	0.00	

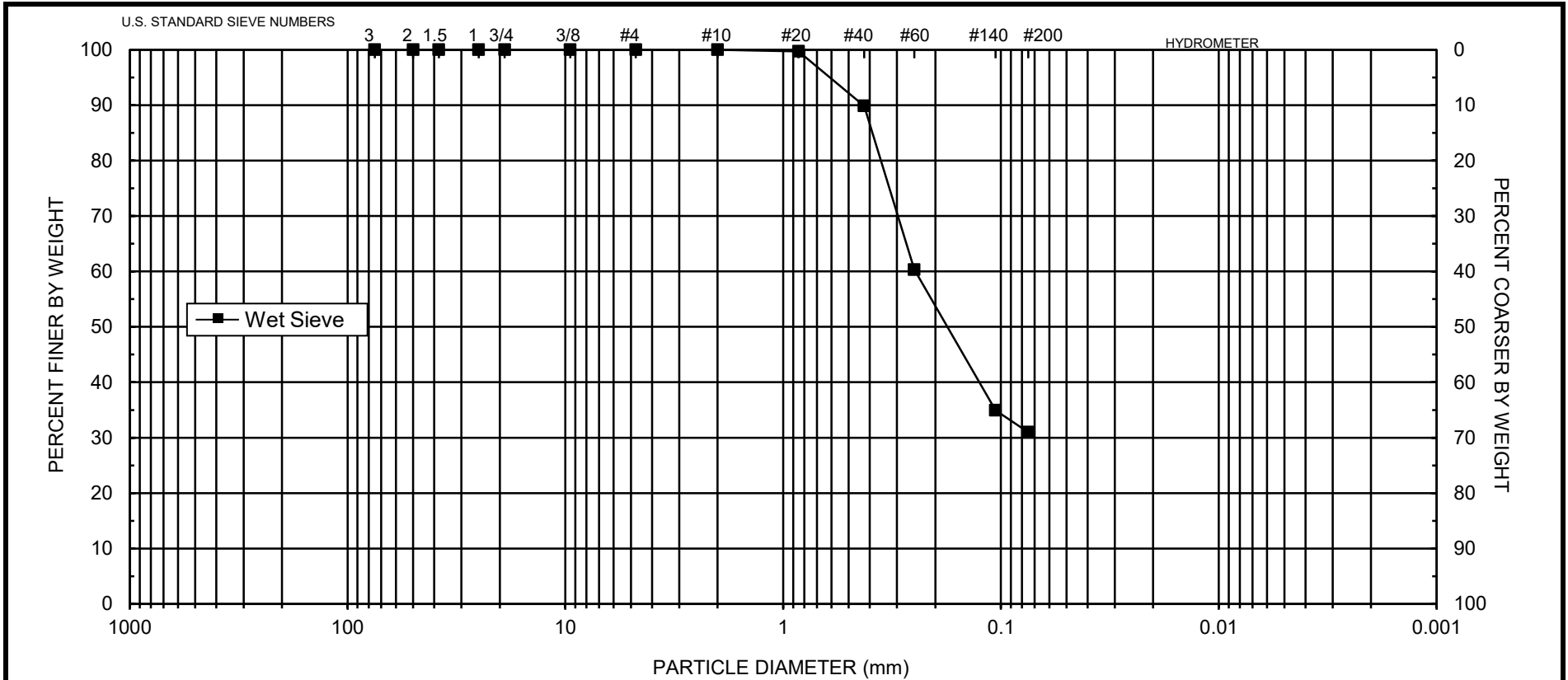
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.18  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.25  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.38

Median Particle Diameter--d<sub>50</sub> (mm): 0.18  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

$d_{10} = \text{NA}$	$d_{30} = \text{NA}$	$d_{50} = 0.18$	$d_{60} = 0.25$	$C_u = \text{NA}$	$C_c = \text{NA}$
SAMPLE NUMBER		PO NUMBER	ASTM CLASSIFICATION		USDA CLASSIFICATION
<b>SA-GM 3B</b>		<b>233001076-DBS</b>	<b>NA</b>		<b>NA</b>

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 787.33
Job Number: DB18.1151.00	Weight Passing #10 (g): 628.52
Sample Number: SA-GM 3T	Weight Retained #10 (g): 158.81
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 61.15
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 76.60
Test Date: 23-May-18	Shape: Angular
	Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	787.33	100.00
	2"	50	0.00	0.00	787.33	100.00
	1.5"	38.1	78.11	78.11	709.22	90.08
	1"	25	28.97	107.08	680.25	86.40
	3/4"	19.0	0.00	107.08	680.25	86.40
	3/8"	9.5	0.00	107.08	680.25	86.40
	4	4.75	11.81	118.89	668.44	84.90
	10	2.00	39.92	158.81	628.52	79.83
-10	(Based on calculated sieve wt.)					
	20	0.85	7.14	22.59	54.01	70.51
	40	0.425	6.48	29.07	47.53	62.05
	60	0.250	5.62	34.69	41.91	54.71
	140	0.106	10.17	44.86	31.74	41.44
	200	0.075	3.47	48.33	28.27	36.91
	dry pan			0.58	48.91	27.69
wet pan				27.69	0.00	

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.18  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.37  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 4.1

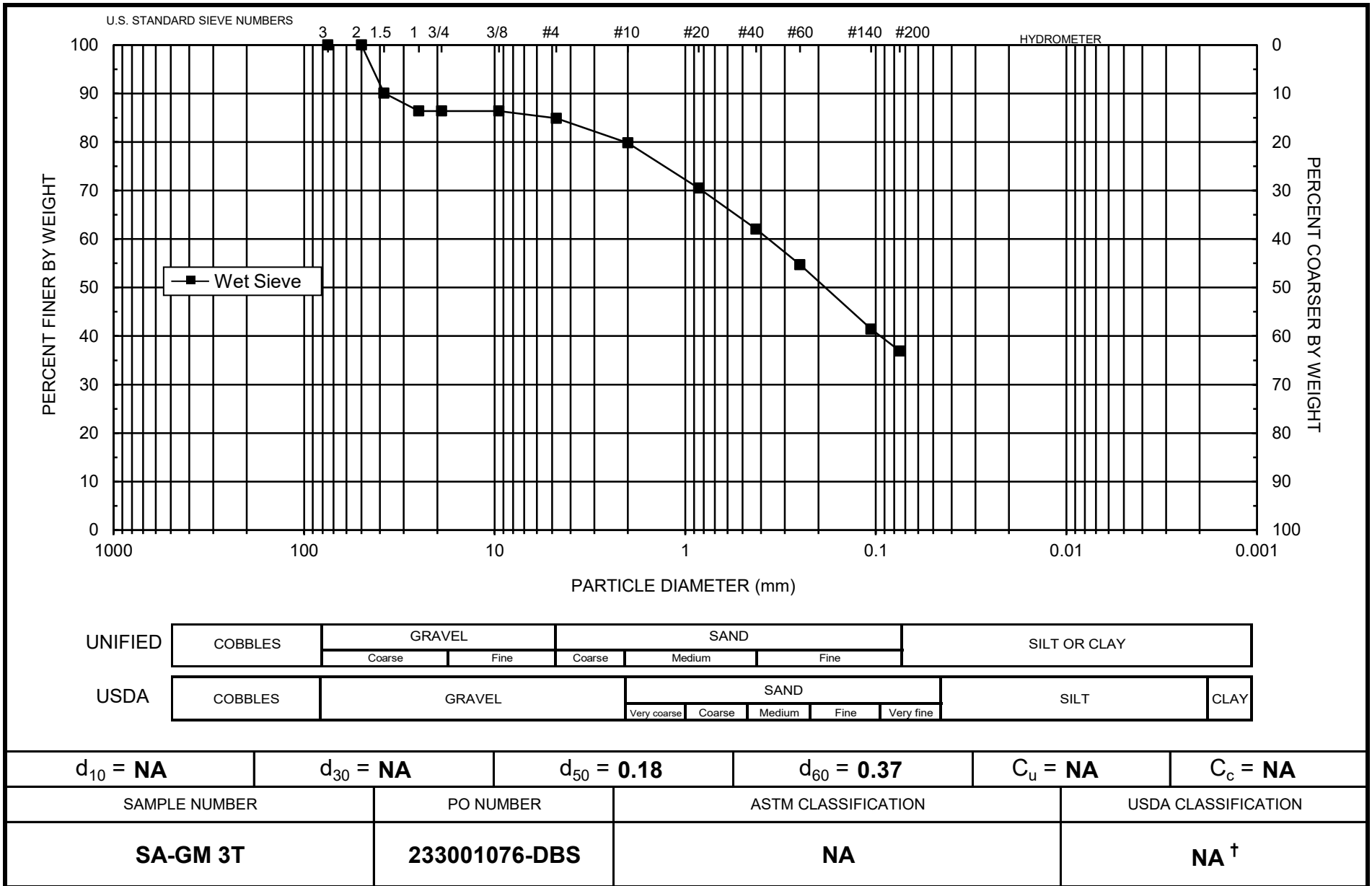
Median Particle Diameter--d<sub>50</sub> (mm): 0.18  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA<sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 587.80
Job Number: DB18.1151.00	Weight Passing #10 (g): 587.80
Sample Number: SA-GM 4B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 66.17
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 66.17
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	587.80	100.00
	2"	50	0.00	0.00	587.80	100.00
	1.5"	38.1	0.00	0.00	587.80	100.00
	1"	25	0.00	0.00	587.80	100.00
	3/4"	19.0	0.00	0.00	587.80	100.00
	3/8"	9.5	0.00	0.00	587.80	100.00
	4	4.75	0.00	0.00	587.80	100.00
	10	2.00	0.00	0.00	587.80	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.04	0.04	66.13	99.94
	40	0.425	0.31	0.35	65.82	99.47
	60	0.250	4.84	5.19	60.98	92.16
	140	0.106	29.07	34.26	31.91	48.22
	200	0.075	8.20	42.46	23.71	35.83
	dry pan			1.24	43.70	22.47
wet pan				22.47	0.00	

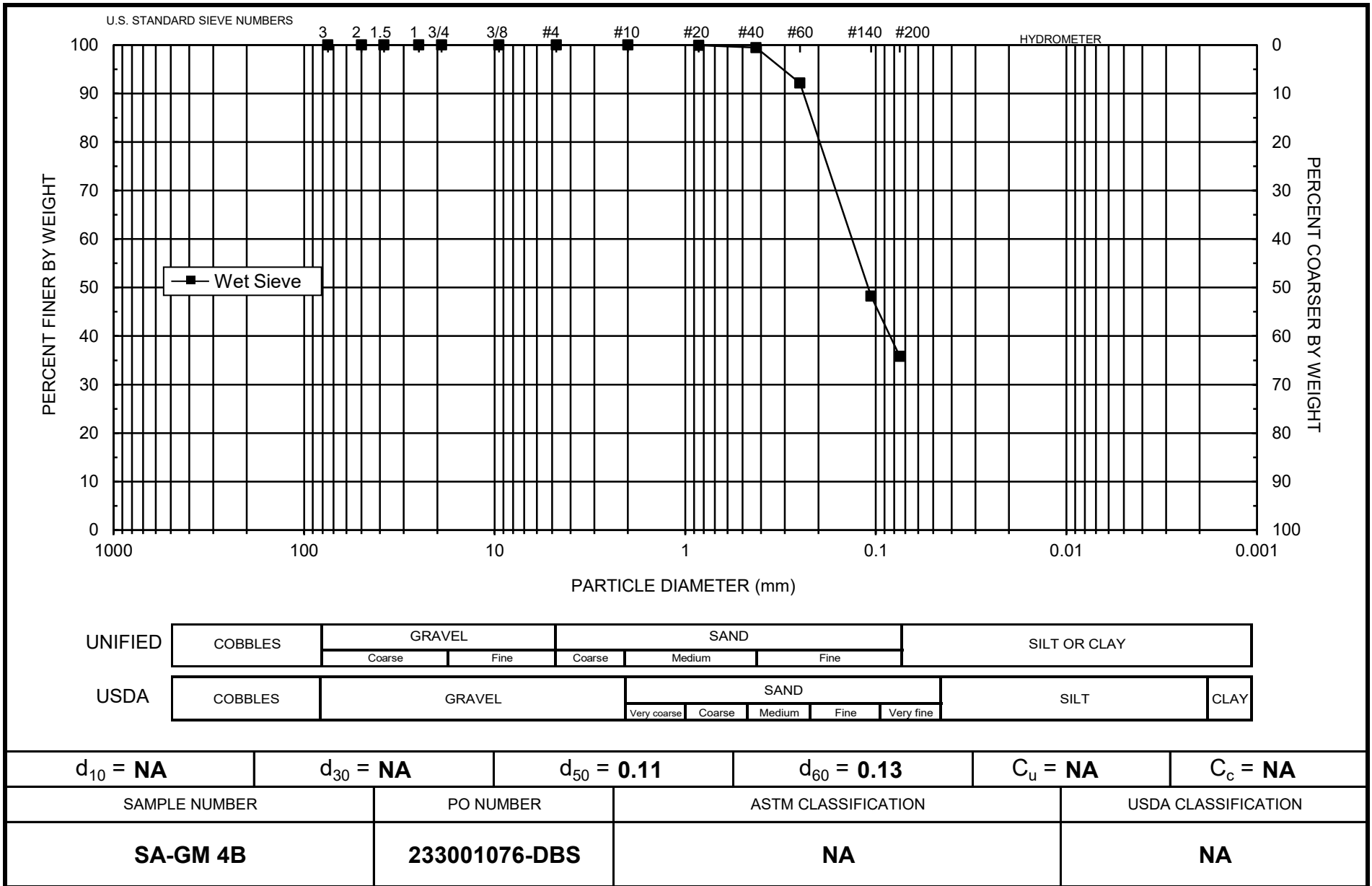
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.11  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.13  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.21

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 556.89
Job Number: DB18.1151.00	Weight Passing #10 (g): 456.92
Sample Number: SA-GM 5B	Weight Retained #10 (g): 99.97
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 65.29
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 79.57
Test Date: 23-May-18	Shape: Angular
	Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	556.89	100.00
	2"	50	0.00	0.00	556.89	100.00
	1.5"	38.1	0.00	0.00	556.89	100.00
	1"	25	47.83	47.83	509.06	91.41
	3/4"	19.0	0.00	47.83	509.06	91.41
	3/8"	9.5	14.63	62.46	494.43	88.78
	4	4.75	18.74	81.20	475.69	85.42
	10	2.00	18.77	99.97	456.92	82.05
-10	(Based on calculated sieve wt.)					
	20	0.85	1.73	16.01	63.56	79.87
	40	0.425	4.81	20.82	58.75	73.83
	60	0.250	14.48	35.30	44.27	55.63
	140	0.106	20.87	56.17	23.40	29.41
	200	0.075	4.63	60.80	18.77	23.59
	dry pan			0.71	61.51	18.06
wet pan				18.06	0.00	

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.21  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.28  
d<sub>30</sub> (mm): 0.11                    d<sub>84</sub> (mm): 3.3

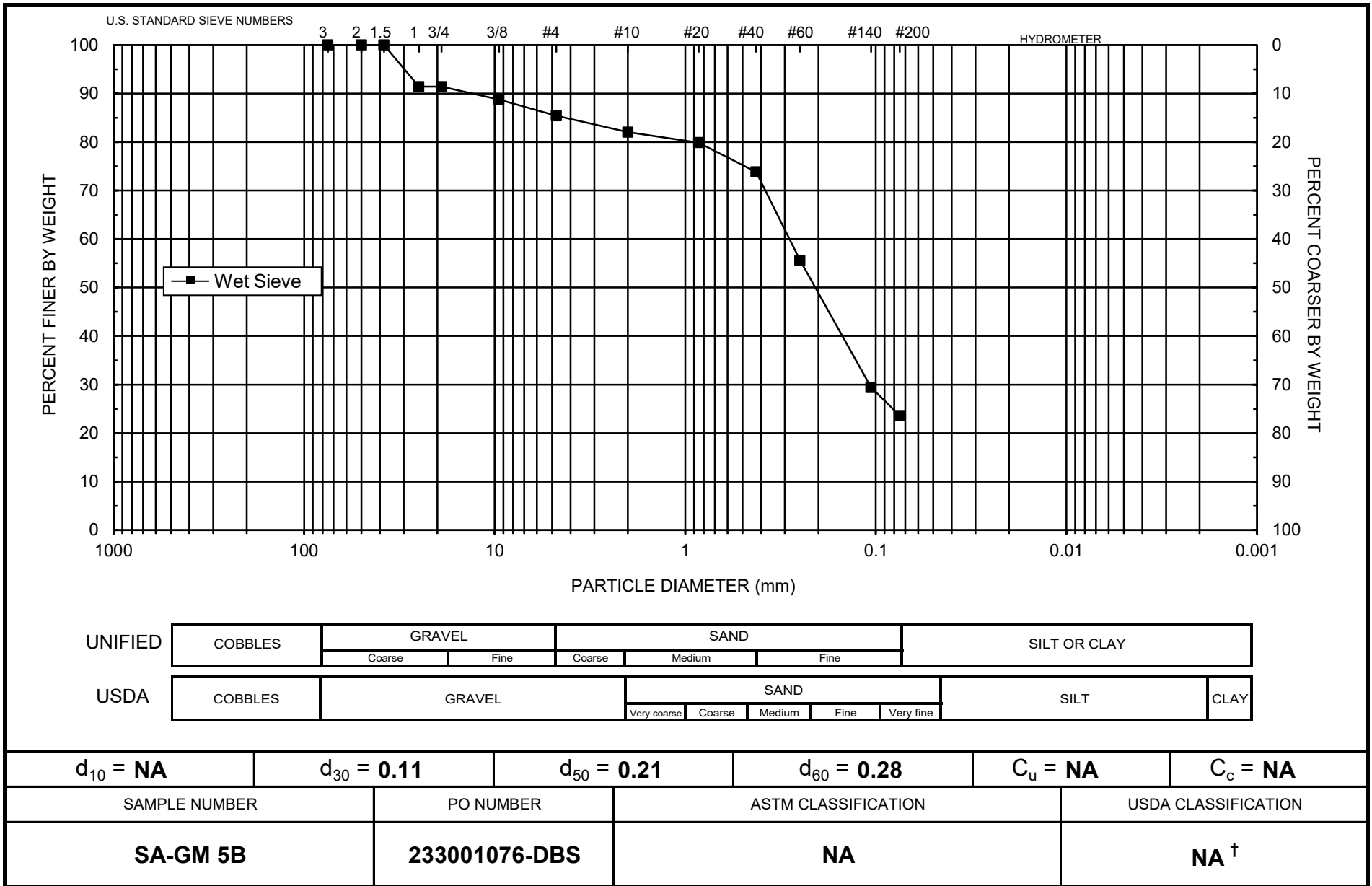
Median Particle Diameter--d<sub>50</sub> (mm): 0.21  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA<sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 1308.27
Job Number: DB18.1151.00	Weight Passing #10 (g): 1305.54
Sample Number: SA-GM 5T	Weight Retained #10 (g): 2.73
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 62.18
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 62.31
Test Date: 4-Jun-18	Shape: Rounded
	Hardness: Hard and durable

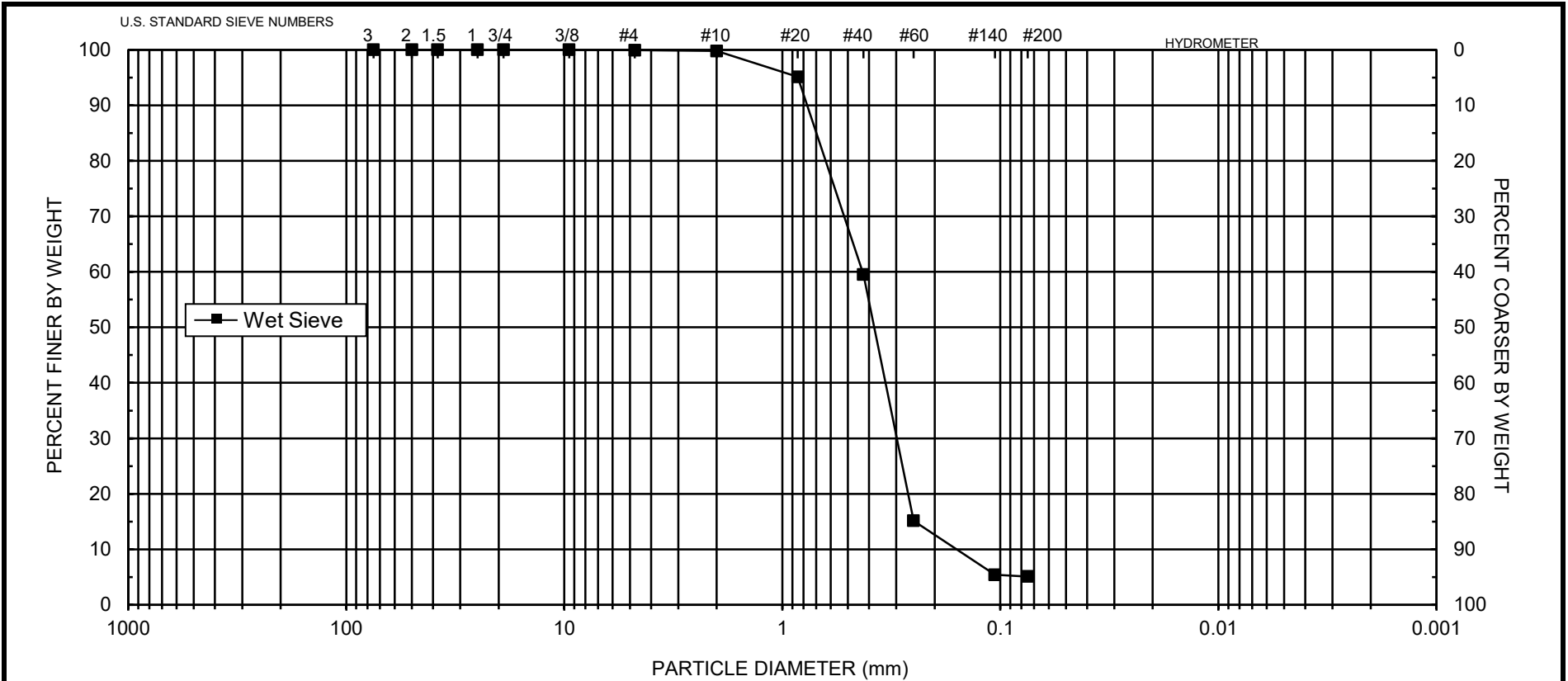
Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	1308.27	100.00
	2"	50	0.00	0.00	1308.27	100.00
	1.5"	38.1	0.00	0.00	1308.27	100.00
	1"	25	0.00	0.00	1308.27	100.00
	3/4"	19.0	0.00	0.00	1308.27	100.00
	3/8"	9.5	0.00	0.00	1308.27	100.00
	4	4.75	0.68	0.68	1307.59	99.95
	10	2.00	2.05	2.73	1305.54	99.79
-10	(Based on calculated sieve wt.)					
	20	0.85	2.91	3.04	59.27	95.12
	40	0.425	22.18	25.22	37.09	59.52
	60	0.250	27.66	52.88	9.43	15.13
	140	0.106	6.06	58.94	3.37	5.41
	200	0.075	0.20	59.14	3.17	5.09
	dry pan			0.02	59.16	3.15
wet pan				3.15	0.00	

d<sub>10</sub> (mm): 0.16                      d<sub>50</sub> (mm): 0.38  
d<sub>16</sub> (mm): 0.25                      d<sub>60</sub> (mm): 0.43  
d<sub>30</sub> (mm): 0.30                      d<sub>84</sub> (mm): 0.68

Median Particle Diameter--d<sub>50</sub> (mm): 0.38  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 2.7  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.3  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): 0.44

ASTM Soil Classification: NA  
USDA Soil Classification: Sand

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
		Very coarse	Coarse	Medium	Fine	Very fine				

$d_{10} = 0.16$	$d_{30} = 0.30$	$d_{50} = 0.38$	$d_{60} = 0.43$	$C_u = 2.7$	$C_c = 1.3$
SAMPLE NUMBER	PO NUMBER	ASTM CLASSIFICATION		USDA CLASSIFICATION	
<b>SA-GM 5T</b>	<b>233001076-DBS</b>	<b>NA</b>		<b>Sand</b>	



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 641.27
Job Number: DB18.1151.00	Weight Passing #10 (g): 641.27
Sample Number: SA-GM 6B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 53.75
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 53.75
Test Date: 25-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	641.27	100.00
	2"	50	0.00	0.00	641.27	100.00
	1.5"	38.1	0.00	0.00	641.27	100.00
	1"	25	0.00	0.00	641.27	100.00
	3/4"	19.0	0.00	0.00	641.27	100.00
	3/8"	9.5	0.00	0.00	641.27	100.00
	4	4.75	0.00	0.00	641.27	100.00
	10	2.00	0.00	0.00	641.27	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.02	0.02	53.73	99.96
	40	0.425	0.05	0.07	53.68	99.87
	60	0.250	0.34	0.41	53.34	99.24
	140	0.106	6.26	6.67	47.08	87.59
	200	0.075	4.31	10.98	42.77	79.57
	dry pan			0.92	11.90	41.85
wet pan				41.85	0.00	

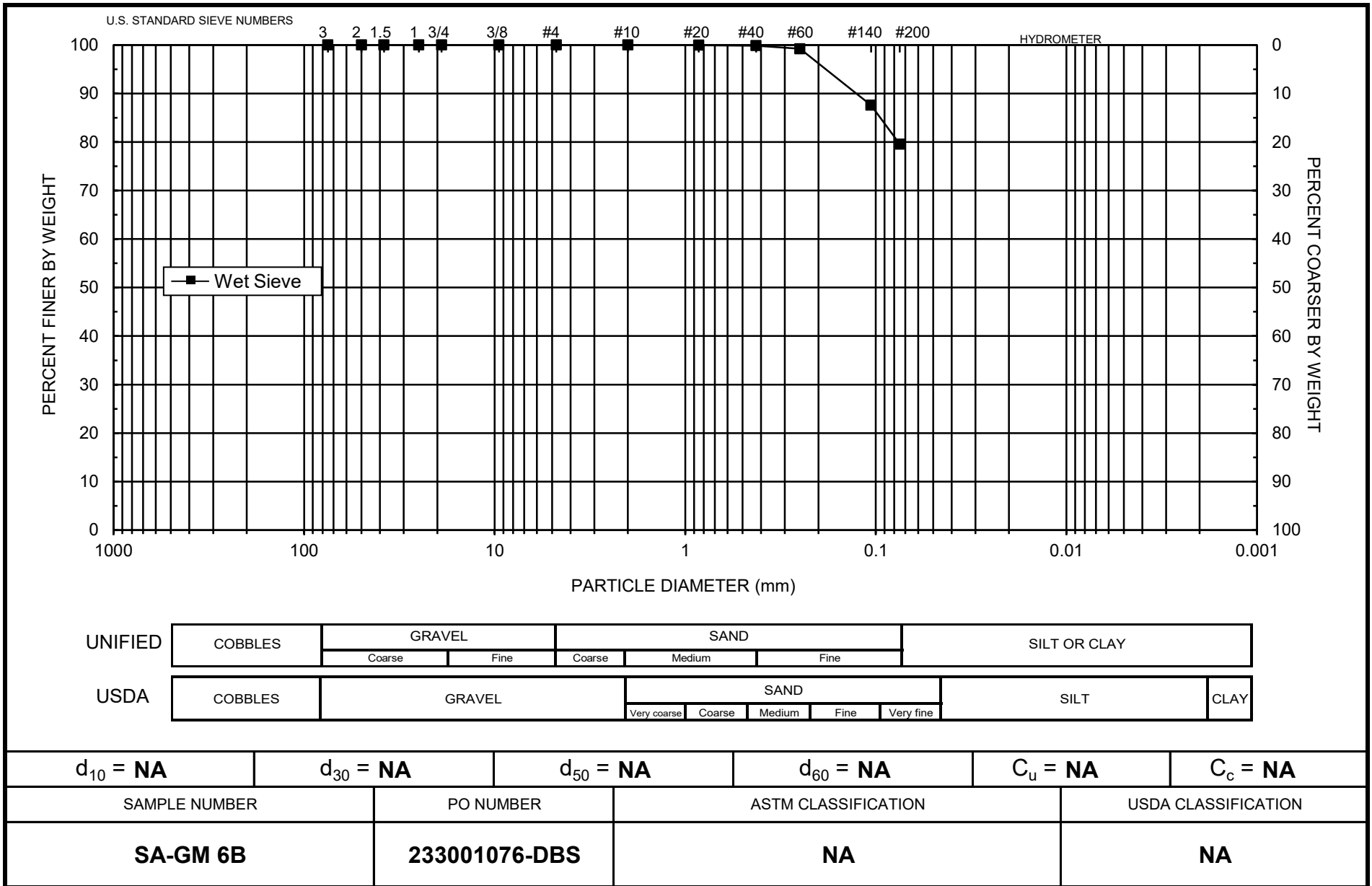
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): NA  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.091

Median Particle Diameter--d<sub>50</sub> (mm): NA  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 508.84
Job Number: DB18.1151.00	Weight Passing #10 (g): 508.84
Sample Number: SA-GM 6T	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 60.17
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 60.17
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing	
+10	3"	75	0.00	0.00	508.84	100.00	
	2"	50	0.00	0.00	508.84	100.00	
	1.5"	38.1	0.00	0.00	508.84	100.00	
	1"	25	0.00	0.00	508.84	100.00	
	3/4"	19.0	0.00	0.00	508.84	100.00	
	3/8"	9.5	0.00	0.00	508.84	100.00	
	4	4.75	0.00	0.00	508.84	100.00	
	10	2.00	0.00	0.00	508.84	100.00	
-10			(Based on calculated sieve wt.)				
		20	0.85	0.55	0.55	59.62	99.09
		40	0.425	0.62	1.17	59.00	98.06
		60	0.250	0.79	1.96	58.21	96.74
		140	0.106	4.78	6.74	53.43	88.80
		200	0.075	3.85	10.59	49.58	82.40
		dry pan		1.07	11.66	48.51	
	wet pan			48.51	0.00		

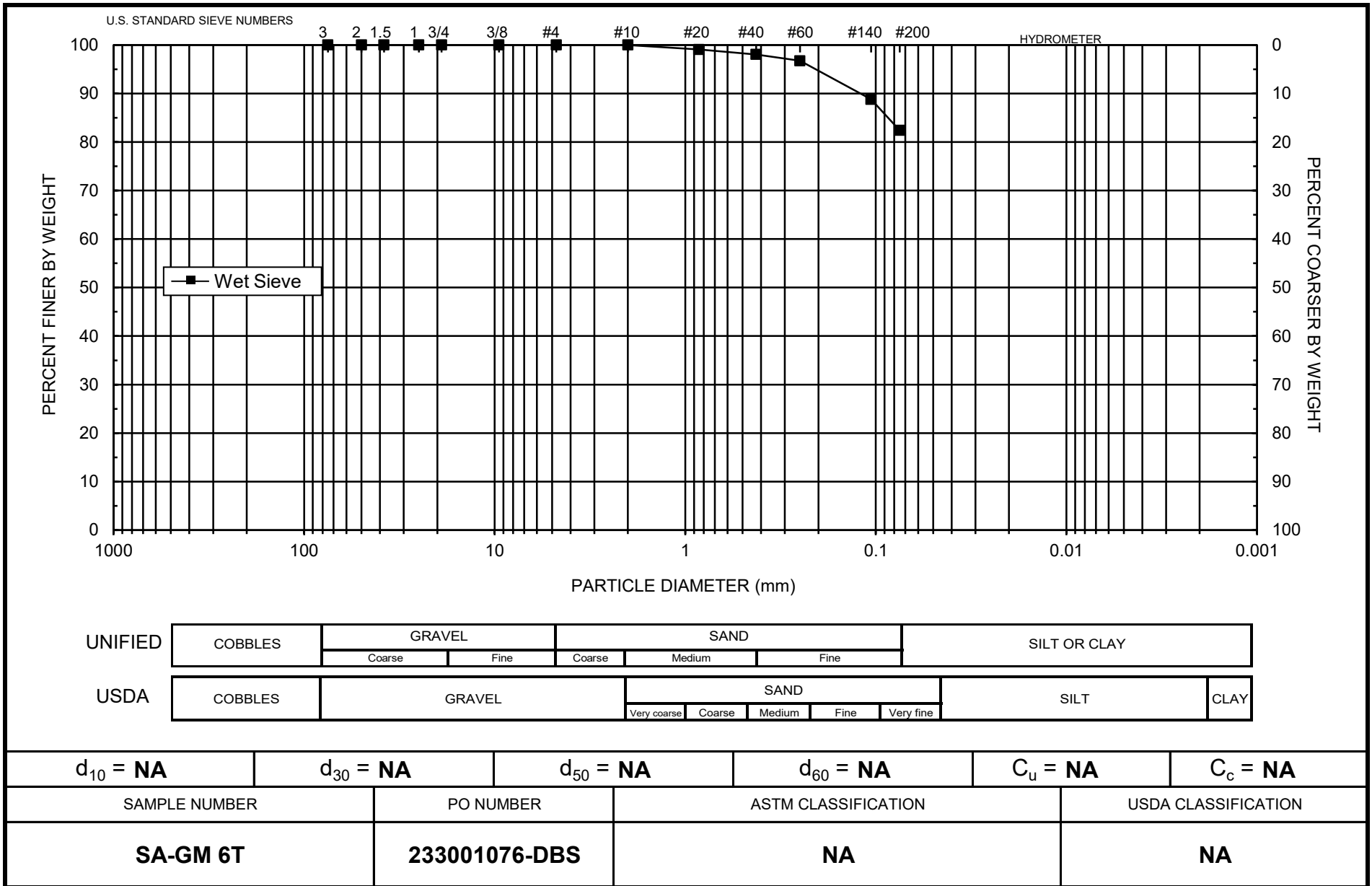
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): NA  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): NA  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.082

Median Particle Diameter--d<sub>50</sub> (mm): NA  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 916.23
Job Number: DB18.1151.00	Weight Passing #10 (g): 916.23
Sample Number: SA-GM 7B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 54.29
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 54.29
Test Date: 25-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	916.23	100.00
	2"	50	0.00	0.00	916.23	100.00
	1.5"	38.1	0.00	0.00	916.23	100.00
	1"	25	0.00	0.00	916.23	100.00
	3/4"	19.0	0.00	0.00	916.23	100.00
	3/8"	9.5	0.00	0.00	916.23	100.00
	4	4.75	0.00	0.00	916.23	100.00
	10	2.00	0.00	0.00	916.23	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	54.29	100.00
	40	0.425	0.33	0.33	53.96	99.39
	60	0.250	4.51	4.84	49.45	91.08
	140	0.106	22.71	27.55	26.74	49.25
	200	0.075	6.44	33.99	20.30	37.39
	dry pan			1.21	35.20	19.09
wet pan				19.09	0.00	

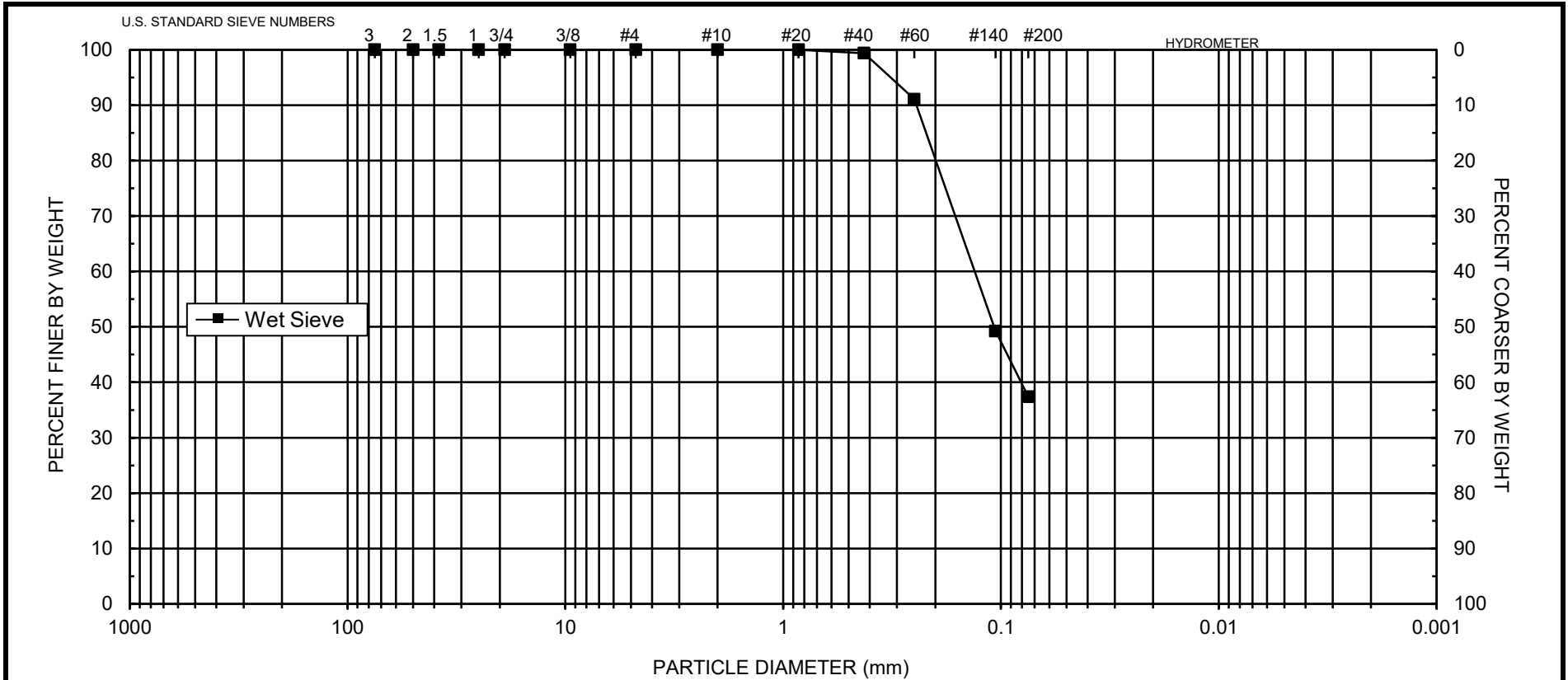
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.11  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.13  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.22

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

$d_{10} = \text{NA}$	$d_{30} = \text{NA}$	$d_{50} = 0.11$	$d_{60} = 0.13$	$C_u = \text{NA}$	$C_c = \text{NA}$
SAMPLE NUMBER		PO NUMBER	ASTM CLASSIFICATION		USDA CLASSIFICATION
<b>SA-GM 7B</b>		<b>233001076-DBS</b>	<b>NA</b>		<b>NA</b>

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*







**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 1050.54
Job Number: DB18.1151.00	Weight Passing #10 (g): 1050.54
Sample Number: SA-GM 8B	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 60.03
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 60.03
Test Date: 25-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	1050.54	100.00
	2"	50	0.00	0.00	1050.54	100.00
	1.5"	38.1	0.00	0.00	1050.54	100.00
	1"	25	0.00	0.00	1050.54	100.00
	3/4"	19.0	0.00	0.00	1050.54	100.00
	3/8"	9.5	0.00	0.00	1050.54	100.00
	4	4.75	0.00	0.00	1050.54	100.00
	10	2.00	0.00	0.00	1050.54	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.10	0.10	59.93	99.83
	40	0.425	2.29	2.39	57.64	96.02
	60	0.250	11.11	13.50	46.53	77.51
	140	0.106	19.19	32.69	27.34	45.54
	200	0.075	3.97	36.66	23.37	38.93
	dry pan			1.27	37.93	22.10
wet pan				22.10	0.00	

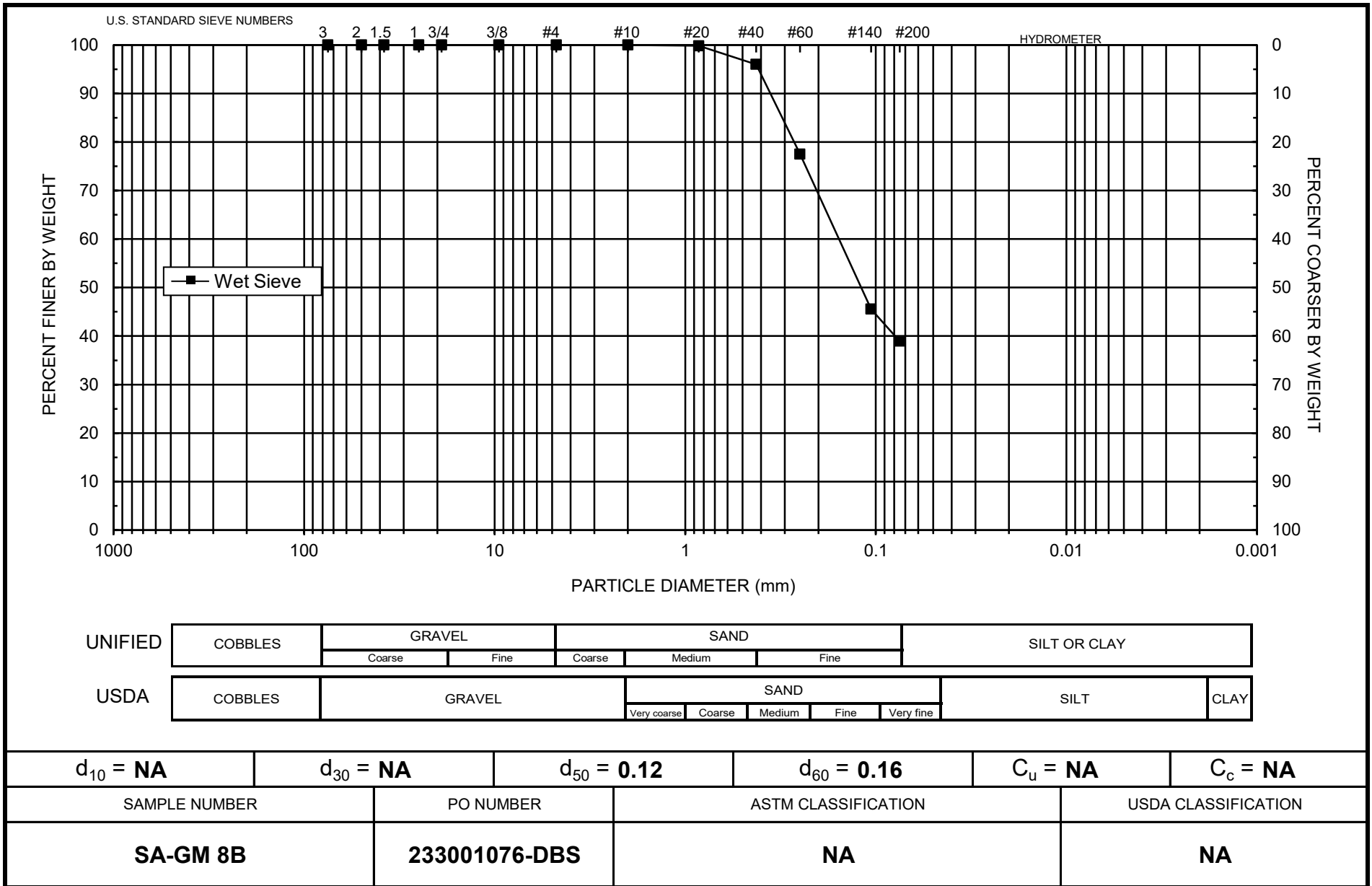
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.12  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.16  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.30

Median Particle Diameter--d<sub>50</sub> (mm): 0.12  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: SA-GM 8T  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 1380.92  
 Weight Passing #10 (g): 1136.29  
 Weight Retained #10 (g): 244.63  
 Wt. of -10 Sieve Sample (g): 57.64  
 Calculated Weight of Sieve Sample (g): 70.05  
 Shape: Rounded  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	1380.92	100.00
	2"	50	0.00	0.00	1380.92	100.00
	1.5"	38.1	0.00	0.00	1380.92	100.00
	1"	25	44.66	44.66	1336.26	96.77
	3/4"	19.0	46.71	91.37	1289.55	93.38
	3/8"	9.5	49.31	140.68	1240.24	89.81
	4	4.75	44.99	185.67	1195.25	86.55
	10	2.00	58.96	244.63	1136.29	82.28
-10	(Based on calculated sieve wt.)					
	20	0.85	7.38	19.79	50.26	71.75
	40	0.425	11.45	31.24	38.81	55.40
	60	0.250	13.38	44.62	25.43	36.30
	140	0.106	12.32	56.94	13.11	18.72
	200	0.075	2.01	58.95	11.10	15.85
	dry pan			0.13	59.08	10.97
wet pan				10.97	0.00	

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.37  
 d<sub>16</sub> (mm): 0.076                    d<sub>60</sub> (mm): 0.52  
 d<sub>30</sub> (mm): 0.18                      d<sub>84</sub> (mm): 2.8

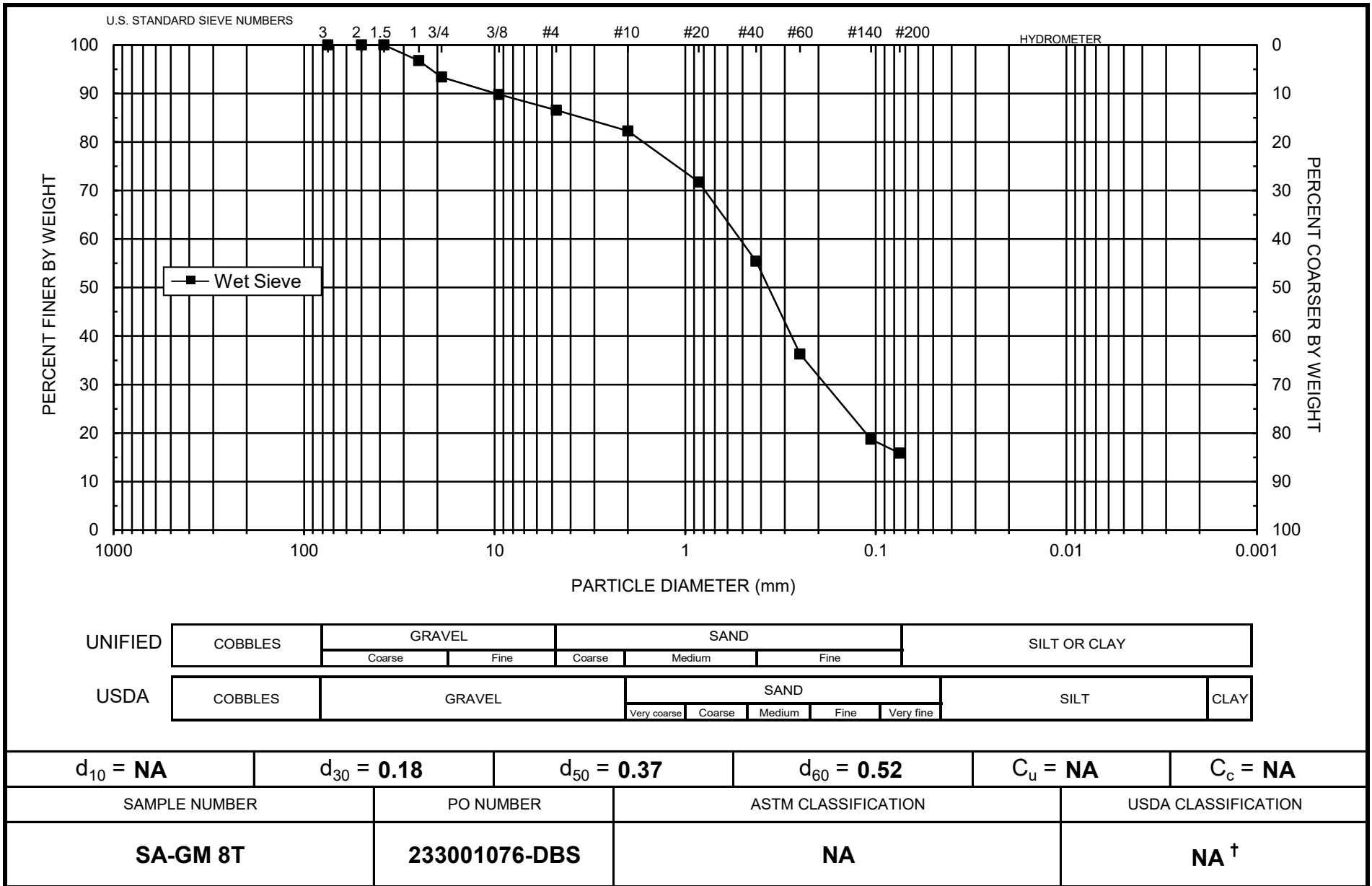
Median Particle Diameter--d<sub>50</sub> (mm): 0.37  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): 1.1

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
 USDA Soil Classification: NA<sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 272.52  
 Weight Passing #10 (g): 272.52  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 56.68  
 Calculated Weight of Sieve Sample (g): 56.68  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	272.52	100.00
	2"	50	0.00	0.00	272.52	100.00
	1.5"	38.1	0.00	0.00	272.52	100.00
	1"	25	0.00	0.00	272.52	100.00
	3/4"	19.0	0.00	0.00	272.52	100.00
	3/8"	9.5	0.00	0.00	272.52	100.00
	4	4.75	0.00	0.00	272.52	100.00
	10	2.00	0.00	0.00	272.52	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.08	0.08	56.60	99.86
	40	0.425	0.16	0.24	56.44	99.58
	60	0.250	0.49	0.73	55.95	98.71
	140	0.106	10.80	11.53	45.15	79.66
	200	0.075	7.28	18.81	37.87	66.81
	dry pan			0.83	19.64	37.04
wet pan				37.04	0.00	

d<sub>10</sub> (mm): 2.2E-05      d<sub>50</sub> (mm): 0.046  
 d<sub>16</sub> (mm): 0.00016      d<sub>60</sub> (mm): 0.061  
 d<sub>30</sub> (mm): 0.0067      d<sub>84</sub> (mm): 0.13

Median Particle Diameter--d<sub>50</sub> (mm): 0.046  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 2773  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 33  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.059

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:00

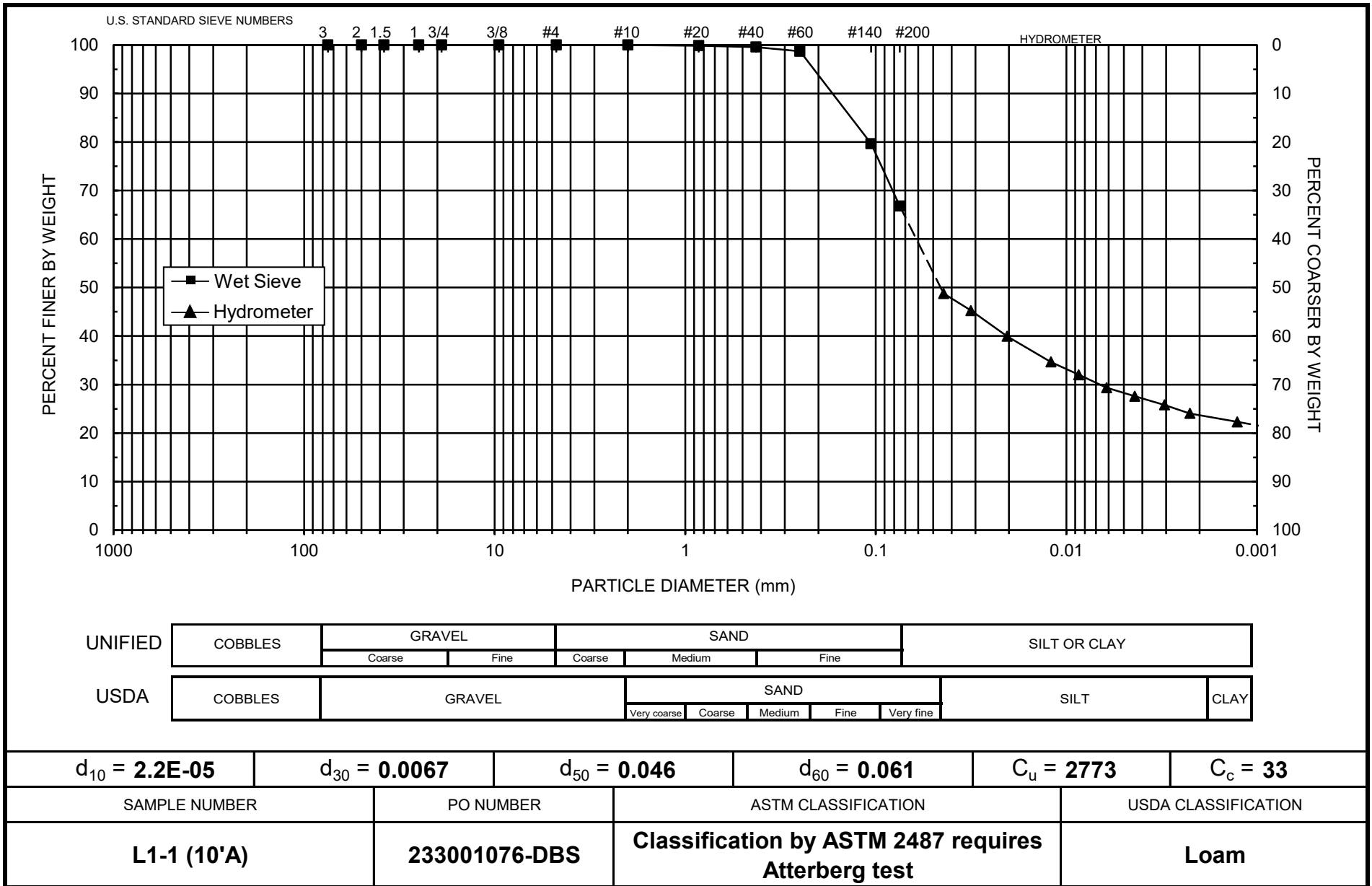
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 56.68  
 Total Sample Wt. (g): 272.52  
 Wt. Passing #10 (g): 272.52

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	33.0	5.4	27.6	10.9	0.04409	48.8	48.8
	2	21.6	31.0	5.4	25.6	11.2	0.03164	45.2	45.2
	5	21.6	28.0	5.4	22.6	11.7	0.02045	39.9	39.9
	15	21.6	25.0	5.4	19.6	12.2	0.01205	34.7	34.7
	30	21.6	23.5	5.4	18.1	12.4	0.00861	32.0	32.0
	60	21.5	22.0	5.4	16.6	12.7	0.00615	29.3	29.3
	120	21.5	21.0	5.4	15.6	12.9	0.00438	27.6	27.6
	250	21.5	20.0	5.4	14.6	13.0	0.00305	25.8	25.8
	468	21.5	19.0	5.4	13.6	13.2	0.00225	24.0	24.0
16-May-18	1484	21.6	18.0	5.4	12.6	13.3	0.00127	22.3	22.3

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-2 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 491.56  
 Weight Passing #10 (g): 489.94  
 Weight Retained #10 (g): 1.62  
 Weight of Hydrometer Sample (g): 57.04  
 Calculated Weight of Sieve Sample (g): 57.23  
 Shape: Rounded  
 Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	491.56	100.00
	2"	50	0.00	0.00	491.56	100.00
	1.5"	38.1	0.00	0.00	491.56	100.00
	1"	25	0.00	0.00	491.56	100.00
	3/4"	19.0	0.00	0.00	491.56	100.00
	3/8"	9.5	0.00	0.00	491.56	100.00
	4	4.75	0.63	0.63	490.93	99.87
	10	2.00	0.99	1.62	489.94	99.67
-10	(Based on calculated sieve wt.)					
	20	0.85	0.12	0.31	56.92	99.46
	40	0.425	0.12	0.43	56.80	99.25
	60	0.250	0.09	0.52	56.71	99.09
	140	0.106	0.42	0.94	56.29	98.36
	200	0.075	0.46	1.40	55.83	97.56
	dry pan		0.12	1.52	55.71	
wet pan			55.71	0.00		

d<sub>10</sub> (mm): 2.8E-05      d<sub>50</sub> (mm): 0.0092  
 d<sub>16</sub> (mm): 0.00010      d<sub>60</sub> (mm): 0.015  
 d<sub>30</sub> (mm): 0.0022      d<sub>84</sub> (mm): 0.044

Median Particle Diameter--d<sub>50</sub> (mm): 0.0092  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 536  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 12  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.018

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines





*Daniel B. Stephens & Associates, Inc.*

**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-2 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:06

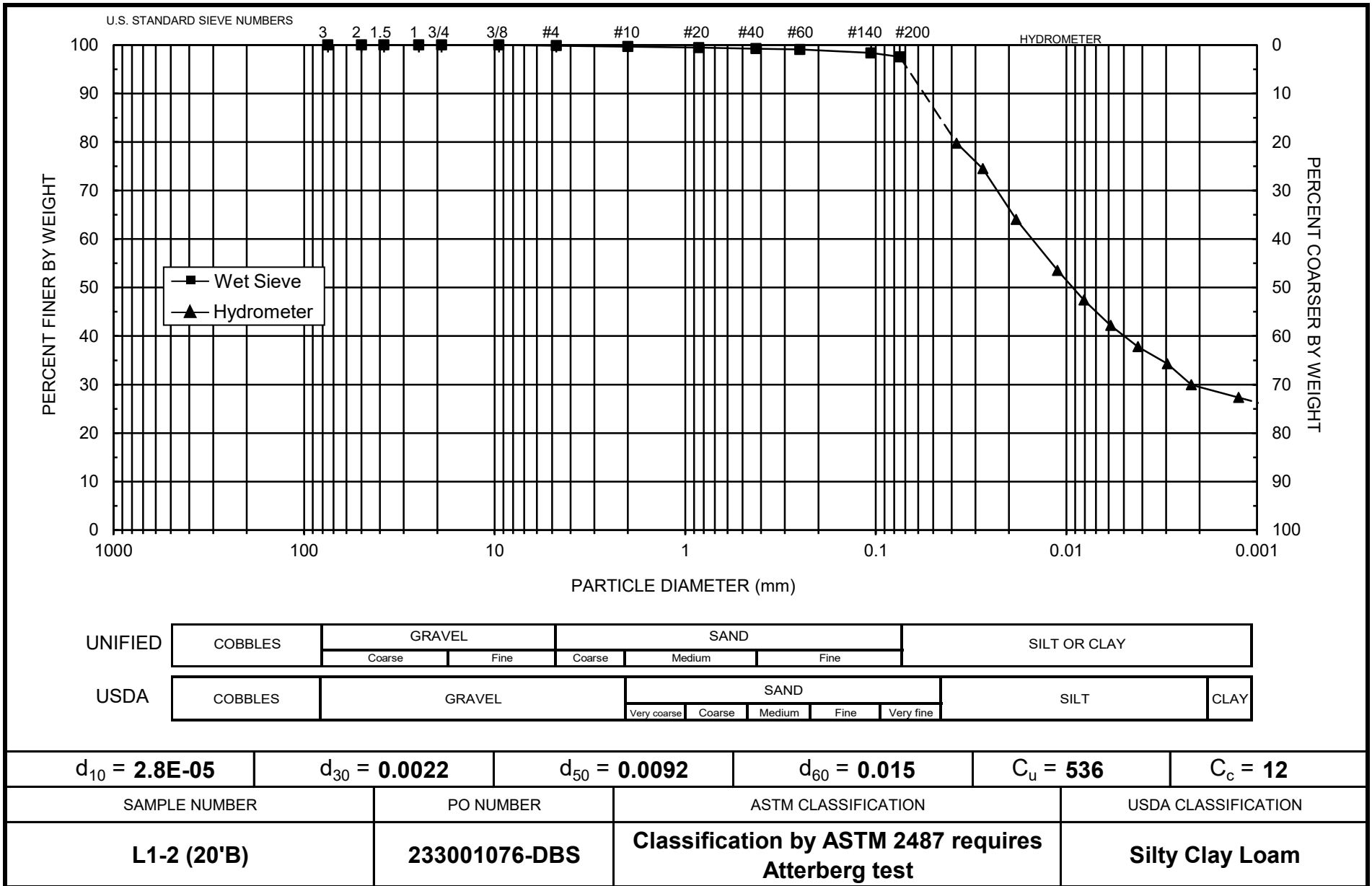
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 57.04  
 Total Sample Wt. (g): 491.56  
 Wt. Passing #10 (g): 489.94

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	51.0	5.4	45.6	7.9	0.03765	80.0	79.8
	2	21.6	48.0	5.4	42.6	8.4	0.02743	74.8	74.5
	5	21.6	42.0	5.4	36.6	9.4	0.01833	64.2	64.0
	15	21.6	36.0	5.4	30.6	10.4	0.01112	53.7	53.5
	30	21.6	32.5	5.4	27.1	11.0	0.00808	47.6	47.4
	60	21.5	29.5	5.4	24.1	11.5	0.00585	42.3	42.2
	120	21.5	27.0	5.4	21.6	11.9	0.00421	37.9	37.8
	250	21.5	25.0	5.4	19.6	12.2	0.00296	34.4	34.3
	463	21.5	22.5	5.4	17.1	12.6	0.00221	30.0	29.9
	16-May-18	1480	21.6	21.0	5.4	15.6	12.9	0.00125	27.4

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-3 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 434.95  
 Weight Passing #10 (g): 434.90  
 Weight Retained #10 (g): 0.05  
 Weight of Hydrometer Sample (g): 59.96  
 Calculated Weight of Sieve Sample (g): 59.97  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	434.95	100.00
	2"	50	0.00	0.00	434.95	100.00
	1.5"	38.1	0.00	0.00	434.95	100.00
	1"	25	0.00	0.00	434.95	100.00
	3/4"	19.0	0.00	0.00	434.95	100.00
	3/8"	9.5	0.00	0.00	434.95	100.00
	4	4.75	0.00	0.00	434.95	100.00
	10	2.00	0.05	0.05	434.90	99.99
-10	(Based on calculated sieve wt.)					
	20	0.85	0.32	0.33	59.64	99.45
	40	0.425	0.65	0.98	58.99	98.37
	60	0.250	1.65	2.63	57.34	95.62
	140	0.106	16.58	19.21	40.76	67.97
	200	0.075	8.65	27.86	32.11	53.55
	dry pan			1.00	28.86	31.11
wet pan				31.11	0.00	

d<sub>10</sub> (mm): 6.4E-45      d<sub>50</sub> (mm): 0.066  
 d<sub>16</sub> (mm): 0.0031      d<sub>60</sub> (mm): 0.088  
 d<sub>30</sub> (mm): 0.034      d<sub>84</sub> (mm): 0.17

Median Particle Diameter--d<sub>50</sub> (mm): 0.066  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1.4E+43  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.1E+42  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.080

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-3 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:12

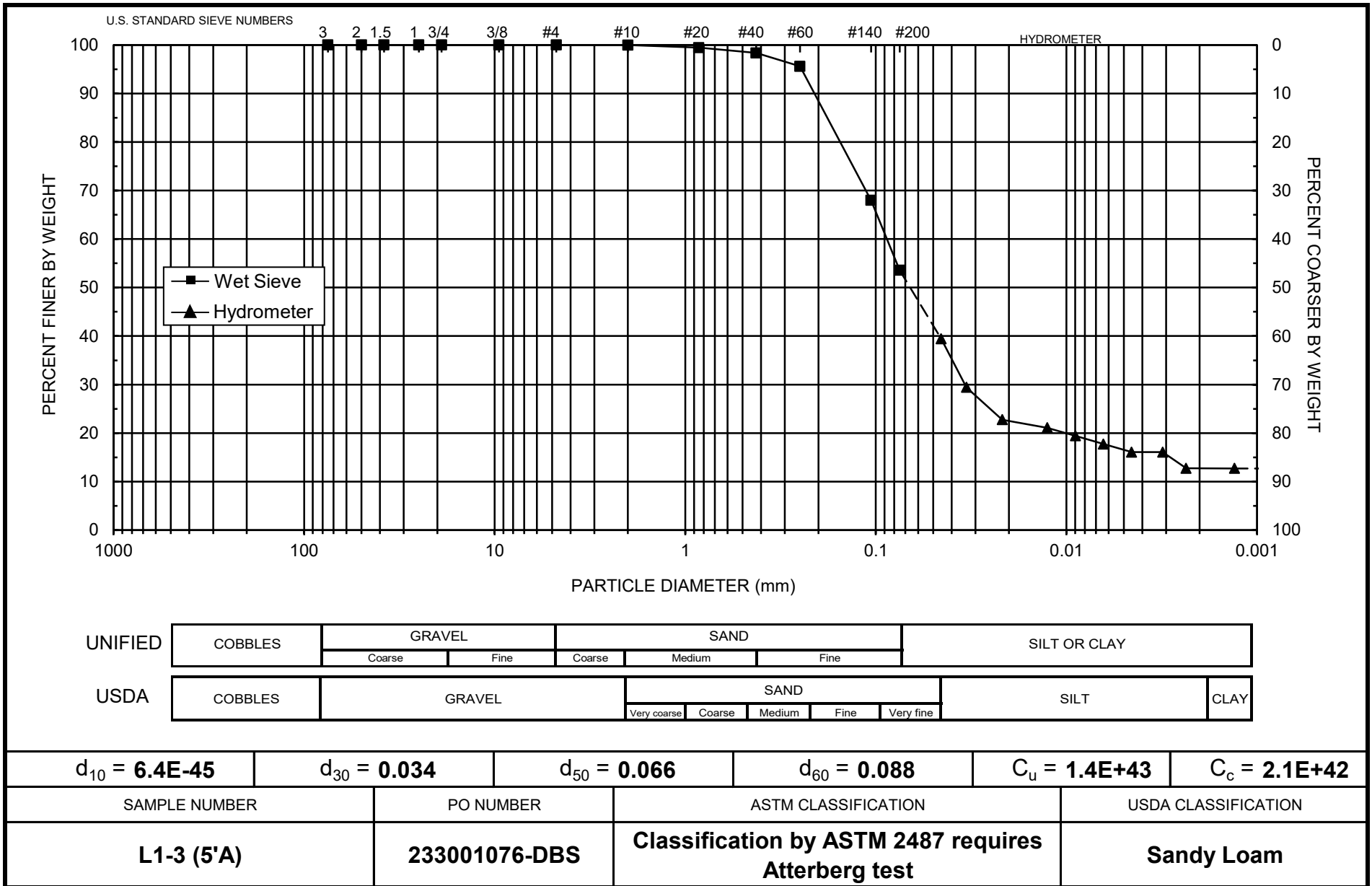
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 59.96  
 Total Sample Wt. (g): 434.95  
 Wt. Passing #10 (g): 434.90

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	29.0	5.4	23.6	11.5	0.04540	39.4	39.4
	2	21.6	23.0	5.4	17.6	12.5	0.03344	29.4	29.4
	5	21.6	19.0	5.4	13.6	13.2	0.02170	22.7	22.7
	15	21.6	18.0	5.4	12.6	13.3	0.01260	21.1	21.1
	30	21.7	17.0	5.4	11.6	13.5	0.00896	19.4	19.4
	60	21.5	16.0	5.4	10.6	13.7	0.00639	17.7	17.7
	120	21.5	15.0	5.4	9.6	13.8	0.00454	16.1	16.1
	254	21.5	15.0	5.4	9.6	13.8	0.00312	16.1	16.1
	458	21.5	13.0	5.4	7.6	14.2	0.00235	12.7	12.7
16-May-18	1475	21.6	13.0	5.4	7.6	14.2	0.00131	12.7	12.7

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-5 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 419.21  
 Weight Passing #10 (g): 419.21  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 55.07  
 Calculated Weight of Sieve Sample (g): 55.07  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	419.21	100.00
	2"	50	0.00	0.00	419.21	100.00
	1.5"	38.1	0.00	0.00	419.21	100.00
	1"	25	0.00	0.00	419.21	100.00
	3/4"	19.0	0.00	0.00	419.21	100.00
	3/8"	9.5	0.00	0.00	419.21	100.00
	4	4.75	0.00	0.00	419.21	100.00
	10	2.00	0.00	0.00	419.21	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.02	0.02	55.05	99.96
	40	0.425	0.05	0.07	55.00	99.87
	60	0.250	0.41	0.48	54.59	99.13
	140	0.106	18.28	18.76	36.31	65.93
	200	0.075	8.60	27.36	27.71	50.32
	dry pan		0.80	28.16	26.91	
	wet pan			26.91	0.00	

d<sub>10</sub> (mm): 0.0011      d<sub>50</sub> (mm): 0.074  
 d<sub>16</sub> (mm): 0.0045      d<sub>60</sub> (mm): 0.093  
 d<sub>30</sub> (mm): 0.042      d<sub>84</sub> (mm): 0.17

Median Particle Diameter--d<sub>50</sub> (mm): 0.074  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 85  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.083

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-5 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:30

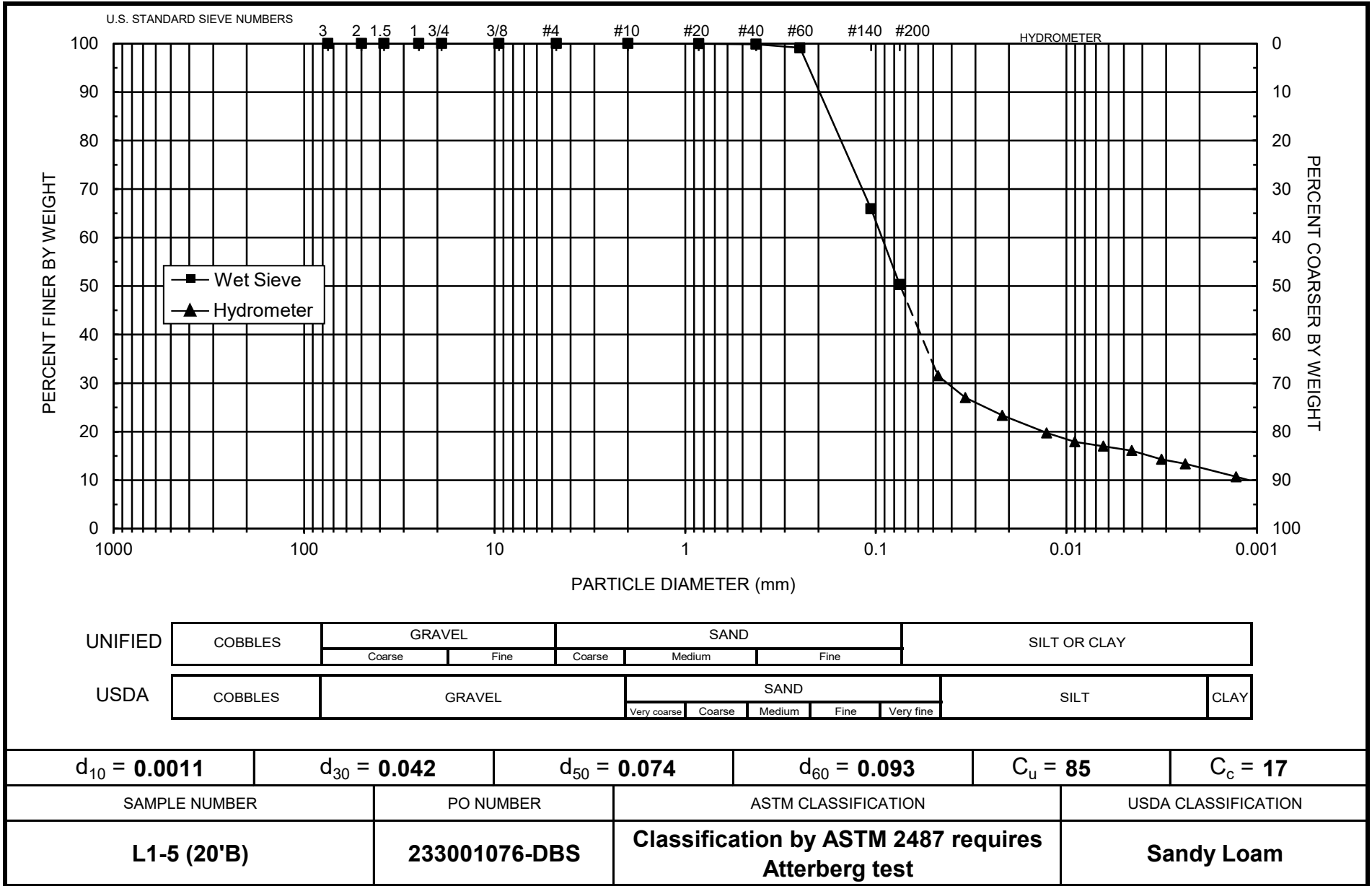
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 55.07  
 Total Sample Wt. (g): 419.21  
 Wt. Passing #10 (g): 419.21

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	23.5	6.1	17.4	12.4	0.04714	31.5	31.5
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.0	27.0
	5	21.6	19.0	6.1	12.9	13.2	0.02170	23.4	23.4
	15	21.6	17.0	6.1	10.9	13.5	0.01268	19.7	19.7
	30	21.6	16.0	6.1	9.9	13.7	0.00902	17.9	17.9
	60	21.6	15.5	6.1	9.4	13.8	0.00640	17.0	17.0
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.1	16.1
	250	21.6	14.0	6.1	7.9	14.0	0.00316	14.3	14.3
	446	21.6	13.5	6.1	7.4	14.1	0.00237	13.4	13.4
	19-May-18	1544	21.7	12.0	6.1	5.9	14.3	0.00129	10.7

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 507.75  
 Weight Passing #10 (g): 507.75  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 65.87  
 Calculated Weight of Sieve Sample (g): 65.87  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	507.75	100.00
	2"	50	0.00	0.00	507.75	100.00
	1.5"	38.1	0.00	0.00	507.75	100.00
	1"	25	0.00	0.00	507.75	100.00
	3/4"	19.0	0.00	0.00	507.75	100.00
	3/8"	9.5	0.00	0.00	507.75	100.00
	4	4.75	0.00	0.00	507.75	100.00
	10	2.00	0.00	0.00	507.75	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.52	0.52	65.35	99.21
	40	0.425	0.54	1.06	64.81	98.39
	60	0.250	0.84	1.90	63.97	97.12
	140	0.106	10.50	12.40	53.47	81.18
	200	0.075	9.01	21.41	44.46	67.50
	dry pan		1.73	23.14	42.73	
	wet pan			42.73	0.00	

d<sub>10</sub> (mm): 0.00040      d<sub>50</sub> (mm): 0.045  
 d<sub>16</sub> (mm): 0.0013      d<sub>60</sub> (mm): 0.060  
 d<sub>30</sub> (mm): 0.015      d<sub>84</sub> (mm): 0.12

Median Particle Diameter--d<sub>50</sub> (mm): 0.045  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 150  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 9.4  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.055

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:18

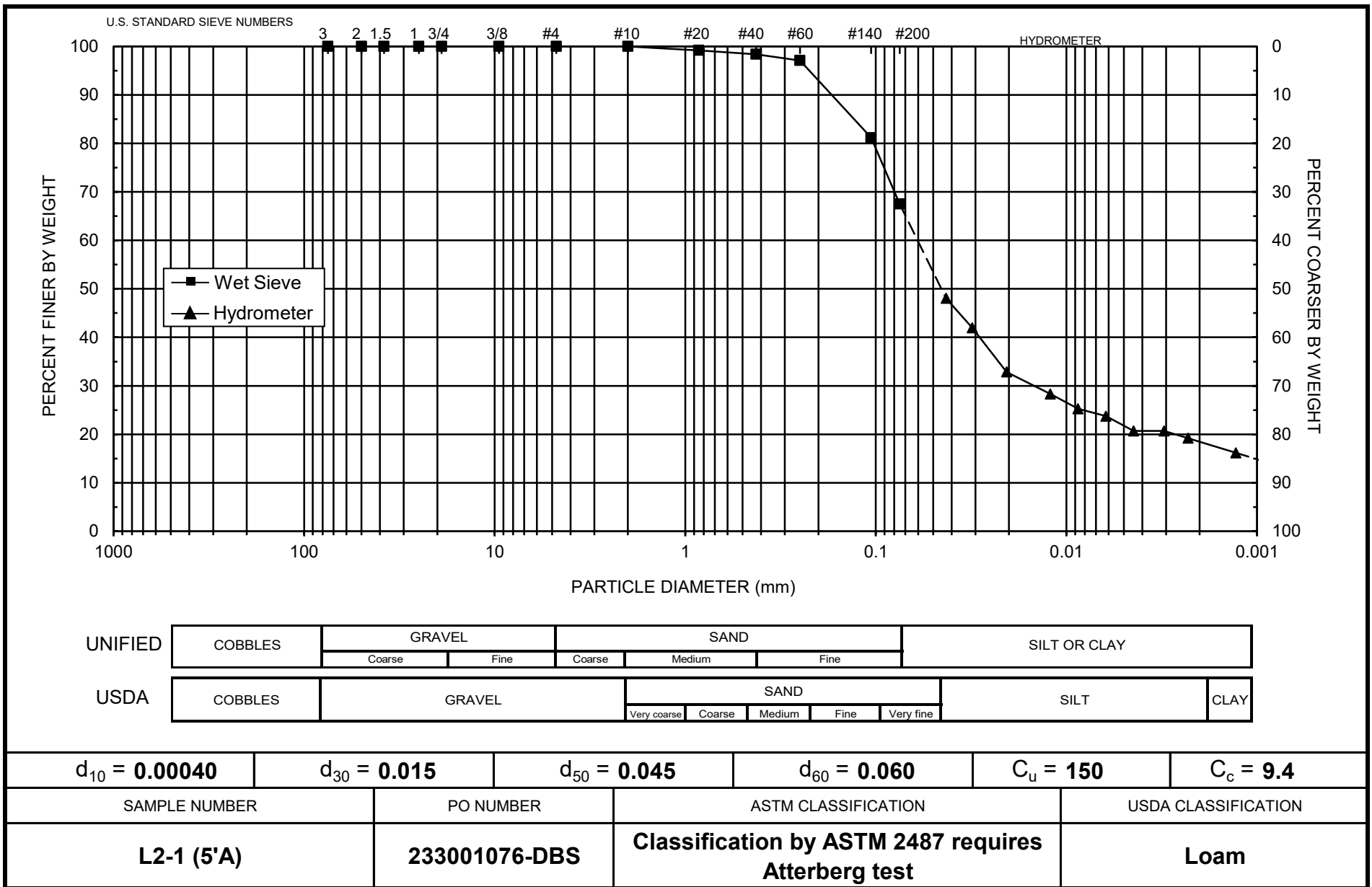
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 65.87  
 Total Sample Wt. (g): 507.75  
 Wt. Passing #10 (g): 507.75

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	37.0	5.4	31.6	10.2	0.04274	48.0	48.0
	2	21.6	33.0	5.4	27.6	10.9	0.03118	42.0	42.0
	5	21.6	27.0	5.4	21.6	11.9	0.02059	32.9	32.9
	15	21.6	24.0	5.4	18.6	12.4	0.01213	28.3	28.3
	30	21.7	22.0	5.4	16.6	12.7	0.00868	25.3	25.3
	60	21.5	21.0	5.4	15.6	12.9	0.00619	23.7	23.7
	120	21.4	19.0	5.4	13.6	13.2	0.00444	20.7	20.7
	250	21.5	19.0	5.4	13.6	13.2	0.00307	20.7	20.7
	453	21.5	18.0	5.4	12.6	13.3	0.00230	19.2	19.2
16-May-18	1472	21.6	16.0	5.4	10.6	13.7	0.00129	16.2	16.2

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 29-Jun-18

Initial Dry Weight of Sample (g): 371.36  
 Weight Passing #10 (g): 371.36  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 52.42  
 Calculated Weight of Sieve Sample (g): 52.42  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	371.36	100.00
	2"	50	0.00	0.00	371.36	100.00
	1.5"	38.1	0.00	0.00	371.36	100.00
	1"	25	0.00	0.00	371.36	100.00
	3/4"	19.0	0.00	0.00	371.36	100.00
	3/8"	9.5	0.00	0.00	371.36	100.00
	4	4.75	0.00	0.00	371.36	100.00
	10	2.00	0.00	0.00	371.36	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.11	0.11	52.31	99.79
	40	0.425	0.19	0.30	52.12	99.43
	60	0.250	0.42	0.72	51.70	98.63
	140	0.106	8.56	9.28	43.14	82.30
	200	0.075	7.21	16.49	35.93	68.54
	dry pan			0.42	16.91	35.51
wet pan				35.51	0.00	

d<sub>10</sub> (mm): 0.00024      d<sub>50</sub> (mm): 0.056  
 d<sub>16</sub> (mm): 0.0012      d<sub>60</sub> (mm): 0.065  
 d<sub>30</sub> (mm): 0.013      d<sub>84</sub> (mm): 0.12

Median Particle Diameter--d<sub>50</sub> (mm): 0.056  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 271  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 11  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.059

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 27-Jun-18  
 Start Time: 9:00

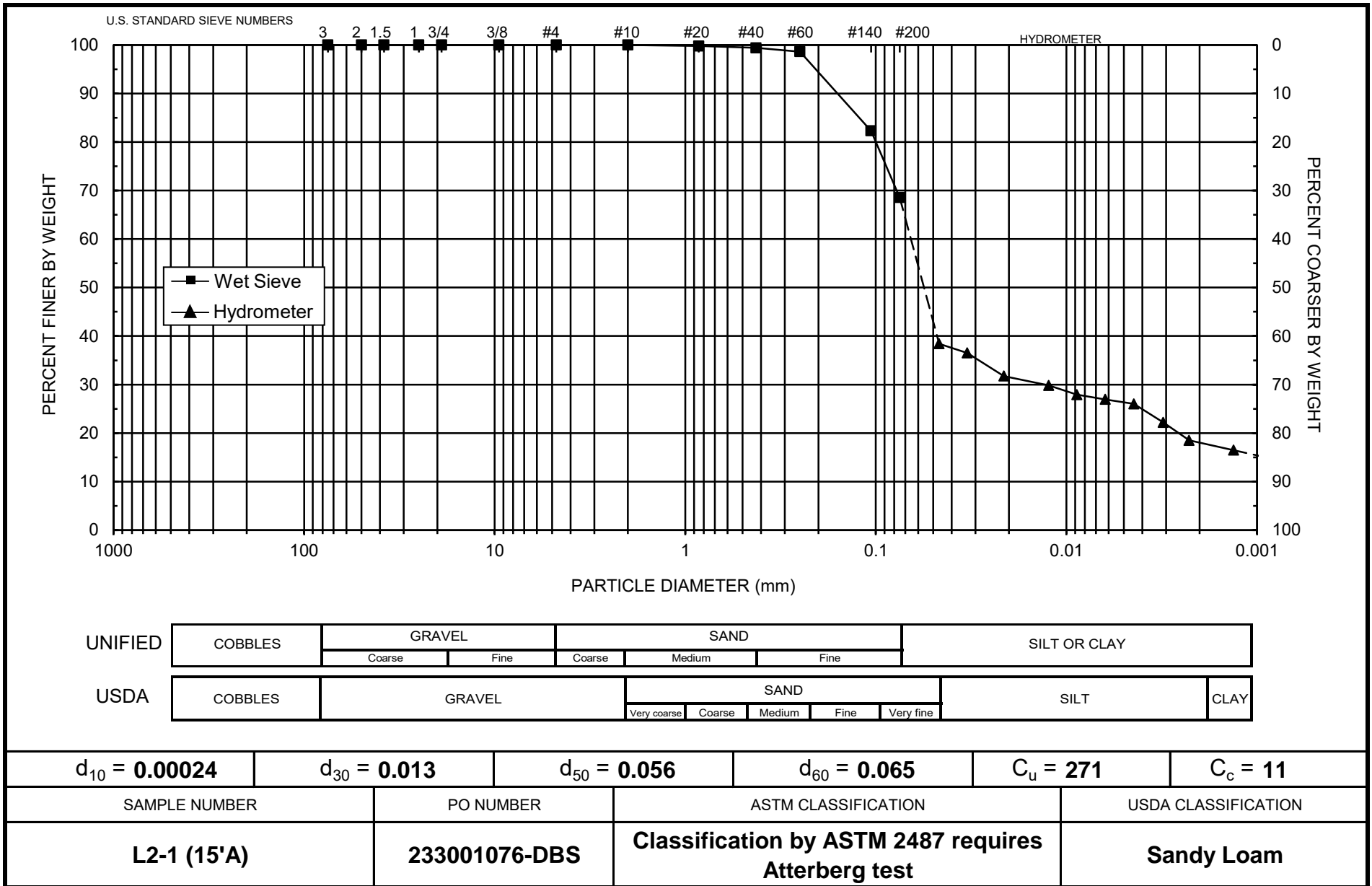
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 52.42  
 Total Sample Wt. (g): 371.36  
 Wt. Passing #10 (g): 371.36

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
27-Jun-18	1	21.6	25.5	5.4	20.1	12.1	0.04651	38.4	38.4
	2	21.6	24.5	5.4	19.1	12.3	0.03311	36.5	36.5
	5	21.6	22.0	5.4	16.6	12.7	0.02129	31.7	31.7
	15	21.5	21.0	5.4	15.6	12.9	0.01238	29.8	29.8
	30	21.5	20.0	5.4	14.6	13.0	0.00881	27.9	27.9
	60	21.4	19.5	5.4	14.1	13.1	0.00626	27.0	27.0
	120	21.6	19.0	5.4	13.6	13.2	0.00443	26.0	26.0
	250	21.6	17.0	5.4	11.6	13.5	0.00311	22.2	22.2
	470	22.5	15.0	5.3	9.7	13.8	0.00227	18.5	18.5
28-Jun-18	1429	21.4	14.0	5.4	8.6	14.0	0.00133	16.5	16.5

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-2 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 483.31  
 Weight Passing #10 (g): 483.31  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 63.94  
 Calculated Weight of Sieve Sample (g): 63.94  
 Shape: Angular  
 Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	483.31	100.00
	2"	50	0.00	0.00	483.31	100.00
	1.5"	38.1	0.00	0.00	483.31	100.00
	1"	25	0.00	0.00	483.31	100.00
	3/4"	19.0	0.00	0.00	483.31	100.00
	3/8"	9.5	0.00	0.00	483.31	100.00
	4	4.75	0.00	0.00	483.31	100.00
	10	2.00	0.00	0.00	483.31	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.09	0.09	63.85	99.86
	40	0.425	0.12	0.21	63.73	99.67
	60	0.250	0.73	0.94	63.00	98.53
	140	0.106	17.65	18.59	45.35	70.93
	200	0.075	11.02	29.61	34.33	53.69
	dry pan			1.32	30.93	33.01
wet pan				33.01	0.00	

d<sub>10</sub> (mm): 0.00019      d<sub>50</sub> (mm): 0.067  
 d<sub>16</sub> (mm): 0.0018      d<sub>60</sub> (mm): 0.085  
 d<sub>30</sub> (mm): 0.031      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.067  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 447  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 60  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.076

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/L. Hill  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-2 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

Test Date: 15-May-18  
 Start Time: 9:24

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65

Initial Wt. (g): 63.94  
 Total Sample Wt. (g): 483.31  
 Wt. Passing #10 (g): 483.31

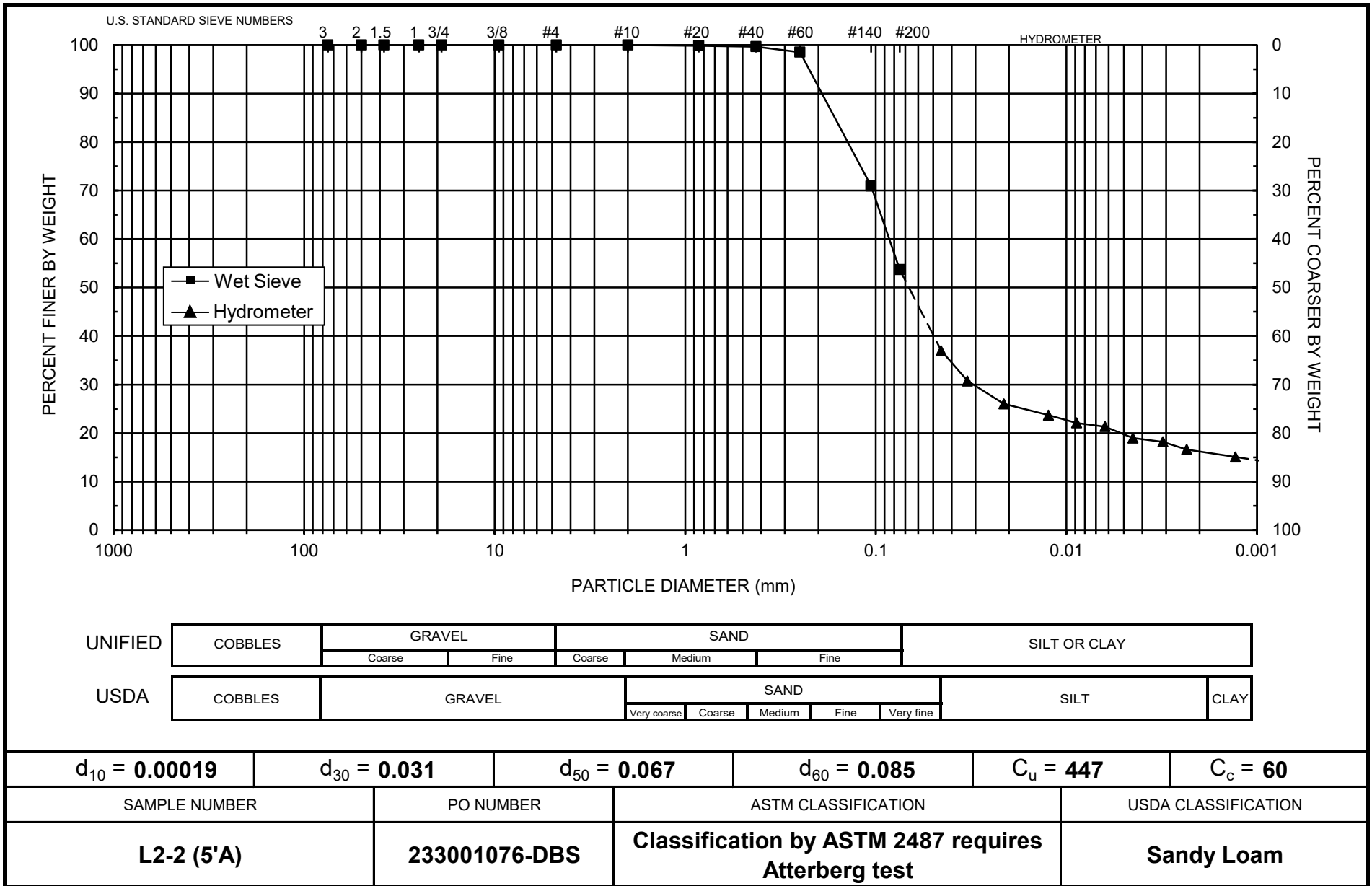
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	29.0	5.4	23.6	11.5	0.04540	37.0	37.0
	2	21.6	25.0	5.4	19.6	12.2	0.03300	30.7	30.7
	5	21.6	22.0	5.4	16.6	12.7	0.02129	26.0	26.0
	15	21.6	20.5	5.4	15.1	12.9	0.01241	23.7	23.7
	30	21.5	19.5	5.4	14.1	13.1	0.00884	22.1	22.1
	60	21.5	19.0	5.4	13.6	13.2	0.00627	21.3	21.3
	120	21.5	17.5	5.4	12.1	13.4	0.00448	19.0	19.0
	250	21.5	17.0	5.4	11.6	13.5	0.00311	18.2	18.2
	448	21.5	16.0	5.4	10.6	13.7	0.00234	16.6	16.6
16-May-18	1468	21.6	15.0	5.4	9.6	13.8	0.00130	15.1	15.1

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-3 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 469.13  
 Weight Passing #10 (g): 469.13  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 60.77  
 Calculated Weight of Sieve Sample (g): 60.77  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	469.13	100.00
	2"	50	0.00	0.00	469.13	100.00
	1.5"	38.1	0.00	0.00	469.13	100.00
	1"	25	0.00	0.00	469.13	100.00
	3/4"	19.0	0.00	0.00	469.13	100.00
	3/8"	9.5	0.00	0.00	469.13	100.00
	4	4.75	0.00	0.00	469.13	100.00
	10	2.00	0.00	0.00	469.13	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.55	0.55	60.22	99.09
	40	0.425	0.62	1.17	59.60	98.07
	60	0.250	1.90	3.07	57.70	94.95
	140	0.106	13.92	16.99	43.78	72.04
	200	0.075	14.10	31.09	29.68	48.84
	dry pan			1.31	32.40	28.37
	wet pan				28.37	0.00

d<sub>10</sub> (mm): 0.00094      d<sub>50</sub> (mm): 0.076  
 d<sub>16</sub> (mm): 0.0097      d<sub>60</sub> (mm): 0.089  
 d<sub>30</sub> (mm): 0.047      d<sub>84</sub> (mm): 0.17

Median Particle Diameter--d<sub>50</sub> (mm): 0.076  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 95  
 Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 26  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.085

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* L2-3 (5'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 15-May-18  
*Start Time:* 9:30

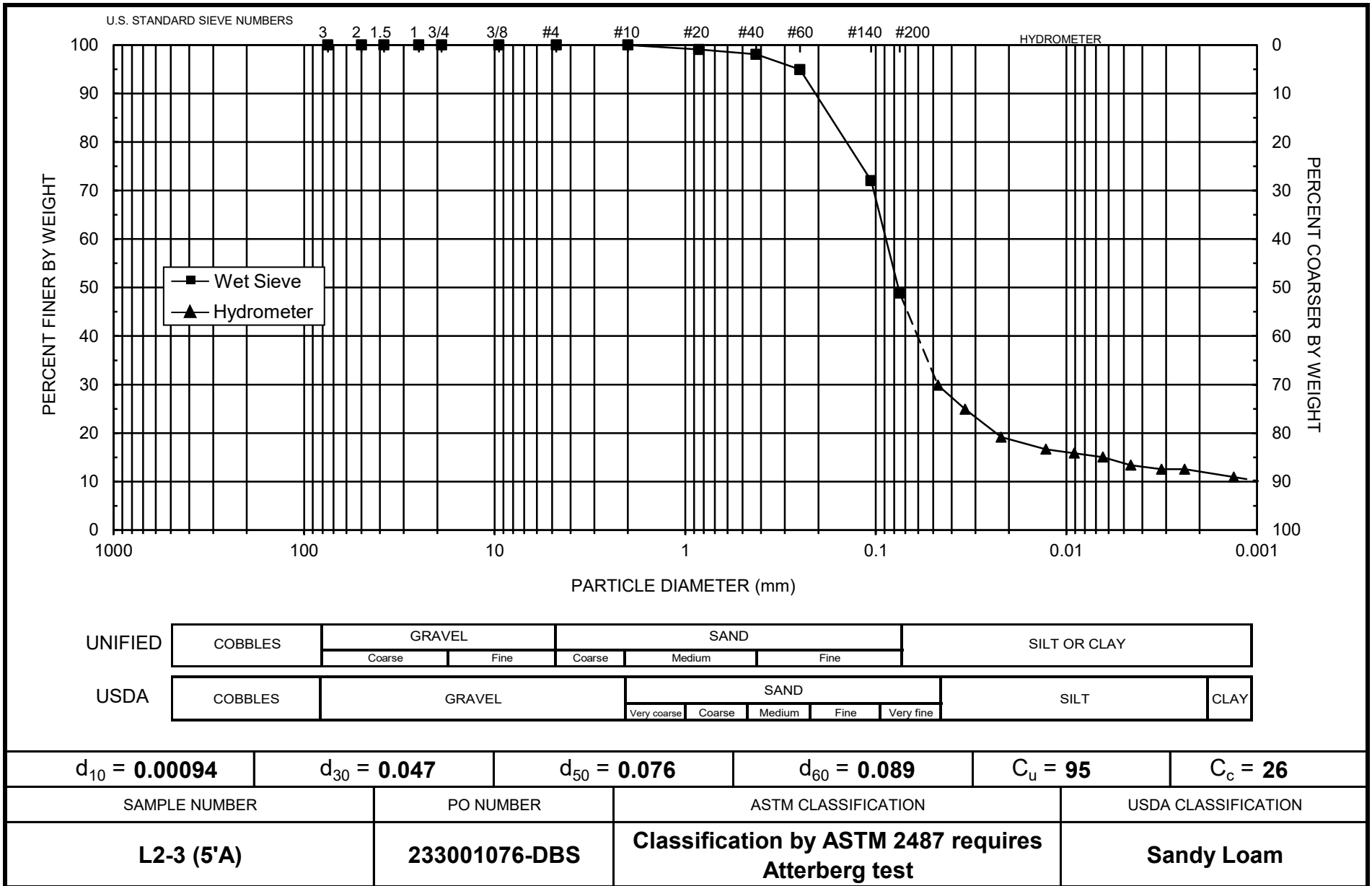
*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* (NaPO<sub>3</sub>)<sub>6</sub>  
*Assumed particle density:* 2.65  
  
*Initial Wt. (g):* 60.77  
*Total Sample Wt. (g):* 469.13  
*Wt. Passing #10 (g):* 469.13

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	23.5	5.4	18.1	12.4	0.04714	29.9	29.9
	2	21.6	20.5	5.4	15.1	12.9	0.03398	24.9	24.9
	5	21.6	17.0	5.4	11.6	13.5	0.02196	19.2	19.2
	15	21.5	15.5	5.4	10.1	13.8	0.01281	16.7	16.7
	30	21.5	15.0	5.4	9.6	13.8	0.00909	15.8	15.8
	60	21.6	14.5	5.4	9.1	13.9	0.00644	15.0	15.0
	120	21.4	13.5	5.4	8.1	14.1	0.00459	13.4	13.4
	253	21.5	13.0	5.4	7.6	14.2	0.00317	12.6	12.6
	443	21.5	13.0	5.4	7.6	14.2	0.00239	12.6	12.6
16-May-18	1463	21.6	12.0	5.4	6.6	14.3	0.00132	10.9	10.9

*Comments:*

\* Dispersion device: mechanically operated stirring device

*Laboratory analysis by:* M. Zbrozek  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-4 (10'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 333.87  
 Weight Passing #10 (g): 333.87  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 58.28  
 Calculated Weight of Sieve Sample (g): 58.28  
 Shape: Angular  
 Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	333.87	100.00
	2"	50	0.00	0.00	333.87	100.00
	1.5"	38.1	0.00	0.00	333.87	100.00
	1"	25	0.00	0.00	333.87	100.00
	3/4"	19.0	0.00	0.00	333.87	100.00
	3/8"	9.5	0.00	0.00	333.87	100.00
	4	4.75	0.00	0.00	333.87	100.00
	10	2.00	0.00	0.00	333.87	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.38	0.38	57.90	99.35
	40	0.425	0.54	0.92	57.36	98.42
	60	0.250	0.84	1.76	56.52	96.98
	140	0.106	7.17	8.93	49.35	84.68
	200	0.075	7.86	16.79	41.49	71.19
	dry pan		1.12	17.91	40.37	
	wet pan			40.37	0.00	

d<sub>10</sub> (mm): 3.9E-05      d<sub>50</sub> (mm): 0.045  
 d<sub>16</sub> (mm): 0.00032      d<sub>60</sub> (mm): 0.057  
 d<sub>30</sub> (mm): 0.012      d<sub>84</sub> (mm): 0.10

Median Particle Diameter--d<sub>50</sub> (mm): 0.045  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1462  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 65  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.048

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-4 (10'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:36

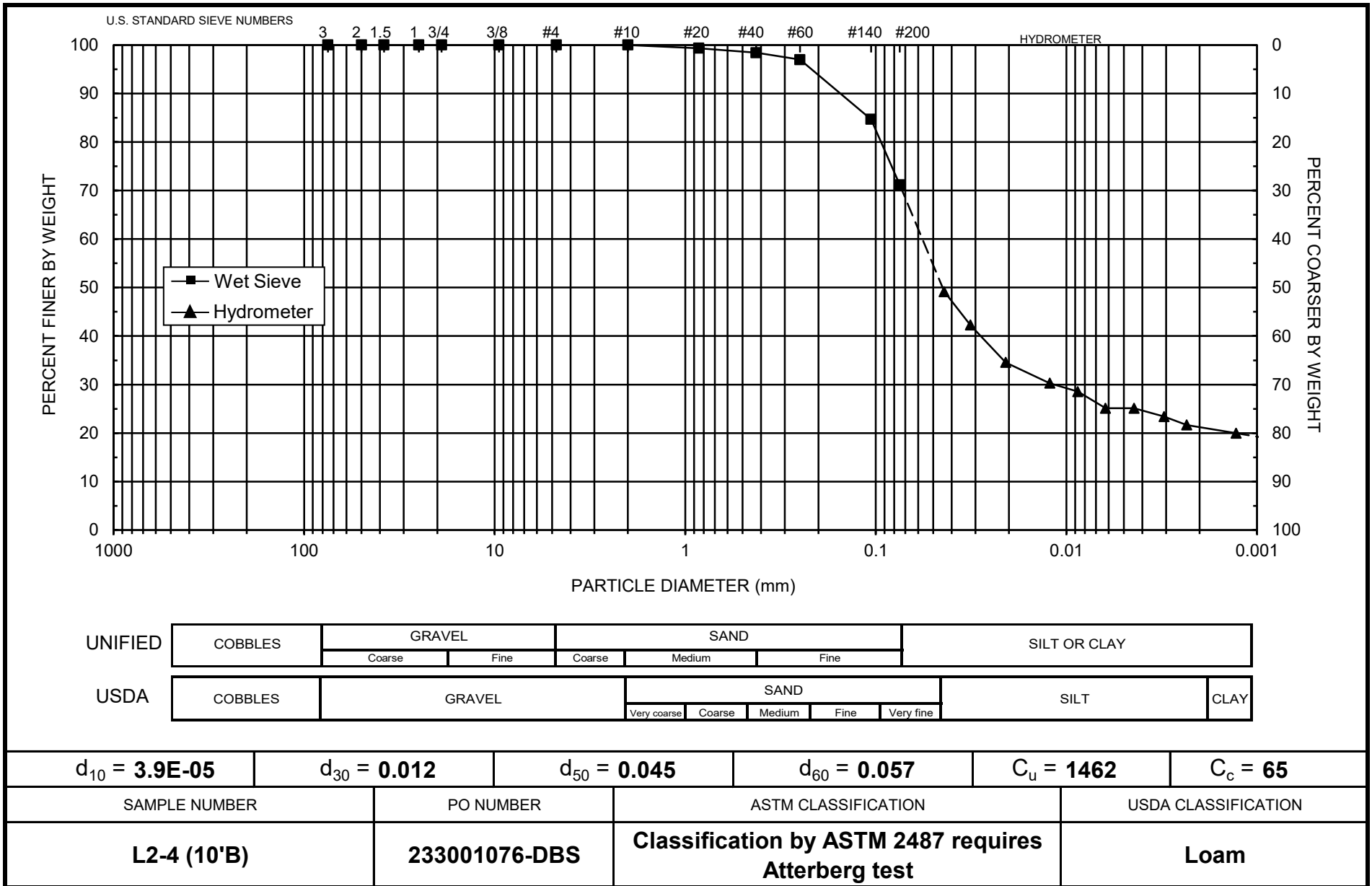
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 58.28  
 Total Sample Wt. (g): 333.87  
 Wt. Passing #10 (g): 333.87

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	34.0	5.4	28.6	10.7	0.04376	49.1	49.1
	2	21.6	30.0	5.4	24.6	11.4	0.03187	42.3	42.3
	5	21.6	25.5	5.4	20.1	12.1	0.02080	34.6	34.6
	15	21.6	23.0	5.4	17.6	12.5	0.01221	30.3	30.3
	30	21.5	22.0	5.4	16.6	12.7	0.00870	28.5	28.5
	60	21.5	20.0	5.4	14.6	13.0	0.00623	25.1	25.1
	120	21.4	20.0	5.4	14.6	13.0	0.00441	25.1	25.1
	250	21.5	19.0	5.4	13.6	13.2	0.00307	23.4	23.4
	438	21.5	18.0	5.4	12.6	13.3	0.00234	21.7	21.7
16-May-18	1458	21.6	17.0	5.4	11.6	13.5	0.00129	20.0	20.0

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-5 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 485.58  
 Weight Passing #10 (g): 485.58  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 59.33  
 Calculated Weight of Sieve Sample (g): 59.33  
 Shape: Angular  
 Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	485.58	100.00
	2"	50	0.00	0.00	485.58	100.00
	1.5"	38.1	0.00	0.00	485.58	100.00
	1"	25	0.00	0.00	485.58	100.00
	3/4"	19.0	0.00	0.00	485.58	100.00
	3/8"	9.5	0.00	0.00	485.58	100.00
	4	4.75	0.00	0.00	485.58	100.00
	10	2.00	0.00	0.00	485.58	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	59.33	100.00
	40	0.425	0.00	0.00	59.33	100.00
	60	0.250	0.04	0.04	59.29	99.93
	140	0.106	0.89	0.93	58.40	98.43
	200	0.075	0.75	1.68	57.65	97.17
	dry pan			0.16	1.84	57.49
wet pan				57.49	0.00	

d<sub>10</sub> (mm): 4.4E-05      d<sub>50</sub> (mm): 0.0022  
 d<sub>16</sub> (mm): 8.0E-05      d<sub>60</sub> (mm): 0.0047  
 d<sub>30</sub> (mm): 0.00032      d<sub>84</sub> (mm): 0.023

Median Particle Diameter--d<sub>50</sub> (mm): 0.0022  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 107  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.50  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.0084

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Silty Clay

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines





**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-5 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:42

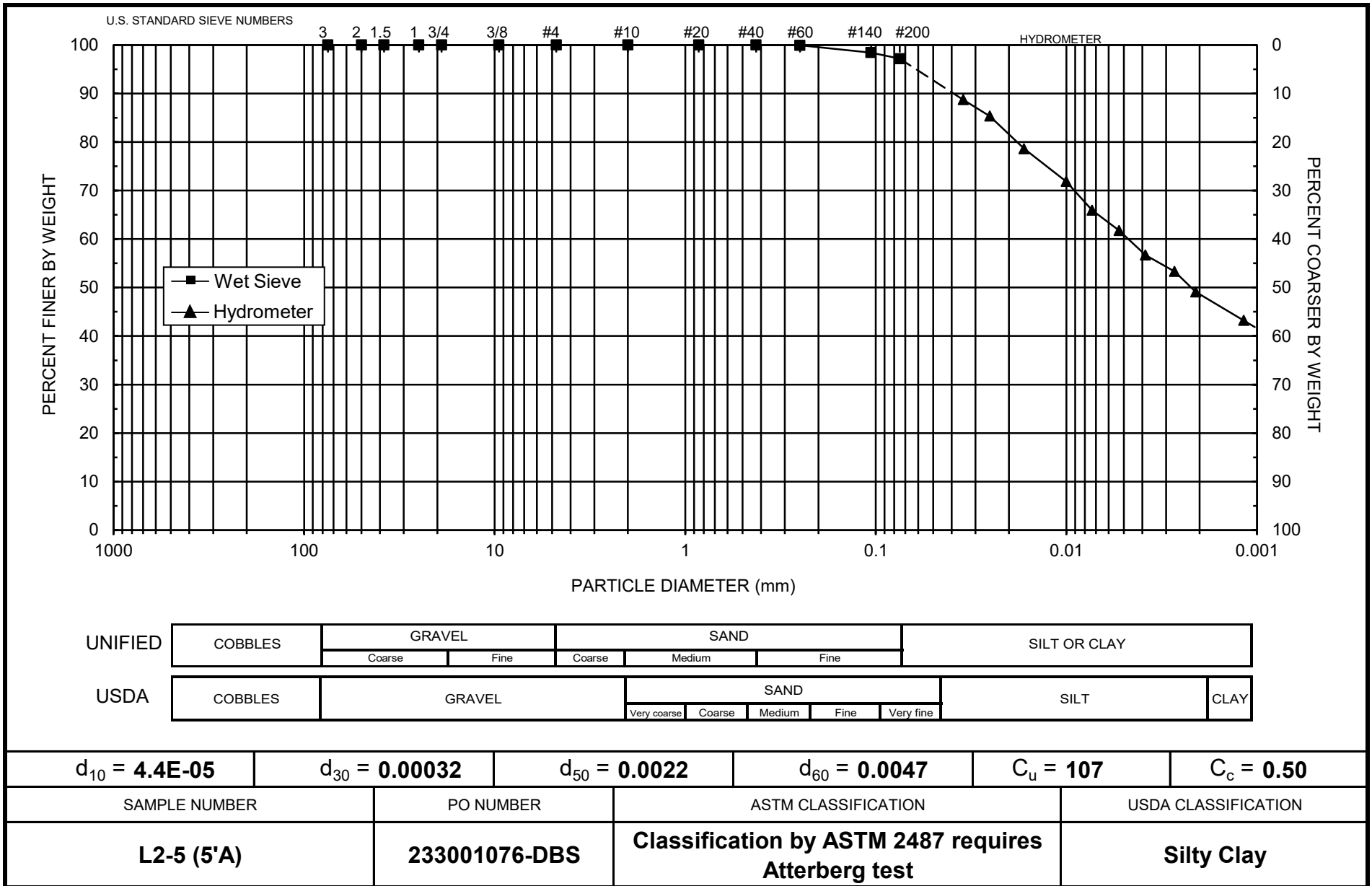
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 59.33  
 Total Sample Wt. (g): 485.58  
 Wt. Passing #10 (g): 485.58

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.7	58.0	5.4	52.6	6.8	0.03478	88.7	88.7
	2	21.6	56.0	5.4	50.6	7.1	0.02521	85.4	85.4
	5	21.6	52.0	5.4	46.6	7.8	0.01666	78.6	78.6
	15	21.6	48.0	5.4	42.6	8.4	0.01002	71.9	71.9
	30	21.5	44.5	5.4	39.1	9.0	0.00733	66.0	66.0
	60	21.6	42.0	5.4	36.6	9.4	0.00529	61.8	61.8
	120	21.5	39.0	5.4	33.6	9.9	0.00384	56.7	56.7
	250	21.5	37.0	5.4	31.6	10.2	0.00271	53.3	53.3
	433	21.5	34.5	5.4	29.1	10.6	0.00210	49.1	49.1
16-May-18	1454	21.6	31.0	5.4	25.6	11.2	0.00117	43.2	43.2

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 230.60  
 Weight Passing #10 (g): 230.60  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 54.02  
 Calculated Weight of Sieve Sample (g): 54.02  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing	
+10	3"	75	0.00	0.00	230.60	100.00	
	2"	50	0.00	0.00	230.60	100.00	
	1.5"	38.1	0.00	0.00	230.60	100.00	
	1"	25	0.00	0.00	230.60	100.00	
	3/4"	19.0	0.00	0.00	230.60	100.00	
	3/8"	9.5	0.00	0.00	230.60	100.00	
	4	4.75	0.00	0.00	230.60	100.00	
	10	2.00	0.00	0.00	230.60	100.00	
-10	(Based on calculated sieve wt.)						
	20	0.85	0.00	0.00	54.02	100.00	
	40	0.425	0.03	0.03	53.99	99.94	
	60	0.250	0.17	0.20	53.82	99.63	
	140	0.106	3.57	3.77	50.25	93.02	
	200	0.075	4.24	8.01	46.01	85.17	
	dry pan			0.65	8.66	45.36	
	wet pan				45.36	0.00	

d<sub>10</sub> (mm): 0.00031      d<sub>50</sub> (mm): 0.013  
 d<sub>16</sub> (mm): 0.00054      d<sub>60</sub> (mm): 0.030  
 d<sub>30</sub> (mm): 0.0020      d<sub>84</sub> (mm): 0.072

Median Particle Diameter--d<sub>50</sub> (mm): 0.013  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 97  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.43  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.029

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)  
 USDA Soil Classification: Clay Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:36

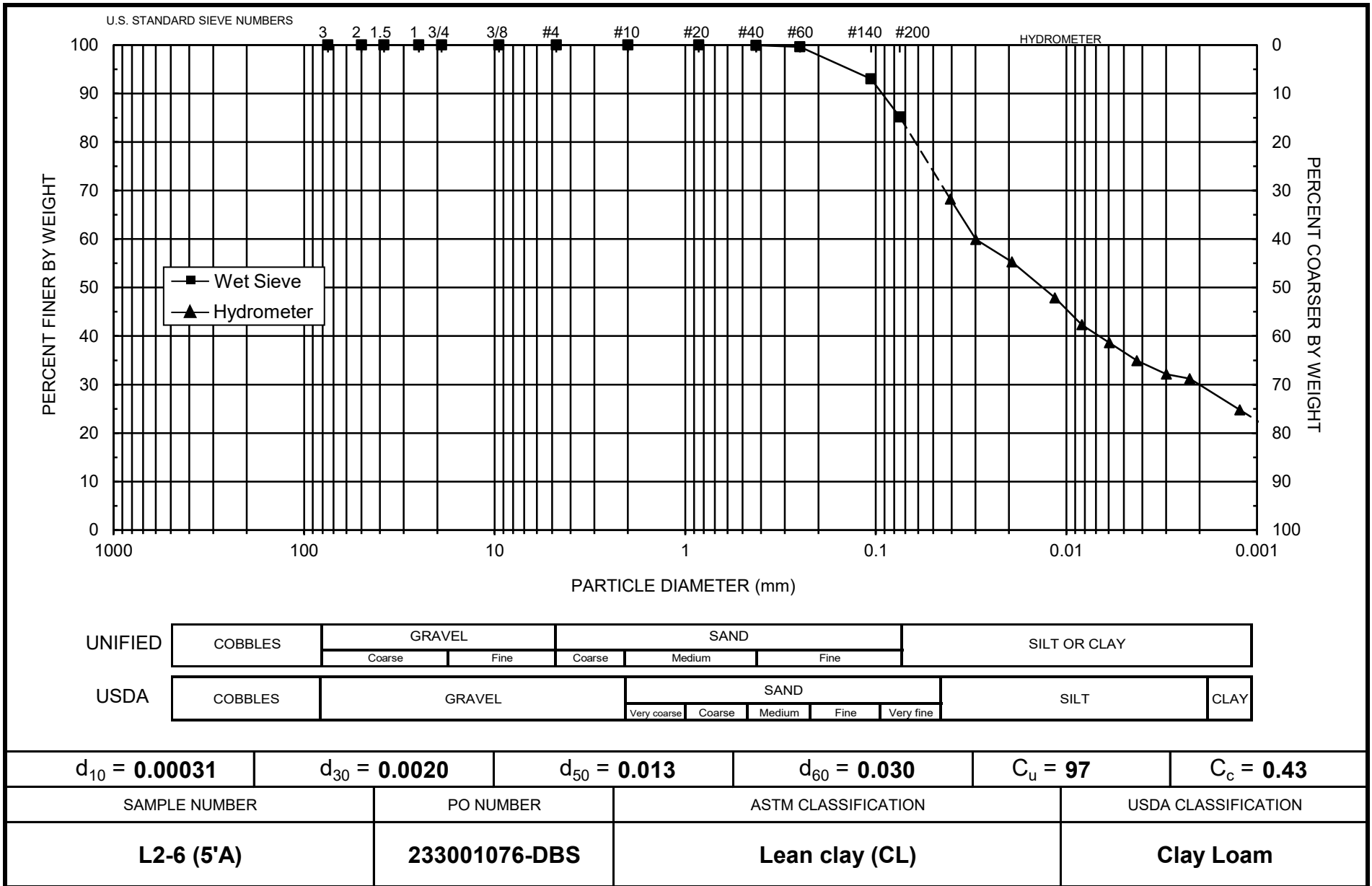
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 54.02  
 Total Sample Wt. (g): 230.60  
 Wt. Passing #10 (g): 230.60

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	43.0	6.1	36.9	9.3	0.04064	68.2	68.2
	2	21.6	38.5	6.1	32.4	10.0	0.02986	59.9	59.9
	5	21.6	36.0	6.1	29.9	10.4	0.01927	55.3	55.3
	15	21.6	32.0	6.1	25.9	11.1	0.01147	47.9	47.9
	30	21.6	29.0	6.1	22.9	11.5	0.00829	42.3	42.3
	60	21.6	27.0	6.1	20.9	11.9	0.00594	38.6	38.6
	120	21.6	25.0	6.1	18.9	12.2	0.00426	34.9	34.9
	250	21.6	23.5	6.1	17.4	12.4	0.00298	32.1	32.1
	441	21.6	23.0	6.1	16.9	12.5	0.00225	31.2	31.2
19-May-18	1539	21.7	19.5	6.1	13.4	13.1	0.00123	24.8	24.8

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-7 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 30-May-18

Initial Dry Weight of Sample (g): 458.29  
 Weight Passing #10 (g): 458.15  
 Weight Retained #10 (g): 0.14  
 Weight of Hydrometer Sample (g): 59.02  
 Calculated Weight of Sieve Sample (g): 59.04  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	458.29	100.00
	2"	50	0.00	0.00	458.29	100.00
	1.5"	38.1	0.00	0.00	458.29	100.00
	1"	25	0.00	0.00	458.29	100.00
	3/4"	19.0	0.00	0.00	458.29	100.00
	3/8"	9.5	0.00	0.00	458.29	100.00
	4	4.75	0.00	0.00	458.29	100.00
	10	2.00	0.14	0.14	458.15	99.97
-10	(Based on calculated sieve wt.)					
	20	0.85	0.10	0.12	58.92	99.80
	40	0.425	0.14	0.26	58.78	99.56
	60	0.250	0.47	0.73	58.31	98.77
	140	0.106	12.39	13.12	45.92	77.78
	200	0.075	10.54	23.66	35.38	59.93
	dry pan		0.75	24.41	34.63	
	wet pan			34.63	0.00	

d<sub>10</sub> (mm): 1.9E-09      d<sub>50</sub> (mm): 0.057  
 d<sub>16</sub> (mm): 0.0067      d<sub>60</sub> (mm): 0.075  
 d<sub>30</sub> (mm): 0.025      d<sub>84</sub> (mm): 0.14

Median Particle Diameter--d<sub>50</sub> (mm): 0.057  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 3.9E+07  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 4.4E+06  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.068

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-7 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

Test Date: 23-May-18  
 Start Time: 9:00

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65

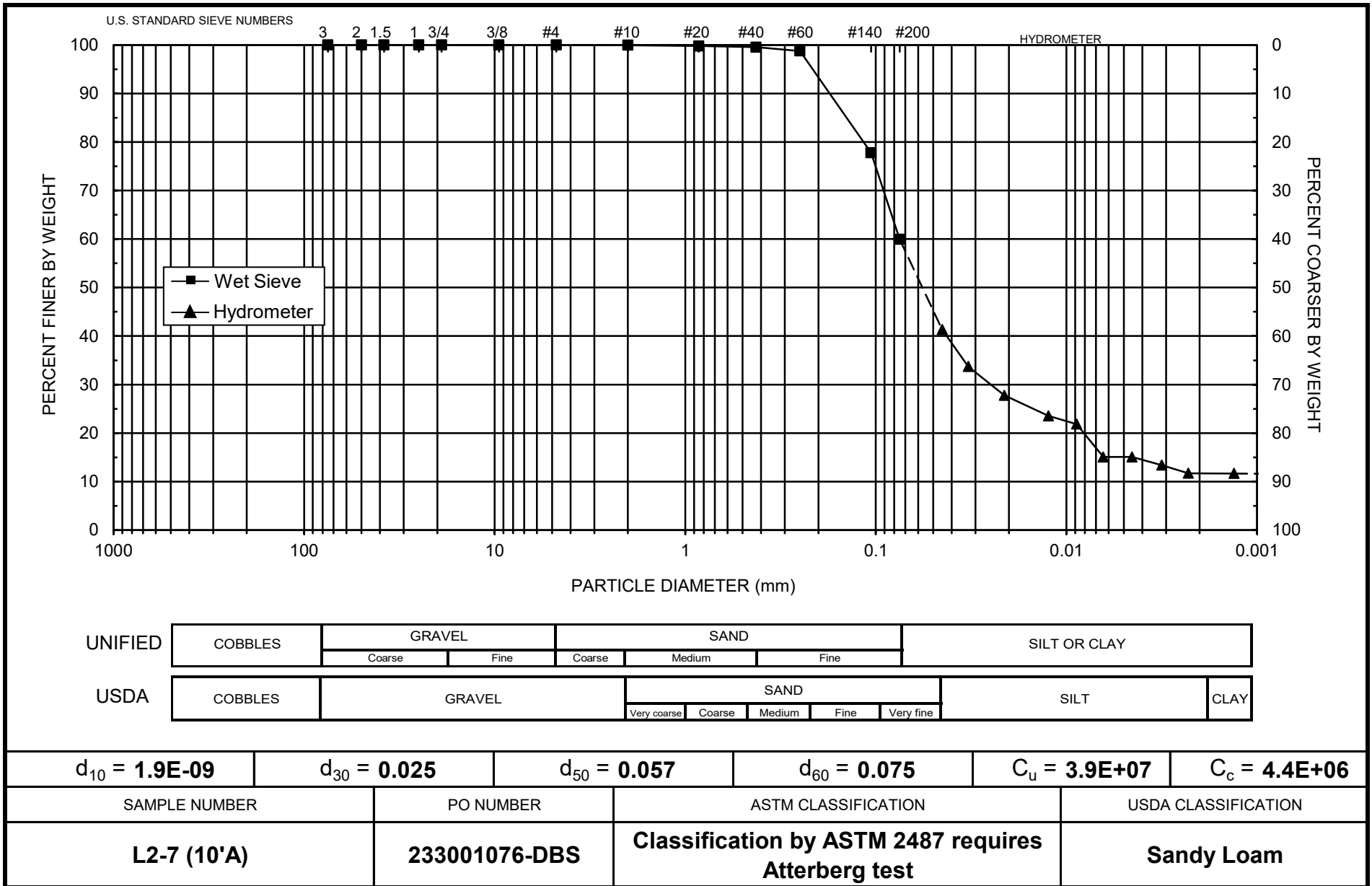
Initial Wt. (g): 59.02  
 Total Sample Wt. (g): 458.29  
 Wt. Passing #10 (g): 458.15

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
23-May-18	1	21.8	30.5	6.1	24.4	11.3	0.04481	41.3	41.3
	2	21.8	26.0	6.1	19.9	12.0	0.03270	33.7	33.7
	5	21.8	22.5	6.1	16.4	12.6	0.02117	27.8	27.8
	15	21.8	20.0	6.1	13.9	13.0	0.01242	23.6	23.5
	30	21.8	19.0	6.1	12.9	13.2	0.00884	21.9	21.9
	60	21.8	15.0	6.1	8.9	13.8	0.00640	15.1	15.1
	120	21.8	15.0	6.1	8.9	13.8	0.00453	15.1	15.1
	250	21.8	14.0	6.1	7.9	14.0	0.00315	13.4	13.4
	480	21.9	13.0	6.1	6.9	14.2	0.00229	11.7	11.7
24-May-18	1455	21.7	13.0	6.1	6.9	14.2	0.00132	11.7	11.7

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-1 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 451.54  
 Weight Passing #10 (g): 449.76  
 Weight Retained #10 (g): 1.78  
 Weight of Hydrometer Sample (g): 54.86  
 Calculated Weight of Sieve Sample (g): 55.08  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	451.54	100.00
	2"	50	0.00	0.00	451.54	100.00
	1.5"	38.1	0.00	0.00	451.54	100.00
	1"	25	0.00	0.00	451.54	100.00
	3/4"	19.0	0.00	0.00	451.54	100.00
	3/8"	9.5	0.00	0.00	451.54	100.00
	4	4.75	1.11	1.11	450.43	99.75
	10	2.00	0.67	1.78	449.76	99.61
-10			(Based on calculated sieve wt.)			
	20	0.85	0.24	0.46	54.62	99.17
	40	0.425	0.21	0.67	54.41	98.79
	60	0.250	0.15	0.82	54.26	98.52
	140	0.106	0.37	1.19	53.89	97.84
	200	0.075	0.72	1.91	53.17	96.54
	dry pan		0.25	2.16	52.92	
	wet pan			52.92	0.00	

d<sub>10</sub> (mm): 0.00030      d<sub>50</sub> (mm): 0.0088  
 d<sub>16</sub> (mm): 0.00052      d<sub>60</sub> (mm): 0.016  
 d<sub>30</sub> (mm): 0.0019      d<sub>84</sub> (mm): 0.043

Median Particle Diameter--d<sub>50</sub> (mm): 0.0088  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 53  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.75  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.017

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: J. Hines  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-1 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 15-May-18  
 Start Time: 9:48

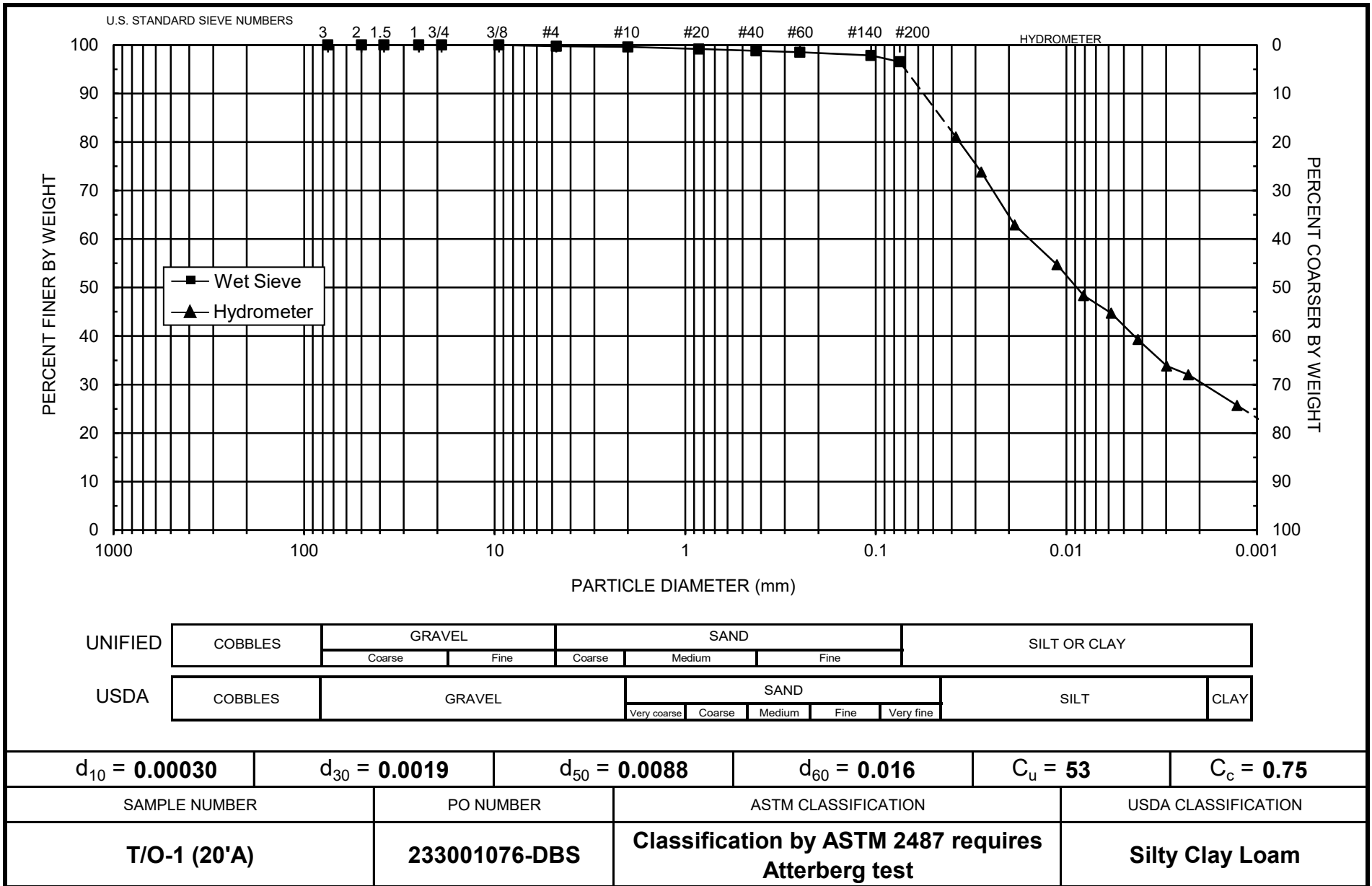
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 54.86  
 Total Sample Wt. (g): 451.54  
 Wt. Passing #10 (g): 449.76

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.7	50.0	5.4	44.6	8.1	0.03799	81.4	81.0
	2	21.7	46.0	5.4	40.6	8.8	0.02793	74.1	73.8
	5	21.5	40.0	5.4	34.6	9.7	0.01867	63.1	62.9
	15	21.5	35.5	5.4	30.1	10.5	0.01118	54.9	54.7
	30	21.5	32.0	5.4	26.6	11.1	0.00812	48.5	48.4
	60	21.6	30.0	5.4	24.6	11.4	0.00582	44.9	44.7
	120	21.5	27.0	5.4	21.6	11.9	0.00421	39.4	39.3
	250	21.5	24.0	5.4	18.6	12.4	0.00298	34.0	33.8
	428	21.5	23.0	5.4	17.6	12.5	0.00229	32.1	32.0
16-May-18	1449	21.6	19.5	5.4	14.1	13.1	0.00127	25.8	25.7

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-1 (45'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Initial Dry Weight of Sample (g): 440.68  
 Weight Passing #10 (g): 440.68  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 53.68  
 Calculated Weight of Sieve Sample (g): 53.68  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	440.68	100.00
	2"	50	0.00	0.00	440.68	100.00
	1.5"	38.1	0.00	0.00	440.68	100.00
	1"	25	0.00	0.00	440.68	100.00
	3/4"	19.0	0.00	0.00	440.68	100.00
	3/8"	9.5	0.00	0.00	440.68	100.00
	4	4.75	0.00	0.00	440.68	100.00
	10	2.00	0.00	0.00	440.68	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.27	0.27	53.41	99.50
	40	0.425	0.29	0.56	53.12	98.96
	60	0.250	0.79	1.35	52.33	97.49
	140	0.106	19.08	20.43	33.25	61.94
	200	0.075	5.28	25.71	27.97	52.11
	dry pan			0.45	26.16	27.52
wet pan				27.52	0.00	

d<sub>10</sub> (mm): 5.1E-05      d<sub>50</sub> (mm): 0.070  
 d<sub>16</sub> (mm): 0.00037      d<sub>60</sub> (mm): 0.099  
 d<sub>30</sub> (mm): 0.016      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.070  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1941  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 51  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.083

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Clay Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* T/O-1 (45'B)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 15-May-18  
*Start Time:* 9:54

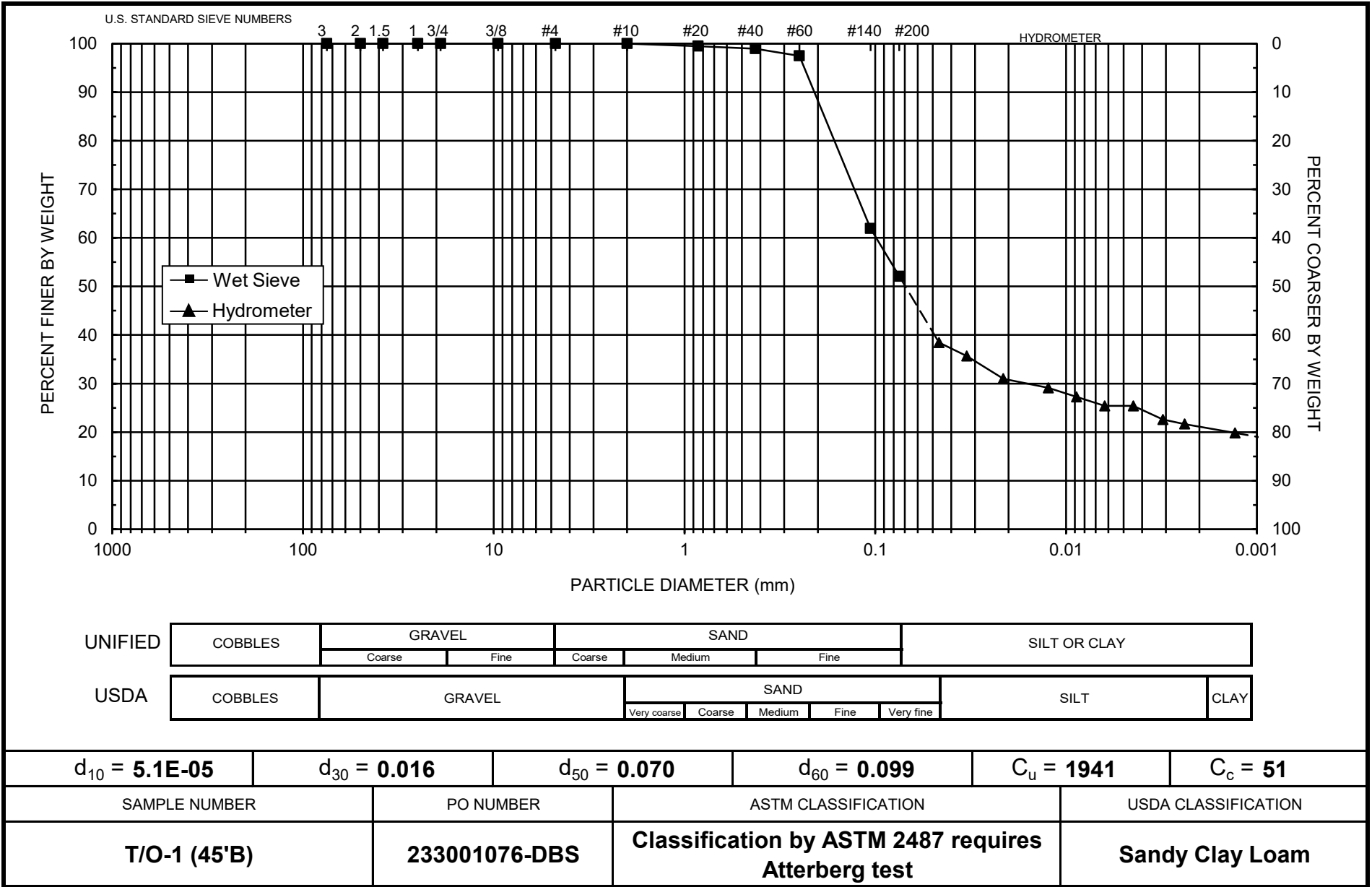
*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* (NaPO<sub>3</sub>)<sub>6</sub>  
*Assumed particle density:* 2.65  
  
*Initial Wt. (g):* 53.68  
*Total Sample Wt. (g):* 440.68  
*Wt. Passing #10 (g):* 440.68

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
15-May-18	1	21.6	26.0	5.4	20.6	12.0	0.04636	38.5	38.5
	2	21.6	24.5	5.4	19.1	12.3	0.03311	35.7	35.7
	5	21.5	22.0	5.4	16.6	12.7	0.02131	31.0	31.0
	15	21.5	21.0	5.4	15.6	12.9	0.01238	29.1	29.1
	30	21.5	20.0	5.4	14.6	13.0	0.00881	27.3	27.3
	60	21.5	19.0	5.4	13.6	13.2	0.00627	25.4	25.4
	120	21.5	19.0	5.4	13.6	13.2	0.00444	25.4	25.4
	250	21.4	17.5	5.4	12.1	13.4	0.00310	22.6	22.6
	423	21.5	17.0	5.4	11.6	13.5	0.00239	21.7	21.7
16-May-18	1444	21.6	16.0	5.4	10.6	13.7	0.00130	19.8	19.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

*Laboratory analysis by:* M. Zbrozek  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-2 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Initial Dry Weight of Sample (g): 502.66  
 Weight Passing #10 (g): 501.78  
 Weight Retained #10 (g): 0.88  
 Weight of Hydrometer Sample (g): 52.20  
 Calculated Weight of Sieve Sample (g): 52.29  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	502.66	100.00
	2"	50	0.00	0.00	502.66	100.00
	1.5"	38.1	0.00	0.00	502.66	100.00
	1"	25	0.00	0.00	502.66	100.00
	3/4"	19.0	0.00	0.00	502.66	100.00
	3/8"	9.5	0.00	0.00	502.66	100.00
	4	4.75	0.00	0.00	502.66	100.00
	10	2.00	0.88	0.88	501.78	99.82
-10	(Based on calculated sieve wt.)					
	20	0.85	2.09	2.18	50.11	95.83
	40	0.425	4.57	6.75	45.54	87.09
	60	0.250	2.38	9.13	43.16	82.54
	140	0.106	2.23	11.36	40.93	78.27
	200	0.075	0.66	12.02	40.27	77.01
	dry pan		0.31	12.33	39.96	
wet pan			39.96	0.00		

d<sub>10</sub> (mm): 0.0025      d<sub>50</sub> (mm): 0.010  
 d<sub>16</sub> (mm): 0.0026      d<sub>60</sub> (mm): 0.022  
 d<sub>30</sub> (mm): 0.0029      d<sub>84</sub> (mm): 0.30

Median Particle Diameter--d<sub>50</sub> (mm): 0.010  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 8.8  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.15  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.10

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Silt Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-2 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:06

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 52.20  
 Total Sample Wt. (g): 502.66  
 Wt. Passing #10 (g): 501.78

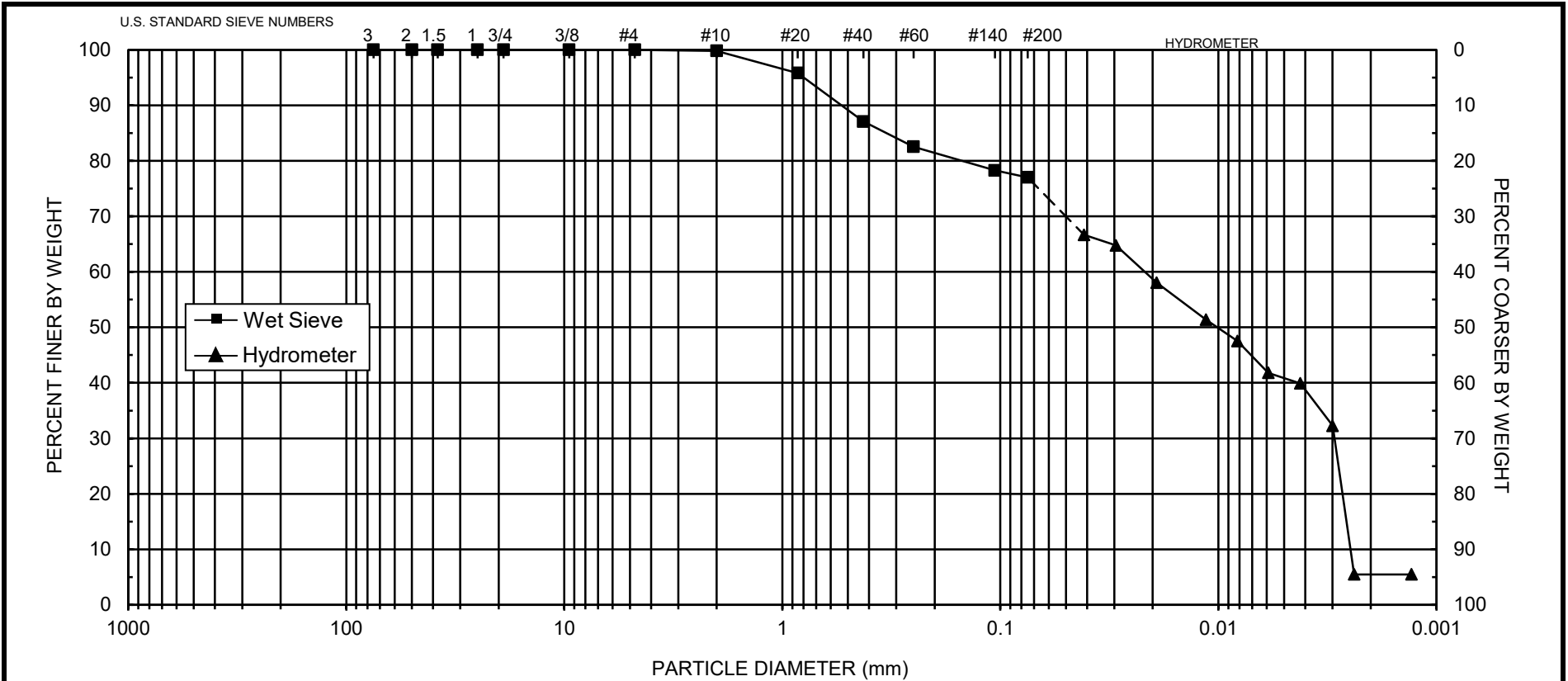
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	41.0	6.1	34.9	9.6	0.04135	66.8	66.7
	2	21.6	40.0	6.1	33.9	9.7	0.02949	64.9	64.8
	5	21.6	36.5	6.1	30.4	10.3	0.01919	58.2	58.1
	15	21.6	33.0	6.1	26.9	10.9	0.01138	51.5	51.4
	30	21.6	31.0	6.1	24.9	11.2	0.00817	47.6	47.5
	60	21.6	28.0	6.1	21.9	11.7	0.00590	41.9	41.8
	120	21.6	27.0	6.1	20.9	11.9	0.00420	40.0	39.9
	250	21.6	23.0	6.1	16.9	12.5	0.00299	32.3	32.2
	466	21.6	9.0	6.1	2.9	14.8	0.00238	5.5	5.5
19-May-18	1565	21.7	9.0	6.1	2.9	14.8	0.00130	5.5	5.5

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines





UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

$d_{10} = 0.0025$	$d_{30} = 0.0029$	$d_{50} = 0.010$	$d_{60} = 0.022$	$C_u = 8.8$	$C_c = 0.15$
SAMPLE NUMBER	PO NUMBER	ASTM CLASSIFICATION		USDA CLASSIFICATION	
<b>T/O-2 (5'A)</b>	<b>233001076-DBS</b>	<b>Classification by ASTM 2487 requires Atterberg test</b>		<b>Silt Loam</b>	



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-3 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 403.81  
 Weight Passing #10 (g): 403.64  
 Weight Retained #10 (g): 0.17  
 Weight of Hydrometer Sample (g): 53.27  
 Calculated Weight of Sieve Sample (g): 53.29  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	403.81	100.00
	2"	50	0.00	0.00	403.81	100.00
	1.5"	38.1	0.00	0.00	403.81	100.00
	1"	25	0.00	0.00	403.81	100.00
	3/4"	19.0	0.00	0.00	403.81	100.00
	3/8"	9.5	0.00	0.00	403.81	100.00
	4	4.75	0.15	0.15	403.66	99.96
	10	2.00	0.02	0.17	403.64	99.96
-10	(Based on calculated sieve wt.)					
	20	0.85	0.14	0.16	53.13	99.70
	40	0.425	0.22	0.38	52.91	99.28
	60	0.250	0.83	1.21	52.08	97.72
	140	0.106	19.16	20.37	32.92	61.77
	200	0.075	7.09	27.46	25.83	48.47
	dry pan			0.50	27.96	25.33
wet pan				25.33	0.00	

d<sub>10</sub> (mm): 0.00083      d<sub>50</sub> (mm): 0.078  
 d<sub>16</sub> (mm): 0.0036      d<sub>60</sub> (mm): 0.10  
 d<sub>30</sub> (mm): 0.041      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.078  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 120  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 20  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.087

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-3 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:12

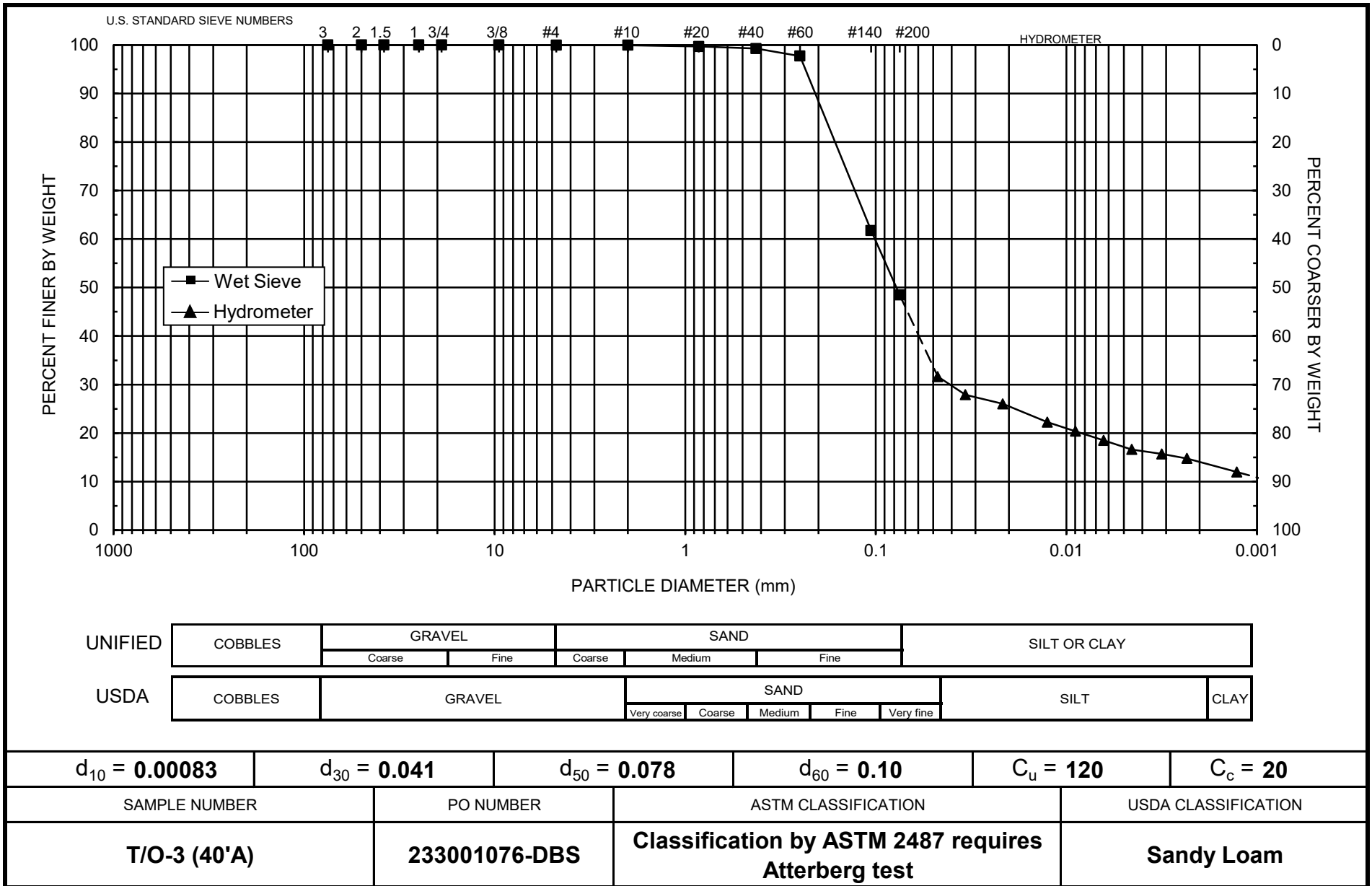
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 53.27  
 Total Sample Wt. (g): 403.81  
 Wt. Passing #10 (g): 403.64

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	23.0	6.1	16.9	12.5	0.04729	31.7	31.6
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.9	27.9
	5	21.6	20.0	6.1	13.9	13.0	0.02156	26.0	26.0
	15	21.6	18.0	6.1	11.9	13.3	0.01260	22.3	22.3
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.4	20.4
	60	21.6	16.0	6.1	9.9	13.7	0.00638	18.5	18.5
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.6	16.6
	250	21.6	14.5	6.1	8.4	13.9	0.00315	15.7	15.7
	462	21.6	14.0	6.1	7.9	14.0	0.00233	14.8	14.7
19-May-18	1560	21.7	12.5	6.1	6.4	14.3	0.00128	12.0	12.0

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-3 (70'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 22-May-18

Initial Dry Weight of Sample (g): 563.72  
 Weight Passing #10 (g): 558.38  
 Weight Retained #10 (g): 5.34  
 Weight of Hydrometer Sample (g): 49.58  
 Calculated Weight of Sieve Sample (g): 50.05  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	563.72	100.00
	2"	50	0.00	0.00	563.72	100.00
	1.5"	38.1	0.00	0.00	563.72	100.00
	1"	25	0.00	0.00	563.72	100.00
	3/4"	19.0	0.00	0.00	563.72	100.00
	3/8"	9.5	0.00	0.00	563.72	100.00
	4	4.75	2.62	2.62	561.10	99.54
	10	2.00	2.72	5.34	558.38	99.05
-10	(Based on calculated sieve wt.)					
	20	0.85	0.13	0.60	49.45	98.79
	40	0.425	0.16	0.76	49.29	98.47
	60	0.250	0.12	0.88	49.17	98.23
	140	0.106	1.05	1.93	48.12	96.14
	200	0.075	2.63	4.56	45.49	90.88
	dry pan		0.53	5.09	44.96	
	wet pan			44.96	0.00	

d<sub>10</sub> (mm): 0.00032      d<sub>50</sub> (mm): 0.034  
 d<sub>16</sub> (mm): 0.0015      d<sub>60</sub> (mm): 0.045  
 d<sub>30</sub> (mm): 0.011      d<sub>84</sub> (mm): 0.067

Median Particle Diameter--d<sub>50</sub> (mm): 0.034  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 141  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 8.4  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.034

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-3 (70'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:48

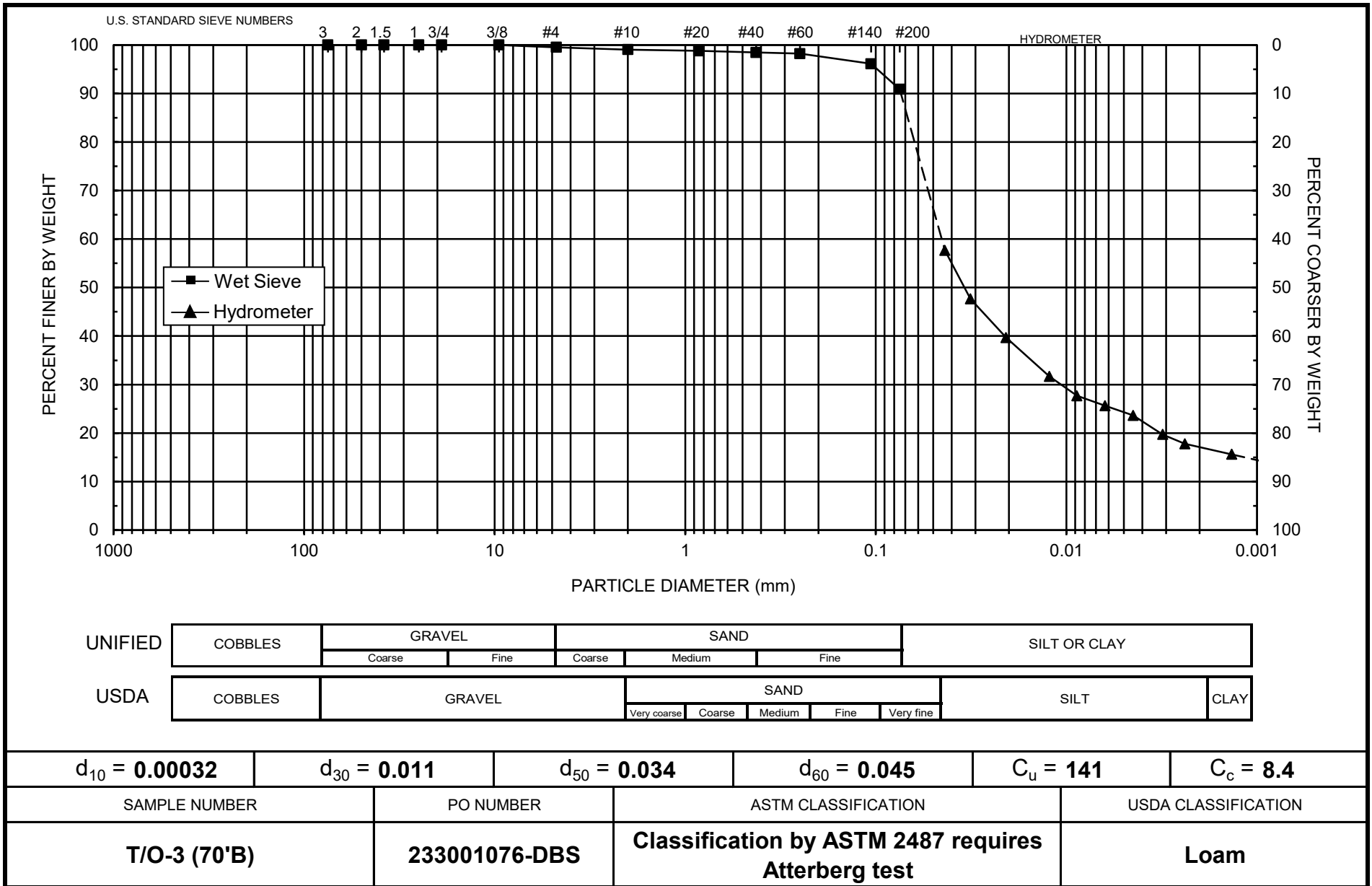
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 49.58  
 Total Sample Wt. (g): 563.72  
 Wt. Passing #10 (g): 558.38

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	35.0	6.1	28.9	10.6	0.04342	58.2	57.7
	2	21.6	30.0	6.1	23.9	11.4	0.03187	48.1	47.7
	5	21.6	26.0	6.1	19.9	12.0	0.02073	40.1	39.7
	15	21.6	22.0	6.1	15.9	12.7	0.01229	32.0	31.7
	30	21.6	20.0	6.1	13.9	13.0	0.00880	28.0	27.7
	60	21.5	19.0	6.2	12.8	13.2	0.00627	25.9	25.6
	120	21.5	18.0	6.2	11.8	13.3	0.00446	23.9	23.6
	250	21.6	16.0	6.1	9.9	13.7	0.00313	19.9	19.7
	431	21.8	15.0	6.1	8.9	13.8	0.00239	18.0	17.8
	18-May-18	1364	21.4	14.0	6.2	7.8	14.0	0.00136	15.8

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-4 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 454.63  
 Weight Passing #10 (g): 454.63  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 53.65  
 Calculated Weight of Sieve Sample (g): 53.65  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	454.63	100.00
	2"	50	0.00	0.00	454.63	100.00
	1.5"	38.1	0.00	0.00	454.63	100.00
	1"	25	0.00	0.00	454.63	100.00
	3/4"	19.0	0.00	0.00	454.63	100.00
	3/8"	9.5	0.00	0.00	454.63	100.00
	4	4.75	0.00	0.00	454.63	100.00
	10	2.00	0.00	0.00	454.63	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.12	0.12	53.53	99.78
	40	0.425	0.13	0.25	53.40	99.53
	60	0.250	0.36	0.61	53.04	98.86
	140	0.106	8.30	8.91	44.74	83.39
	200	0.075	4.41	13.32	40.33	75.17
	dry pan			0.53	13.85	39.80
wet pan				39.80	0.00	

d<sub>10</sub> (mm): 0.00059      d<sub>50</sub> (mm): 0.034  
 d<sub>16</sub> (mm): 0.0016      d<sub>60</sub> (mm): 0.050  
 d<sub>30</sub> (mm): 0.011      d<sub>84</sub> (mm): 0.11

Median Particle Diameter--d<sub>50</sub> (mm): 0.034  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 85  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 4.1  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.049

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines





**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-4 (20'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:18

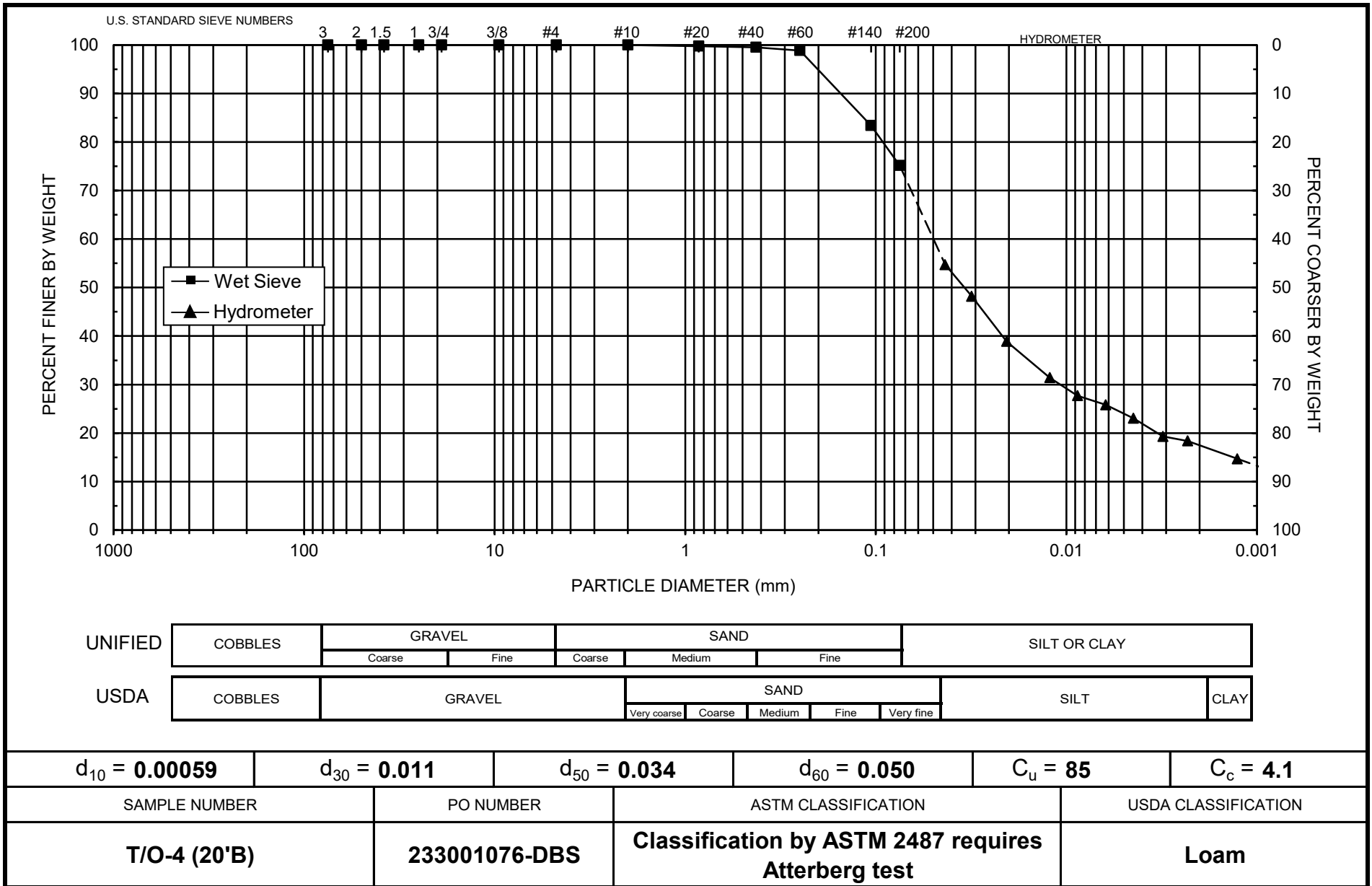
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 53.65  
 Total Sample Wt. (g): 454.63  
 Wt. Passing #10 (g): 454.63

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	35.5	6.1	29.4	10.5	0.04325	54.7	54.7
	2	21.6	32.0	6.1	25.9	11.1	0.03141	48.2	48.2
	5	21.6	27.0	6.1	20.9	11.9	0.02059	38.9	38.9
	15	21.6	23.0	6.1	16.9	12.5	0.01221	31.4	31.4
	30	21.6	21.0	6.1	14.9	12.9	0.00875	27.7	27.7
	60	21.6	20.0	6.1	13.9	13.0	0.00622	25.8	25.8
	120	21.6	18.5	6.1	12.4	13.3	0.00444	23.0	23.0
	250	21.6	16.5	6.1	10.4	13.6	0.00312	19.3	19.3
	457	21.6	16.0	6.1	9.9	13.7	0.00231	18.4	18.4
19-May-18	1555	21.7	14.0	6.1	7.9	14.0	0.00127	14.7	14.7

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-5 (10'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 402.66  
 Weight Passing #10 (g): 402.55  
 Weight Retained #10 (g): 0.11  
 Weight of Hydrometer Sample (g): 52.88  
 Calculated Weight of Sieve Sample (g): 52.89  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	402.66	100.00
	2"	50	0.00	0.00	402.66	100.00
	1.5"	38.1	0.00	0.00	402.66	100.00
	1"	25	0.00	0.00	402.66	100.00
	3/4"	19.0	0.00	0.00	402.66	100.00
	3/8"	9.5	0.00	0.00	402.66	100.00
	4	4.75	0.00	0.00	402.66	100.00
	10	2.00	0.11	0.11	402.55	99.97
-10			(Based on calculated sieve wt.)			
	20	0.85	0.37	0.38	52.51	99.27
	40	0.425	0.27	0.65	52.24	98.76
	60	0.250	0.24	0.89	52.00	98.31
	140	0.106	1.60	2.49	50.40	95.28
	200	0.075	2.85	5.34	47.55	89.90
	dry pan		0.66	6.00	46.89	
	wet pan			46.89	0.00	

d<sub>10</sub> (mm): 0.0011      d<sub>50</sub> (mm): 0.028  
 d<sub>16</sub> (mm): 0.0025      d<sub>60</sub> (mm): 0.039  
 d<sub>30</sub> (mm): 0.0100      d<sub>84</sub> (mm): 0.066

Median Particle Diameter--d<sub>50</sub> (mm): 0.028  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 35  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.3  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.032

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Silt Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-5 (10'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:24

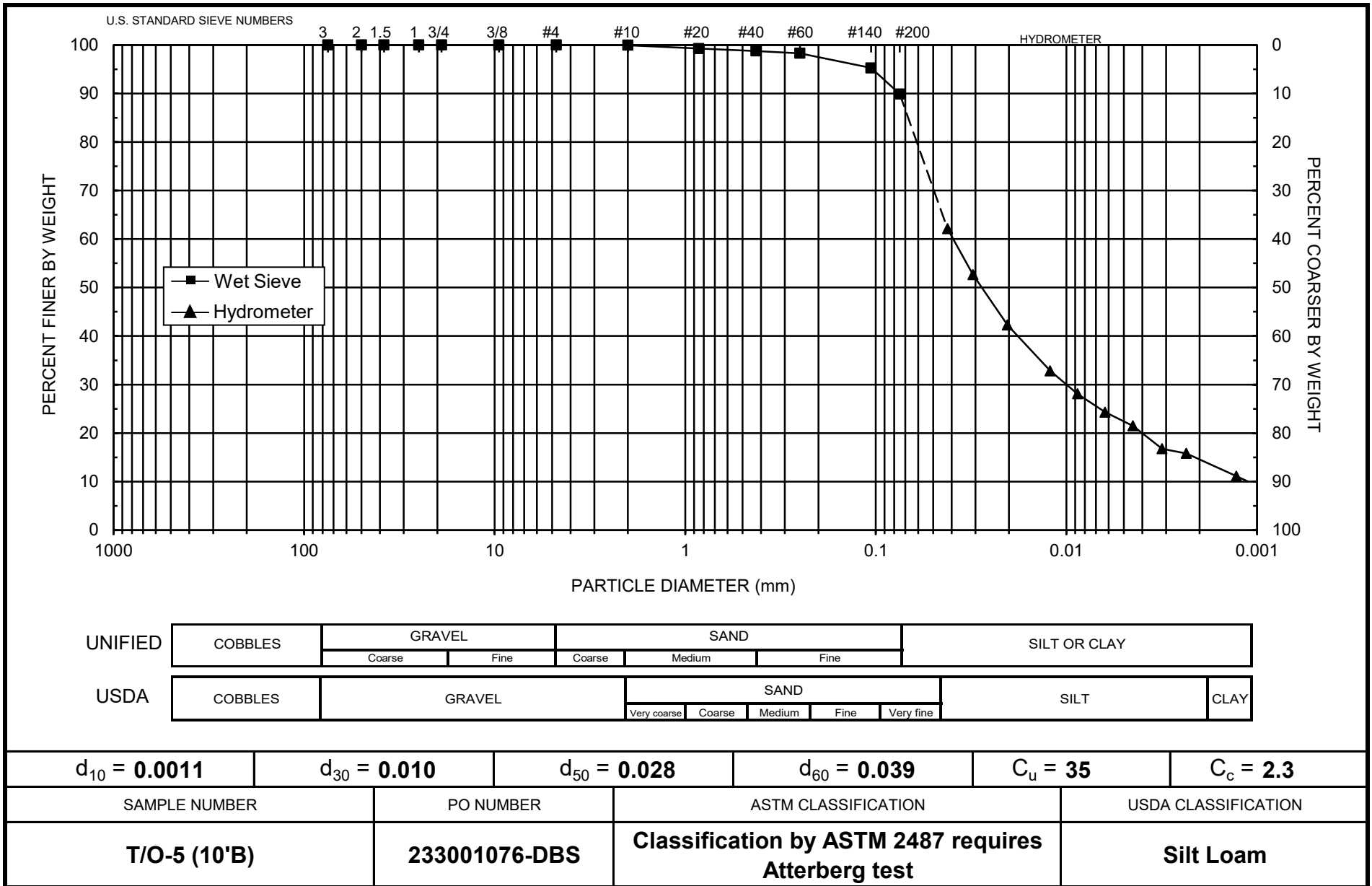
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 52.88  
 Total Sample Wt. (g): 402.66  
 Wt. Passing #10 (g): 402.55

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	39.0	6.1	32.9	9.9	0.04205	62.1	62.1
	2	21.6	34.0	6.1	27.9	10.7	0.03094	52.7	52.7
	5	21.6	28.5	6.1	22.4	11.6	0.02038	42.3	42.3
	15	21.6	23.5	6.1	17.4	12.4	0.01217	32.8	32.8
	30	21.6	21.0	6.1	14.9	12.9	0.00875	28.1	28.1
	60	21.6	19.0	6.1	12.9	13.2	0.00626	24.3	24.3
	120	21.6	17.5	6.1	11.4	13.4	0.00447	21.5	21.5
	250	21.6	15.0	6.1	8.9	13.8	0.00314	16.8	16.8
	451	21.6	14.5	6.1	8.4	13.9	0.00235	15.8	15.8
19-May-18	1549	21.7	12.0	6.1	5.9	14.3	0.00128	11.1	11.1

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-6 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 507.52  
 Weight Passing #10 (g): 507.52  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 49.32  
 Calculated Weight of Sieve Sample (g): 49.32  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	507.52	100.00
	2"	50	0.00	0.00	507.52	100.00
	1.5"	38.1	0.00	0.00	507.52	100.00
	1"	25	0.00	0.00	507.52	100.00
	3/4"	19.0	0.00	0.00	507.52	100.00
	3/8"	9.5	0.00	0.00	507.52	100.00
	4	4.75	0.00	0.00	507.52	100.00
	10	2.00	0.00	0.00	507.52	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.95	0.95	48.37	98.07
	40	0.425	0.44	1.39	47.93	97.18
	60	0.250	0.38	1.77	47.55	96.41
	140	0.106	5.12	6.89	42.43	86.03
	200	0.075	5.08	11.97	37.35	75.73
	dry pan		0.69	12.66	36.66	
wet pan			36.66	0.00		

d<sub>10</sub> (mm): 0.00066      d<sub>50</sub> (mm): 0.043  
 d<sub>16</sub> (mm): 0.0020      d<sub>60</sub> (mm): 0.054  
 d<sub>30</sub> (mm): 0.018      d<sub>84</sub> (mm): 0.099

Median Particle Diameter--d<sub>50</sub> (mm): 0.043  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 82  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 9.1  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.048

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-6 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:42

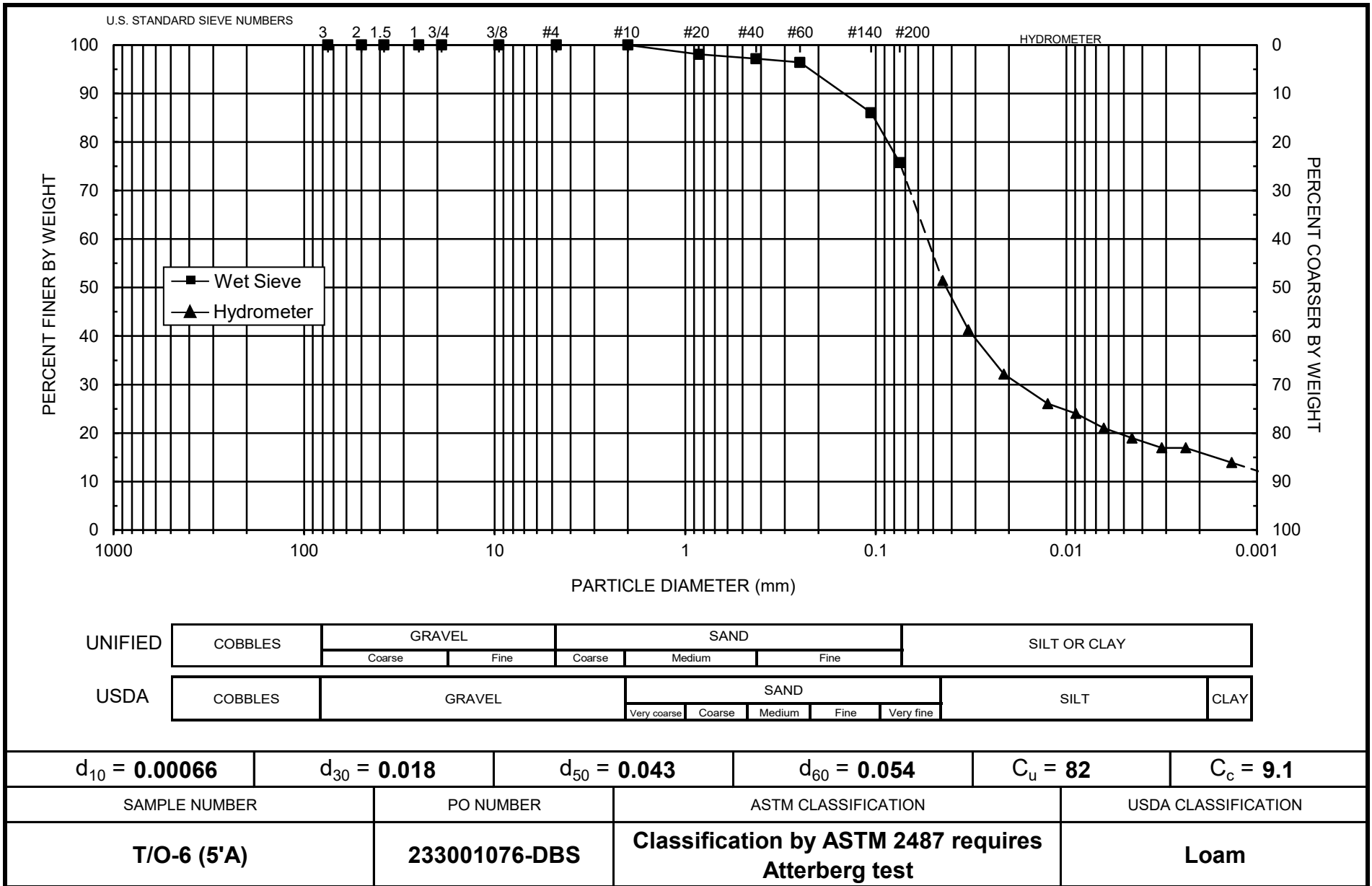
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 49.32  
 Total Sample Wt. (g): 507.52  
 Wt. Passing #10 (g): 507.52

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	31.5	6.1	25.4	11.1	0.04459	51.4	51.4
	2	21.6	26.5	6.1	20.4	12.0	0.03267	41.3	41.3
	5	21.6	22.0	6.1	15.9	12.7	0.02129	32.2	32.2
	15	21.6	19.0	6.1	12.9	13.2	0.01253	26.1	26.1
	30	21.6	18.0	6.1	11.9	13.3	0.00891	24.0	24.0
	60	21.6	16.5	6.1	10.4	13.6	0.00636	21.0	21.0
	120	21.6	15.5	6.1	9.4	13.8	0.00452	19.0	19.0
	250	21.6	14.5	6.1	8.4	13.9	0.00315	17.0	17.0
	445	21.6	14.5	6.1	8.4	13.9	0.00236	17.0	17.0
17-May-18	1377	21.6	13.0	6.1	6.9	14.2	0.00136	13.9	13.9

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TN-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Initial Dry Weight of Sample (g): 489.48  
 Weight Passing #10 (g): 485.66  
 Weight Retained #10 (g): 3.82  
 Weight of Hydrometer Sample (g): 60.67  
 Calculated Weight of Sieve Sample (g): 61.15  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	489.48	100.00
	2"	50	0.00	0.00	489.48	100.00
	1.5"	38.1	0.00	0.00	489.48	100.00
	1"	25	0.00	0.00	489.48	100.00
	3/4"	19.0	0.00	0.00	489.48	100.00
	3/8"	9.5	0.00	0.00	489.48	100.00
	4	4.75	1.81	1.81	487.67	99.63
	10	2.00	2.01	3.82	485.66	99.22
-10	(Based on calculated sieve wt.)					
	20	0.85	0.49	0.97	60.18	98.42
	40	0.425	0.42	1.39	59.76	97.73
	60	0.250	1.04	2.43	58.72	96.03
	140	0.106	19.80	22.23	38.92	63.65
	200	0.075	9.15	31.38	29.77	48.69
	dry pan			1.39	32.77	28.38
	wet pan				28.38	0.00

d<sub>10</sub> (mm): 0.00074      d<sub>50</sub> (mm): 0.077  
 d<sub>16</sub> (mm): 0.0022      d<sub>60</sub> (mm): 0.097  
 d<sub>30</sub> (mm): 0.035      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.077  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 131  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.086

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TN-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:00

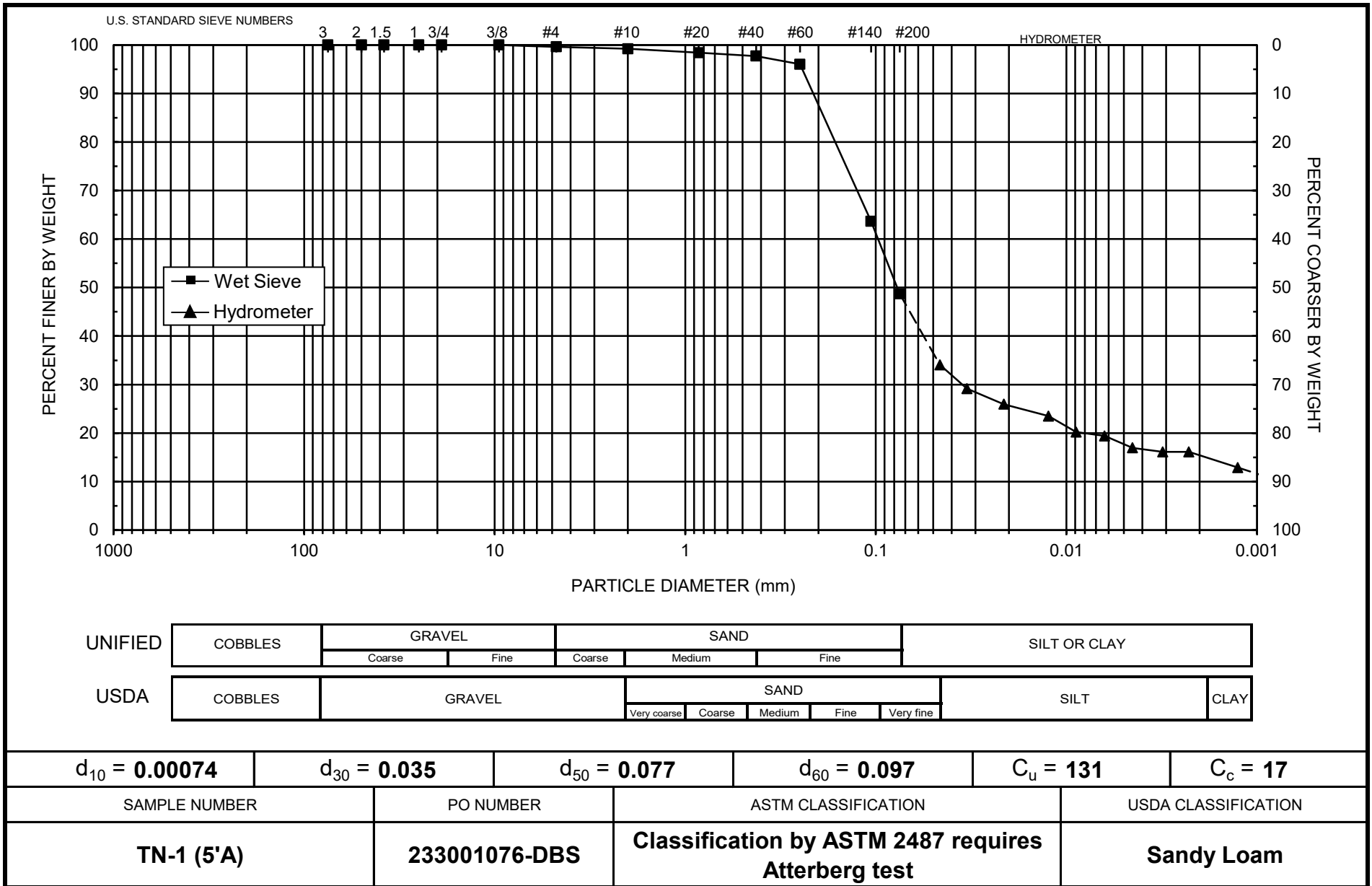
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 60.67  
 Total Sample Wt. (g): 489.48  
 Wt. Passing #10 (g): 485.66

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.5	27.0	6.2	20.8	11.9	0.04609	34.3	34.1
	2	21.5	24.0	6.2	17.8	12.4	0.03326	29.4	29.2
	5	21.6	22.0	6.1	15.9	12.7	0.02129	26.1	25.9
	15	21.6	20.5	6.1	14.4	12.9	0.01241	23.7	23.5
	30	21.6	18.5	6.1	12.4	13.3	0.00889	20.4	20.2
	60	21.6	18.0	6.1	11.9	13.3	0.00630	19.5	19.4
	120	21.6	16.5	6.1	10.4	13.6	0.00450	17.1	16.9
	250	21.6	16.0	6.1	9.9	13.7	0.00313	16.3	16.1
	471	21.6	16.0	6.1	9.9	13.7	0.00228	16.3	16.1
19-May-18	1570	21.7	14.0	6.1	7.9	14.0	0.00126	13.0	12.9

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TN-2 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 276.75  
 Weight Passing #10 (g): 276.75  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 68.55  
 Calculated Weight of Sieve Sample (g): 68.55  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	276.75	100.00
	2"	50	0.00	0.00	276.75	100.00
	1.5"	38.1	0.00	0.00	276.75	100.00
	1"	25	0.00	0.00	276.75	100.00
	3/4"	19.0	0.00	0.00	276.75	100.00
	3/8"	9.5	0.00	0.00	276.75	100.00
	4	4.75	0.00	0.00	276.75	100.00
	10	2.00	0.00	0.00	276.75	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.22	0.22	68.33	99.68
	40	0.425	0.29	0.51	68.04	99.26
	60	0.250	1.08	1.59	66.96	97.68
	140	0.106	24.88	26.47	42.08	61.39
	200	0.075	9.08	35.55	33.00	48.14
	dry pan			0.99	36.54	32.01
wet pan				32.01	0.00	

d<sub>10</sub> (mm): 0.00077      d<sub>50</sub> (mm): 0.079  
 d<sub>16</sub> (mm): 0.0036      d<sub>60</sub> (mm): 0.10  
 d<sub>30</sub> (mm): 0.037      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.079  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 130  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 18  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.088

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* TN-2 (20'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 16-May-18  
*Start Time:* 9:36

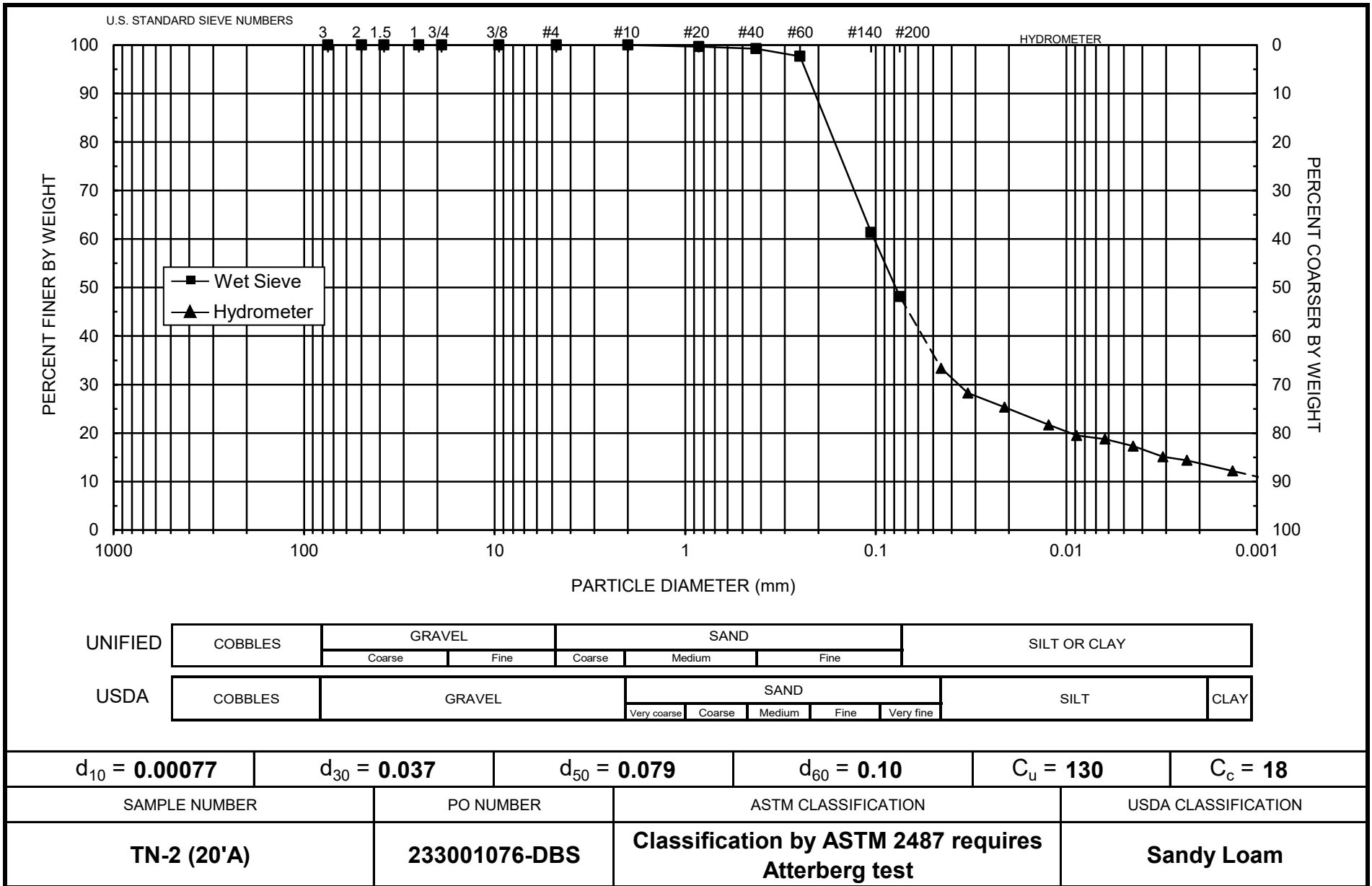
*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* (NaPO<sub>3</sub>)<sub>6</sub>  
*Assumed particle density:* 2.65  
  
*Initial Wt. (g):* 68.55  
*Total Sample Wt. (g):* 276.75  
*Wt. Passing #10 (g):* 276.75

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	29.0	6.1	22.9	11.5	0.04540	33.3	33.3
	2	21.6	25.5	6.1	19.4	12.1	0.03289	28.2	28.2
	5	21.6	23.5	6.1	17.4	12.4	0.02108	25.3	25.3
	15	21.6	21.0	6.1	14.9	12.9	0.01237	21.7	21.7
	30	21.6	19.5	6.1	13.4	13.1	0.00883	19.5	19.5
	60	21.6	19.0	6.1	12.9	13.2	0.00626	18.8	18.8
	120	21.6	18.0	6.1	11.9	13.3	0.00446	17.3	17.3
	250	21.6	16.5	6.1	10.4	13.6	0.00312	15.1	15.1
	450	21.6	16.0	6.1	9.9	13.7	0.00233	14.4	14.4
17-May-18	1383	21.6	14.5	6.1	8.4	13.9	0.00134	12.2	12.2

*Comments:*

\* Dispersion device: mechanically operated stirring device

*Laboratory analysis by:* A. Bland  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 426.30  
 Weight Passing #10 (g): 426.30  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 56.34  
 Calculated Weight of Sieve Sample (g): 56.34  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	426.30	100.00
	2"	50	0.00	0.00	426.30	100.00
	1.5"	38.1	0.00	0.00	426.30	100.00
	1"	25	0.00	0.00	426.30	100.00
	3/4"	19.0	0.00	0.00	426.30	100.00
	3/8"	9.5	0.00	0.00	426.30	100.00
	4	4.75	0.00	0.00	426.30	100.00
	10	2.00	0.00	0.00	426.30	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.29	0.29	56.05	99.49
	40	0.425	0.26	0.55	55.79	99.02
	60	0.250	0.71	1.26	55.08	97.76
	140	0.106	13.36	14.62	41.72	74.05
	200	0.075	8.38	23.00	33.34	59.18
	dry pan		0.98	23.98	32.36	
	wet pan			32.36	0.00	

d<sub>10</sub> (mm): 0.00029      d<sub>50</sub> (mm): 0.052  
 d<sub>16</sub> (mm): 0.00070      d<sub>60</sub> (mm): 0.076  
 d<sub>30</sub> (mm): 0.0098      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.052  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 262  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 4.4  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.068

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Clay Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

Test Date: 16-May-18  
 Start Time: 9:00

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65

Initial Wt. (g): 56.34  
 Total Sample Wt. (g): 426.30  
 Wt. Passing #10 (g): 426.30

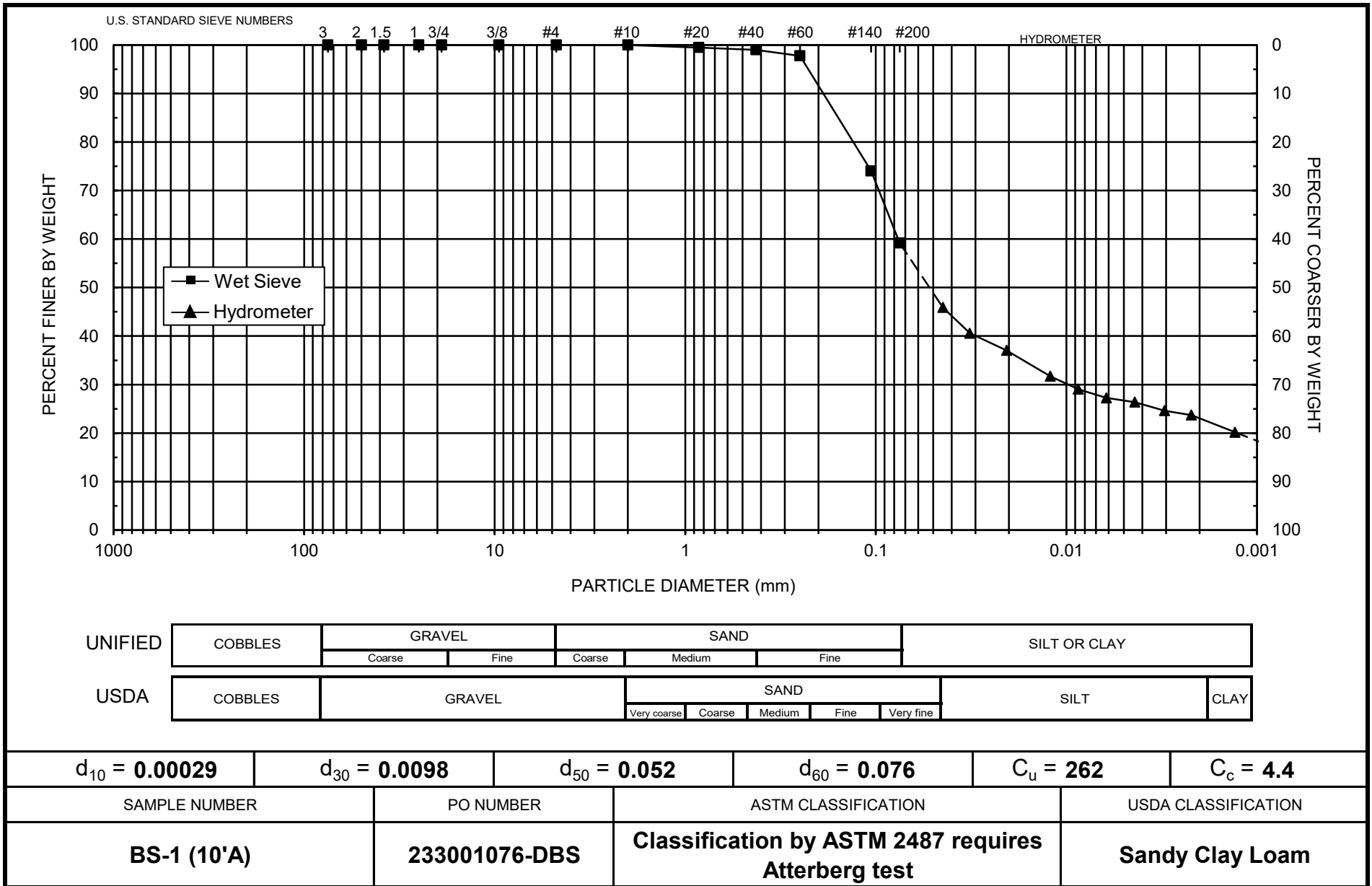
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	32.0	6.1	25.9	11.1	0.04442	45.9	45.9
	2	21.6	29.0	6.1	22.9	11.5	0.03210	40.6	40.6
	5	21.6	27.0	6.1	20.9	11.9	0.02059	37.0	37.0
	15	21.6	24.0	6.1	17.9	12.4	0.01213	31.7	31.7
	30	21.6	22.5	6.1	16.4	12.6	0.00866	29.0	29.0
	60	21.6	21.5	6.1	15.4	12.8	0.00617	27.3	27.3
	120	21.6	21.0	6.1	14.9	12.9	0.00437	26.4	26.4
	250	21.6	20.0	6.1	13.9	13.0	0.00305	24.6	24.6
	480	21.6	19.5	6.1	13.4	13.1	0.00221	23.7	23.7
17-May-18	1414	21.6	17.5	6.1	11.4	13.4	0.00130	20.2	20.2

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-2 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 413.95  
 Weight Passing #10 (g): 413.95  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 53.66  
 Calculated Weight of Sieve Sample (g): 53.66  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	413.95	100.00
	2"	50	0.00	0.00	413.95	100.00
	1.5"	38.1	0.00	0.00	413.95	100.00
	1"	25	0.00	0.00	413.95	100.00
	3/4"	19.0	0.00	0.00	413.95	100.00
	3/8"	9.5	0.00	0.00	413.95	100.00
	4	4.75	0.00	0.00	413.95	100.00
	10	2.00	0.00	0.00	413.95	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	1.44	1.44	52.22	97.32
	40	0.425	1.17	2.61	51.05	95.14
	60	0.250	1.42	4.03	49.63	92.49
	140	0.106	12.29	16.32	37.34	69.59
	200	0.075	6.78	23.10	30.56	56.95
	dry pan			0.58	23.68	29.98
	wet pan				29.98	0.00

d<sub>10</sub> (mm): 0.0039      d<sub>50</sub> (mm): 0.061  
 d<sub>16</sub> (mm): 0.0048      d<sub>60</sub> (mm): 0.082  
 d<sub>30</sub> (mm): 0.014      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.061  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 21  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.61  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.082

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-2 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:06

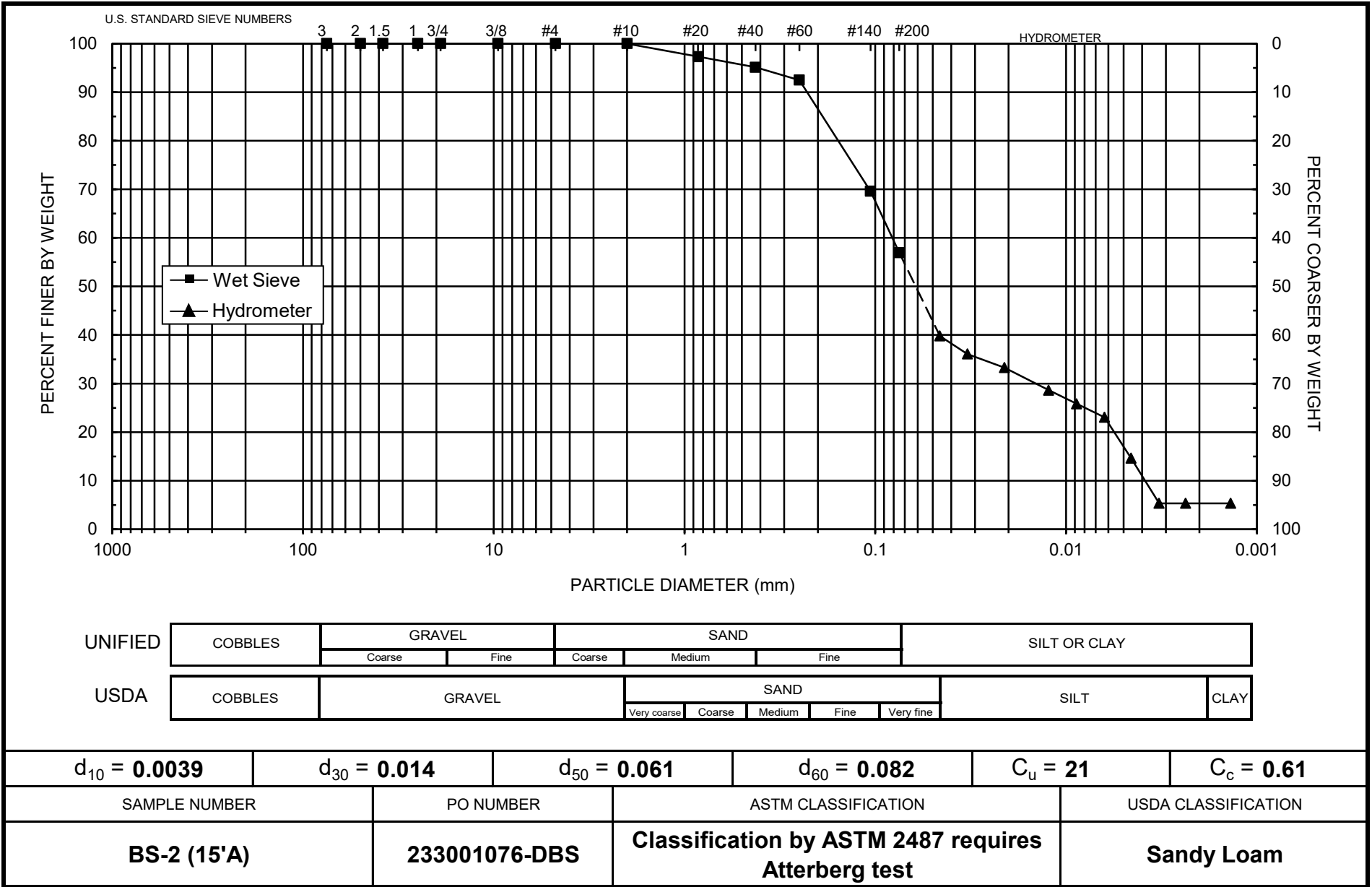
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 53.66  
 Total Sample Wt. (g): 413.95  
 Wt. Passing #10 (g): 413.95

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	27.5	6.1	21.4	11.8	0.04588	39.8	39.8
	2	21.6	25.5	6.1	19.4	12.1	0.03289	36.1	36.1
	5	21.6	24.0	6.1	17.9	12.4	0.02101	33.3	33.3
	15	21.6	21.5	6.1	15.4	12.8	0.01233	28.6	28.6
	30	21.6	20.0	6.1	13.9	13.0	0.00880	25.8	25.8
	60	21.6	18.5	6.1	12.4	13.3	0.00628	23.0	23.0
	120	21.6	14.0	6.1	7.9	14.0	0.00456	14.6	14.6
	250	21.6	9.0	6.1	2.9	14.8	0.00325	5.3	5.3
	475	21.6	9.0	6.1	2.9	14.8	0.00236	5.3	5.3
17-May-18	1409	21.6	9.0	6.1	2.9	14.8	0.00137	5.3	5.3

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-6 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 371.11  
 Weight Passing #10 (g): 371.11  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 56.55  
 Calculated Weight of Sieve Sample (g): 56.55  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	371.11	100.00
	2"	50	0.00	0.00	371.11	100.00
	1.5"	38.1	0.00	0.00	371.11	100.00
	1"	25	0.00	0.00	371.11	100.00
	3/4"	19.0	0.00	0.00	371.11	100.00
	3/8"	9.5	0.00	0.00	371.11	100.00
	4	4.75	0.00	0.00	371.11	100.00
	10	2.00	0.00	0.00	371.11	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.01	0.01	56.54	99.98
	40	0.425	0.02	0.03	56.52	99.95
	60	0.250	0.06	0.09	56.46	99.84
	140	0.106	6.93	7.02	49.53	87.59
	200	0.075	7.85	14.87	41.68	73.70
	dry pan			0.92	15.79	40.76
wet pan				40.76	0.00	

d<sub>10</sub> (mm): 0.00018      d<sub>50</sub> (mm): 0.054  
 d<sub>16</sub> (mm): 0.0011      d<sub>60</sub> (mm): 0.062  
 d<sub>30</sub> (mm): 0.022      d<sub>84</sub> (mm): 0.097

Median Particle Diameter--d<sub>50</sub> (mm): 0.054  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 344  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 43  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.051

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BS-6 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:12

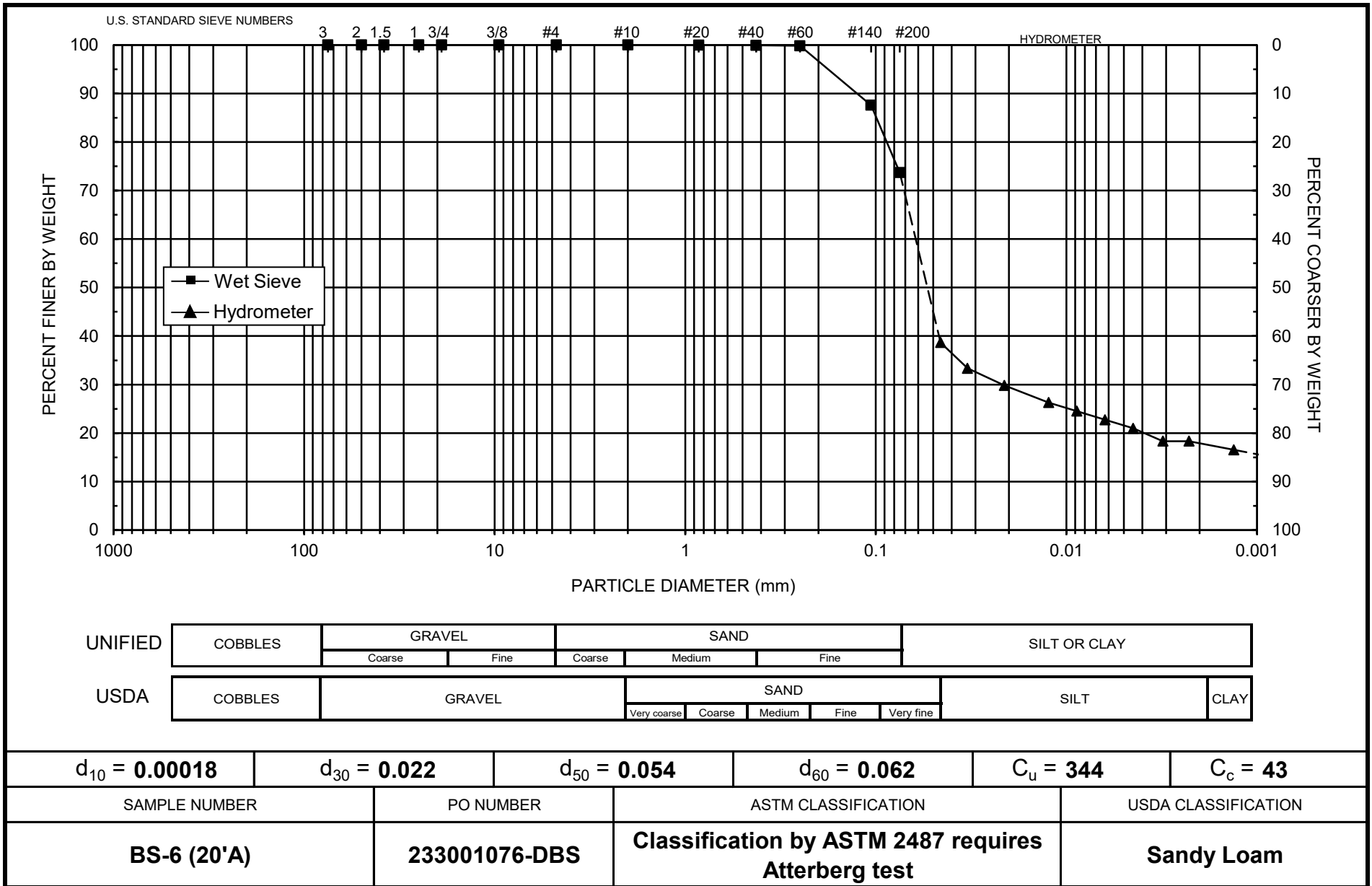
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 56.55  
 Total Sample Wt. (g): 371.11  
 Wt. Passing #10 (g): 371.11

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	28.0	6.1	21.9	11.7	0.04572	38.7	38.7
	2	21.6	25.0	6.1	18.9	12.2	0.03300	33.4	33.4
	5	21.6	23.0	6.1	16.9	12.5	0.02115	29.8	29.8
	15	21.6	21.0	6.1	14.9	12.9	0.01237	26.3	26.3
	30	21.6	20.0	6.1	13.9	13.0	0.00880	24.5	24.5
	60	21.6	19.0	6.1	12.9	13.2	0.00626	22.7	22.7
	120	21.6	18.0	6.1	11.9	13.3	0.00446	21.0	21.0
	250	21.6	16.5	6.1	10.4	13.6	0.00312	18.3	18.3
	470	21.6	16.5	6.1	10.4	13.6	0.00227	18.3	18.3
17-May-18	1404	21.6	15.5	6.1	9.4	13.8	0.00132	16.6	16.6

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-1 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 512.99  
 Weight Passing #10 (g): 510.37  
 Weight Retained #10 (g): 2.62  
 Weight of Hydrometer Sample (g): 56.02  
 Calculated Weight of Sieve Sample (g): 56.31  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	512.99	100.00
	2"	50	0.00	0.00	512.99	100.00
	1.5"	38.1	0.00	0.00	512.99	100.00
	1"	25	0.00	0.00	512.99	100.00
	3/4"	19.0	0.00	0.00	512.99	100.00
	3/8"	9.5	0.00	0.00	512.99	100.00
	4	4.75	0.00	0.00	512.99	100.00
	10	2.00	2.62	2.62	510.37	99.49
-10	(Based on calculated sieve wt.)					
	20	0.85	0.88	1.17	55.14	97.93
	40	0.425	0.47	1.64	54.67	97.09
	60	0.250	0.33	1.97	54.34	96.51
	140	0.106	1.86	3.83	52.48	93.20
	200	0.075	6.41	10.24	46.07	81.82
	dry pan		1.03	11.27	45.04	
wet pan			45.04	0.00		

d<sub>10</sub> (mm): 0.0010      d<sub>50</sub> (mm): 0.035  
 d<sub>16</sub> (mm): 0.0019      d<sub>60</sub> (mm): 0.048  
 d<sub>30</sub> (mm): 0.0098      d<sub>84</sub> (mm): 0.080

Median Particle Diameter--d<sub>50</sub> (mm): 0.035  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 48  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.0  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.039

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines





*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* TS-1 (20'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 18-May-18  
*Start Time:* 9:48

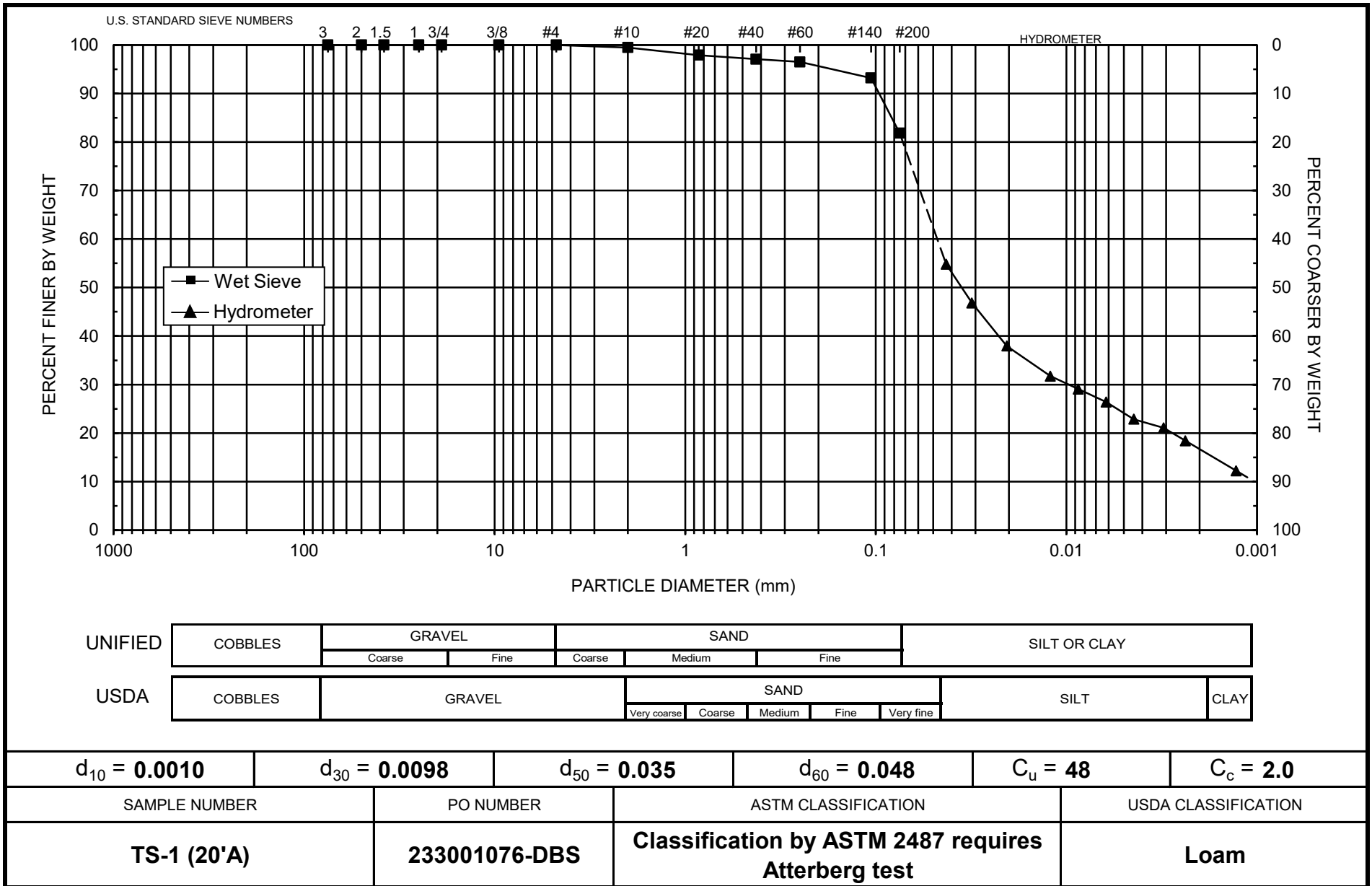
*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* (NaPO<sub>3</sub>)<sub>6</sub>  
*Assumed particle density:* 2.65  
  
*Initial Wt. (g):* 56.02  
*Total Sample Wt. (g):* 512.99  
*Wt. Passing #10 (g):* 510.37

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	37.0	6.1	30.9	10.2	0.04274	55.1	54.8
	2	21.6	32.5	6.1	26.4	11.0	0.03129	47.1	46.8
	5	21.6	27.5	6.1	21.4	11.8	0.02052	38.1	37.9
	15	21.6	24.0	6.1	17.9	12.4	0.01213	31.9	31.7
	30	21.6	22.5	6.1	16.4	12.6	0.00866	29.2	29.1
	60	21.6	21.0	6.1	14.9	12.9	0.00618	26.5	26.4
	120	21.6	19.0	6.1	12.9	13.2	0.00443	23.0	22.8
	250	21.6	18.0	6.1	11.9	13.3	0.00309	21.2	21.1
	431	21.6	16.5	6.1	10.4	13.6	0.00237	18.5	18.4
	19-May-18	1529	21.7	13.0	6.1	6.9	14.2	0.00128	12.3

*Comments:*

\* Dispersion device: mechanically operated stirring device

*Laboratory analysis by:* M. Zbrozek  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-2 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 343.53  
 Weight Passing #10 (g): 343.53  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 57.64  
 Calculated Weight of Sieve Sample (g): 57.64  
 Shape: Rounded  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	343.53	100.00
	2"	50	0.00	0.00	343.53	100.00
	1.5"	38.1	0.00	0.00	343.53	100.00
	1"	25	0.00	0.00	343.53	100.00
	3/4"	19.0	0.00	0.00	343.53	100.00
	3/8"	9.5	0.00	0.00	343.53	100.00
	4	4.75	0.00	0.00	343.53	100.00
	10	2.00	0.00	0.00	343.53	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.88	0.88	56.76	98.47
	40	0.425	0.65	1.53	56.11	97.35
	60	0.250	1.09	2.62	55.02	95.45
	140	0.106	23.08	25.70	31.94	55.41
	200	0.075	5.36	31.06	26.58	46.11
	dry pan		0.22	31.28	26.36	
wet pan			26.36	0.00		

d<sub>10</sub> (mm): 0.0019      d<sub>50</sub> (mm): 0.087  
 d<sub>16</sub> (mm): 0.0027      d<sub>60</sub> (mm): 0.12  
 d<sub>30</sub> (mm): 0.026      d<sub>84</sub> (mm): 0.20

Median Particle Diameter--d<sub>50</sub> (mm): 0.087  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 63  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 3.0  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.097

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-2 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:48

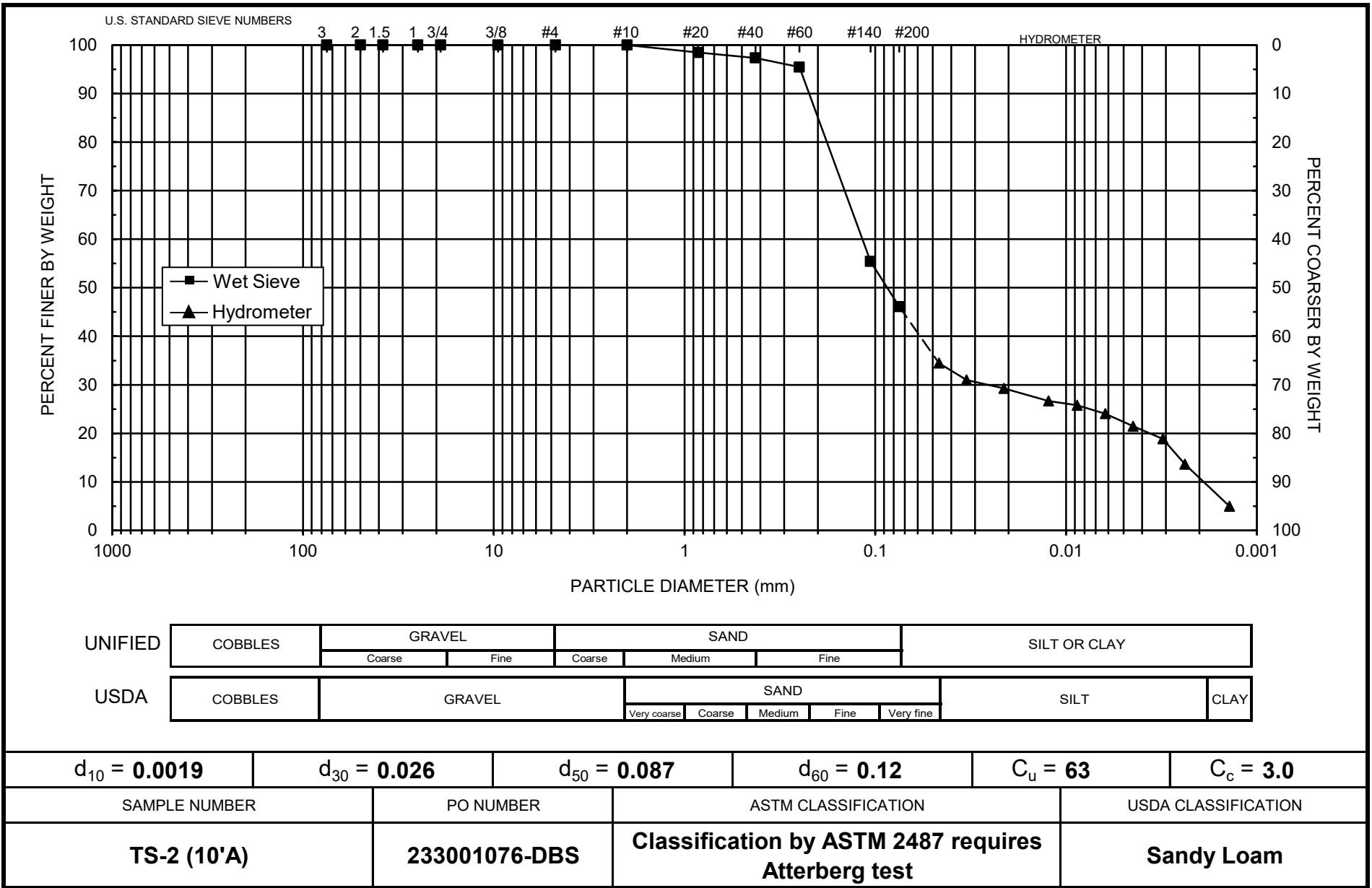
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 57.64  
 Total Sample Wt. (g): 343.53  
 Wt. Passing #10 (g): 343.53

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	26.0	6.1	19.9	12.0	0.04636	34.5	34.5
	2	21.6	24.0	6.1	17.9	12.4	0.03322	31.0	31.0
	5	21.6	23.0	6.1	16.9	12.5	0.02115	29.3	29.3
	15	21.6	21.5	6.1	15.4	12.8	0.01233	26.6	26.6
	30	21.6	21.0	6.1	14.9	12.9	0.00875	25.8	25.8
	60	21.6	20.0	6.1	13.9	13.0	0.00622	24.0	24.0
	120	21.6	18.5	6.1	12.4	13.3	0.00444	21.4	21.4
	250	21.6	17.0	6.1	10.9	13.5	0.00311	18.8	18.8
	440	21.6	14.0	6.1	7.9	14.0	0.00238	13.6	13.6
	17-May-18	1372	21.6	9.0	6.1	2.9	14.8	0.00139	5.0

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-3 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 470.01  
 Weight Passing #10 (g): 469.83  
 Weight Retained #10 (g): 0.18  
 Weight of Hydrometer Sample (g): 57.40  
 Calculated Weight of Sieve Sample (g): 57.42  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	470.01	100.00
	2"	50	0.00	0.00	470.01	100.00
	1.5"	38.1	0.00	0.00	470.01	100.00
	1"	25	0.00	0.00	470.01	100.00
	3/4"	19.0	0.00	0.00	470.01	100.00
	3/8"	9.5	0.00	0.00	470.01	100.00
	4	4.75	0.00	0.00	470.01	100.00
	10	2.00	0.18	0.18	469.83	99.96
-10	(Based on calculated sieve wt.)					
	20	0.85	0.40	0.42	57.00	99.27
	40	0.425	0.43	0.85	56.57	98.52
	60	0.250	0.30	1.15	56.27	97.99
	140	0.106	1.19	2.34	55.08	95.92
	200	0.075	6.92	9.26	48.16	83.87
	dry pan		1.73	10.99	46.43	
wet pan			46.43	0.00		

d<sub>10</sub> (mm): 0.00086      d<sub>50</sub> (mm): 0.043  
 d<sub>16</sub> (mm): 0.0023      d<sub>60</sub> (mm): 0.051  
 d<sub>30</sub> (mm): 0.013      d<sub>84</sub> (mm): 0.075

Median Particle Diameter--d<sub>50</sub> (mm): 0.043  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 59  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 3.9  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.040

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: E. Bastien/Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-3 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:54

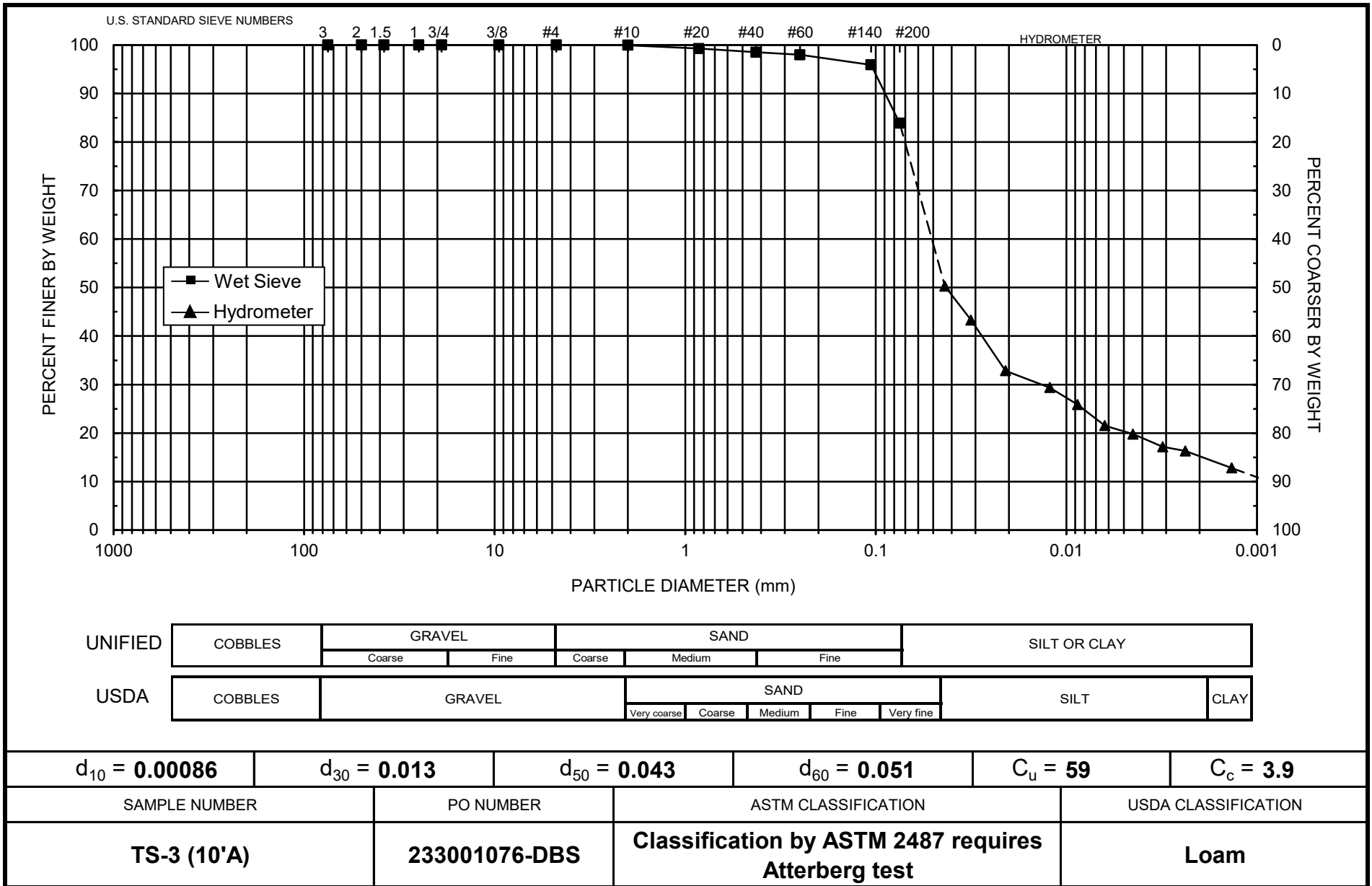
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 57.40  
 Total Sample Wt. (g): 470.01  
 Wt. Passing #10 (g): 469.83

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	35.0	6.1	28.9	10.6	0.04342	50.3	50.3
	2	21.6	31.0	6.1	24.9	11.2	0.03164	43.3	43.3
	5	21.6	25.0	6.1	18.9	12.2	0.02087	32.9	32.8
	15	21.6	23.0	6.1	16.9	12.5	0.01221	29.4	29.4
	30	21.6	21.0	6.1	14.9	12.9	0.00875	25.9	25.9
	60	21.6	18.5	6.1	12.4	13.3	0.00628	21.5	21.5
	120	21.6	17.5	6.1	11.4	13.4	0.00447	19.8	19.8
	250	21.6	16.0	6.1	9.9	13.7	0.00313	17.2	17.2
	435	21.6	15.5	6.1	9.4	13.8	0.00238	16.3	16.3
	17-May-18	1367	21.6	13.5	6.1	7.4	14.1	0.00136	12.8

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-4 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 536.95  
 Weight Passing #10 (g): 522.77  
 Weight Retained #10 (g): 14.18  
 Weight of Hydrometer Sample (g): 52.41  
 Calculated Weight of Sieve Sample (g): 53.83  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	536.95	100.00
	2"	50	0.00	0.00	536.95	100.00
	1.5"	38.1	0.00	0.00	536.95	100.00
	1"	25	0.00	0.00	536.95	100.00
	3/4"	19.0	0.00	0.00	536.95	100.00
	3/8"	9.5	0.00	0.00	536.95	100.00
	4	4.75	3.53	3.53	533.42	99.34
	10	2.00	10.65	14.18	522.77	97.36
-10	(Based on calculated sieve wt.)					
	20	0.85	0.64	2.06	51.77	96.17
	40	0.425	0.53	2.59	51.24	95.19
	60	0.250	0.87	3.46	50.37	93.57
	140	0.106	24.08	27.54	26.29	48.84
	200	0.075	6.80	34.34	19.49	36.21
	dry pan		0.49	34.83	19.00	
wet pan			19.00	0.00		

d<sub>10</sub> (mm): 0.0011      d<sub>50</sub> (mm): 0.11  
 d<sub>16</sub> (mm): 0.0038      d<sub>60</sub> (mm): 0.13  
 d<sub>30</sub> (mm): 0.054      d<sub>84</sub> (mm): 0.21

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 118  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 20  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.11

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: TS-4 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:54

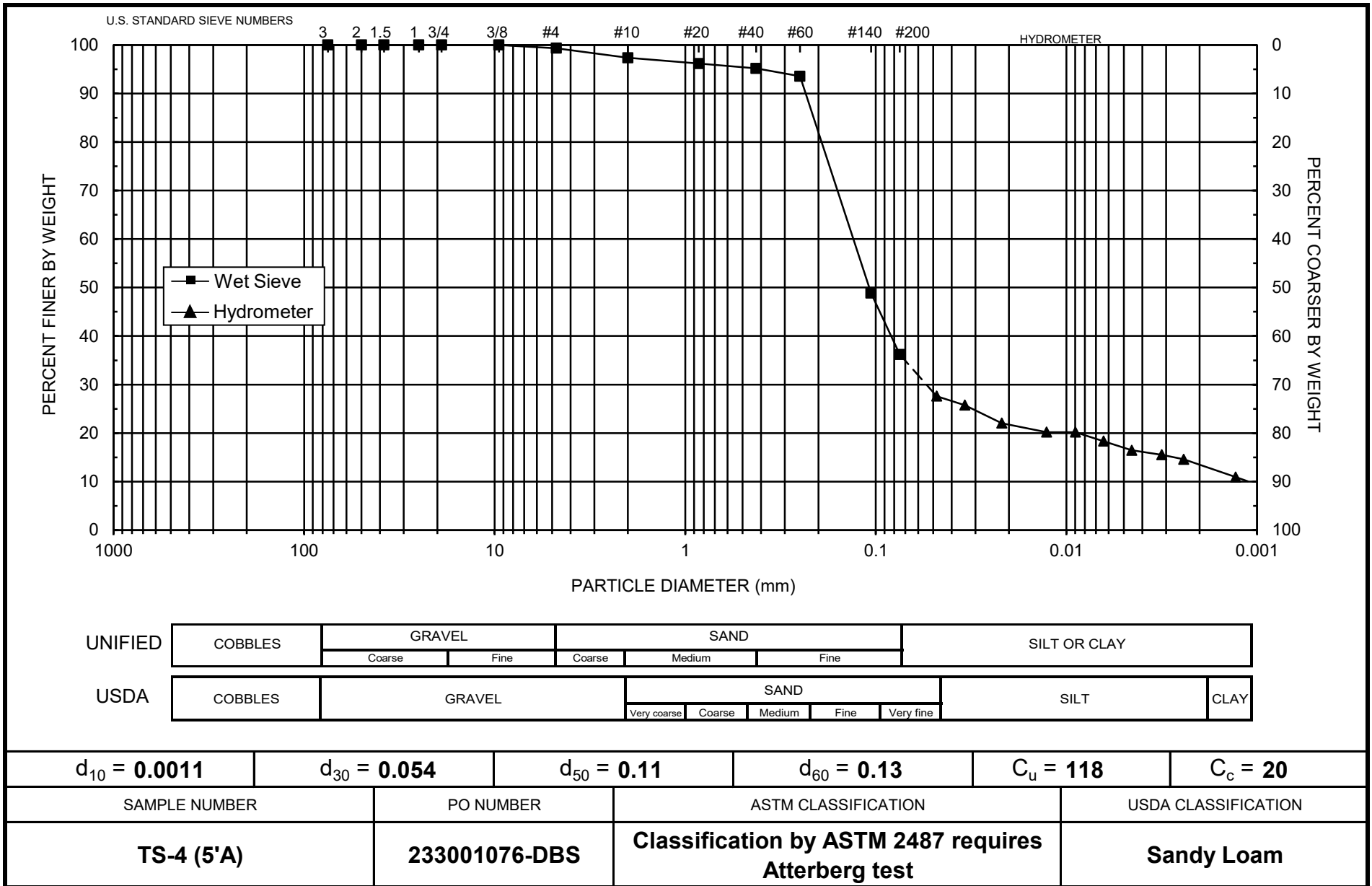
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 52.41  
 Total Sample Wt. (g): 536.95  
 Wt. Passing #10 (g): 522.77

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	21.0	6.1	14.9	12.9	0.04791	28.4	27.6
	2	21.6	20.0	6.1	13.9	13.0	0.03409	26.4	25.7
	5	21.6	18.0	6.1	11.9	13.3	0.02183	22.6	22.0
	15	21.6	17.0	6.1	10.9	13.5	0.01268	20.7	20.2
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.7	20.2
	60	21.6	16.0	6.1	9.9	13.7	0.00638	18.8	18.3
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.9	16.5
	250	21.6	14.5	6.1	8.4	13.9	0.00315	16.0	15.5
	426	21.6	14.0	6.1	7.9	14.0	0.00242	15.0	14.6
	19-May-18	1524	21.7	12.0	6.1	5.9	14.3	0.00129	11.2

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 323.18  
 Weight Passing #10 (g): 254.78  
 Weight Retained #10 (g): 68.40  
 Weight of Hydrometer Sample (g): 68.64  
 Calculated Weight of Sieve Sample (g): 87.07  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	323.18	100.00
	2"	50	0.00	0.00	323.18	100.00
	1.5"	38.1	0.00	0.00	323.18	100.00
	1"	25	0.00	0.00	323.18	100.00
	3/4"	19.0	15.05	15.05	308.13	95.34
	3/8"	9.5	35.95	51.00	272.18	84.22
	4	4.75	9.84	60.84	262.34	81.17
	10	2.00	7.56	68.40	254.78	78.84
-10	(Based on calculated sieve wt.)					
	20	0.85	1.63	20.06	67.01	76.96
	40	0.425	0.95	21.01	66.06	75.87
	60	0.250	1.17	22.18	64.89	74.53
	140	0.106	27.03	49.21	37.86	43.48
	200	0.075	10.55	59.76	27.31	31.37
	dry pan			0.88	60.64	26.43
wet pan				26.43	0.00	

d<sub>10</sub> (mm): 0.0012      d<sub>50</sub> (mm): 0.13  
 d<sub>16</sub> (mm): 0.013      d<sub>60</sub> (mm): 0.17  
 d<sub>30</sub> (mm): 0.069      d<sub>84</sub> (mm): 9.0

Median Particle Diameter--d<sub>50</sub> (mm): 0.13  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 142  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 23  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 3.0

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-1 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:00

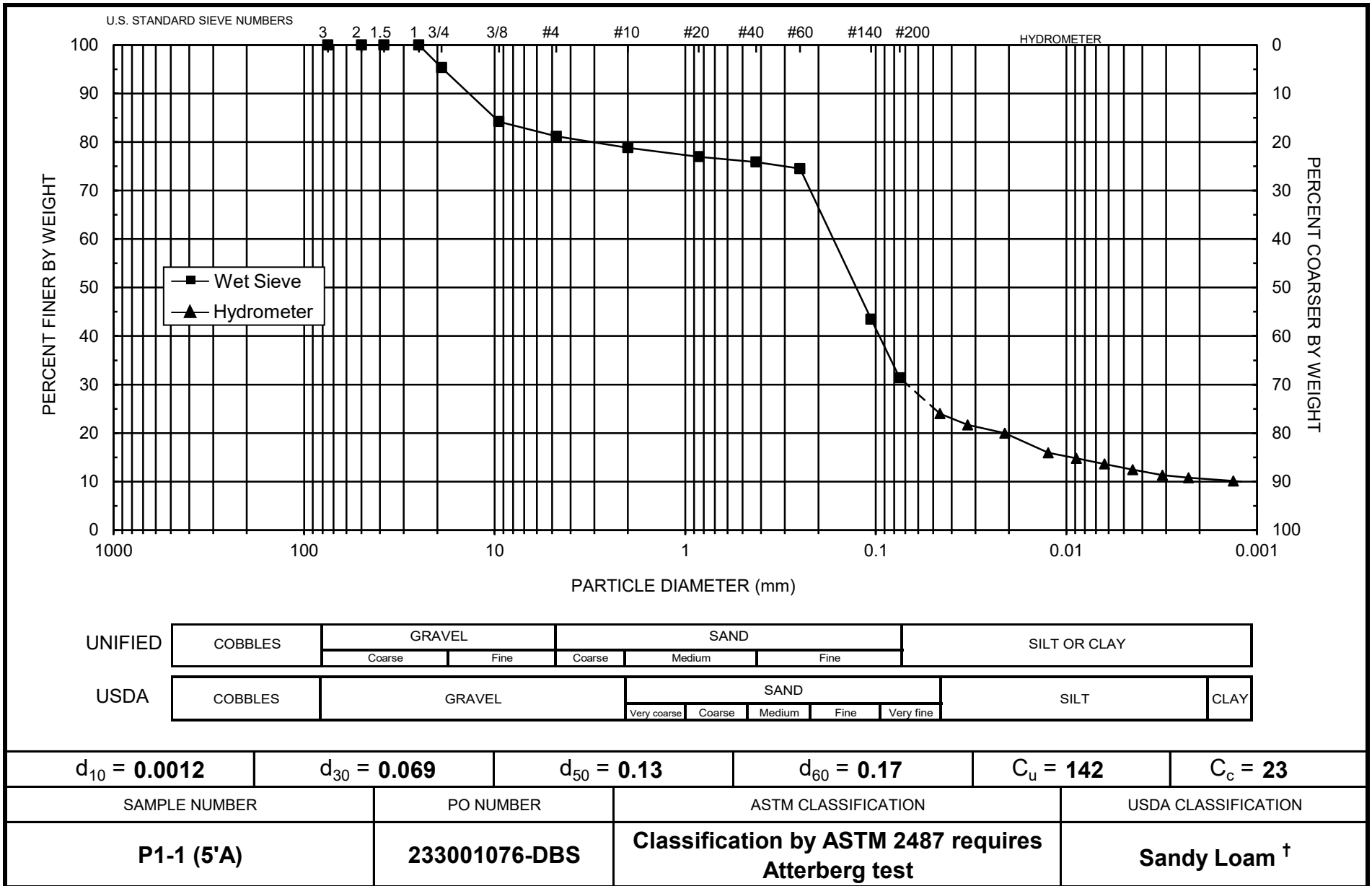
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 68.64  
 Total Sample Wt. (g): 323.18  
 Wt. Passing #10 (g): 254.78

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.7	27.0	6.1	20.9	11.9	0.04598	30.4	24.0
	2	21.7	25.0	6.1	18.9	12.2	0.03296	27.5	21.7
	5	21.7	23.5	6.1	17.4	12.4	0.02106	25.3	20.0
	15	21.6	20.0	6.1	13.9	13.0	0.01245	20.2	15.9
	30	21.6	19.0	6.1	12.9	13.2	0.00886	18.7	14.8
	60	21.6	18.0	6.1	11.9	13.3	0.00630	17.3	13.6
	120	21.5	17.0	6.2	10.8	13.5	0.00449	15.8	12.4
	250	21.6	16.0	6.2	9.8	13.7	0.00313	14.3	11.3
	471	21.7	15.5	6.1	9.4	13.8	0.00228	13.7	10.8
18-May-18	1404	21.4	15.0	6.2	8.8	13.8	0.00133	12.8	10.1

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-2 (30'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 268.32  
 Weight Passing #10 (g): 210.98  
 Weight Retained #10 (g): 57.34  
 Weight of Hydrometer Sample (g): 57.55  
 Calculated Weight of Sieve Sample (g): 73.19  
 Shape: Rounded  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	268.32	100.00
	2"	50	0.00	0.00	268.32	100.00
	1.5"	38.1	0.00	0.00	268.32	100.00
	1"	25	0.00	0.00	268.32	100.00
	3/4"	19.0	31.23	31.23	237.09	88.36
	3/8"	9.5	17.38	48.61	219.71	81.88
	4	4.75	5.97	54.58	213.74	79.66
	10	2.00	2.76	57.34	210.98	78.63
-10	(Based on calculated sieve wt.)					
	20	0.85	1.55	17.19	56.00	76.51
	40	0.425	1.00	18.19	55.00	75.15
	60	0.250	1.18	19.37	53.82	73.53
	140	0.106	18.74	38.11	35.08	47.93
	200	0.075	8.23	46.34	26.85	36.68
	dry pan		0.54	46.88	26.31	
	wet pan			26.31	0.00	

d<sub>10</sub> (mm): 0.0010      d<sub>50</sub> (mm): 0.11  
 d<sub>16</sub> (mm): 0.0071      d<sub>60</sub> (mm): 0.16  
 d<sub>30</sub> (mm): 0.058      d<sub>84</sub> (mm): 12

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 160  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 21  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 4.0

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-2 (30'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:06

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 57.55  
 Total Sample Wt. (g): 268.32  
 Wt. Passing #10 (g): 210.98

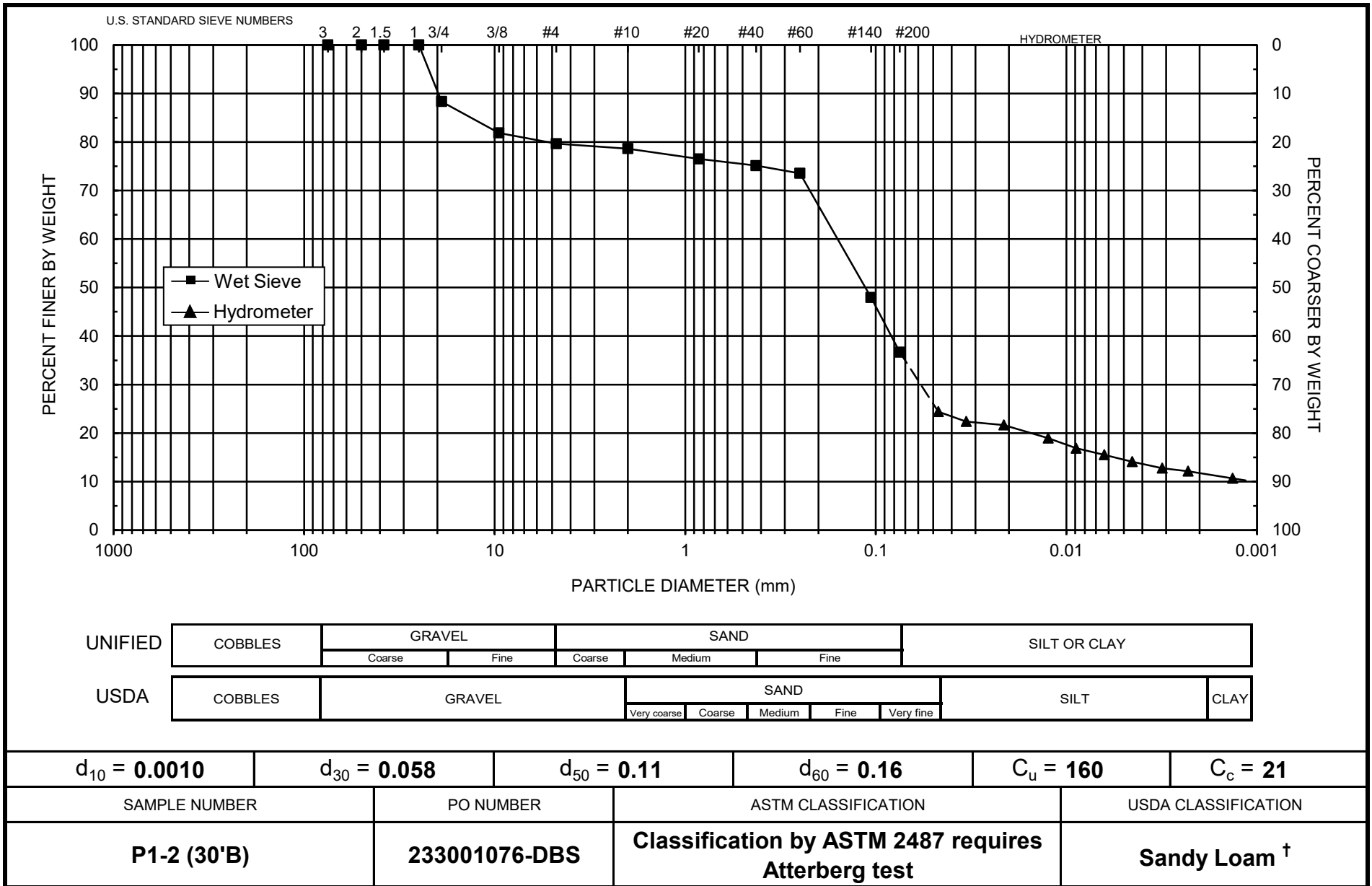
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.7	24.0	6.1	17.9	12.4	0.04696	31.1	24.4
	2	21.7	22.5	6.1	16.4	12.6	0.03353	28.4	22.4
	5	21.6	22.0	6.1	15.9	12.7	0.02129	27.6	21.7
	15	21.6	20.0	6.1	13.9	13.0	0.01245	24.1	18.9
	30	21.6	18.5	6.1	12.4	13.3	0.00889	21.5	16.9
	60	21.6	17.5	6.1	11.4	13.4	0.00632	19.7	15.5
	120	21.5	16.5	6.2	10.3	13.6	0.00451	17.9	14.1
	250	21.6	15.5	6.2	9.3	13.8	0.00314	16.2	12.8
	466	21.7	15.0	6.1	8.9	13.8	0.00230	15.4	12.1
18-May-18	1399	21.4	14.0	6.2	7.8	14.0	0.00134	13.6	10.7

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines





† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P2-1 (25'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 487.96  
 Weight Passing #10 (g): 485.94  
 Weight Retained #10 (g): 2.02  
 Weight of Hydrometer Sample (g): 59.29  
 Calculated Weight of Sieve Sample (g): 59.54  
 Shape: Rounded  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	487.96	100.00
	2"	50	0.00	0.00	487.96	100.00
	1.5"	38.1	0.00	0.00	487.96	100.00
	1"	25	0.00	0.00	487.96	100.00
	3/4"	19.0	0.00	0.00	487.96	100.00
	3/8"	9.5	0.00	0.00	487.96	100.00
	4	4.75	1.27	1.27	486.69	99.74
	10	2.00	0.75	2.02	485.94	99.59
-10	(Based on calculated sieve wt.)					
	20	0.85	1.48	1.73	57.81	97.10
	40	0.425	1.24	2.97	56.57	95.02
	60	0.250	1.60	4.57	54.97	92.33
	140	0.106	22.04	26.61	32.93	55.31
	200	0.075	5.68	32.29	27.25	45.77
	dry pan		0.42	32.71	26.83	
	wet pan			26.83	0.00	

d<sub>10</sub> (mm): 0.00071      d<sub>50</sub> (mm): 0.087  
 d<sub>16</sub> (mm): 0.0025      d<sub>60</sub> (mm): 0.12  
 d<sub>30</sub> (mm): 0.030      d<sub>84</sub> (mm): 0.21

Median Particle Diameter--d<sub>50</sub> (mm): 0.087  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 169  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 11  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.100

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P2-1 (25'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:12

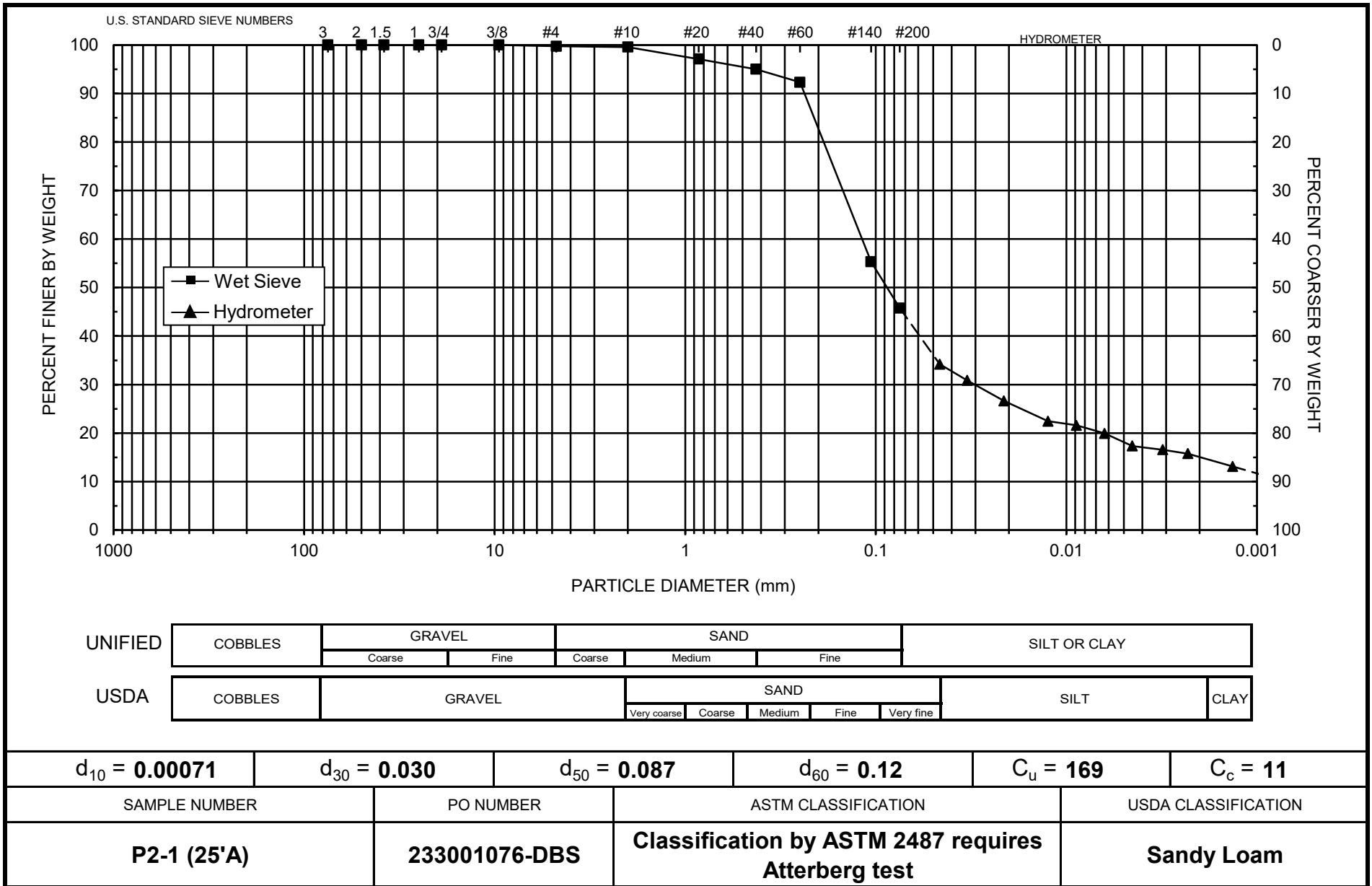
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 59.29  
 Total Sample Wt. (g): 487.96  
 Wt. Passing #10 (g): 485.94

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	26.5	6.1	20.4	12.0	0.04620	34.3	34.2
	2	21.6	24.5	6.1	18.4	12.3	0.03311	31.0	30.8
	5	21.6	22.0	6.1	15.9	12.7	0.02129	26.7	26.6
	15	21.6	19.5	6.1	13.4	13.1	0.01249	22.5	22.4
	30	21.6	19.0	6.1	12.9	13.2	0.00886	21.7	21.6
	60	21.6	18.0	6.1	11.9	13.3	0.00630	20.0	19.9
	120	21.5	16.5	6.2	10.3	13.6	0.00451	17.4	17.3
	250	21.6	16.0	6.1	9.9	13.7	0.00313	16.6	16.6
	461	21.7	15.5	6.1	9.4	13.8	0.00231	15.8	15.8
18-May-18	1394	21.4	14.0	6.2	7.8	14.0	0.00134	13.2	13.1

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P2-2 (5'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 509.13  
 Weight Passing #10 (g): 474.49  
 Weight Retained #10 (g): 34.64  
 Weight of Hydrometer Sample (g): 72.59  
 Calculated Weight of Sieve Sample (g): 77.89  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	509.13	100.00
	2"	50	0.00	0.00	509.13	100.00
	1.5"	38.1	0.00	0.00	509.13	100.00
	1"	25	0.00	0.00	509.13	100.00
	3/4"	19.0	0.00	0.00	509.13	100.00
	3/8"	9.5	18.36	18.36	490.77	96.39
	4	4.75	7.79	26.15	482.98	94.86
	10	2.00	8.49	34.64	474.49	93.20
-10	(Based on calculated sieve wt.)					
	20	0.85	1.21	6.51	71.38	91.64
	40	0.425	0.60	7.11	70.78	90.87
	60	0.250	0.63	7.74	70.15	90.06
	140	0.106	24.65	32.39	45.50	58.42
	200	0.075	13.04	45.43	32.46	41.67
	dry pan			0.72	46.15	31.74
wet pan				31.74	0.00	

d<sub>10</sub> (mm): 0.00078      d<sub>50</sub> (mm): 0.089  
 d<sub>16</sub> (mm): 0.0027      d<sub>60</sub> (mm): 0.11  
 d<sub>30</sub> (mm): 0.049      d<sub>84</sub> (mm): 0.21

Median Particle Diameter--d<sub>50</sub> (mm): 0.089  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 141  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 28  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.10

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P2-2 (5'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:18

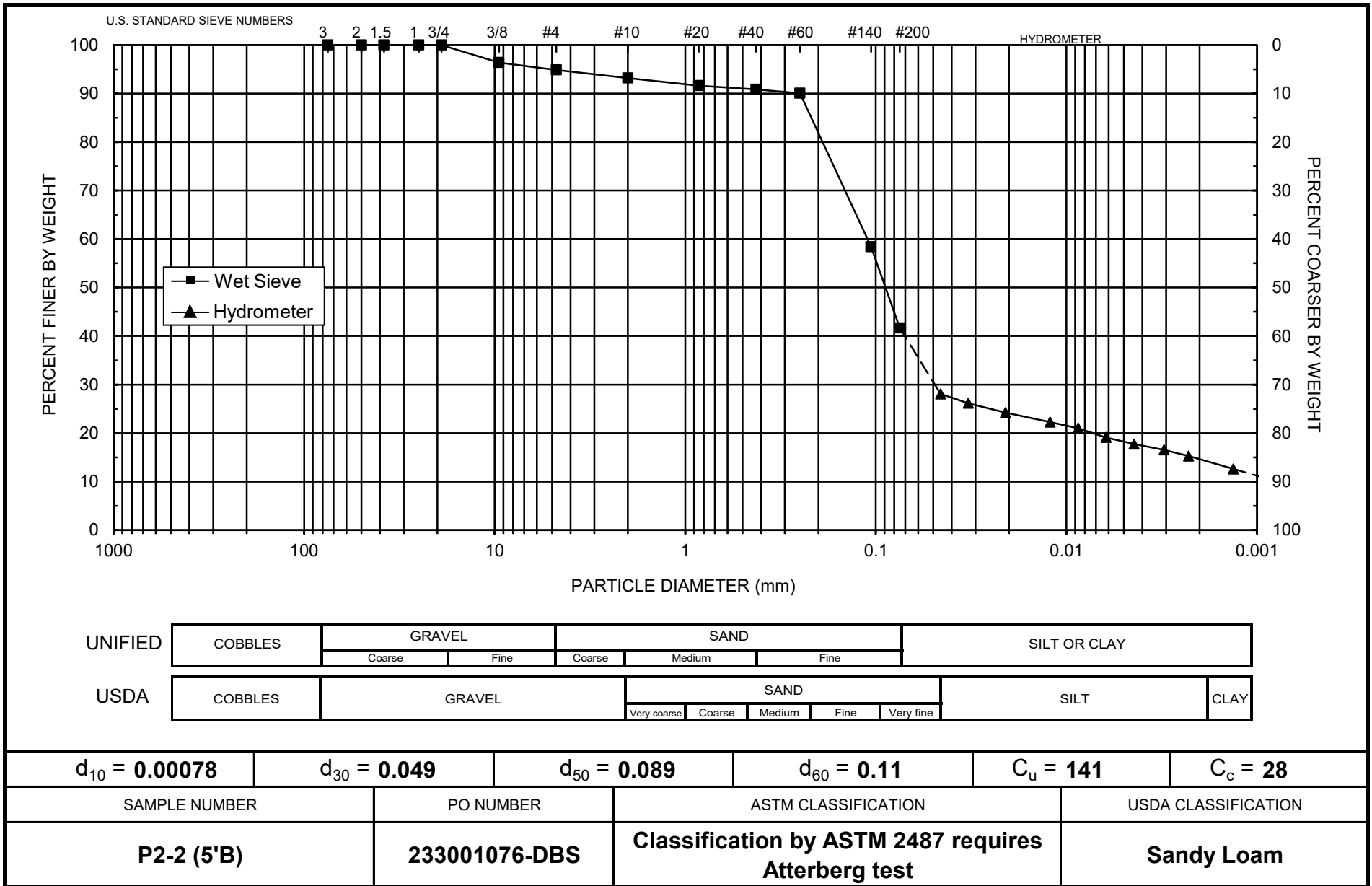
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 72.59  
 Total Sample Wt. (g): 509.13  
 Wt. Passing #10 (g): 474.49

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	28.0	6.1	21.9	11.7	0.04572	30.1	28.1
	2	21.6	26.5	6.1	20.4	12.0	0.03267	28.0	26.1
	5	21.6	25.0	6.1	18.9	12.2	0.02087	26.0	24.2
	15	21.6	23.5	6.2	17.3	12.4	0.01218	23.9	22.3
	30	21.6	22.5	6.1	16.4	12.6	0.00866	22.5	21.0
	60	21.6	21.0	6.1	14.9	12.9	0.00618	20.5	19.1
	120	21.5	20.0	6.2	13.8	13.0	0.00441	19.0	17.7
	250	21.6	19.0	6.1	12.9	13.2	0.00307	17.7	16.5
	456	21.7	18.0	6.1	11.9	13.3	0.00228	16.4	15.3
	18-May-18	1389	21.4	16.0	6.2	9.8	13.7	0.00133	13.5

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 541.45
Job Number: DB18.1151.00	Weight Passing #10 (g): 418.25
Sample Number: P3-1 (5'A)	Weight Retained #10 (g): 123.20
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 57.93
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 74.99
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	541.45	100.00
	2"	50	0.00	0.00	541.45	100.00
	1.5"	38.1	0.00	0.00	541.45	100.00
	1"	25	0.00	0.00	541.45	100.00
	3/4"	19.0	39.21	39.21	502.24	92.76
	3/8"	9.5	34.72	73.93	467.52	86.35
	4	4.75	32.76	106.69	434.76	80.30
	10	2.00	16.51	123.20	418.25	77.25
-10	(Based on calculated sieve wt.)					
	20	0.85	3.93	20.99	54.00	72.01
	40	0.425	4.22	25.21	49.78	66.38
	60	0.250	9.70	34.91	40.08	53.44
	140	0.106	24.22	59.13	15.86	21.15
	200	0.075	4.35	63.48	11.51	15.35
	dry pan			0.84	64.32	10.67
wet pan				10.67	0.00	

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.23  
d<sub>16</sub> (mm): 0.078                    d<sub>60</sub> (mm): 0.33  
d<sub>30</sub> (mm): 0.13                      d<sub>84</sub> (mm): 7.3

Median Particle Diameter--d<sub>50</sub> (mm): 0.23  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 2.5

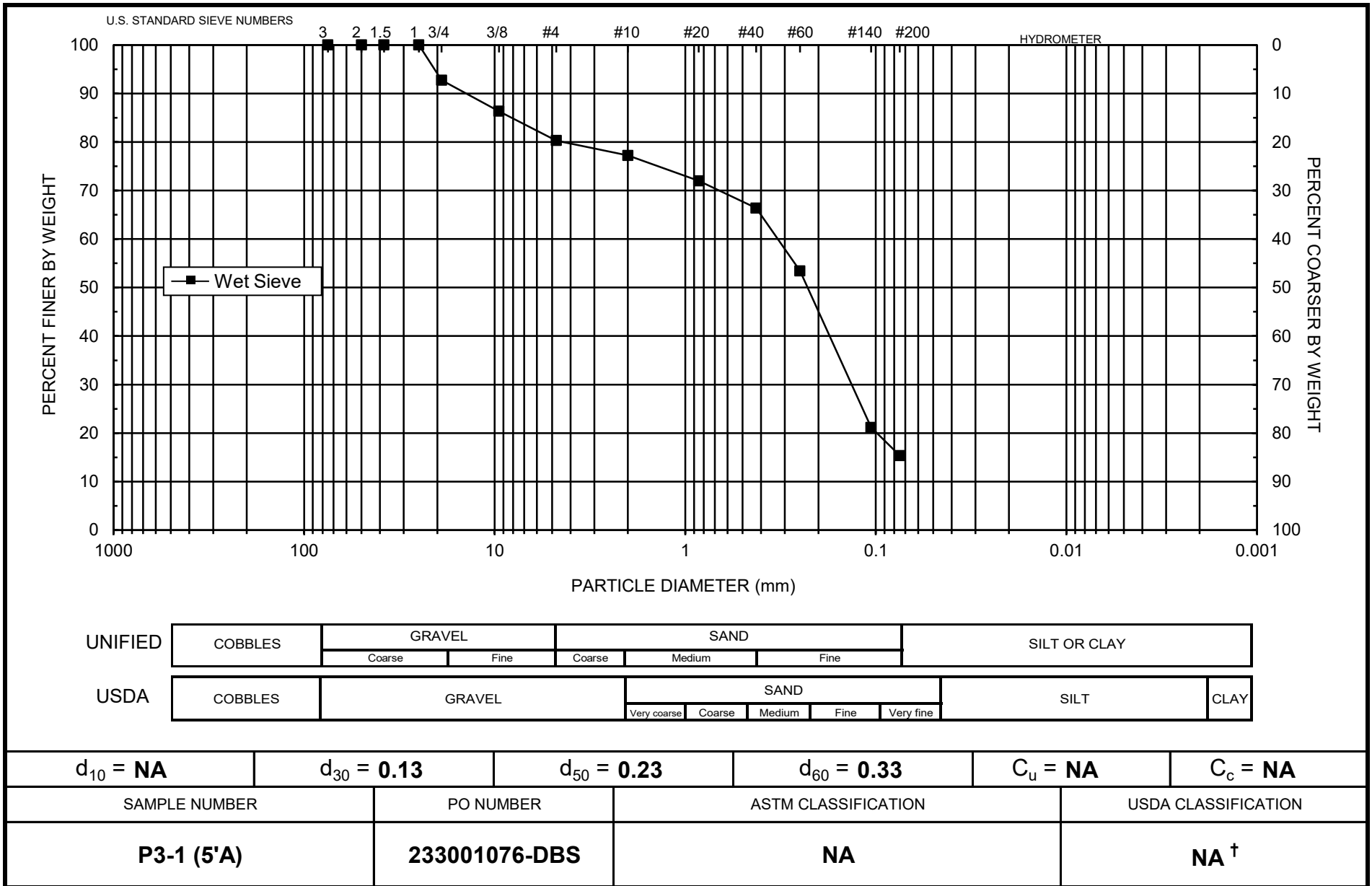
Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA<sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 410.00
Job Number: DB18.1151.00	Weight Passing #10 (g): 410.00
Sample Number: P3-2 (15'B)	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 58.51
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 58.51
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	410.00	100.00
	2"	50	0.00	0.00	410.00	100.00
	1.5"	38.1	0.00	0.00	410.00	100.00
	1"	25	0.00	0.00	410.00	100.00
	3/4"	19.0	0.00	0.00	410.00	100.00
	3/8"	9.5	0.00	0.00	410.00	100.00
	4	4.75	0.00	0.00	410.00	100.00
	10	2.00	0.00	0.00	410.00	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.89	0.89	57.62	98.48
	40	0.425	4.90	5.79	52.72	90.10
	60	0.250	17.46	23.25	35.26	60.26
	140	0.106	21.30	44.55	13.96	23.86
	200	0.075	1.58	46.13	12.38	21.16
	wet pan			0.24	46.37	12.14
				12.14	0.00	

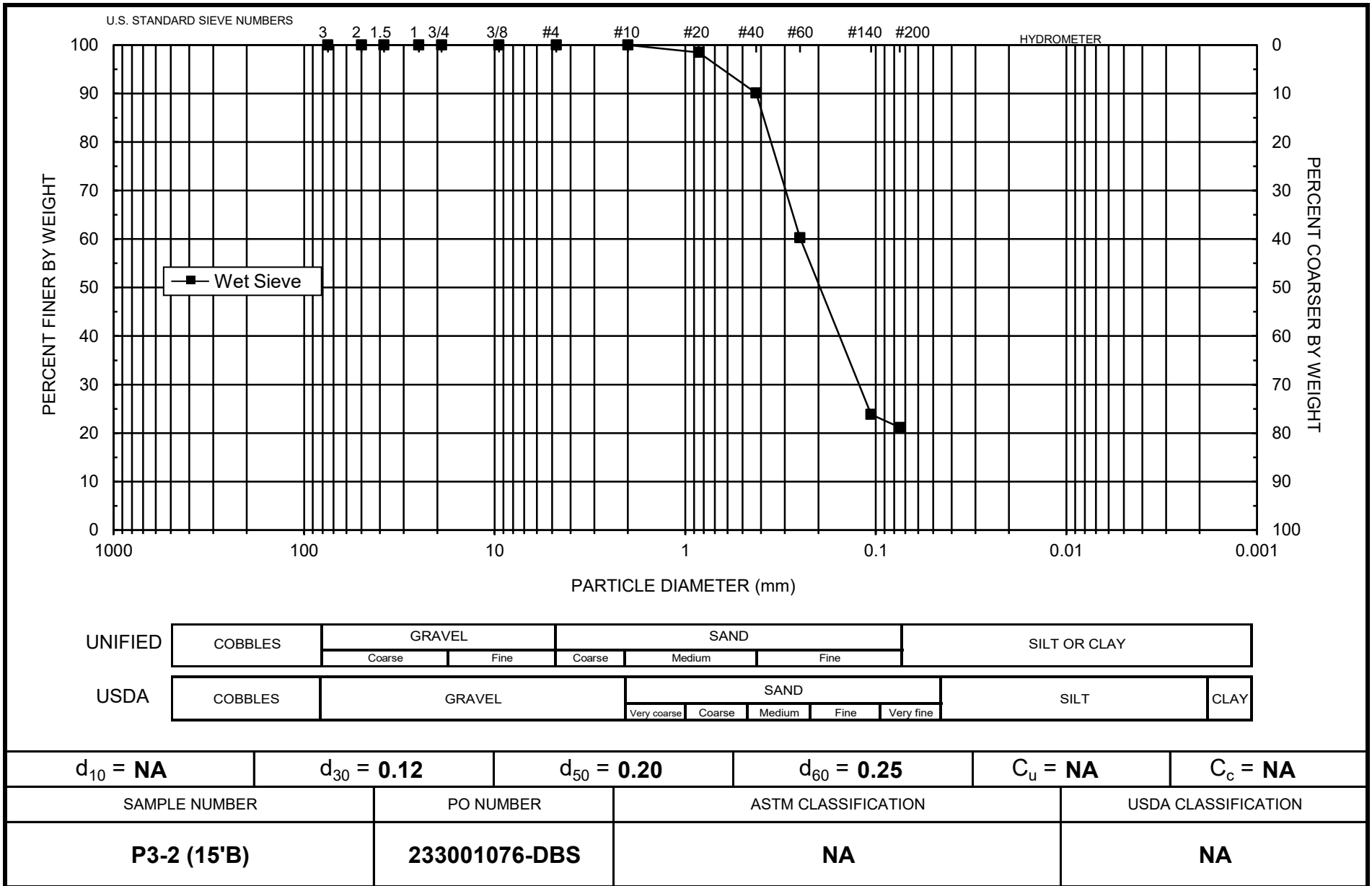
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.20  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.25  
d<sub>30</sub> (mm): 0.12                      d<sub>84</sub> (mm): 0.38

Median Particle Diameter--d<sub>50</sub> (mm): 0.20  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 426.94
Job Number: DB18.1151.00	Weight Passing #10 (g): 422.32
Sample Number: P3-2 (35'B)	Weight Retained #10 (g): 4.62
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 58.70
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 59.34
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	426.94	100.00
	2"	50	0.00	0.00	426.94	100.00
	1.5"	38.1	0.00	0.00	426.94	100.00
	1"	25	0.00	0.00	426.94	100.00
	3/4"	19.0	0.00	0.00	426.94	100.00
	3/8"	9.5	4.62	4.62	422.32	98.92
	4	4.75	0.00	4.62	422.32	98.92
	10	2.00	0.00	4.62	422.32	98.92
-10	(Based on calculated sieve wt.)					
	20	0.85	1.10	1.74	57.60	97.06
	40	0.425	2.97	4.71	54.63	92.06
	60	0.250	11.98	16.69	42.65	71.87
	140	0.106	22.65	39.34	20.00	33.70
	200	0.075	1.76	41.10	18.24	30.74
	dry pan		0.27	41.37	17.97	
	wet pan			17.97	0.00	

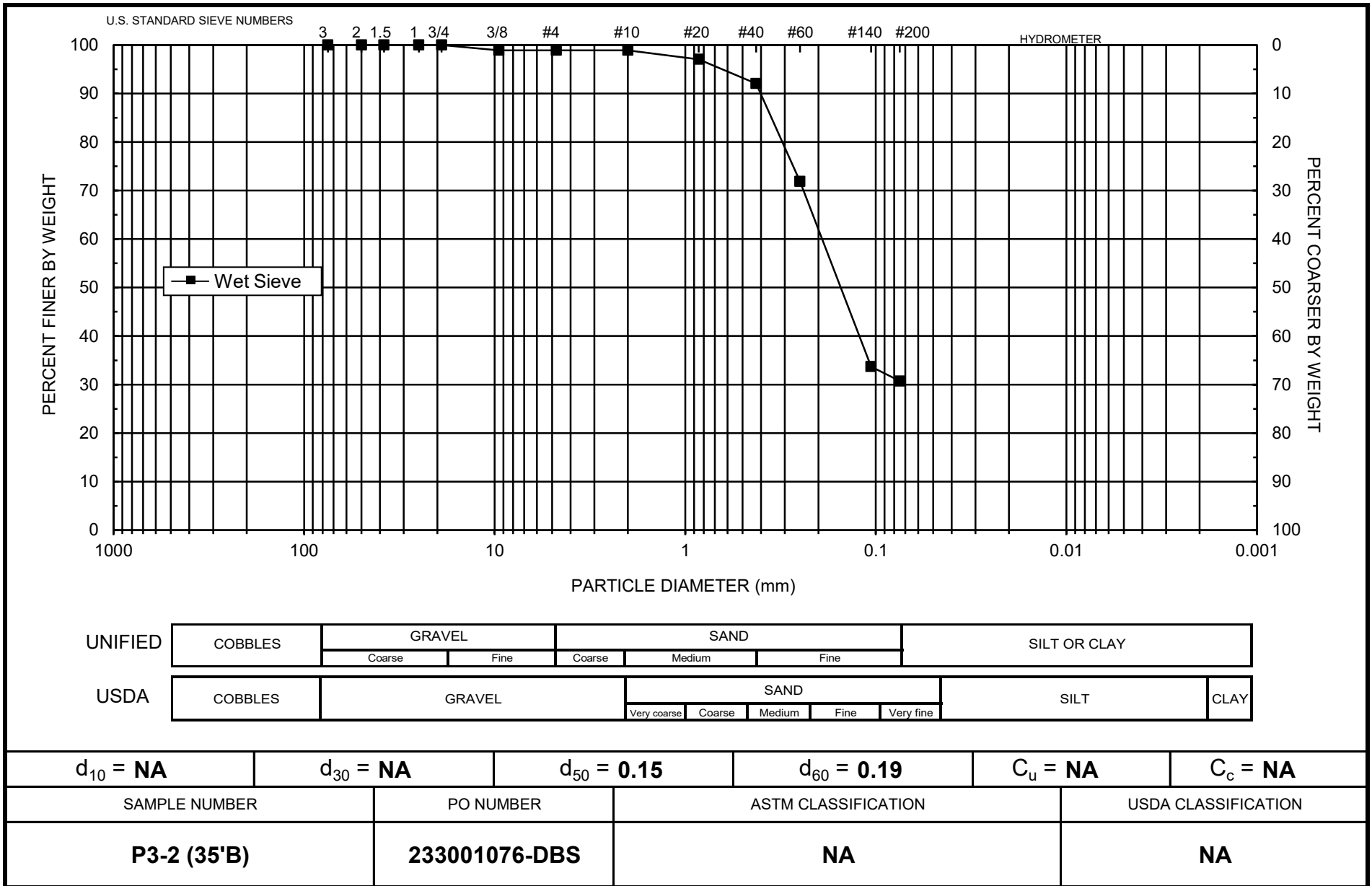
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.15  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.19  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.34

Median Particle Diameter--d<sub>50</sub> (mm): 0.15  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 492.77
Job Number: DB18.1151.00	Weight Passing #10 (g): 489.86
Sample Number: P3-3 (5'A)	Weight Retained #10 (g): 2.91
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 65.64
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 66.03
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	492.77	100.00
	2"	50	0.00	0.00	492.77	100.00
	1.5"	38.1	0.00	0.00	492.77	100.00
	1"	25	0.00	0.00	492.77	100.00
	3/4"	19.0	0.00	0.00	492.77	100.00
	3/8"	9.5	0.00	0.00	492.77	100.00
	4	4.75	1.58	1.58	491.19	99.68
	10	2.00	1.33	2.91	489.86	99.41
-10	(Based on calculated sieve wt.)					
	20	0.85	0.69	1.08	64.95	98.36
	40	0.425	3.51	4.59	61.44	93.05
	60	0.250	13.49	18.08	47.95	72.62
	140	0.106	24.20	42.28	23.75	35.97
	200	0.075	2.66	44.94	21.09	31.94
	dry pan		0.39	45.33	20.70	
wet pan			20.70	0.00		

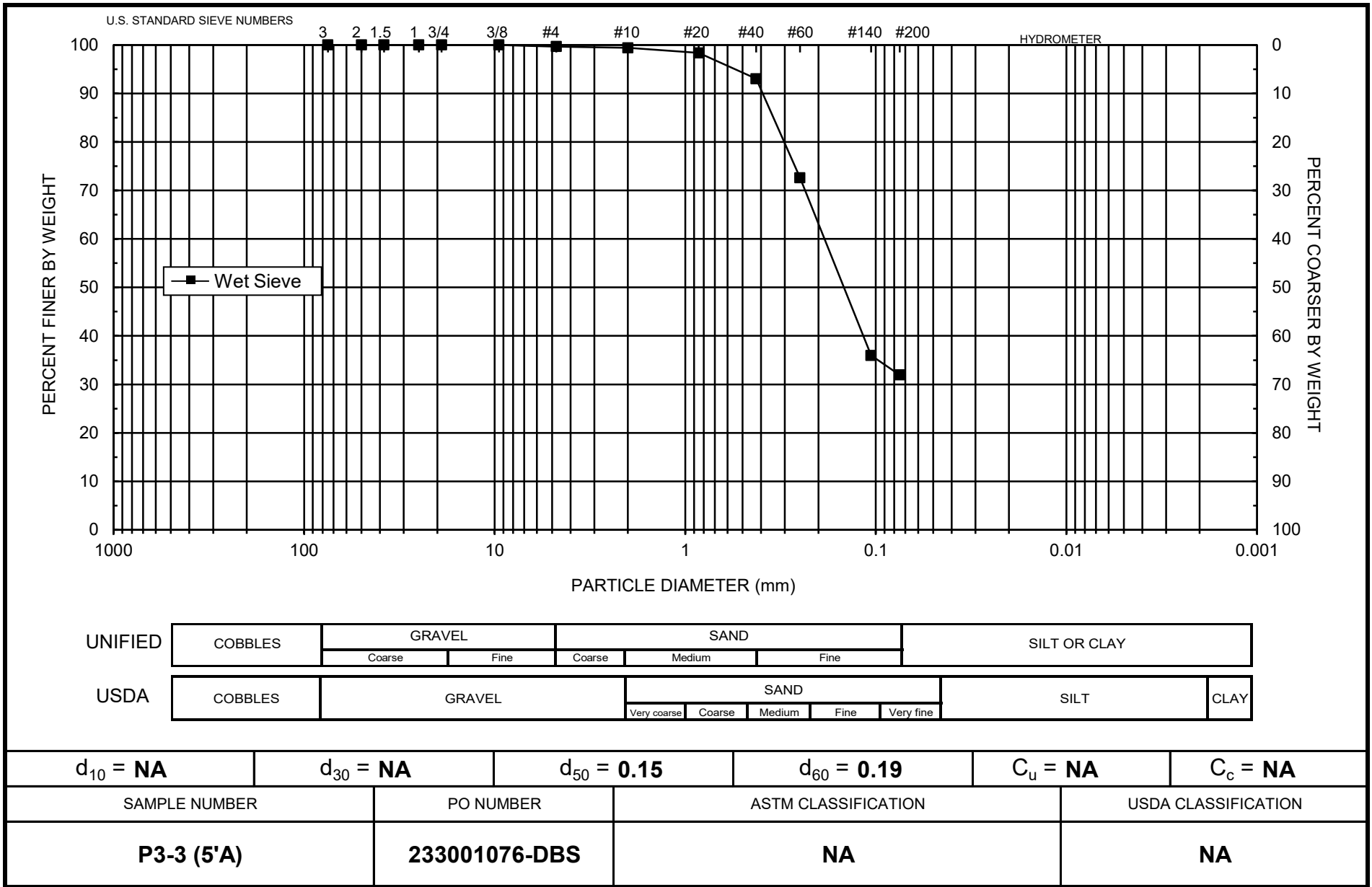
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.15  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.19  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.34

Median Particle Diameter--d<sub>50</sub> (mm): 0.15  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 501.86
Job Number: DB18.1151.00	Weight Passing #10 (g): 478.89
Sample Number: P3-3 (40'B)	Weight Retained #10 (g): 22.97
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 53.69
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 56.27
Test Date: 23-May-18	Shape: Angular
	Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	501.86	100.00
	2"	50	0.00	0.00	501.86	100.00
	1.5"	38.1	0.00	0.00	501.86	100.00
	1"	25	0.00	0.00	501.86	100.00
	3/4"	19.0	0.00	0.00	501.86	100.00
	3/8"	9.5	0.00	0.00	501.86	100.00
	4	4.75	7.07	7.07	494.79	98.59
	10	2.00	15.90	22.97	478.89	95.42
-10	(Based on calculated sieve wt.)					
	20	0.85	1.13	3.71	52.56	93.41
	40	0.425	0.97	4.68	51.59	91.69
	60	0.250	1.37	6.05	50.22	89.26
	140	0.106	14.16	20.21	36.06	64.09
	200	0.075	12.28	32.49	23.78	42.26
	dry pan		1.47	33.96	22.31	
	wet pan			22.31	0.00	

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.085  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.099  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.21

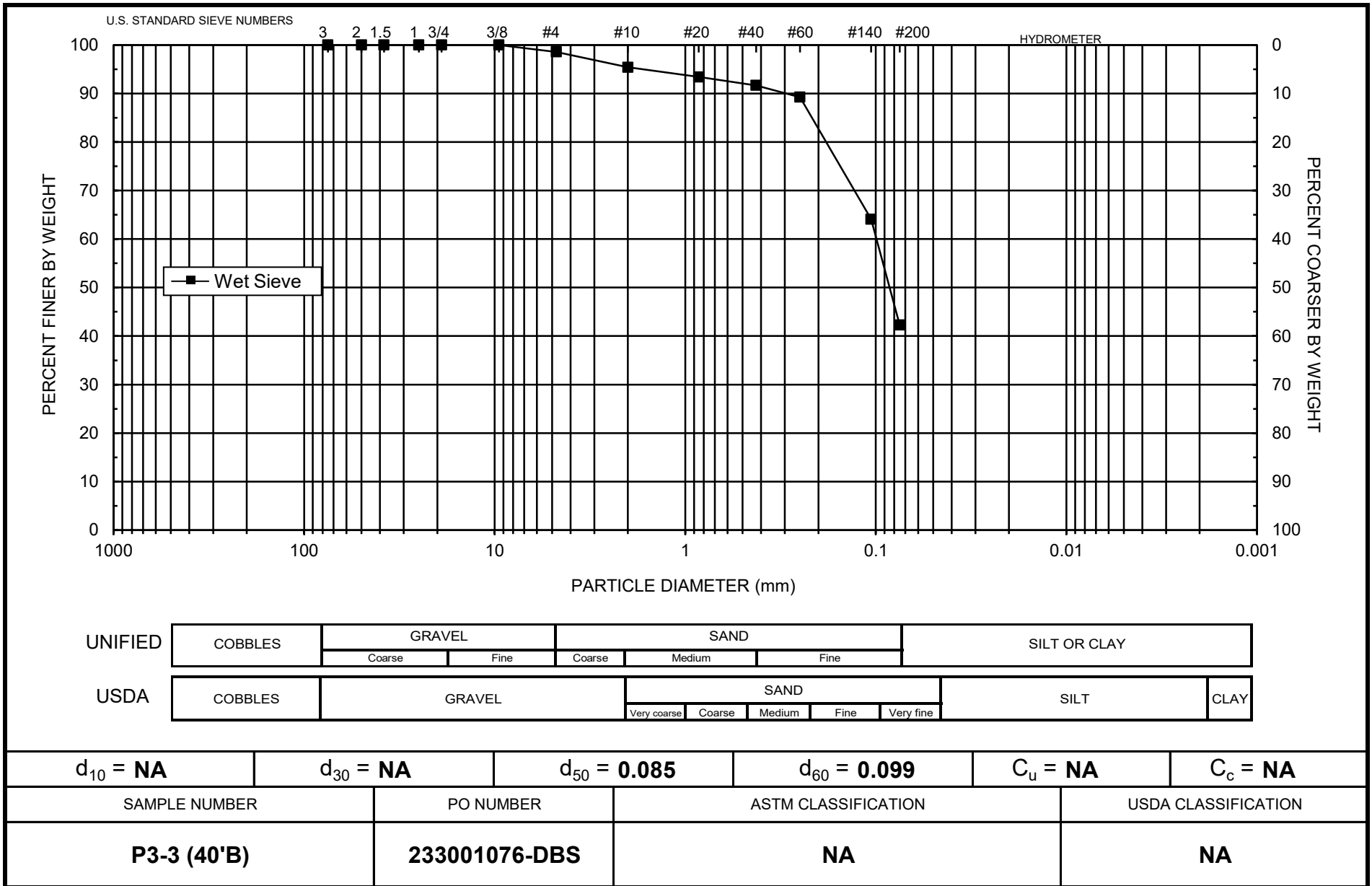
Median Particle Diameter--d<sub>50</sub> (mm): 0.085  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 489.96
Job Number: DB18.1151.00	Weight Passing #10 (g): 489.74
Sample Number: P3-4 (20'A)	Weight Retained #10 (g): 0.22
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 64.28
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 64.31
Test Date: 23-May-18	Shape: Rounded
	Hardness: Soft

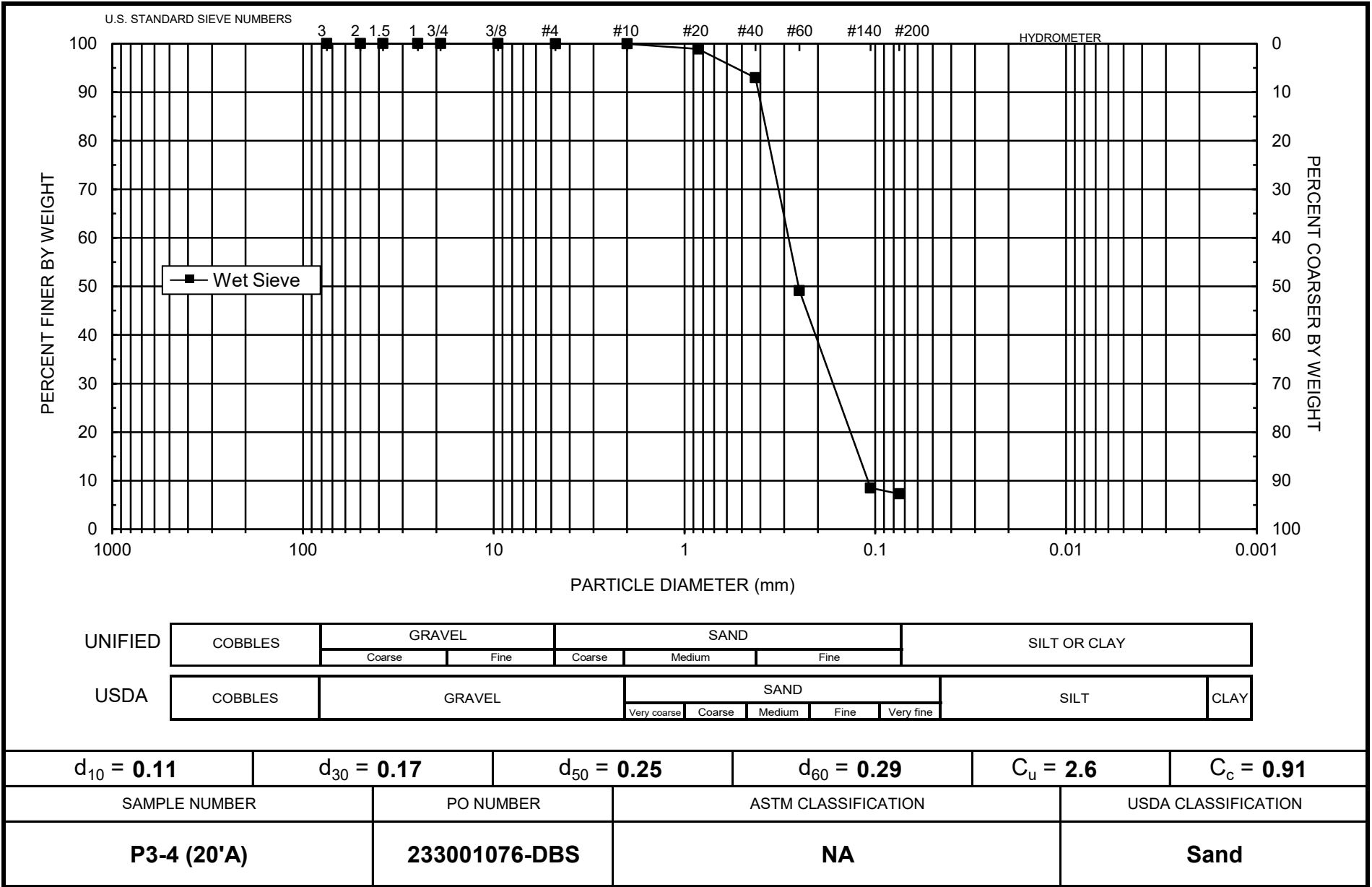
Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	489.96	100.00
	2"	50	0.00	0.00	489.96	100.00
	1.5"	38.1	0.00	0.00	489.96	100.00
	1"	25	0.00	0.00	489.96	100.00
	3/4"	19.0	0.00	0.00	489.96	100.00
	3/8"	9.5	0.00	0.00	489.96	100.00
	4	4.75	0.19	0.19	489.77	99.96
	10	2.00	0.03	0.22	489.74	99.96
-10	(Based on calculated sieve wt.)					
	20	0.85	0.69	0.72	63.59	98.88
	40	0.425	3.81	4.53	59.78	92.96
	60	0.250	28.17	32.70	31.61	49.15
	140	0.106	26.15	58.85	5.46	8.49
	200	0.075	0.78	59.63	4.68	7.28
	dry pan			0.18	59.81	4.50
wet pan				4.50	0.00	

d<sub>10</sub> (mm): 0.11                      d<sub>50</sub> (mm): 0.25  
d<sub>16</sub> (mm): 0.12                      d<sub>60</sub> (mm): 0.29  
d<sub>30</sub> (mm): 0.17                      d<sub>84</sub> (mm): 0.38

Median Particle Diameter--d<sub>50</sub> (mm): 0.25  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 2.6  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.91  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): 0.25

ASTM Soil Classification: NA  
USDA Soil Classification: Sand

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 437.63
Job Number: DB18.1151.00	Weight Passing #10 (g): 437.63
Sample Number: P3-4 (30'A)	Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 76.13
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 76.13
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

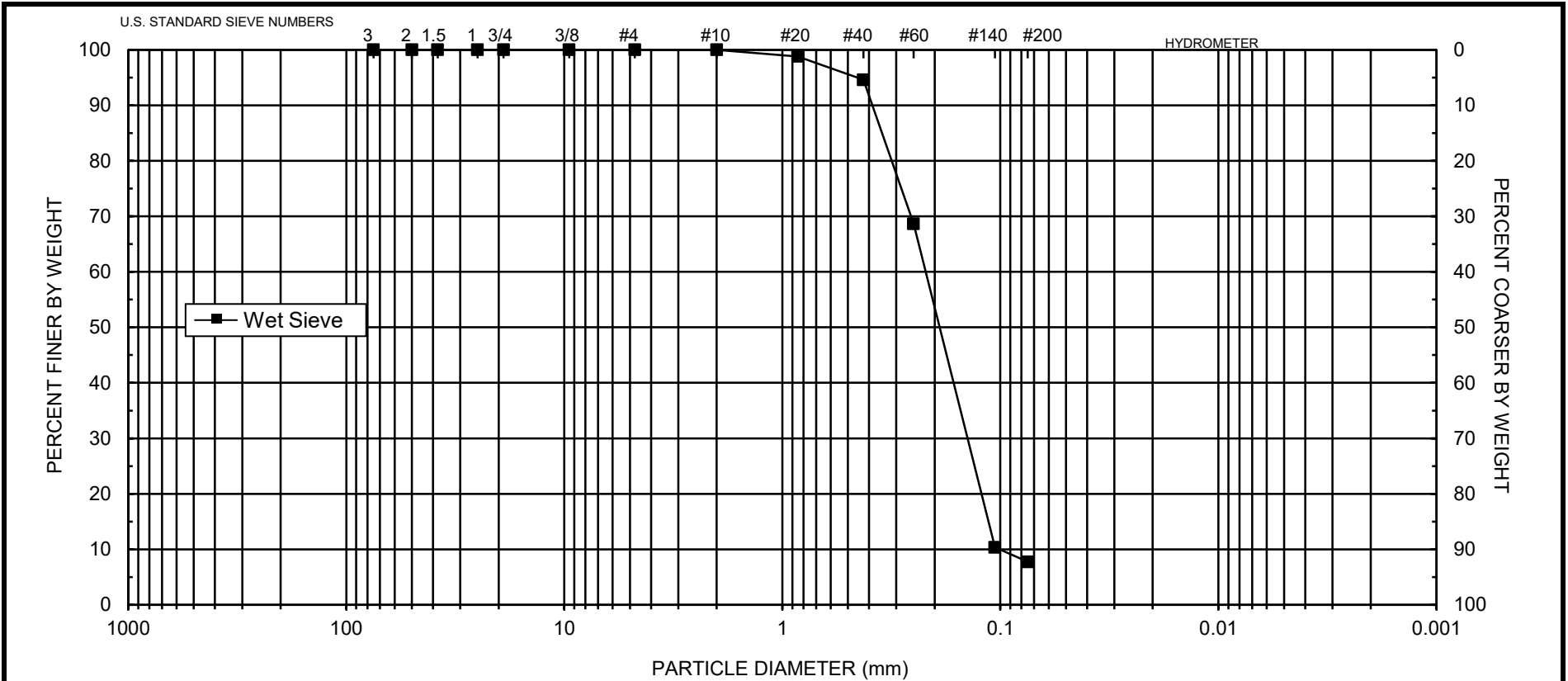
Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	437.63	100.00
	2"	50	0.00	0.00	437.63	100.00
	1.5"	38.1	0.00	0.00	437.63	100.00
	1"	25	0.00	0.00	437.63	100.00
	3/4"	19.0	0.00	0.00	437.63	100.00
	3/8"	9.5	0.00	0.00	437.63	100.00
	4	4.75	0.00	0.00	437.63	100.00
	10	2.00	0.00	0.00	437.63	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.90	0.90	75.23	98.82
	40	0.425	3.21	4.11	72.02	94.60
	60	0.250	19.75	23.86	52.27	68.66
	140	0.106	44.38	68.24	7.89	10.36
	200	0.075	2.00	70.24	5.89	7.74
	dry pan		0.12	70.36	5.77	
	wet pan			5.77	0.00	

d<sub>10</sub> (mm): 0.10                      d<sub>50</sub> (mm): 0.19  
d<sub>16</sub> (mm): 0.12                      d<sub>60</sub> (mm): 0.22  
d<sub>30</sub> (mm): 0.14                      d<sub>84</sub> (mm): 0.34

Median Particle Diameter--d<sub>50</sub> (mm): 0.19  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 2.2  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.89  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): 0.22

ASTM Soil Classification: NA  
USDA Soil Classification: Sand

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
		Very coarse	Coarse	Medium	Fine	Very fine				

$d_{10} = 0.10$	$d_{30} = 0.14$	$d_{50} = 0.19$	$d_{60} = 0.22$	$C_u = 2.2$	$C_c = 0.89$
SAMPLE NUMBER		PO NUMBER	ASTM CLASSIFICATION		USDA CLASSIFICATION
<b>P3-4 (30'A)</b>		<b>233001076-DBS</b>	<b>NA</b>		<b>Sand</b>



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-4 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

Initial Dry Weight of Sample (g): 546.30  
 Weight Passing #10 (g): 546.30  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 54.62  
 Calculated Weight of Sieve Sample (g): 54.62  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing	
+10	3"	75	0.00	0.00	546.30	100.00	
	2"	50	0.00	0.00	546.30	100.00	
	1.5"	38.1	0.00	0.00	546.30	100.00	
	1"	25	0.00	0.00	546.30	100.00	
	3/4"	19.0	0.00	0.00	546.30	100.00	
	3/8"	9.5	0.00	0.00	546.30	100.00	
	4	4.75	0.00	0.00	546.30	100.00	
	10	2.00	0.00	0.00	546.30	100.00	
-10	(Based on calculated sieve wt.)						
	20	0.85	0.03	0.03	54.59	99.95	
	40	0.425	0.07	0.10	54.52	99.82	
	60	0.250	0.14	0.24	54.38	99.56	
	140	0.106	16.01	16.25	38.37	70.25	
	200	0.075	10.01	26.26	28.36	51.92	
	dry pan			1.23	27.49	27.13	
	wet pan				27.13	0.00	

d<sub>10</sub> (mm): 0.0029      d<sub>50</sub> (mm): 0.072  
 d<sub>16</sub> (mm): 0.0099      d<sub>60</sub> (mm): 0.087  
 d<sub>30</sub> (mm): 0.044      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.072  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 30  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 7.7  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.081

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-4 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18  
 Start Time: 9:42

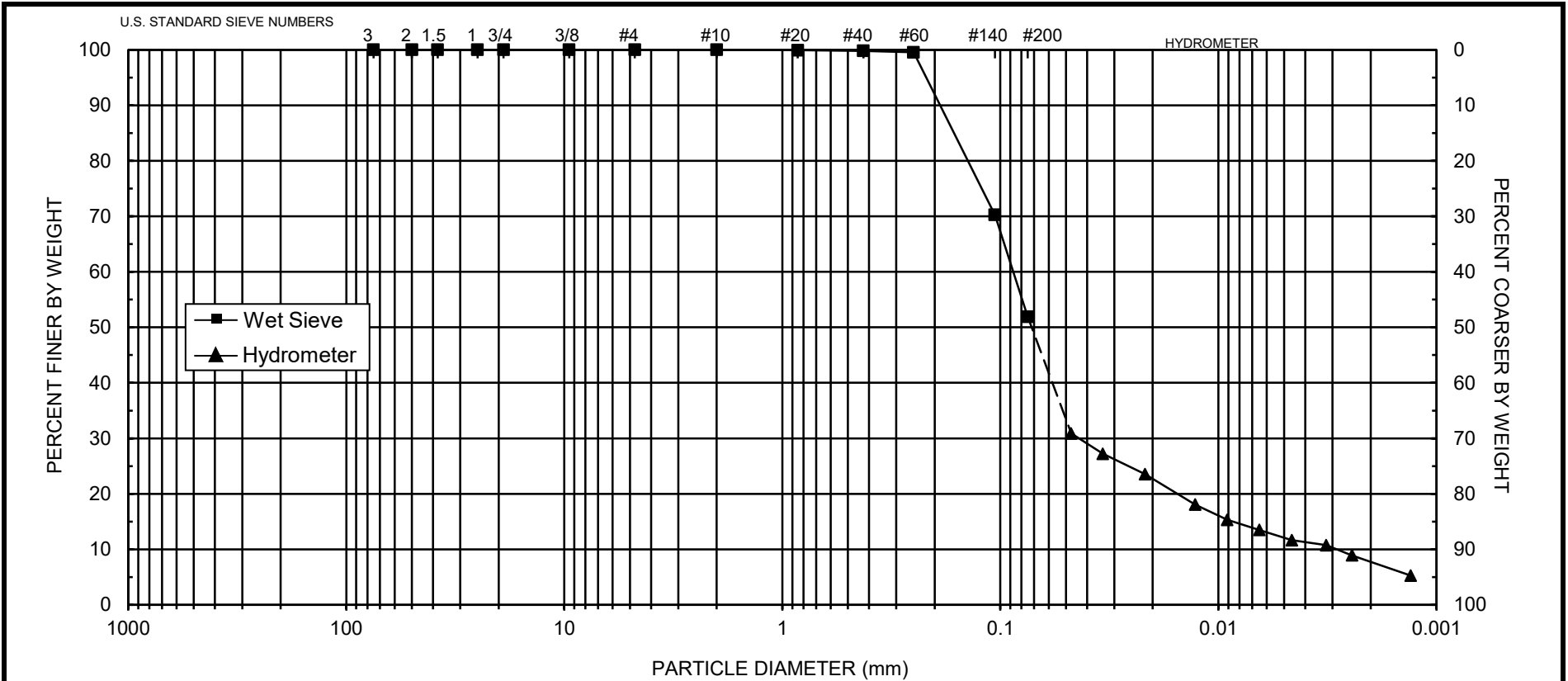
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 54.62  
 Total Sample Wt. (g): 546.30  
 Wt. Passing #10 (g): 546.30

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-May-18	1	21.6	23.0	6.1	16.9	12.5	0.04729	30.9	30.9
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.2	27.2
	5	21.6	19.0	6.1	12.9	13.2	0.02170	23.5	23.5
	15	21.6	16.0	6.1	9.9	13.7	0.01276	18.1	18.1
	30	21.6	14.5	6.1	8.4	13.9	0.00910	15.3	15.3
	60	21.6	13.5	6.1	7.4	14.1	0.00647	13.5	13.5
	120	21.6	12.5	6.1	6.4	14.3	0.00460	11.6	11.6
	250	21.6	12.0	6.1	5.9	14.3	0.00320	10.7	10.7
	436	21.6	11.0	6.1	4.9	14.5	0.00244	8.9	8.9
19-May-18	1534	21.7	9.0	6.1	2.9	14.8	0.00131	5.3	5.3

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
		Very coarse	Coarse	Medium	Fine	Very fine				

$d_{10} = 0.0029$        $d_{30} = 0.044$        $d_{50} = 0.072$        $d_{60} = 0.087$        $C_u = 30$        $C_c = 7.7$

SAMPLE NUMBER      PO NUMBER      ASTM CLASSIFICATION      USDA CLASSIFICATION

**P3-4 (40'A)**      **233001076-DBS**      **Classification by ASTM 2487 requires Atterberg test**      **Sandy Loam**



Daniel B. Stephens & Associates, Inc.





**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-5 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 530.27  
 Weight Passing #10 (g): 530.27  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 51.69  
 Calculated Weight of Sieve Sample (g): 51.69  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	530.27	100.00
	2"	50	0.00	0.00	530.27	100.00
	1.5"	38.1	0.00	0.00	530.27	100.00
	1"	25	0.00	0.00	530.27	100.00
	3/4"	19.0	0.00	0.00	530.27	100.00
	3/8"	9.5	0.00	0.00	530.27	100.00
	4	4.75	0.00	0.00	530.27	100.00
	10	2.00	0.00	0.00	530.27	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.24	0.24	51.45	99.54
	40	0.425	0.48	0.72	50.97	98.61
	60	0.250	0.74	1.46	50.23	97.18
	140	0.106	21.82	23.28	28.41	54.96
	200	0.075	12.18	35.46	16.23	31.40
	dry pan		1.16	36.62	15.07	
	wet pan			15.07	0.00	

d<sub>10</sub> (mm): 0.020                      d<sub>50</sub> (mm): 0.099  
 d<sub>16</sub> (mm): 0.040                      d<sub>60</sub> (mm): 0.12  
 d<sub>30</sub> (mm): 0.072                      d<sub>84</sub> (mm): 0.19

Median Particle Diameter--d<sub>50</sub> (mm): 0.099  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 6.0  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.2  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.11

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loamy Sand

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-5 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:24

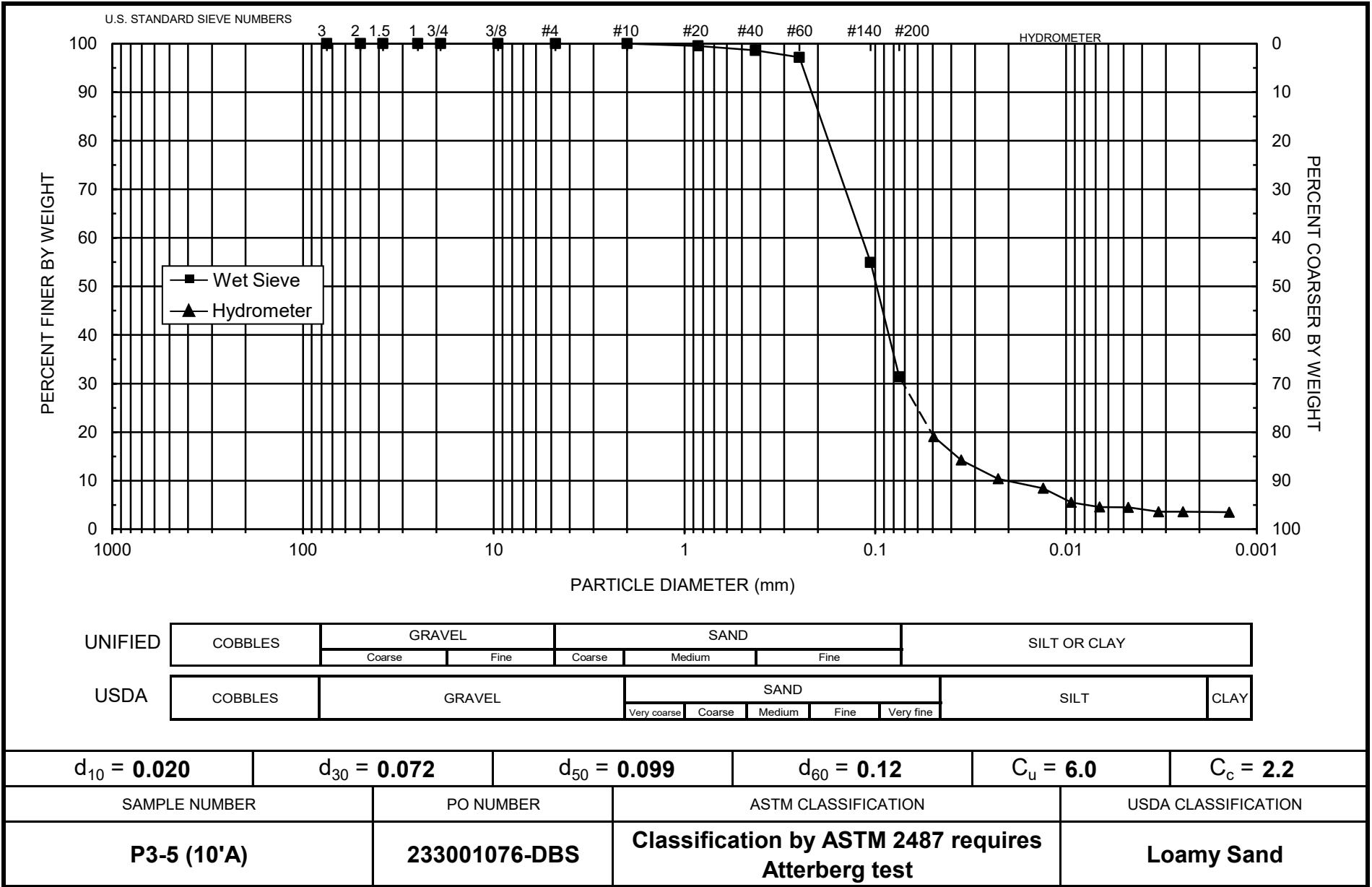
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 51.69  
 Total Sample Wt. (g): 530.27  
 Wt. Passing #10 (g): 530.27

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	16.0	6.1	9.9	13.7	0.04941	19.1	19.1
	2	21.6	13.5	6.1	7.4	14.1	0.03546	14.2	14.2
	5	21.6	11.5	6.1	5.4	14.4	0.02269	10.4	10.4
	15	21.6	10.5	6.1	4.4	14.6	0.01317	8.4	8.4
	30	21.6	9.0	6.1	2.9	14.8	0.00939	5.5	5.5
	60	21.6	8.5	6.1	2.4	14.9	0.00666	4.6	4.6
	120	21.5	8.5	6.2	2.3	14.9	0.00472	4.5	4.5
	250	21.6	8.0	6.1	1.9	15.0	0.00327	3.6	3.6
	451	21.7	8.0	6.1	1.9	15.0	0.00243	3.6	3.6
18-May-18	1384	21.4	8.0	6.2	1.8	15.0	0.00139	3.5	3.5

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 504.36
Job Number: DB18.1151.00	Weight Passing #10 (g): 504.12
Sample Number: P3-6 (20'A)	Weight Retained #10 (g): 0.24
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 67.91
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 67.94
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	504.36	100.00
	2"	50	0.00	0.00	504.36	100.00
	1.5"	38.1	0.00	0.00	504.36	100.00
	1"	25	0.00	0.00	504.36	100.00
	3/4"	19.0	0.00	0.00	504.36	100.00
	3/8"	9.5	0.00	0.00	504.36	100.00
	4	4.75	0.00	0.00	504.36	100.00
	10	2.00	0.24	0.24	504.12	99.95
-10	(Based on calculated sieve wt.)					
	20	0.85	0.74	0.77	67.17	98.86
	40	0.425	4.63	5.40	62.54	92.05
	60	0.250	20.41	25.81	42.13	62.01
	140	0.106	30.53	56.34	11.60	17.07
	200	0.075	1.53	57.87	10.07	14.82
	dry pan			0.27	58.14	9.80
wet pan				9.80	0.00	

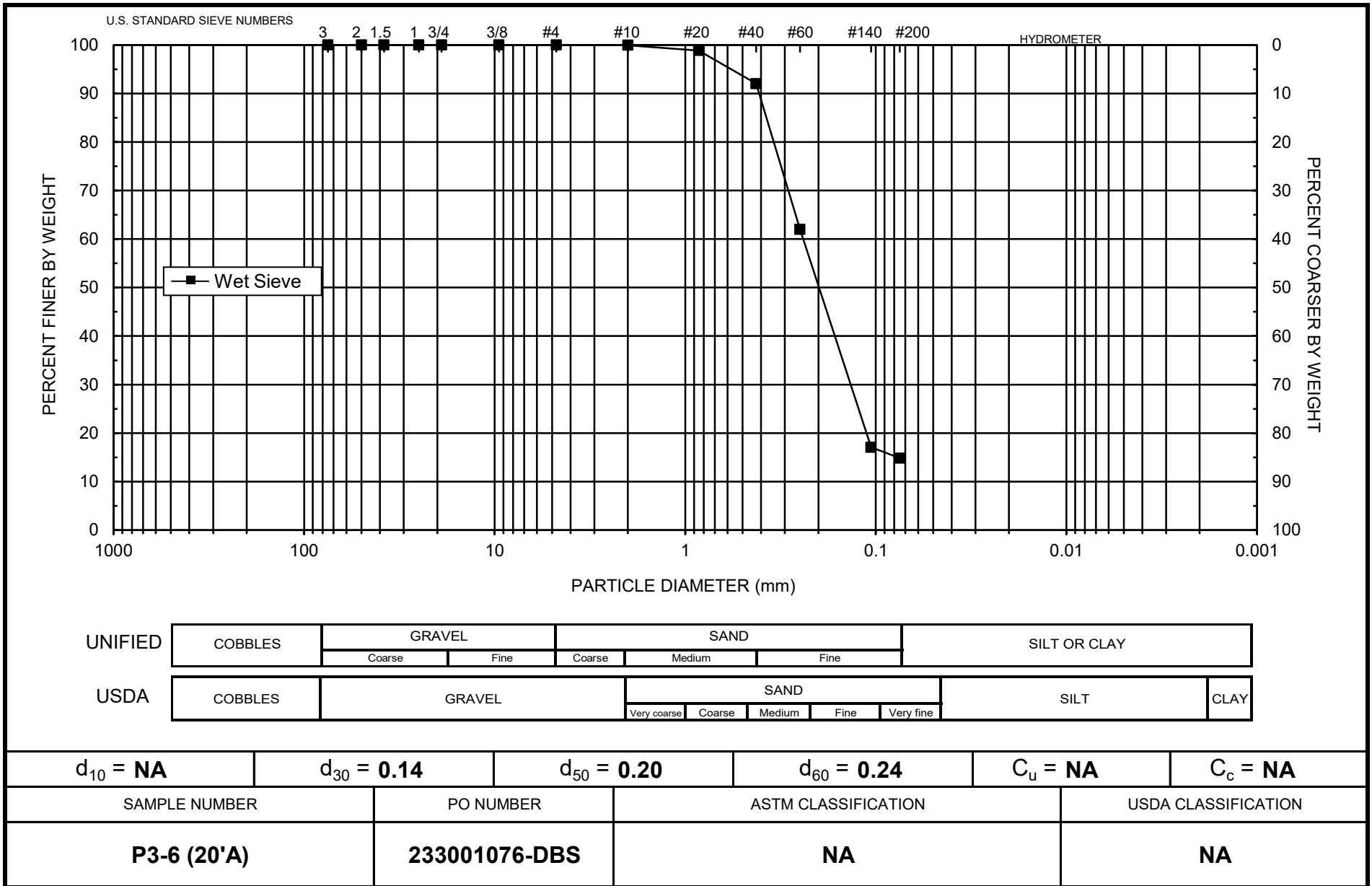
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.20  
d<sub>16</sub> (mm): 0.090                    d<sub>60</sub> (mm): 0.24  
d<sub>30</sub> (mm): 0.14                      d<sub>84</sub> (mm): 0.37

Median Particle Diameter--d<sub>50</sub> (mm): 0.20  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3 (mm): 0.22

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines

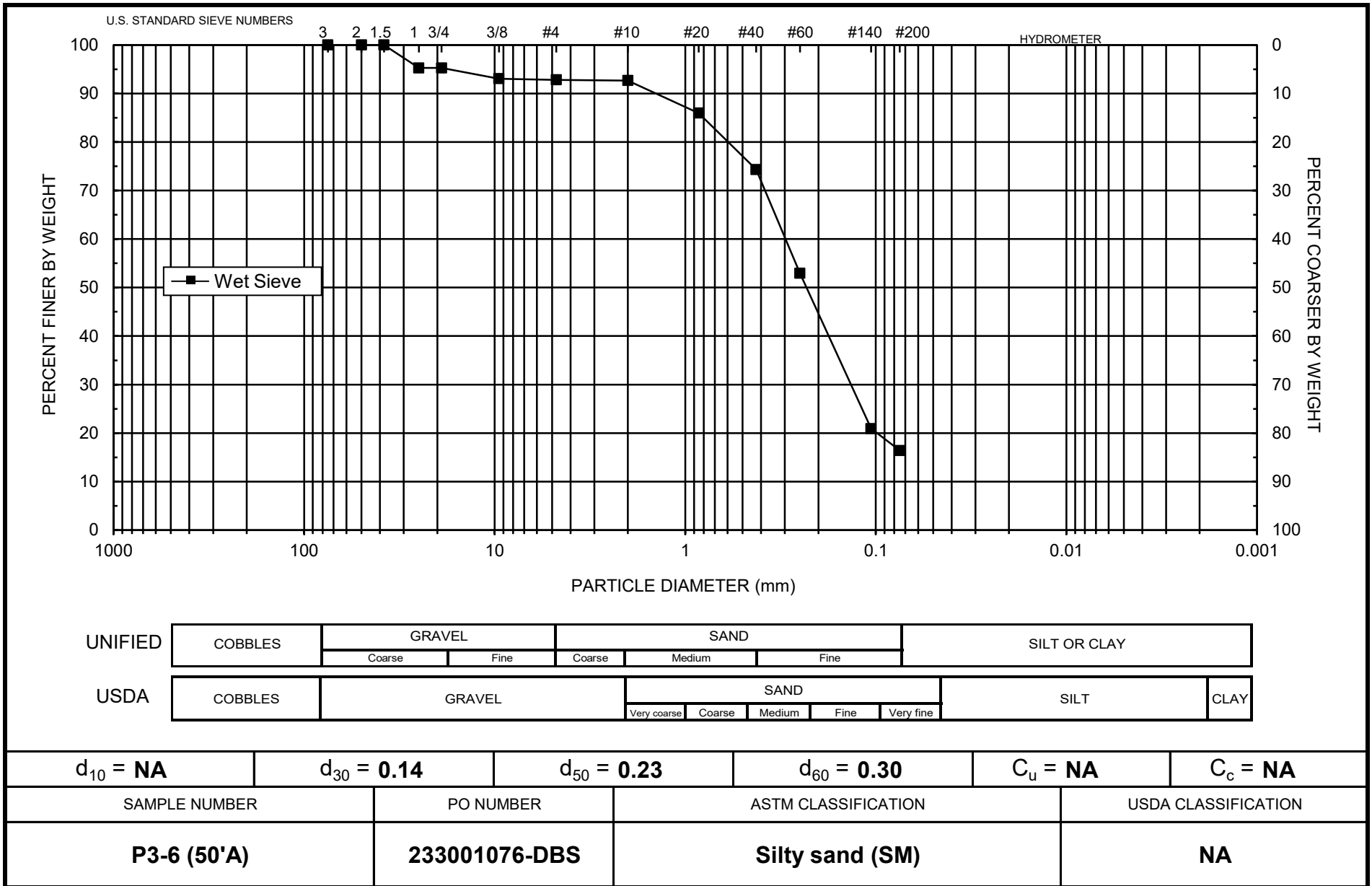


Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 466.53
Job Number: DB18.1151.00	Weight Passing #10 (g): 348.80
Sample Number: P4-5 (20'A)	Weight Retained #10 (g): 117.73
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 79.83
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 106.77
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing	
+10	3"	75	0.00	0.00	466.53	100.00	
	2"	50	0.00	0.00	466.53	100.00	
	1.5"	38.1	0.00	0.00	466.53	100.00	
	1"	25	30.38	30.38	436.15	93.49	
	3/4"	19.0	73.43	103.81	362.72	77.75	
	3/8"	9.5	11.00	114.81	351.72	75.39	
	4	4.75	1.17	115.98	350.55	75.14	
	10	2.00	1.75	117.73	348.80	74.76	
-10			(Based on calculated sieve wt.)				
		20	0.85	4.15	31.09	75.68	70.88
		40	0.425	8.37	39.46	67.31	63.04
		60	0.250	21.50	60.96	45.81	42.90
		140	0.106	27.64	88.60	18.17	17.02
		200	0.075	3.11	91.71	15.06	14.10
		dry pan		0.44	92.15	14.62	
	wet pan			14.62	0.00		

d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.30  
d<sub>16</sub> (mm): 0.094                    d<sub>60</sub> (mm): 0.39  
d<sub>30</sub> (mm): 0.16                      d<sub>84</sub> (mm): 21

Median Particle Diameter--d<sub>50</sub> (mm): 0.30  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 7.1

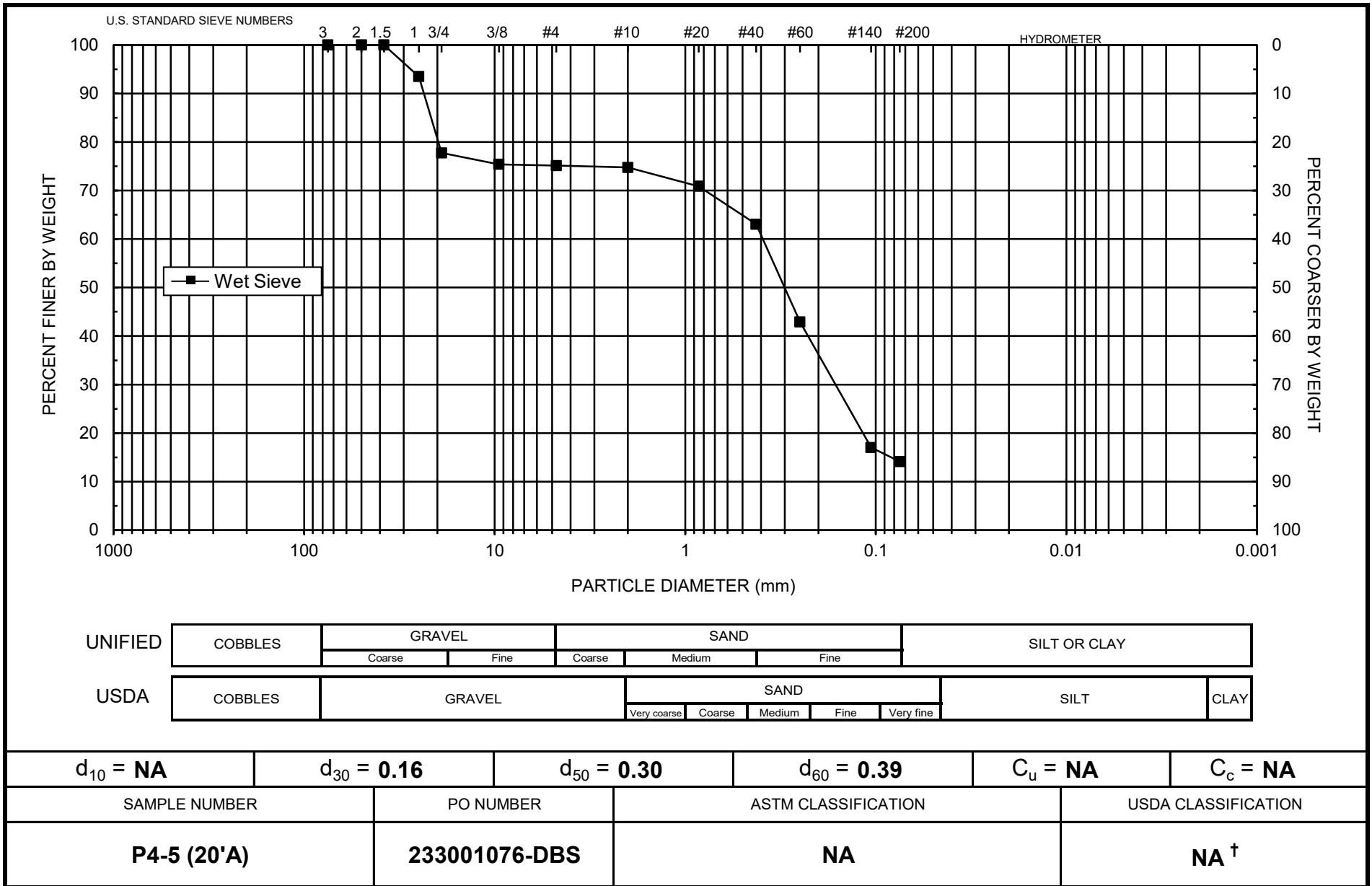
Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA<sup>†</sup>

† Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-6 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 462.06  
 Weight Passing #10 (g): 462.06  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 51.81  
 Calculated Weight of Sieve Sample (g): 51.81  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	462.06	100.00
	2"	50	0.00	0.00	462.06	100.00
	1.5"	38.1	0.00	0.00	462.06	100.00
	1"	25	0.00	0.00	462.06	100.00
	3/4"	19.0	0.00	0.00	462.06	100.00
	3/8"	9.5	0.00	0.00	462.06	100.00
	4	4.75	0.00	0.00	462.06	100.00
	10	2.00	0.00	0.00	462.06	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	2.10	2.10	49.71	95.95
	40	0.425	1.18	3.28	48.53	93.67
	60	0.250	0.88	4.16	47.65	91.97
	140	0.106	7.66	11.82	39.99	77.19
	200	0.075	13.05	24.87	26.94	52.00
	dry pan		0.98	25.85	25.96	
	wet pan			25.96	0.00	

d<sub>10</sub> (mm): 0.0012      d<sub>50</sub> (mm): 0.072  
 d<sub>16</sub> (mm): 0.0087      d<sub>60</sub> (mm): 0.084  
 d<sub>30</sub> (mm): 0.048      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.072  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 70  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 23  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.080

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-6 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:30

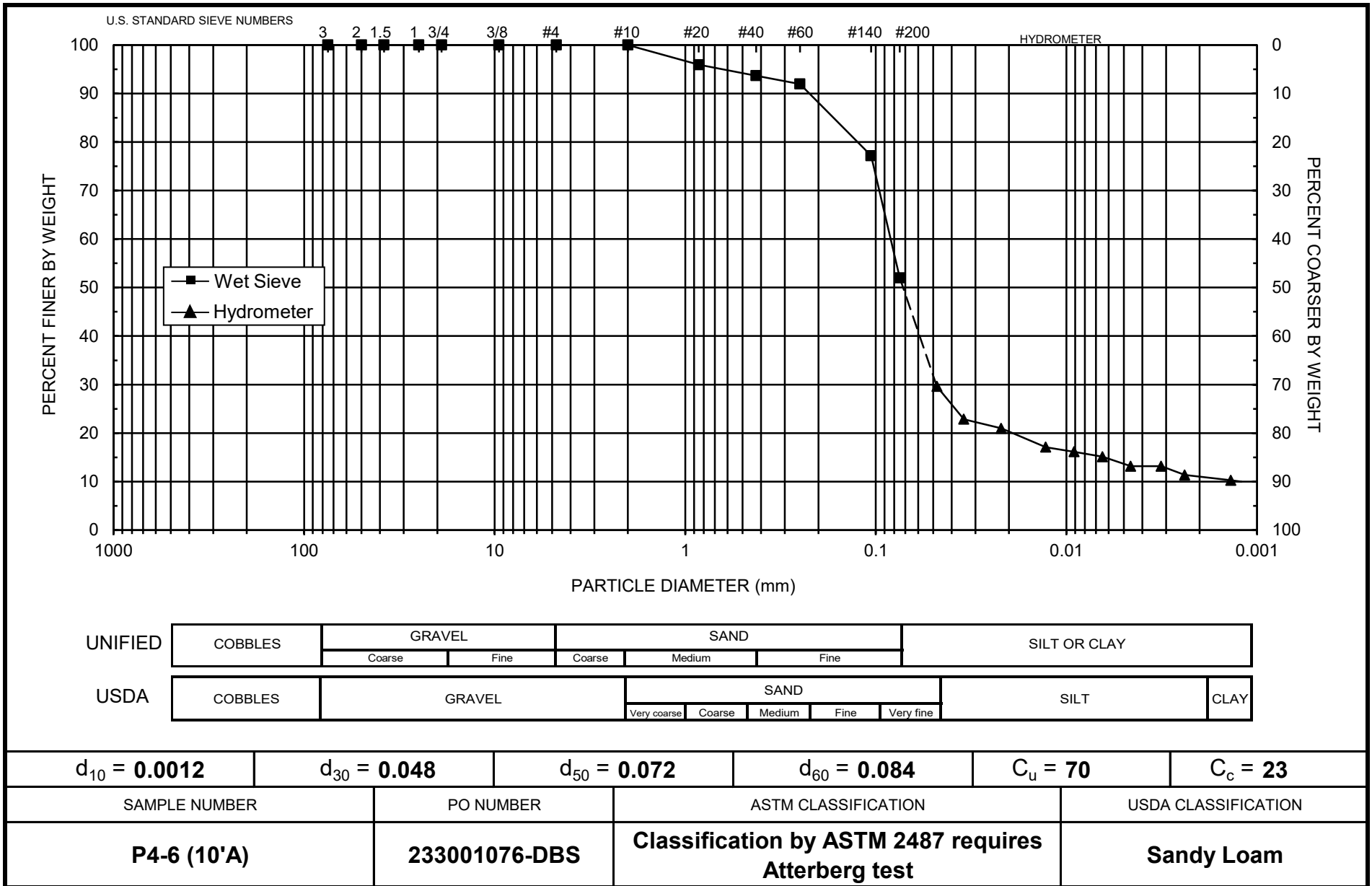
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 51.81  
 Total Sample Wt. (g): 462.06  
 Wt. Passing #10 (g): 462.06

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	21.5	6.2	15.3	12.8	0.04778	29.6	29.6
	2	21.6	18.0	6.2	11.8	13.3	0.03454	22.9	22.9
	5	21.6	17.0	6.1	10.9	13.5	0.02196	21.0	21.0
	15	21.6	15.0	6.1	8.9	13.8	0.01283	17.1	17.1
	30	21.6	14.5	6.1	8.4	13.9	0.00910	16.1	16.1
	60	21.5	14.0	6.2	7.8	14.0	0.00646	15.1	15.1
	120	21.5	13.0	6.2	6.8	14.2	0.00460	13.2	13.2
	250	21.6	13.0	6.2	6.8	14.2	0.00318	13.2	13.2
	446	21.7	12.0	6.1	5.9	14.3	0.00239	11.3	11.3
18-May-18	1379	21.4	11.5	6.2	5.3	14.4	0.00137	10.2	10.2

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc	Initial Dry Weight of Sample (g): 392.69
Job Number: DB18.1151.00	Weight Passing #10 (g): 363.52
Sample Number: P4-7 (5'A)	Weight Retained #10 (g): 29.17
Project Name: St. Anthony Geotech Investigation	Wt. of -10 Sieve Sample (g): 70.76
PO Number: 233001076-DBS	Calculated Weight of Sieve Sample (g): 76.44
Test Date: 23-May-18	Shape: Angular
	Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	392.69	100.00
	2"	50	0.00	0.00	392.69	100.00
	1.5"	38.1	0.00	0.00	392.69	100.00
	1"	25	0.00	0.00	392.69	100.00
	3/4"	19.0	0.00	0.00	392.69	100.00
	3/8"	9.5	19.91	19.91	372.78	94.93
	4	4.75	8.24	28.15	364.54	92.83
	10	2.00	1.02	29.17	363.52	92.57
-10	(Based on calculated sieve wt.)					
	20	0.85	2.09	7.77	68.67	89.84
	40	0.425	1.75	9.52	66.92	87.55
	60	0.250	4.75	14.27	62.17	81.33
	140	0.106	12.43	26.70	49.74	65.07
	200	0.075	12.32	39.02	37.42	48.95
	dry pan			1.84	40.86	35.58
wet pan				35.58	0.00	

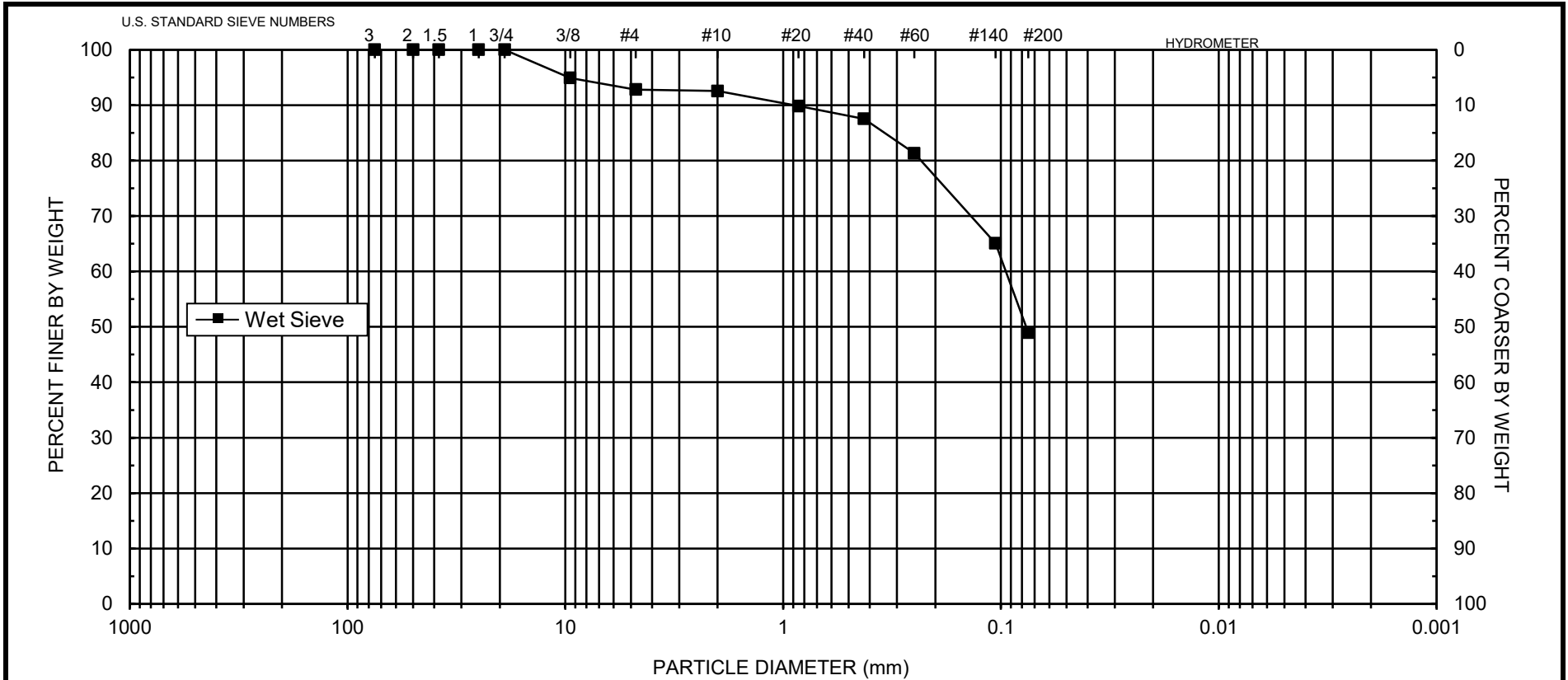
d<sub>10</sub> (mm): NA                      d<sub>50</sub> (mm): 0.077  
d<sub>16</sub> (mm): NA                      d<sub>60</sub> (mm): 0.095  
d<sub>30</sub> (mm): NA                      d<sub>84</sub> (mm): 0.31

Median Particle Diameter--d<sub>50</sub> (mm): 0.077  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA  
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



UNIFIED	COBBLES	GRAVEL Coarse    Fine		SAND Coarse    Medium    Fine			SILT OR CLAY			
USDA	COBBLES	GRAVEL		SAND Very coarse    Coarse    Medium    Fine    Very fine					SILT	CLAY
$d_{10} = \text{NA}$	$d_{30} = \text{NA}$	$d_{50} = 0.077$		$d_{60} = 0.095$		$C_u = \text{NA}$		$C_c = \text{NA}$		
SAMPLE NUMBER		PO NUMBER		ASTM CLASSIFICATION				USDA CLASSIFICATION		
<b>P4-7 (5'A)</b>		<b>233001076-DBS</b>		<b>NA</b>				<b>NA</b>		

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-7 (25'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 512.00  
 Weight Passing #10 (g): 512.00  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 63.98  
 Calculated Weight of Sieve Sample (g): 63.98  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	512.00	100.00
	2"	50	0.00	0.00	512.00	100.00
	1.5"	38.1	0.00	0.00	512.00	100.00
	1"	25	0.00	0.00	512.00	100.00
	3/4"	19.0	0.00	0.00	512.00	100.00
	3/8"	9.5	0.00	0.00	512.00	100.00
	4	4.75	0.00	0.00	512.00	100.00
	10	2.00	0.00	0.00	512.00	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	1.36	1.36	62.62	97.87
	40	0.425	15.92	17.28	46.70	72.99
	60	0.250	18.56	35.84	28.14	43.98
	140	0.106	12.11	47.95	16.03	25.05
	200	0.075	1.34	49.29	14.69	22.96
	dry pan		0.11	49.40	14.58	
	wet pan			14.58	0.00	

d<sub>10</sub> (mm): 0.0052      d<sub>50</sub> (mm): 0.28  
 d<sub>16</sub> (mm): 0.026      d<sub>60</sub> (mm): 0.34  
 d<sub>30</sub> (mm): 0.13      d<sub>84</sub> (mm): 0.58

Median Particle Diameter--d<sub>50</sub> (mm): 0.28  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 65  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 9.6  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.30

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loamy Sand

Laboratory analysis by: J. Hines/M. Garcia  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-7 (25'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:36

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 63.98  
 Total Sample Wt. (g): 512.00  
 Wt. Passing #10 (g): 512.00

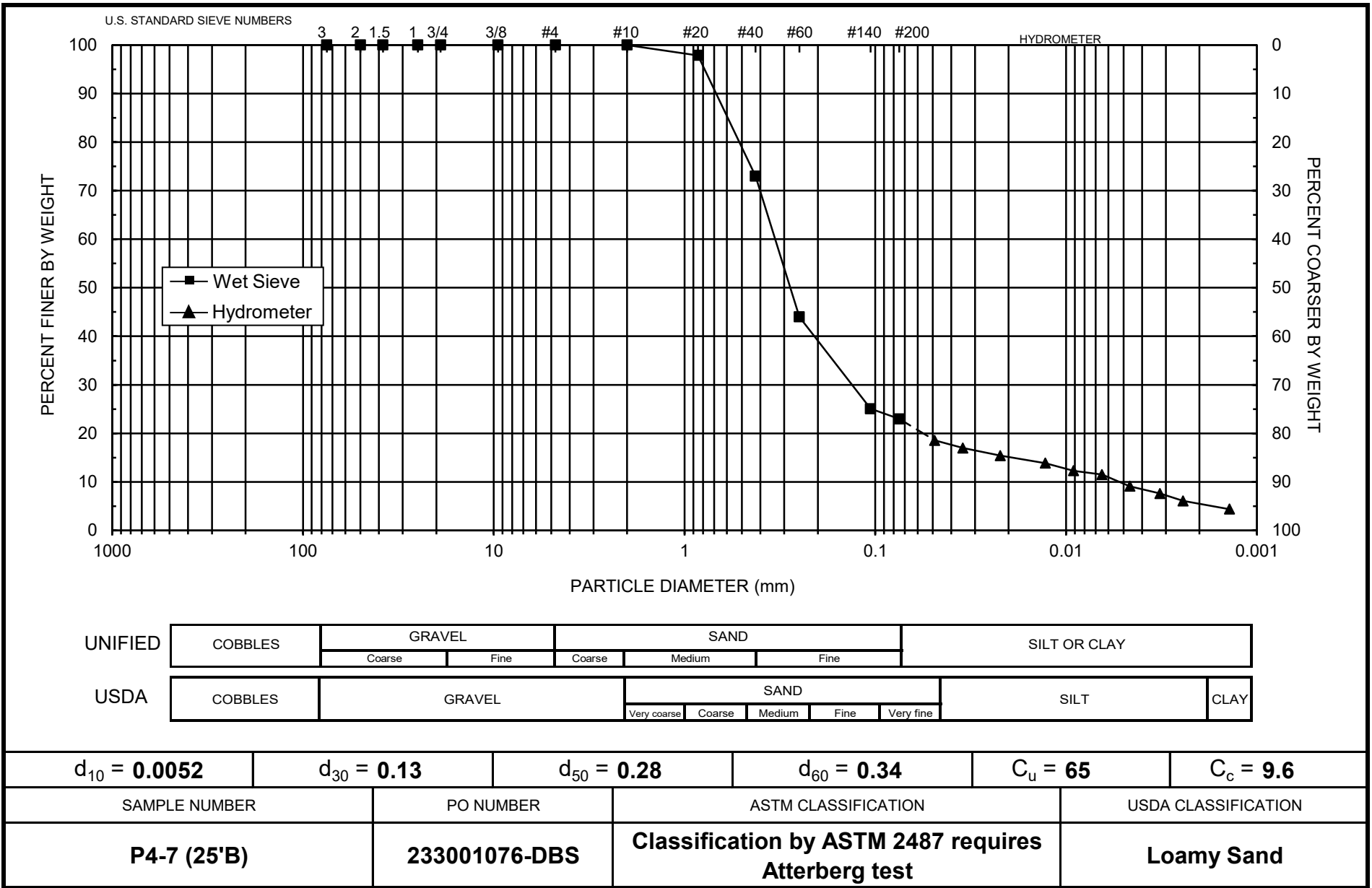
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	18.0	6.1	11.9	13.3	0.04882	18.5	18.5
	2	21.6	17.0	6.1	10.9	13.5	0.03473	17.0	17.0
	5	21.6	16.0	6.1	9.9	13.7	0.02210	15.4	15.4
	15	21.6	15.0	6.1	8.9	13.8	0.01283	13.8	13.8
	30	21.6	14.0	6.1	7.9	14.0	0.00913	12.3	12.3
	60	21.6	13.5	6.1	7.4	14.1	0.00647	11.5	11.5
	120	21.5	12.0	6.2	5.8	14.3	0.00463	9.1	9.1
	250	21.6	11.0	6.1	4.9	14.5	0.00322	7.6	7.6
	441	21.7	10.0	6.1	3.9	14.7	0.00243	6.1	6.1
18-May-18	1374	21.4	9.0	6.2	2.8	14.8	0.00139	4.4	4.4

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines





Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-8 (15'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 22-May-18

Initial Dry Weight of Sample (g): 447.92  
 Weight Passing #10 (g): 441.77  
 Weight Retained #10 (g): 6.15  
 Weight of Hydrometer Sample (g): 53.46  
 Calculated Weight of Sieve Sample (g): 54.20  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	447.92	100.00
	2"	50	0.00	0.00	447.92	100.00
	1.5"	38.1	0.00	0.00	447.92	100.00
	1"	25	0.00	0.00	447.92	100.00
	3/4"	19.0	0.00	0.00	447.92	100.00
	3/8"	9.5	0.00	0.00	447.92	100.00
	4	4.75	2.23	2.23	445.69	99.50
	10	2.00	3.92	6.15	441.77	98.63
-10			(Based on calculated sieve wt.)			
	20	0.85	3.56	4.30	49.90	92.06
	40	0.425	3.26	7.56	46.64	86.04
	60	0.250	2.80	10.36	43.84	80.88
	140	0.106	14.27	24.63	29.57	54.55
	200	0.075	3.78	28.41	25.79	47.58
	dry pan		0.41	28.82	25.38	
	wet pan			25.38	0.00	

d<sub>10</sub> (mm): 0.0011      d<sub>50</sub> (mm): 0.085  
 d<sub>16</sub> (mm): 0.0061      d<sub>60</sub> (mm): 0.13  
 d<sub>30</sub> (mm): 0.027      d<sub>84</sub> (mm): 0.34

Median Particle Diameter--d<sub>50</sub> (mm): 0.085  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 118  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 5.1  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.14

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia/Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-8 (15'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:42

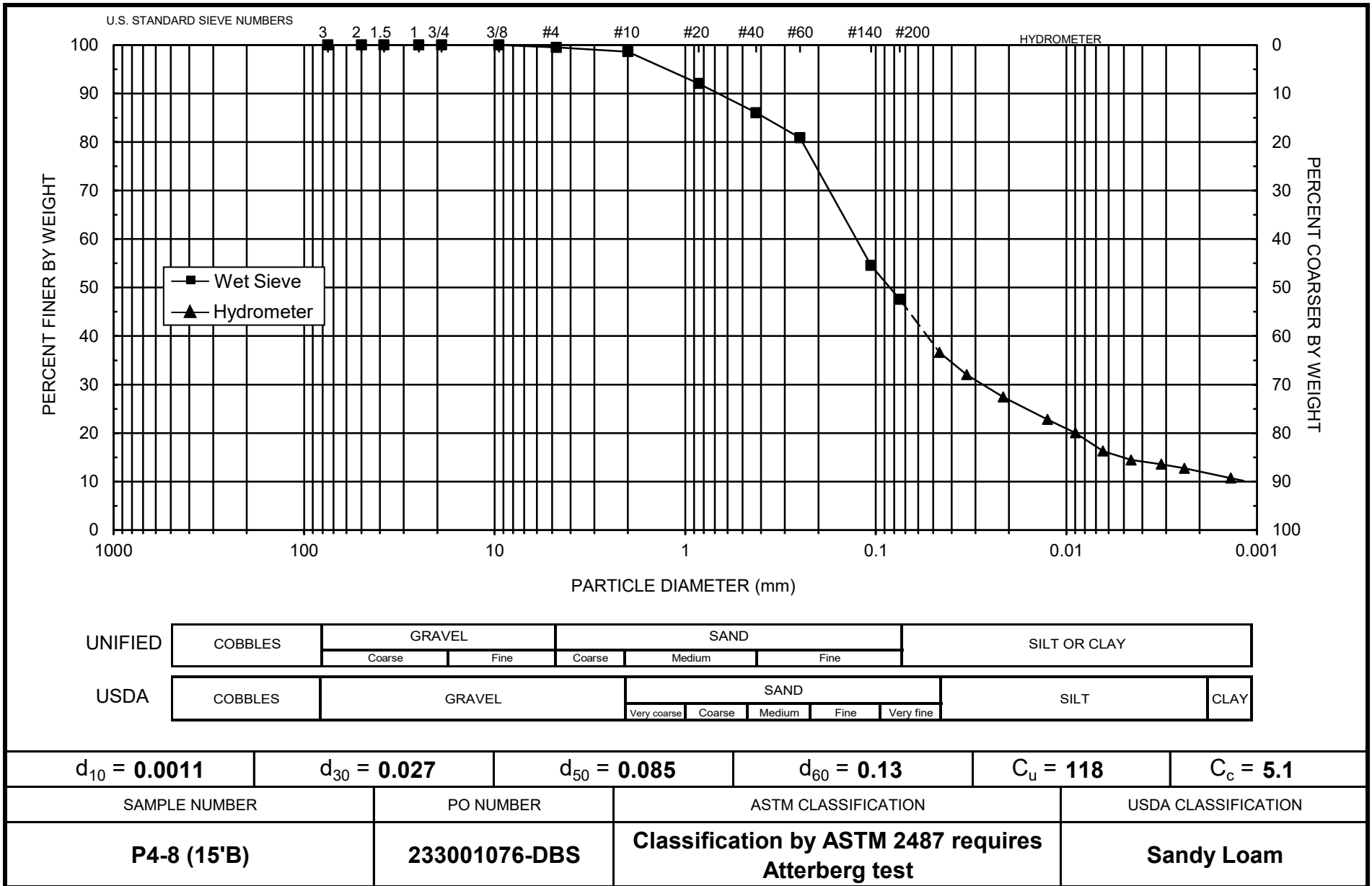
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 53.46  
 Total Sample Wt. (g): 447.92  
 Wt. Passing #10 (g): 441.77

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	26.0	6.1	19.9	12.0	0.04636	37.1	36.6
	2	21.6	23.5	6.1	17.4	12.4	0.03333	32.5	32.0
	5	21.6	21.0	6.1	14.9	12.9	0.02143	27.8	27.4
	15	21.6	18.5	6.1	12.4	13.3	0.01257	23.1	22.8
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.3	20.0
	60	21.5	15.0	6.2	8.8	13.8	0.00642	16.5	16.3
	120	21.5	14.0	6.2	7.8	14.0	0.00457	14.6	14.4
	250	21.6	13.5	6.1	7.4	14.1	0.00317	13.8	13.6
	436	21.8	13.0	6.1	6.9	14.2	0.00240	12.9	12.7
	18-May-18	1369	21.4	12.0	6.2	5.8	14.3	0.00137	10.9

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-9 (35'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 21-May-18

Initial Dry Weight of Sample (g): 471.98  
 Weight Passing #10 (g): 382.23  
 Weight Retained #10 (g): 89.75  
 Weight of Hydrometer Sample (g): 52.47  
 Calculated Weight of Sieve Sample (g): 64.79  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	471.98	100.00
	2"	50	0.00	0.00	471.98	100.00
	1.5"	38.1	0.00	0.00	471.98	100.00
	1"	25	0.00	0.00	471.98	100.00
	3/4"	19.0	19.43	19.43	452.55	95.88
	3/8"	9.5	37.71	57.14	414.84	87.89
	4	4.75	16.82	73.96	398.02	84.33
	10	2.00	15.79	89.75	382.23	80.98
-10	(Based on calculated sieve wt.)					
	20	0.85	2.15	14.47	50.32	77.67
	40	0.425	1.87	16.34	48.45	74.78
	60	0.250	2.63	18.97	45.82	70.72
	140	0.106	5.03	24.00	40.79	62.96
	200	0.075	3.36	27.36	37.43	57.77
	dry pan			0.79	28.15	36.64
wet pan				36.64	0.00	

d<sub>10</sub> (mm): 6.7E-06      d<sub>50</sub> (mm): 0.061  
 d<sub>16</sub> (mm): 0.0035      d<sub>60</sub> (mm): 0.087  
 d<sub>30</sub> (mm): 0.026      d<sub>84</sub> (mm): 4.4

Median Particle Diameter--d<sub>50</sub> (mm): 0.061  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1.3E+04  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1160  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 1.5

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia/Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-9 (35'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18  
 Start Time: 9:54

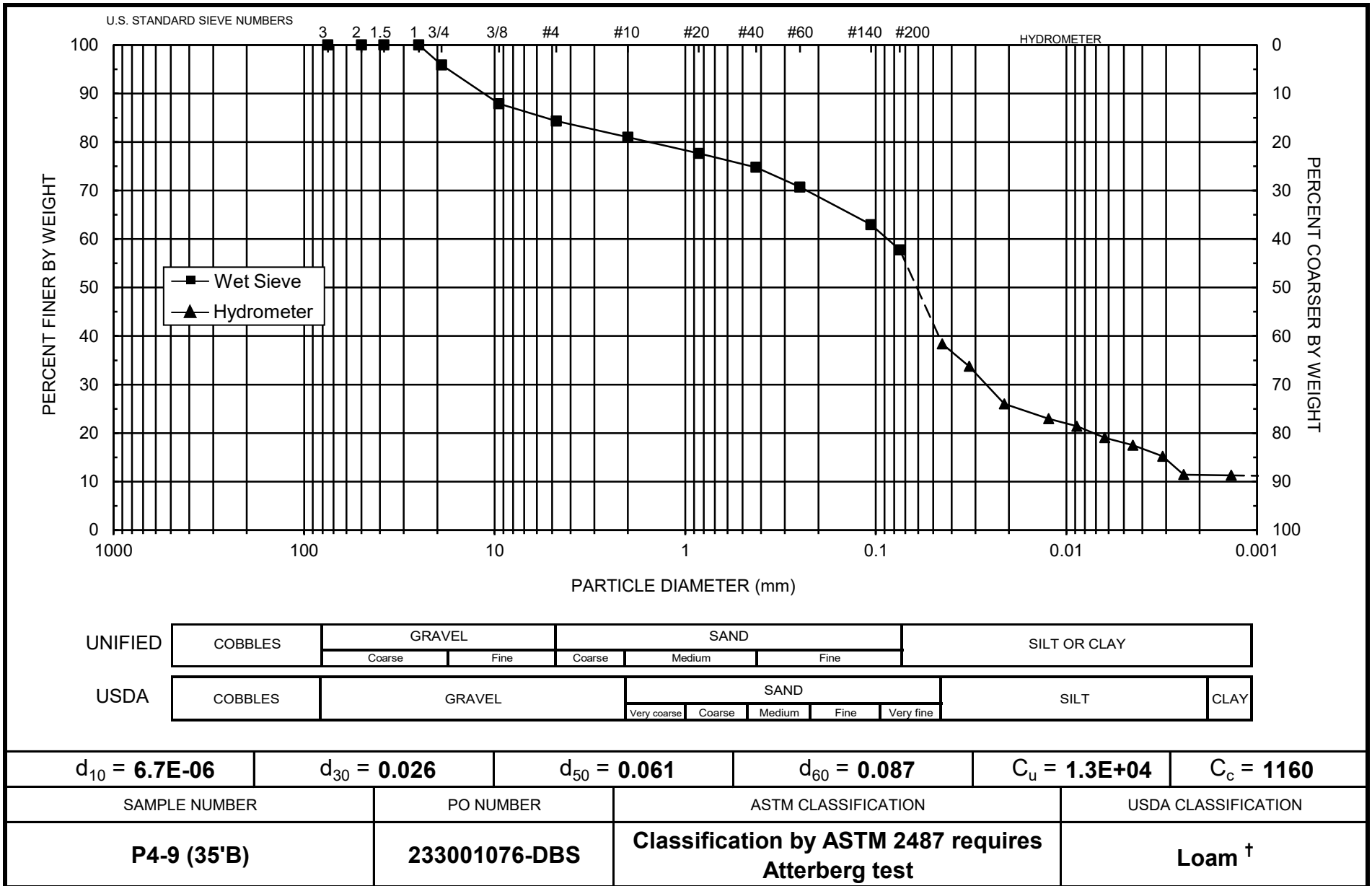
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 52.47  
 Total Sample Wt. (g): 471.98  
 Wt. Passing #10 (g): 382.23

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
17-May-18	1	21.6	31.0	6.1	24.9	11.2	0.04475	47.4	38.4
	2	21.6	28.0	6.1	21.9	11.7	0.03233	41.7	33.7
	5	21.6	23.0	6.1	16.9	12.5	0.02115	32.1	26.0
	15	21.6	21.0	6.1	14.9	12.9	0.01237	28.3	22.9
	30	21.6	20.0	6.1	13.9	13.0	0.00880	26.4	21.4
	60	21.5	18.5	6.2	12.3	13.3	0.00629	23.5	19.0
	120	21.5	17.5	6.2	11.3	13.4	0.00448	21.6	17.5
	250	21.6	16.0	6.1	9.9	13.7	0.00313	18.8	15.2
	426	21.8	13.5	6.1	7.4	14.1	0.00242	14.1	11.4
	18-May-18	1359	21.4	13.5	6.2	7.3	14.1	0.00136	13.9

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Zbrozek  
 Data entered by: M. Garcia  
 Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-1 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 400.84  
 Weight Passing #10 (g): 400.84  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 53.41  
 Calculated Weight of Sieve Sample (g): 53.41  
 Shape: Rounded  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	400.84	100.00
	2"	50	0.00	0.00	400.84	100.00
	1.5"	38.1	0.00	0.00	400.84	100.00
	1"	25	0.00	0.00	400.84	100.00
	3/4"	19.0	0.00	0.00	400.84	100.00
	3/8"	9.5	0.00	0.00	400.84	100.00
	4	4.75	0.00	0.00	400.84	100.00
	10	2.00	0.00	0.00	400.84	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.12	0.12	53.29	99.78
	40	0.425	0.36	0.48	52.93	99.10
	60	0.250	1.22	1.70	51.71	96.82
	140	0.106	12.74	14.44	38.97	72.96
	200	0.075	9.80	24.24	29.17	54.62
	dry pan		2.09	26.33	27.08	
	wet pan			27.08	0.00	

d<sub>10</sub> (mm): 0.0012      d<sub>50</sub> (mm): 0.047  
 d<sub>16</sub> (mm): 0.0017      d<sub>60</sub> (mm): 0.083  
 d<sub>30</sub> (mm): 0.011      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.047  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 69  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.2  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.070

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines





**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-1 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:18

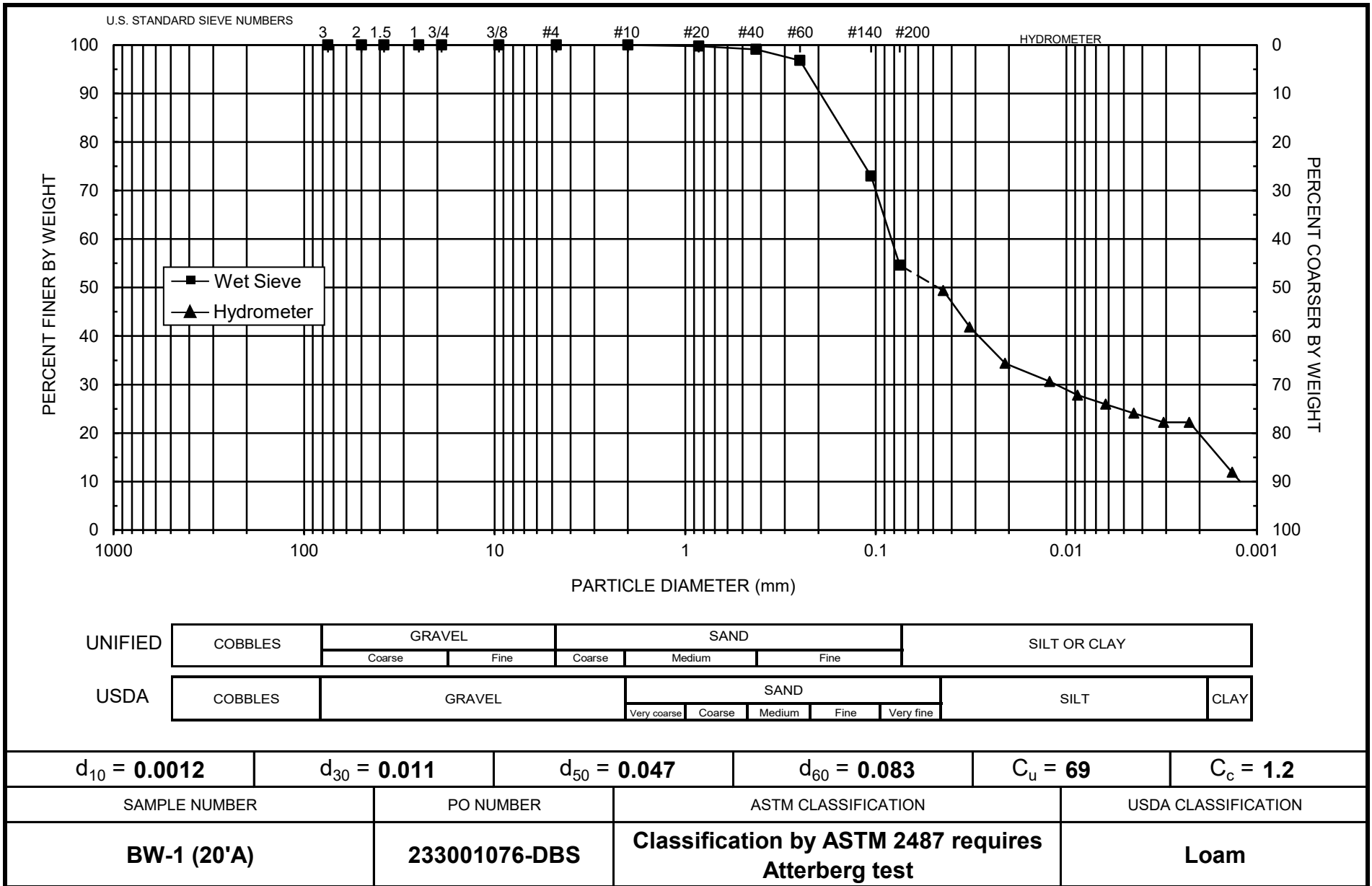
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 53.41  
 Total Sample Wt. (g): 400.84  
 Wt. Passing #10 (g): 400.84

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	32.5	6.1	26.4	11.0	0.04426	49.4	49.4
	2	21.6	28.5	6.1	22.4	11.6	0.03222	41.9	41.9
	5	21.6	24.5	6.1	18.4	12.3	0.02094	34.4	34.4
	15	21.6	22.5	6.1	16.4	12.6	0.01225	30.6	30.6
	30	21.6	21.0	6.1	14.9	12.9	0.00875	27.8	27.8
	60	21.6	20.0	6.1	13.9	13.0	0.00622	26.0	26.0
	120	21.6	19.0	6.1	12.9	13.2	0.00443	24.1	24.1
	250	21.6	18.0	6.1	11.9	13.3	0.00309	22.2	22.2
	465	21.6	18.0	6.1	11.9	13.3	0.00226	22.2	22.2
17-May-18	1398	21.6	12.5	6.1	6.4	14.3	0.00135	11.9	11.9

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-2 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 441.31  
 Weight Passing #10 (g): 441.31  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 61.69  
 Calculated Weight of Sieve Sample (g): 61.69  
 Shape: Angular  
 Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	441.31	100.00
	2"	50	0.00	0.00	441.31	100.00
	1.5"	38.1	0.00	0.00	441.31	100.00
	1"	25	0.00	0.00	441.31	100.00
	3/4"	19.0	0.00	0.00	441.31	100.00
	3/8"	9.5	0.00	0.00	441.31	100.00
	4	4.75	0.00	0.00	441.31	100.00
	10	2.00	0.00	0.00	441.31	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.39	0.39	61.30	99.37
	40	0.425	0.38	0.77	60.92	98.75
	60	0.250	0.69	1.46	60.23	97.63
	140	0.106	17.78	19.24	42.45	68.81
	200	0.075	7.96	27.20	34.49	55.91
	dry pan			1.02	28.22	33.47
wet pan				33.47	0.00	

d<sub>10</sub> (mm): 0.00035      d<sub>50</sub> (mm): 0.062  
 d<sub>16</sub> (mm): 0.0013      d<sub>60</sub> (mm): 0.084  
 d<sub>30</sub> (mm): 0.023      d<sub>84</sub> (mm): 0.17

Median Particle Diameter--d<sub>50</sub> (mm): 0.062  
 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 240  
 Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 18  
 Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.078

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-2 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65

Test Date: 16-May-18  
 Start Time: 9:24

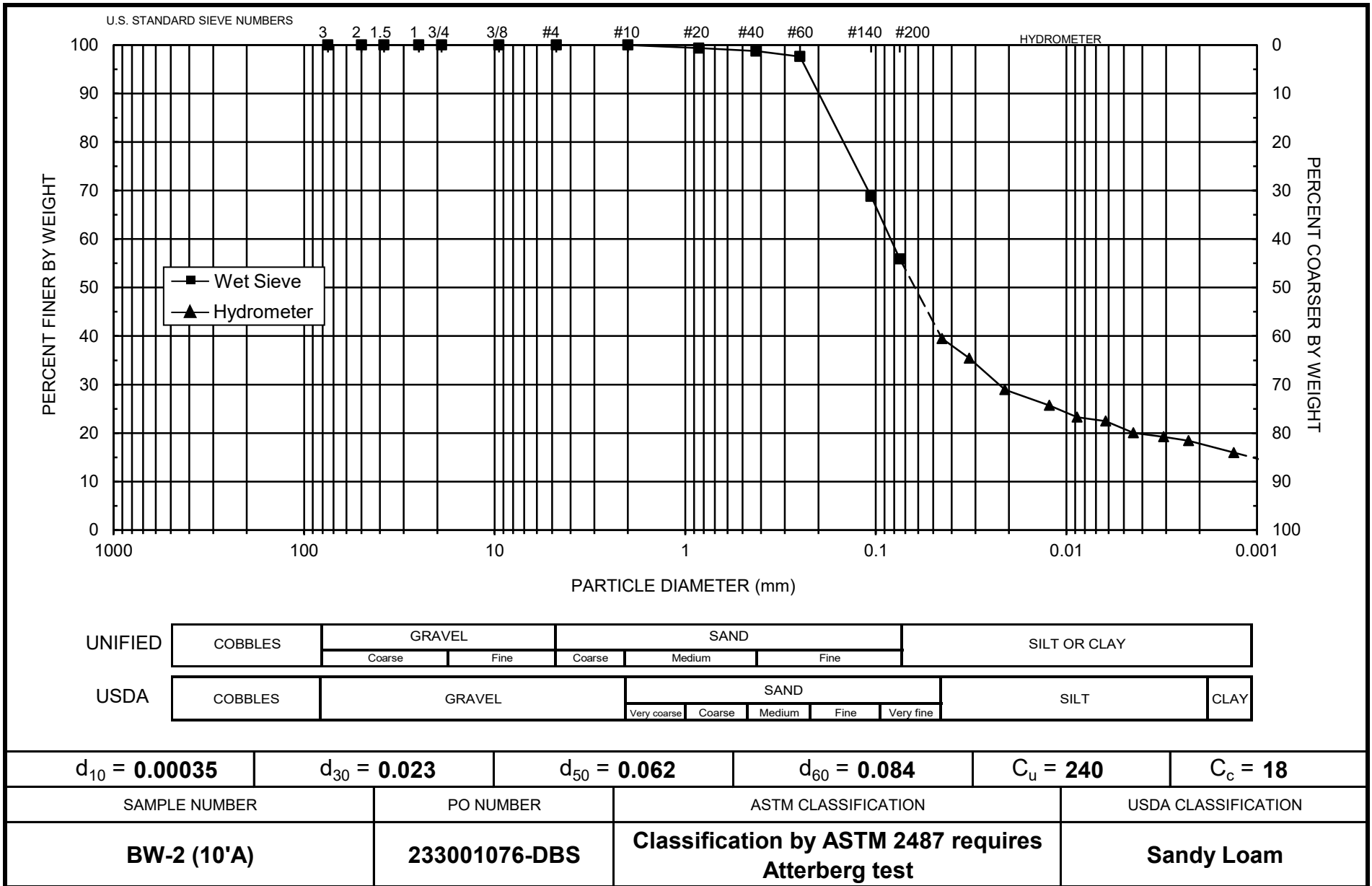
Initial Wt. (g): 61.69  
 Total Sample Wt. (g): 441.31  
 Wt. Passing #10 (g): 441.31

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	30.5	6.1	24.4	11.3	0.04491	39.5	39.5
	2	21.6	28.0	6.1	21.9	11.7	0.03233	35.4	35.4
	5	21.6	24.0	6.1	17.9	12.4	0.02101	29.0	29.0
	15	21.6	22.0	6.1	15.9	12.7	0.01229	25.7	25.7
	30	21.6	20.5	6.1	14.4	12.9	0.00877	23.3	23.3
	60	21.6	20.0	6.1	13.9	13.0	0.00622	22.5	22.5
	120	21.6	18.5	6.1	12.4	13.3	0.00444	20.0	20.0
	250	21.6	18.0	6.1	11.9	13.3	0.00309	19.2	19.2
	460	21.6	17.5	6.1	11.4	13.4	0.00228	18.4	18.4
17-May-18	1393	21.6	16.0	6.1	9.9	13.7	0.00132	16.0	16.0

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-3 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 18-May-18

Initial Dry Weight of Sample (g): 470.38  
 Weight Passing #10 (g): 470.38  
 Weight Retained #10 (g): 0.00  
 Weight of Hydrometer Sample (g): 56.32  
 Calculated Weight of Sieve Sample (g): 56.32  
 Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	470.38	100.00
	2"	50	0.00	0.00	470.38	100.00
	1.5"	38.1	0.00	0.00	470.38	100.00
	1"	25	0.00	0.00	470.38	100.00
	3/4"	19.0	0.00	0.00	470.38	100.00
	3/8"	9.5	0.00	0.00	470.38	100.00
	4	4.75	0.00	0.00	470.38	100.00
	10	2.00	0.00	0.00	470.38	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.41	0.41	55.91	99.27
	40	0.425	0.58	0.99	55.33	98.24
	60	0.250	1.26	2.25	54.07	96.00
	140	0.106	18.31	20.56	35.76	63.49
	200	0.075	9.35	29.91	26.41	46.89
	dry pan			1.59	31.50	24.82
wet pan				24.82	0.00	

d<sub>10</sub> (mm): 0.0011      d<sub>50</sub> (mm): 0.080  
 d<sub>16</sub> (mm): 0.014      d<sub>60</sub> (mm): 0.099  
 d<sub>30</sub> (mm): 0.050      d<sub>84</sub> (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.080  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 90  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 23  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.091

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
 USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: BW-3 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 Start Time: 9:30

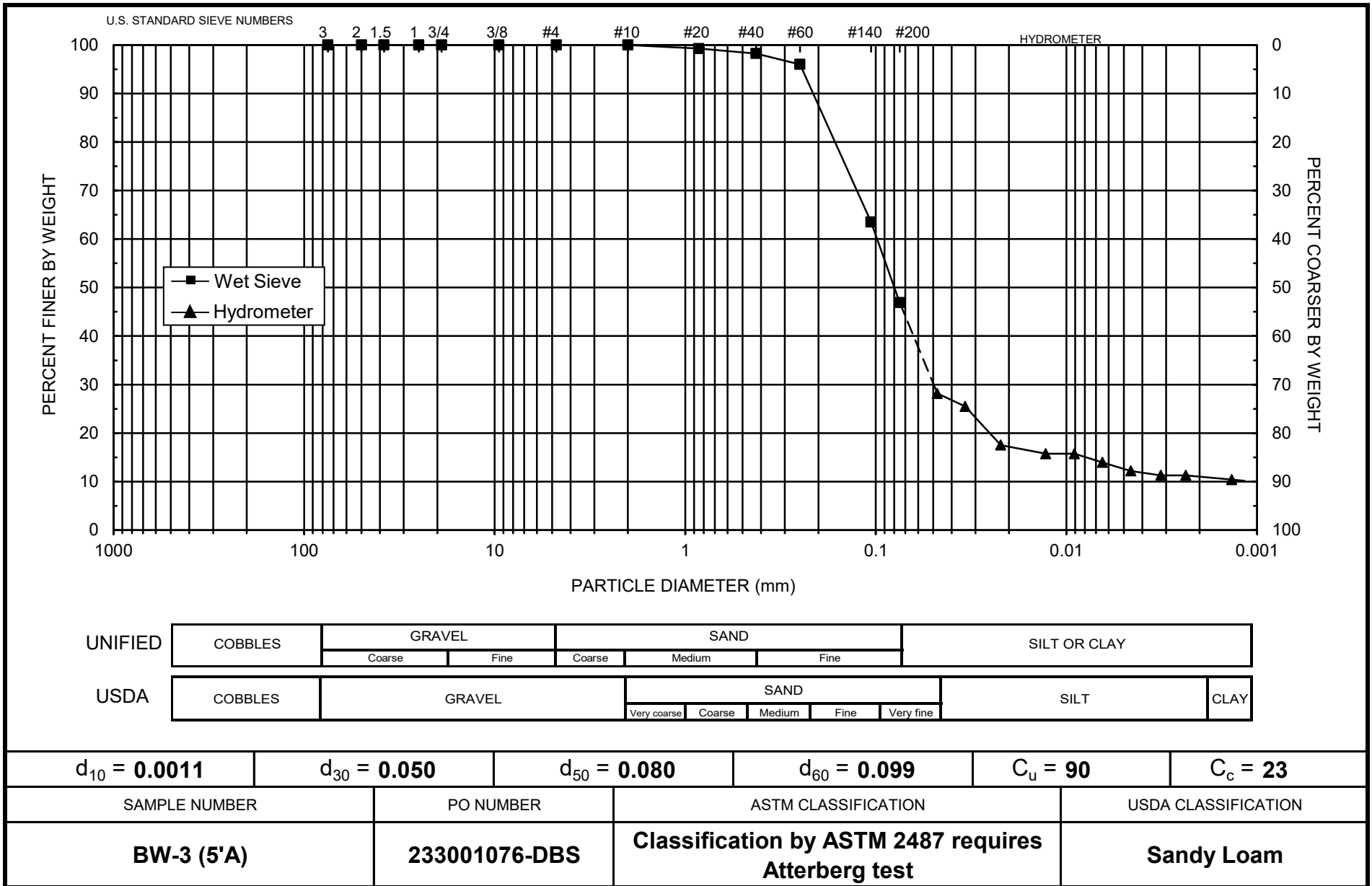
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 56.32  
 Total Sample Wt. (g): 470.38  
 Wt. Passing #10 (g): 470.38

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
16-May-18	1	21.6	22.0	6.1	15.9	12.7	0.04760	28.2	28.2
	2	21.6	20.5	6.1	14.4	12.9	0.03398	25.5	25.5
	5	21.6	16.0	6.1	9.9	13.7	0.02210	17.5	17.5
	15	21.6	15.0	6.1	8.9	13.8	0.01283	15.7	15.7
	30	21.6	15.0	6.1	8.9	13.8	0.00908	15.7	15.7
	60	21.6	14.0	6.1	7.9	14.0	0.00646	14.0	14.0
	120	21.6	13.0	6.1	6.9	14.2	0.00459	12.2	12.2
	250	21.6	12.5	6.1	6.4	14.3	0.00319	11.3	11.3
	455	21.6	12.5	6.1	6.4	14.3	0.00236	11.3	11.3
17-May-18	1388	21.6	12.0	6.1	5.9	14.3	0.00136	10.4	10.4

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: M. Garcia  
 Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



*Daniel B. Stephens & Associates, Inc.*



## **Atterberg Limits/ Identification of Fines**



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)	---	---	---	ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)	---	---	---	ML
P1-1 (10'A)	---	---	---	ML
P1-2 (15'A)	---	---	---	ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)	---	---	---	ML
P3-3 (40'A)	---	---	---	ML
P3-4 (40'B)	---	---	---	ML
P3-5 (10'B)	---	---	---	ML
P3-6 (50'A)	---	---	---	ML
P4-8 (15'A)	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1-2 (20'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	19
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	129.37	123.19	125.05
Weight of pan plus dry soil (g)	126.57	120.14	121.57
Weight of pan (g):	119.34	112.55	113.30
Gravimetric moisture content (% g/g):	38.73	40.18	42.08
Liquid Limit:	41		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	123.79	122.02
Weight of pan plus dry soil (g)	122.47	120.79
Weight of pan (g):	115.57	114.20
Gravimetric moisture content (% g/g):	19.13	18.66
Plastic Limit:	19	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 41  
 Plastic Limit: 19  
 Plasticity Index: 22  
 Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-2 (5'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 24-May-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g):			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g):		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O' Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* L2-2 (5'B)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (5'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 25-May-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	33	26	21
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.79	125.83	128.90
Weight of pan plus dry soil (g)	123.84	122.43	125.45
Weight of pan (g):	114.42	112.27	115.70
Gravimetric moisture content (% g/g):	31.32	33.46	35.38
Liquid Limit:	34		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.68	122.40
Weight of pan plus dry soil (g)	124.31	120.96
Weight of pan (g):	116.56	112.62
Gravimetric moisture content (% g/g):	17.68	17.27
Plastic Limit:	17	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 34  
 Plastic Limit: 17  
 Plasticity Index: 17  
 Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: T/O-1 (25'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 24-May-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	26	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	131.02	130.17	133.23
Weight of pan plus dry soil (g)	127.58	126.82	129.76
Weight of pan (g):	115.76	115.62	118.66
Gravimetric moisture content (% g/g):	29.10	29.91	31.26
Liquid Limit:	30		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.77	125.95
Weight of pan plus dry soil (g)	124.55	124.61
Weight of pan (g):	116.80	116.23
Gravimetric moisture content (% g/g):	15.74	15.99
Plastic Limit:	16	

## Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 30  
Plastic Limit: 16  
Plasticity Index: 14  
Classification: CL

### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-2 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	34	27	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.06	125.51	129.53
Weight of pan plus dry soil (g)	123.09	121.88	125.52
Weight of pan (g):	116.49	114.26	117.44
Gravimetric moisture content (% g/g):	45.00	47.64	49.63
Liquid Limit:	48		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	124.49	122.16
Weight of pan plus dry soil (g)	122.97	120.57
Weight of pan (g):	116.26	113.70
Gravimetric moisture content (% g/g):	22.65	23.14
Plastic Limit:	23	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 48  
 Plastic Limit: 23  
 Plasticity Index: 25  
 Classification: CL

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines





### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O-3 (60'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* T/ 0-3 (60'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-1 (10'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 25-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P1-1 (10'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P1-2 (15'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 25-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P1-2 (15'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P2-2 (5'A)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	30	23	17
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	125.25	125.09	124.77
Weight of pan plus dry soil (g)	121.92	121.40	121.35
Weight of pan (g):	113.14	112.25	113.24
Gravimetric moisture content (% g/g):	37.93	40.33	42.17
Liquid Limit:	39		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.23	122.78
Weight of pan plus dry soil (g)	125.93	121.53
Weight of pan (g):	117.26	113.02
Gravimetric moisture content (% g/g):	14.99	14.69
Plastic Limit:	15	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 39  
Plastic Limit: 15  
Plasticity Index: 24  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-1 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 25-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines





**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P3-1 (15'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3-3 (40'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 25-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P3-3 (40'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Light Olive Brown (2.5Y 5/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-4 (40'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 25-May-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P3-4 (40'B)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Very Dark Gray (2.5Y 3/1)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: P3-5 (10'B)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS  
Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P3-5 (10'B)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-3 (10'B)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines





**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P4-3 (10'B)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Grayish Brown (2.5 Y 5/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4-8 (15'A)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 24-May-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve  
 Liquid Limit: ---  
 Plastic Limit: ---  
 Plasticity Index: ---  
 Classification (Visual Method): ML

Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc  
*Job Number:* DB18.1151.00  
*Sample Number:* P4-8 (15'A)  
*Project Name:* St. Anthony Geotech Investigation  
*PO Number:* 233001076-DBS  
  
*Test Date:* 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: None

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

# Proctor Compaction



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
L1 Auger Cuttings (1 & 2)	14.6	1.81	---	---
L2 Auger Cuttings (1 & 2)	14.1	1.81	---	---
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	1.83	---	---
Topsoil North Cuttings (1 & 2)	12.6	1.89	---	---
Borrow South Cuttings (1 & 2)	13.0	1.84	---	---
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	1.81	12.3	1.92
Borrow West Auger Cuttings (1 & 2)	12.7	1.87	---	---
P1-2 Auger Cuttings	12.8	1.82	---	---
P3 Auger Cuttings (1 & 2)	9.9	1.96	9.2	2.00
P4 Auger Cuttings (1 & 2)	11.1	1.94	9.0	2.05

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L1 Auger Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 1706.10  
 Mass of fines material (g): 42928.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6030	1077.29	1000.09	289.63	1.73	10.87
2	6119	922.44	850.65	284.61	1.78	12.68
3	6185	1005.58	908.36	282.13	1.80	15.52
4	6138	1012.94	907.34	297.40	1.73	17.31
5	6088	942.07	835.56	269.59	1.66	18.82

Soil Fractions

Coarse Fraction (% g/g): 3.8  
 Fines Fraction (% g/g): 96.2

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

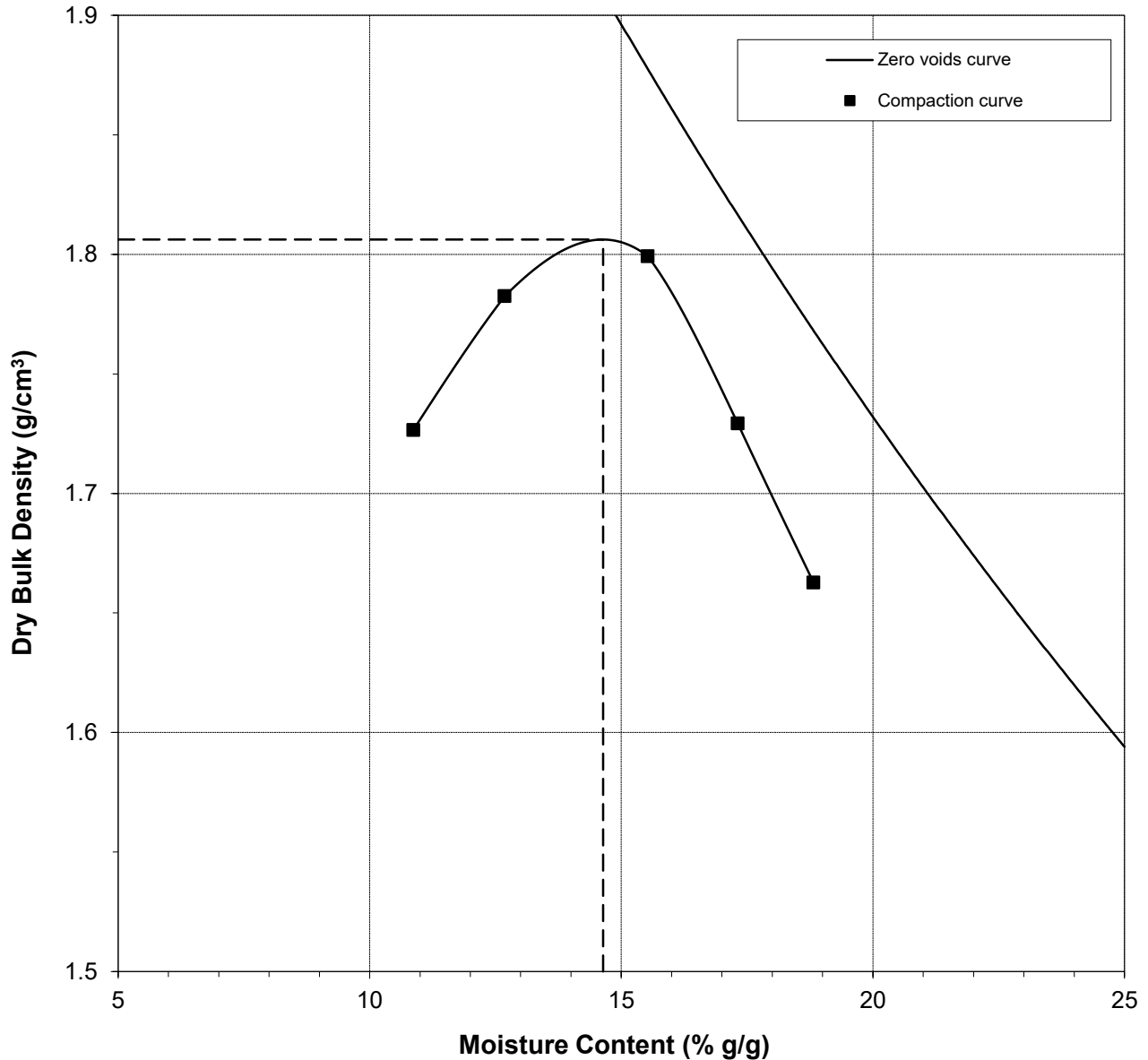


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: L1 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.6	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	---

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2 Auger Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 892.80  
 Mass of fines material (g): 47420.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6011	962.16	898.93	268.39	1.72	10.03
2	6116	1085.28	1000.85	290.42	1.79	11.88
3	6176	1062.87	968.24	298.44	1.81	14.13
4	6179	1009.32	906.58	284.54	1.78	16.52
5	6127	923.31	825.37	284.32	1.71	18.10

Soil Fractions

Coarse Fraction (% g/g): 1.8  
 Fines Fraction (% g/g): 98.2

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



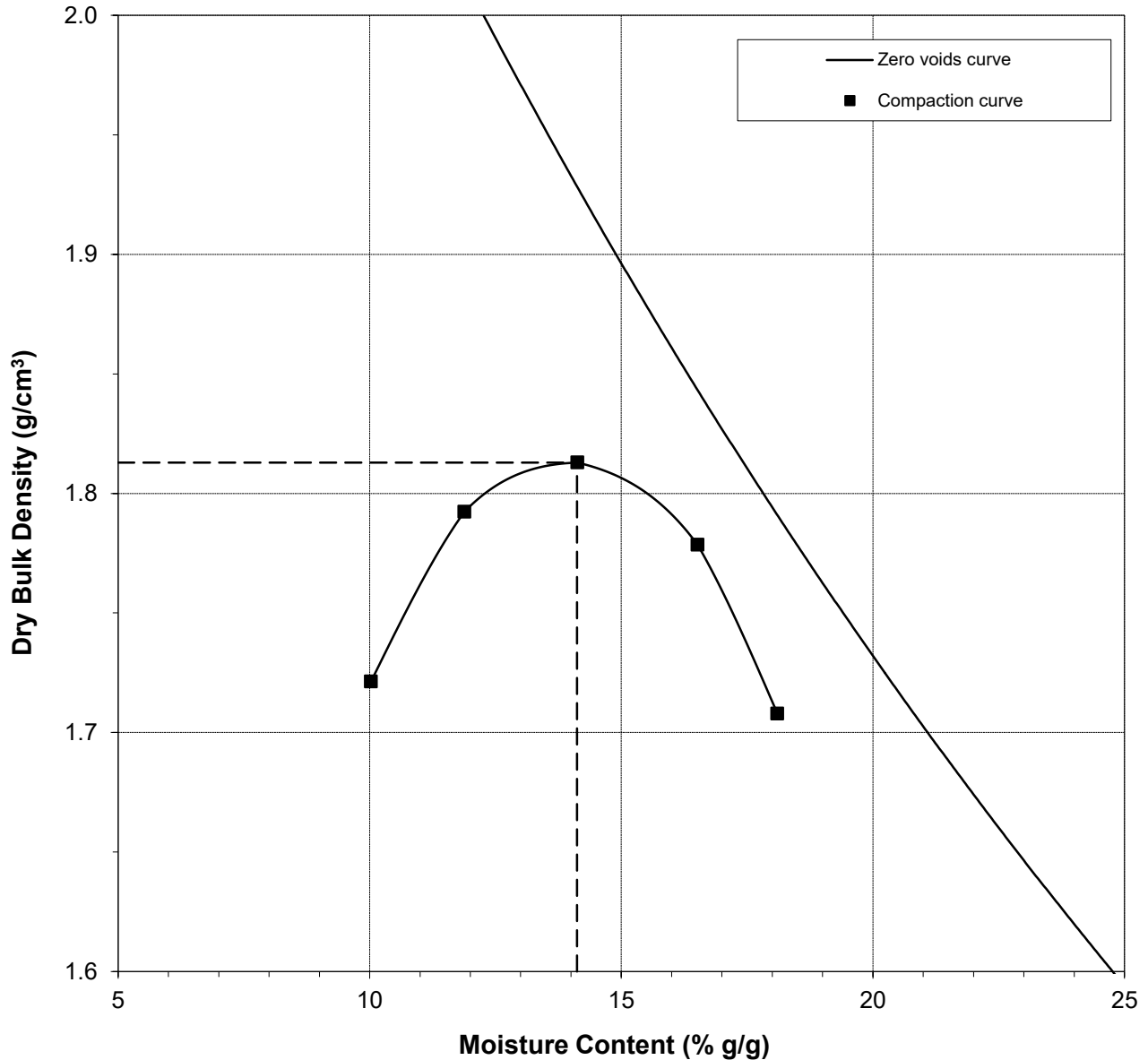


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: L2 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.1	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	---

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 2357.50  
 Mass of fines material (g): 45348.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6014	997.05	925.87	269.45	1.71	10.84
2	6144	1095.35	1004.84	292.22	1.81	12.70
3	6204	1132.12	1022.57	282.88	1.83	14.81
4	6199	899.82	813.68	289.57	1.80	16.44
5	6139	938.80	831.19	269.92	1.70	19.17

Soil Fractions  
 Coarse Fraction (% g/g): 4.9  
 Fines Fraction (% g/g): 95.1

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

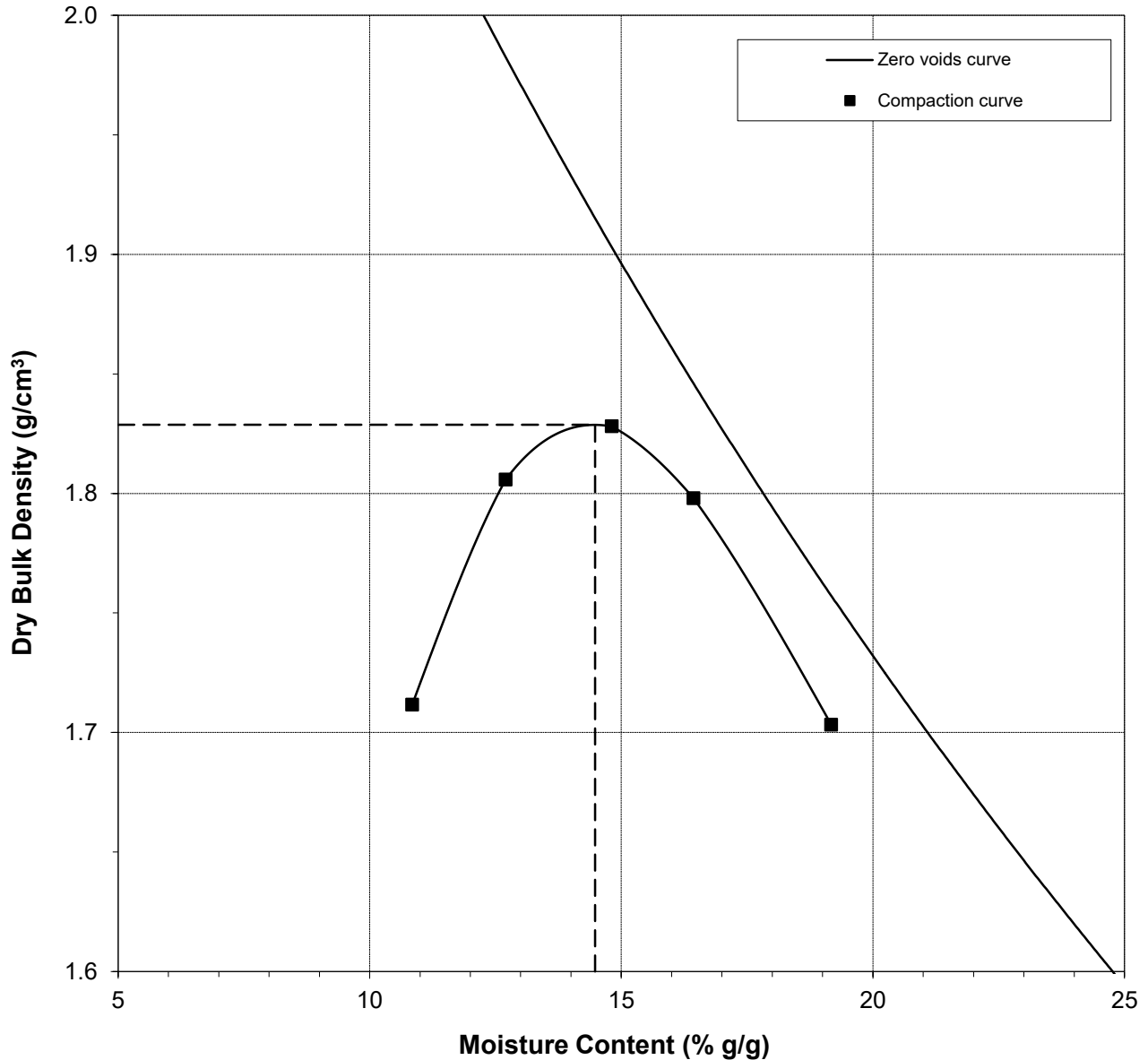
Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data Points with Fitted Curve**  
 Sample Number: T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.5	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.83	---

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: Topsoil North Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 591.00  
 Mass of fines material (g): 34020.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6064	996.39	937.78	268.08	1.79	8.75
2	6162	1063.65	988.83	291.63	1.86	10.73
3	6237	1016.08	933.26	289.17	1.89	12.86
4	6179	1055.57	954.88	269.83	1.81	14.70
5	6121	1195.75	1063.30	292.88	1.72	17.19

Soil Fractions

Coarse Fraction (% g/g): 1.7  
 Fines Fraction (% g/g): 98.3

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

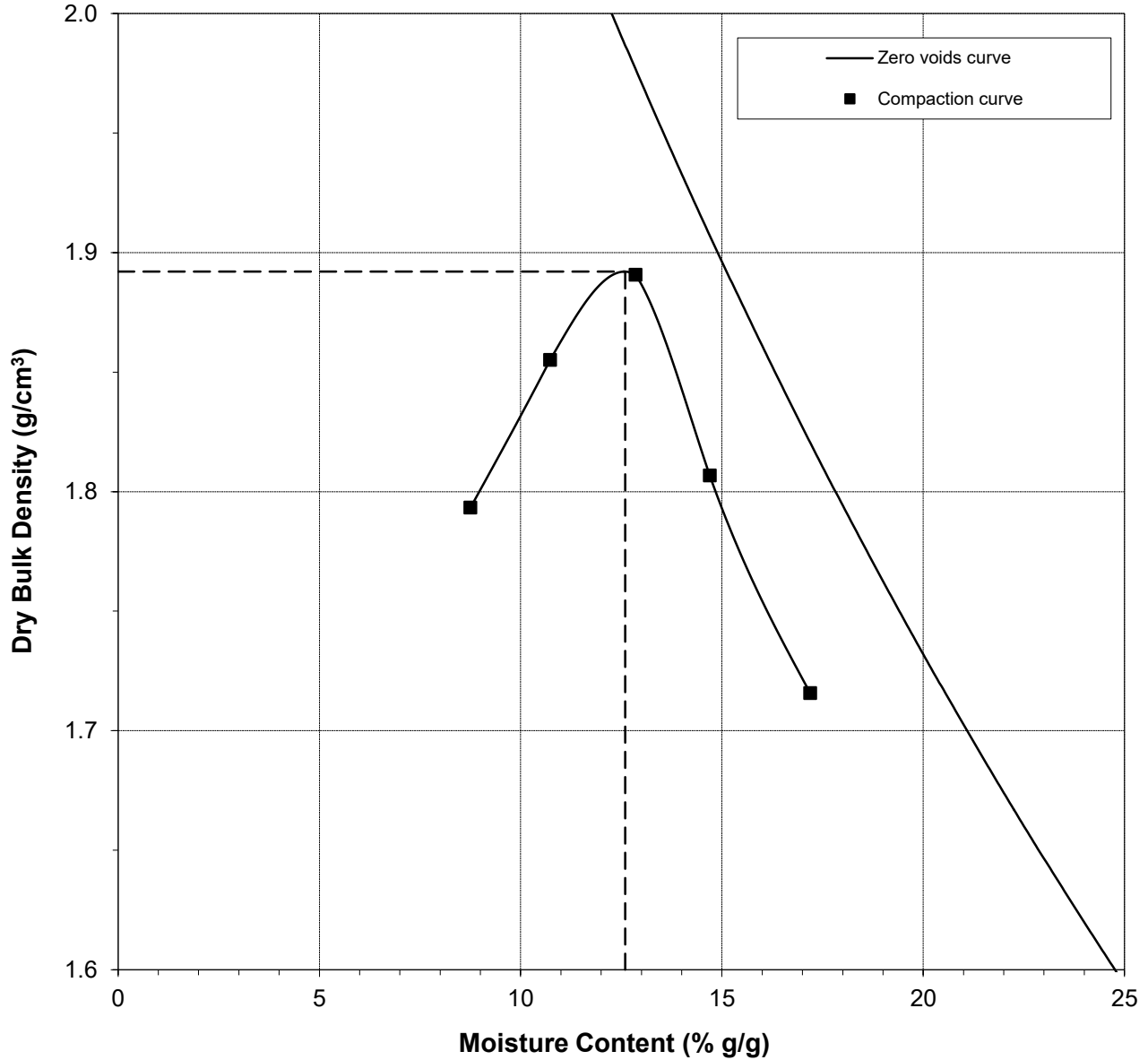


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: Topsoil North Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.6	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.89	---

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia

Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: Borrow South Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 337.52  
 Mass of fines material (g): 46770.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5947	979.08	925.82	286.94	1.69	8.34
2	6077	1068.89	996.06	293.36	1.78	10.36
3	6186	1143.03	1047.75	300.24	1.84	12.75
4	6197	1059.23	959.03	283.30	1.82	14.83
5	6143	1147.62	1022.92	289.53	1.74	17.00

Soil Fractions

Coarse Fraction (% g/g): 0.7  
 Fines Fraction (% g/g): 99.3

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

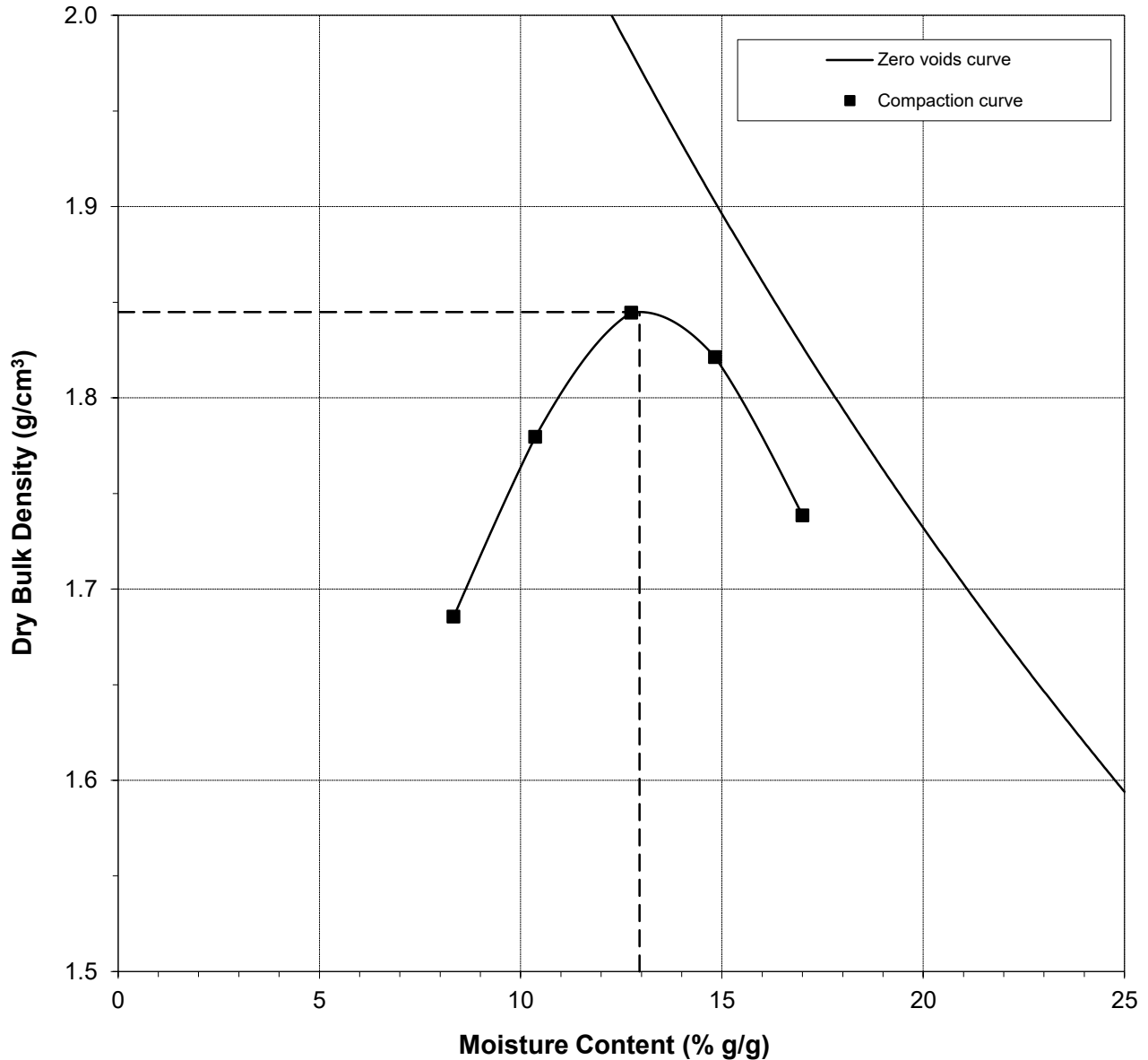


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: Borrow South Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.0	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.84	---

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: Topsoil South Cuttings (1 & 2) (TS-2 & TS-3)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 16-May-18  
 As Received Moisture Content (% g/g): NA

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 5710.40  
 Mass of fines material (g): 24015.18  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6038	1126.72	1054.15	296.93	1.75	9.58
2	6097	1085.79	1004.40	284.58	1.78	11.31
3	6160	1015.23	924.00	267.30	1.80	13.89
4	6181	994.82	892.02	289.75	1.77	17.07
5	6124	1073.18	954.74	296.46	1.71	17.99

Soil Fractions  
 Coarse Fraction (% g/g): 19.2  
 Fines Fraction (% g/g): 80.8

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	1.88	7.74
2	1.90	9.13
3	1.92	11.22
4	1.89	13.79
5	1.83	14.54

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

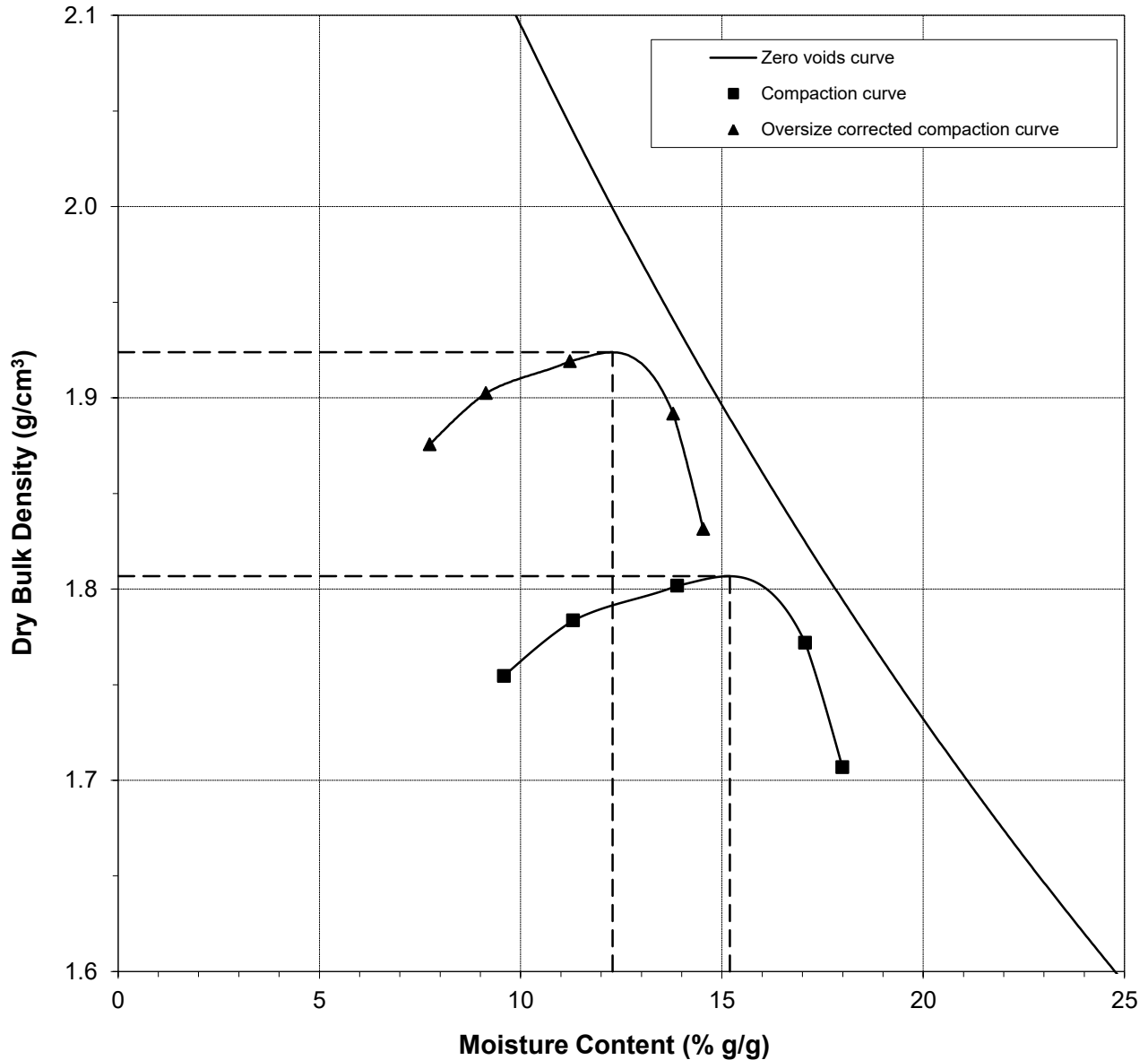




**Proctor Compaction Data Points with Fitted Curve**  
 Sample Number: Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)

	Measured	Corrected
Optimum Moisture Content (% g/g):	15.2	12.3
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	1.92

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



### Proctor Compaction Data

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: Borrow West Auger Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 699.80  
 Mass of fines material (g): 44700.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5996	993.18	936.74	268.32	1.73	8.44
2	6120	1052.40	976.47	267.86	1.82	10.72
3	6211	977.97	899.31	270.20	1.87	12.50
4	6203	1078.97	975.04	269.32	1.83	14.73
5	6129	1070.18	955.15	268.21	1.73	16.75

Soil Fractions

Coarse Fraction (% g/g): 1.5  
 Fines Fraction (% g/g): 98.5

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

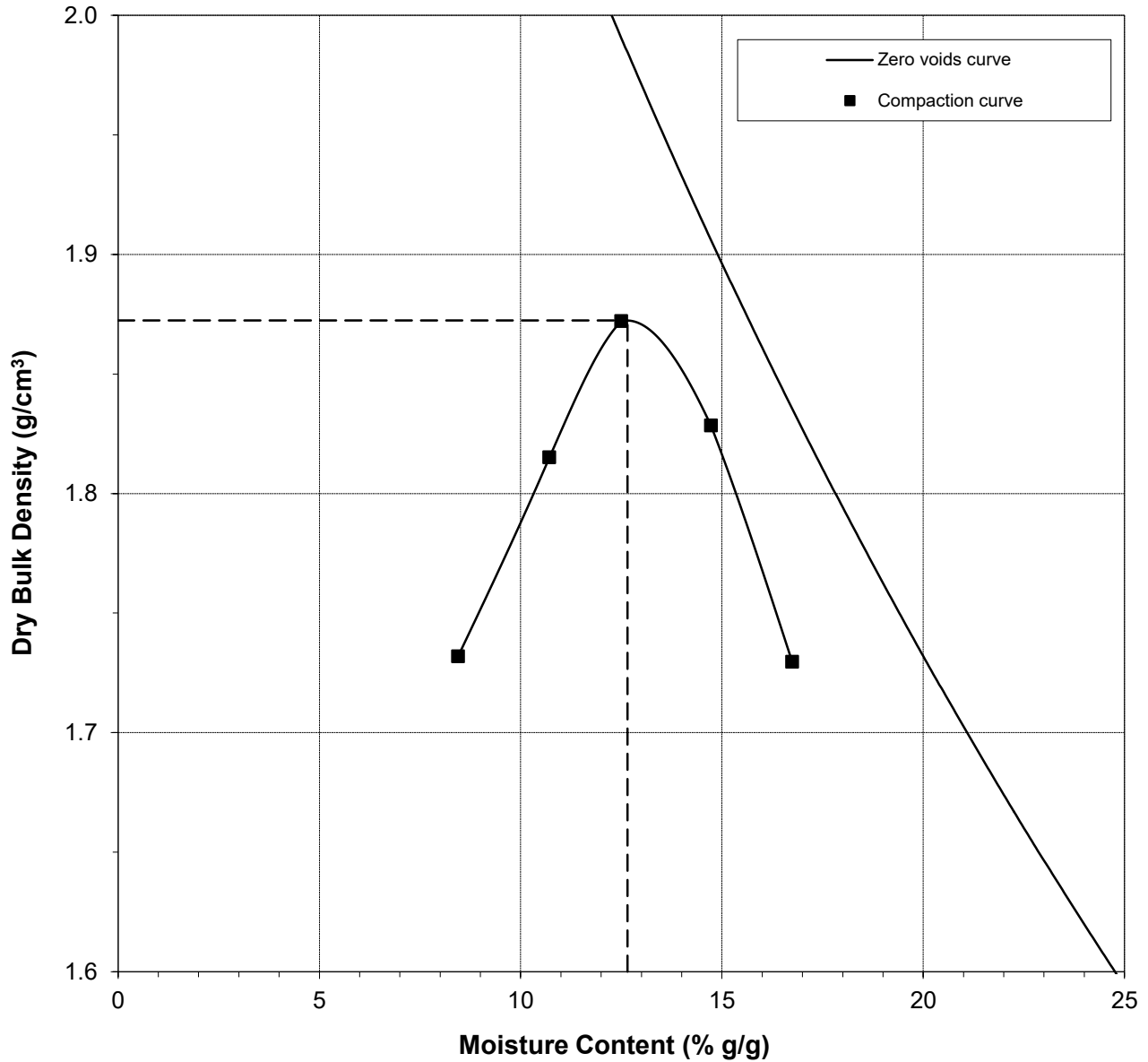


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: Borrow West Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.7	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.87	---

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P1-2 Auger Cuttings  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 793.10  
 Mass of fines material (g): 20670.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5992	939.86	883.72	284.26	1.71	9.37
2	6096	1025.24	953.81	288.60	1.79	10.74
3	6166	959.37	880.64	269.61	1.82	12.88
4	6158	1079.80	974.79	284.78	1.78	15.22
5	6107	976.63	872.96	284.13	1.70	17.61

Soil Fractions

Coarse Fraction (% g/g): 3.7  
 Fines Fraction (% g/g): 96.3

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

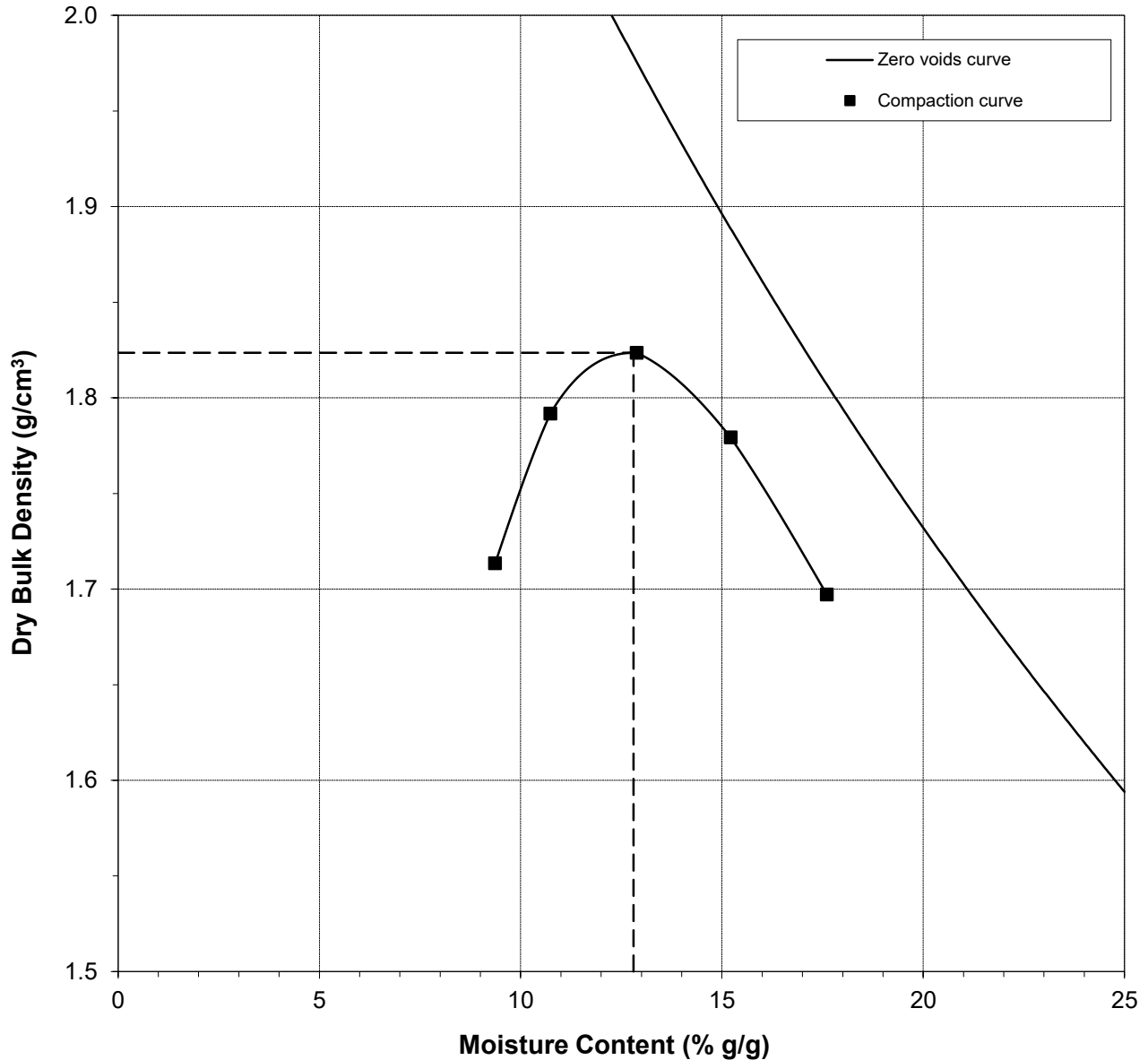


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: P1-2 Auger Cuttings

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.82	---

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P3 Auger Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 17-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 2644.40  
 Mass of fines material (g): 36609.20  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6095	968.15	927.41	298.44	1.86	6.48
2	6185	1116.67	1054.91	292.84	1.92	8.10
3	6258	1191.07	1109.22	283.88	1.96	9.92
4	6246	1167.22	1073.30	294.43	1.91	12.06
5	6182	1228.99	1112.04	286.79	1.82	14.17

Soil Fractions

Coarse Fraction (% g/g): 6.7  
 Fines Fraction (% g/g): 93.3

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	1.90	6.04
2	1.96	7.56
3	2.00	9.25
4	1.95	11.25
5	1.86	13.22

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O' Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

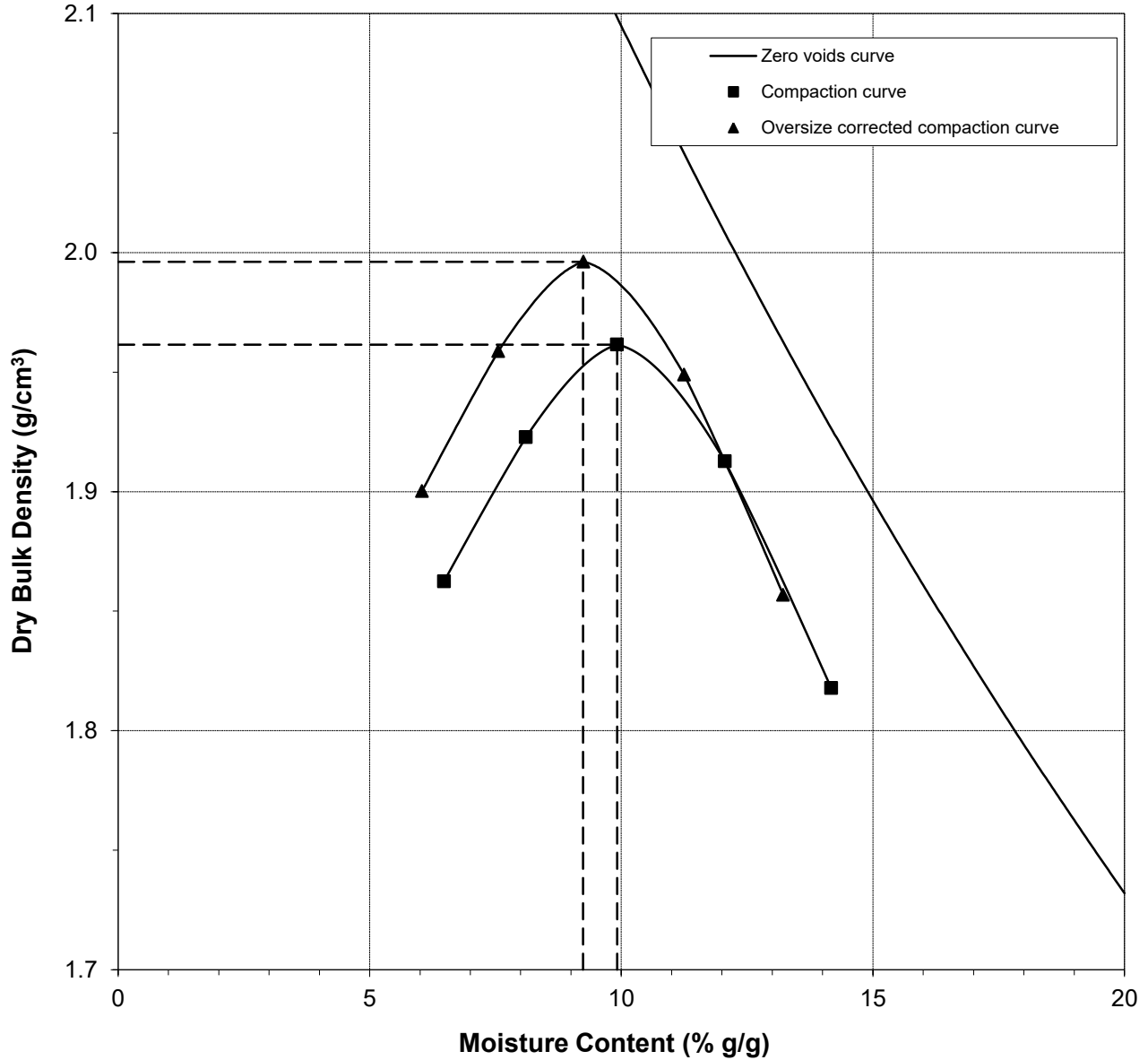


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: P3 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	9.9	9.2
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.96	2.00

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O' Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: P4 Auger Cuttings (1 & 2)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS  
 Test Date: 23-May-18

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 7810.70  
 Mass of fines material (g): 32410.00  
 Mold weight (g): 4226  
 Mold volume (cm<sup>3</sup>): 942.46  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6021	1062.03	1016.33	283.72	1.79	6.24
2	6138	1145.66	1078.20	269.57	1.87	8.34
3	6236	1004.05	935.64	269.39	1.93	10.27
4	6265	1028.30	946.86	282.76	1.93	12.26
5	6192	1002.37	912.55	284.64	1.82	14.30

Soil Fractions

Coarse Fraction (% g/g): 19.4  
 Fines Fraction (% g/g): 80.6

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	1.91	5.03
2	1.98	6.72
3	2.04	8.27
4	2.03	9.88
5	1.94	11.53

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines



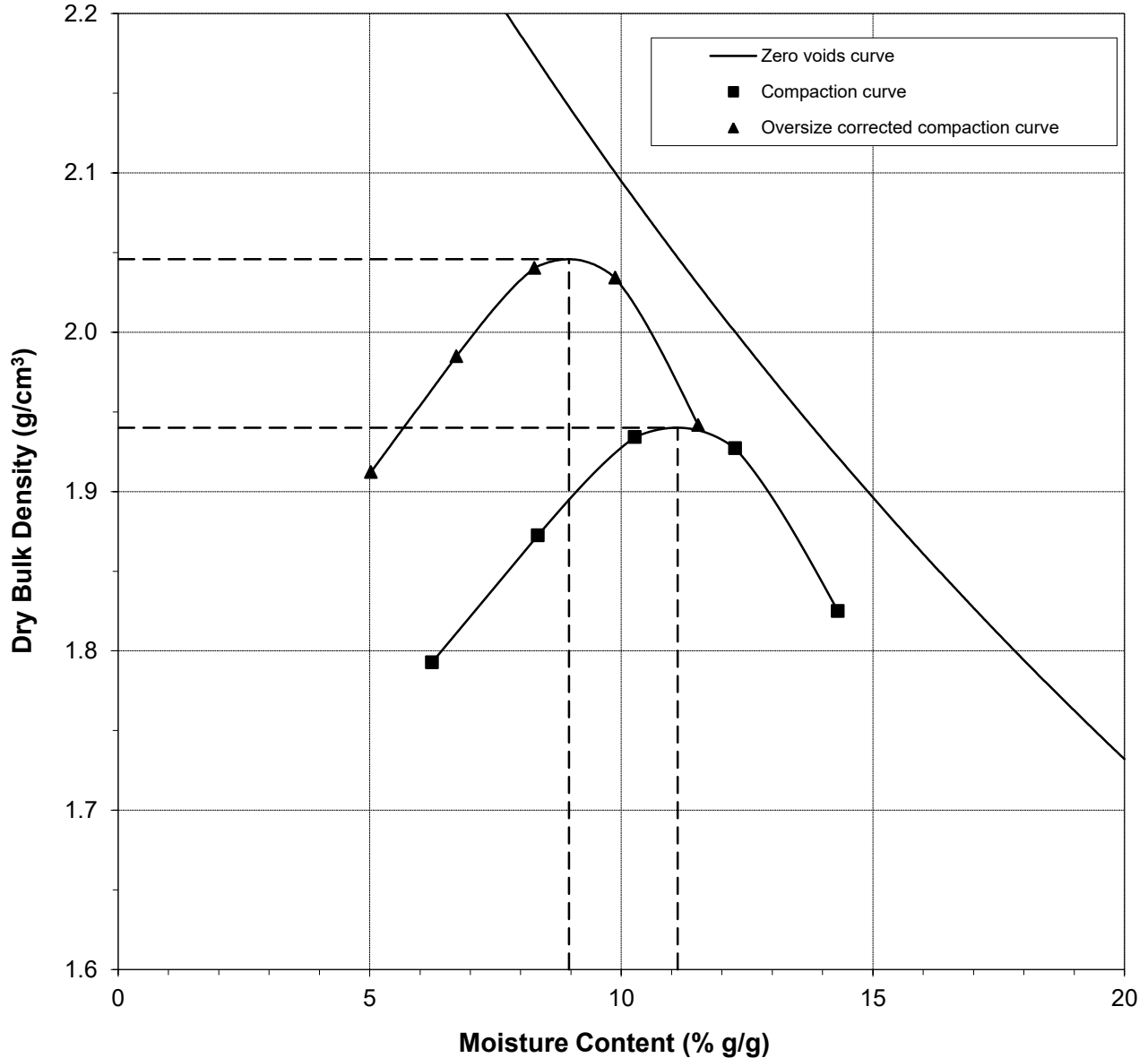


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: P4 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	11.1	9.0
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.94	2.05

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garcia  
 Checked by: J. Hines

# **Consolidated Undrained Testing**



### Summary of Consolidated Undrained (CU) Triaxial Shear Testing

Sample Number	Effective Consolidation Stress (psi)	Effective Minor Stress at Failure (psi)	Effective Major Stress at Failure (psi)	Pore-Water Pressure at Failure (psi)	Total Minor Stress at Failure (psi)	Total Major Stress at Failure (psi)	% Strain at Failure*
L2-1 (15'A) CU Stage 1 (6.0 psi)	6.0	2.5	8.4	75.0	77.6	83.4	2.12
L2-1 (15'A) CU Stage 2 (12.0 psi)	12.0	5.0	18.0	78.6	83.6	96.6	2.96
L2-1 (15'A) CU Stage 3 (24.0 psi)	24.0	9.6	35.8	86.1	95.6	121.9	7.73
L2-5 (5'B) CU Stage 1 (2.0 psi)	2.0	0.7	5.2	81.9	82.7	87.1	1.88
L2-5 (5'B) CU Stage 2 (4.0 psi)	4.0	2.0	9.4	82.5	84.6	91.9	0.97
L2-5 (5'B) CU Stage 3 (8.0 psi)	8.0	3.3	15.4	85.4	88.7	100.9	1.13
L2-6 (10'B) CU Stage 1 (3.5 psi)	3.5	2.1	3.5	83.0	85.1	86.4	0.69
L2-6 (10'B) CU Stage 2 (7.1 psi)	7.1	3.2	10.3	85.5	88.6	95.8	3.02
L2-6 (10'B) CU Stage 3 (14.0 psi)	14.0	6.0	22.4	89.7	95.7	112.1	11.74

\*Noted percent strain used as failure criterion.



**Summary of Consolidated Undrained Estimated Effective Friction Angle and Cohesion**

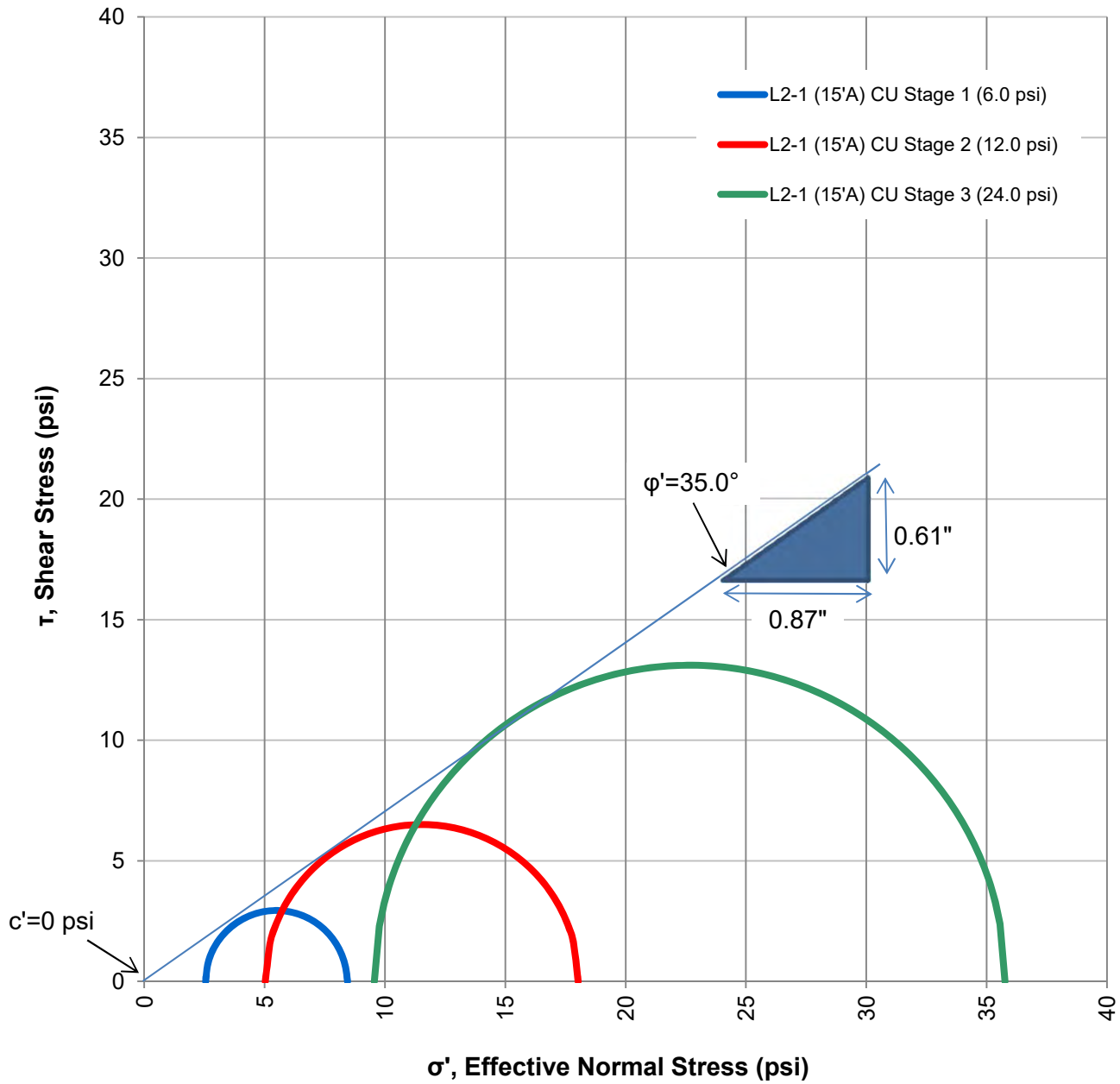
Sample Number	c' Cohesion (psi)	$\phi'$ Friction Angle (°)
L2-1 (15'A) CU	0	35
L2-5 (5'B) CU	0.9	35.8
L2-6 (10'B) CU	0	32.3

---

<sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

# Mohr's Circles: Effective

## L2-1 (15'A) CU



**Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:**  
cohesion ( $c'$ )(psi) = 0  
friction angle ( $\phi'$ )( $^\circ$ ) = 35.0

<sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Remolded or Initial Sample Properties

---

Initial Mass (g): 389.62  
Length (cm): 11.35  
Diameter (cm): 4.89  
Area (cm<sup>2</sup>): 18.80  
Volume (cm<sup>3</sup>): 213.46  
Dry Mass (g): 371.07  
Dry Density (g/cm<sup>3</sup>): 1.74  
Dry Unit Weight (lb/ft<sup>3</sup>): 108.53  
Equivalent Height of Solids (cm): 7.45  
Water Content (% g/g): 5.0  
Water Content (% vol): 8.7  
Water Content Based On:  Cuttings  Whole Specimen  
Porosity (% vol): 34.4  
Void Ratio (e): 0.524  
Saturation (%): 25.3

### Test and Sample Conditions

---

Height to Diameter Ratio: 2.3  
Largest Particle Dimension (approx.) (cm): 0.475  
Diameter to Largest Particle Ratio (approx.): 10.30  
Visual Description of Sample: Silt-Consolidated  
USCS Classification: NA  
Plastic Limit: NA  
Liquid Limit: NA  
Sample Preparation:  In situ sample, extruded  Remolded Sample  
Trimming Procedure: NA  
Split: NA  
Percent Coarse Material (%): <5%  
Particle Density (g/cm<sup>3</sup>): 2.65  Assumed  Measured  
B-Value Post Saturation: 0.99  
Method for Specimen Saturation:  Dry  Wet

Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



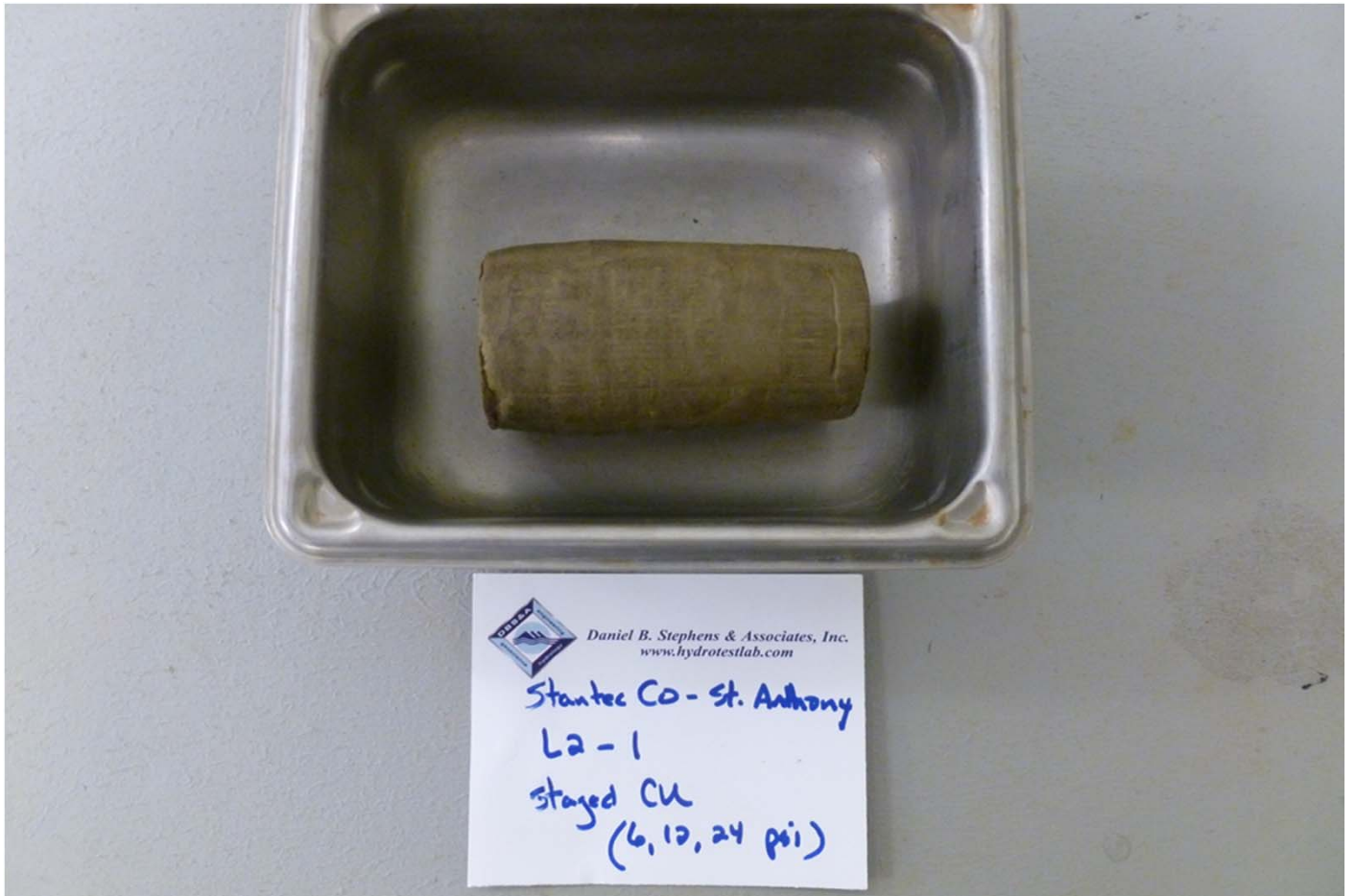
## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

Photograph of Failure





## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 1

---

Date/Time Shear Initiated: 6/14/18 1240  
Date/Time Shear Completed: 6/14/18 1255

### Consolidation Data

---

Length (cm): 11.08  
Diameter (cm): 4.89  
Measured outflow (cm<sup>3</sup>): 5.04  
Area (cm<sup>2</sup>): 18.80  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 208.42  
Dry Density (g/cm<sup>3</sup>): 1.78  
Dry Unit Weight (lb/ft<sup>3</sup>): 111.15  
Equivalent Height of Solids (cm): 7.45  
Porosity (% vol): 32.8  
Void Ratio (e): 0.488  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.7

### Shear Data

---

Effective Consolidation Stress (psi): 5.98  
Total Back Pressure (psi) : 71.58  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 5.9  
Effective Minor Stress at Failure (psi): 2.5  
Effective Major Stress at Failure (psi): 8.4  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 2.12  
Strain Rate (%/hr): 8.5

#### Test Notes:

Test was halted prior to reaching a maximum target of 3% strain, after a reduction in deviator stress was recorded. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines

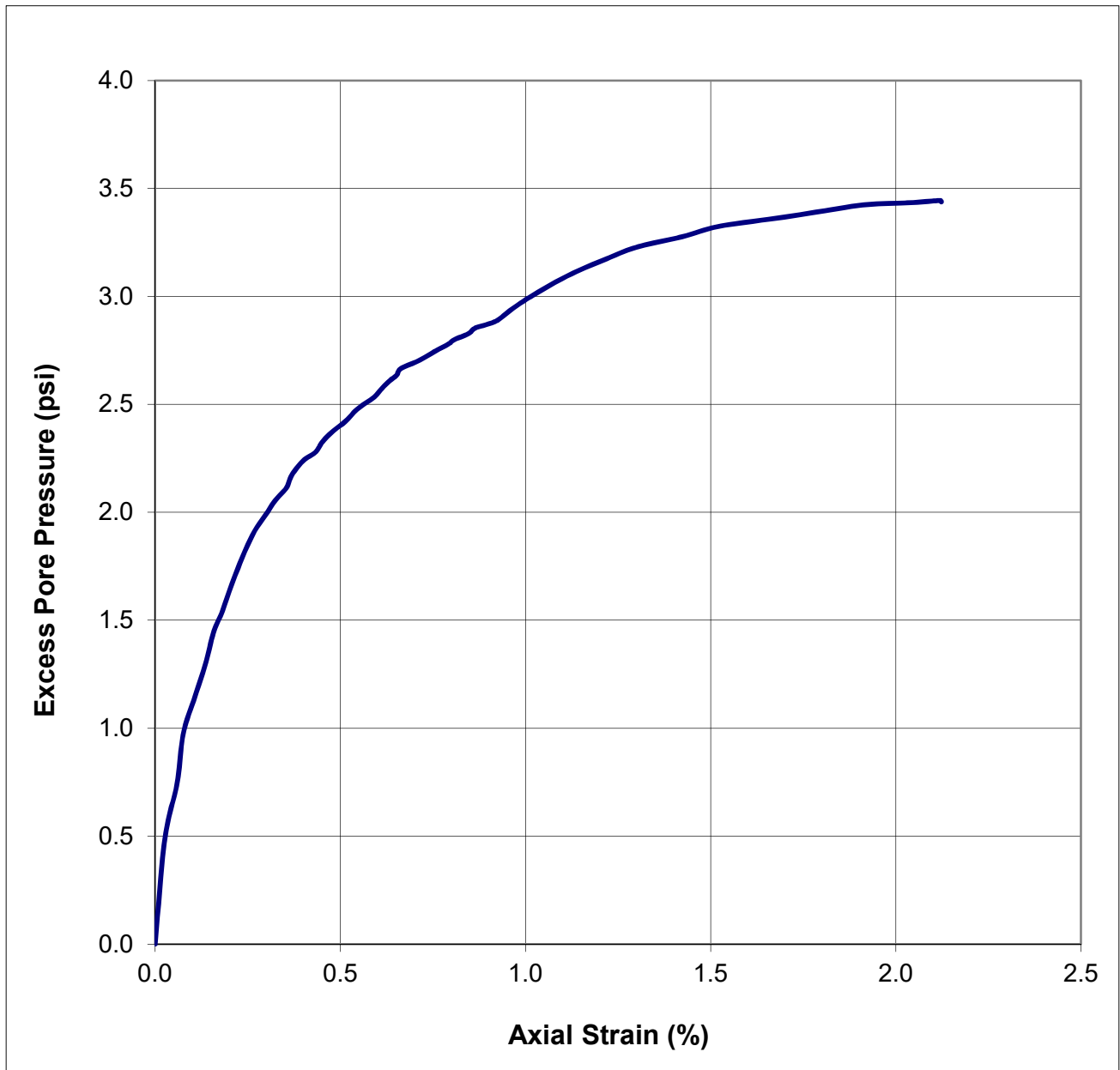




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

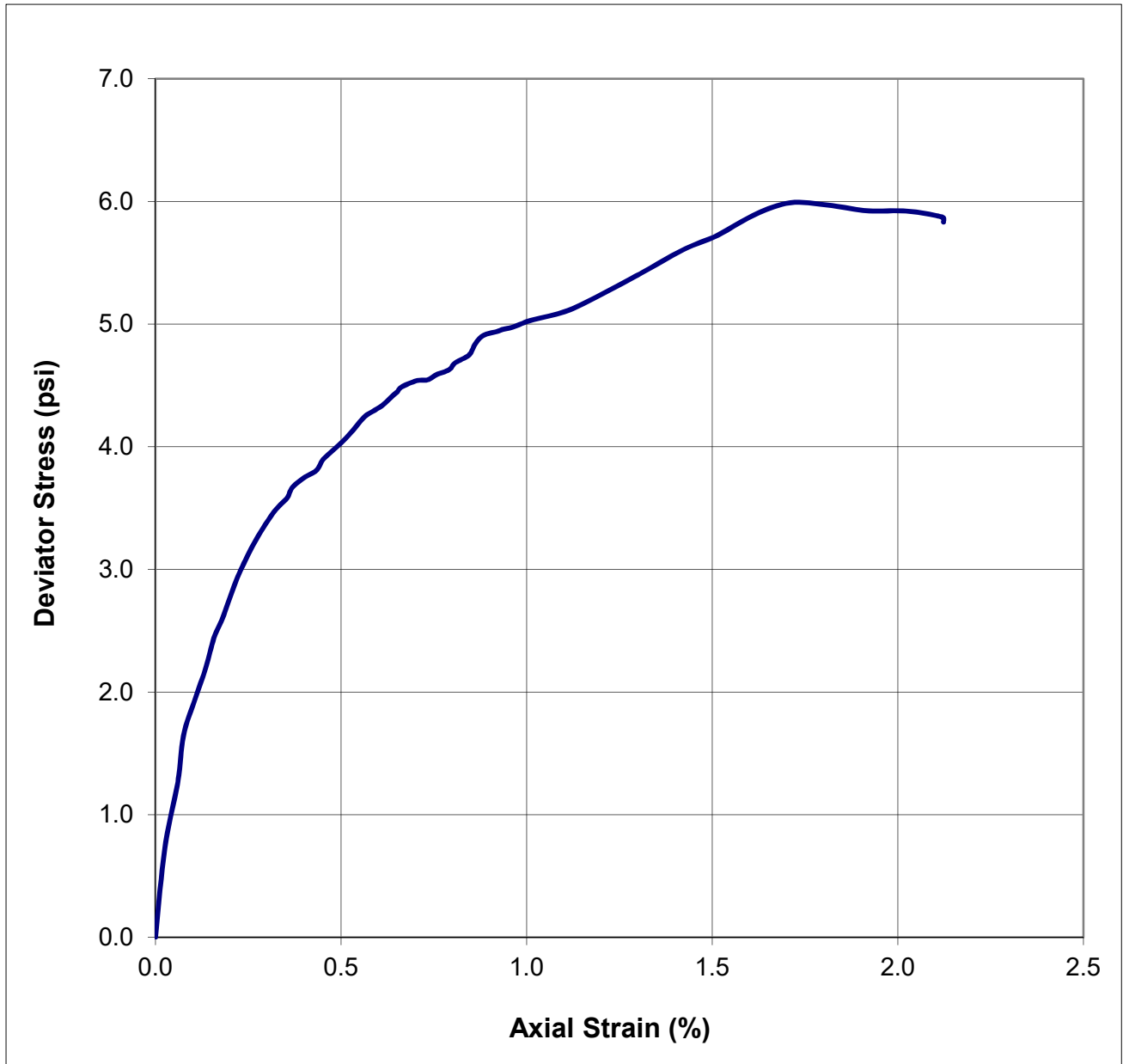




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

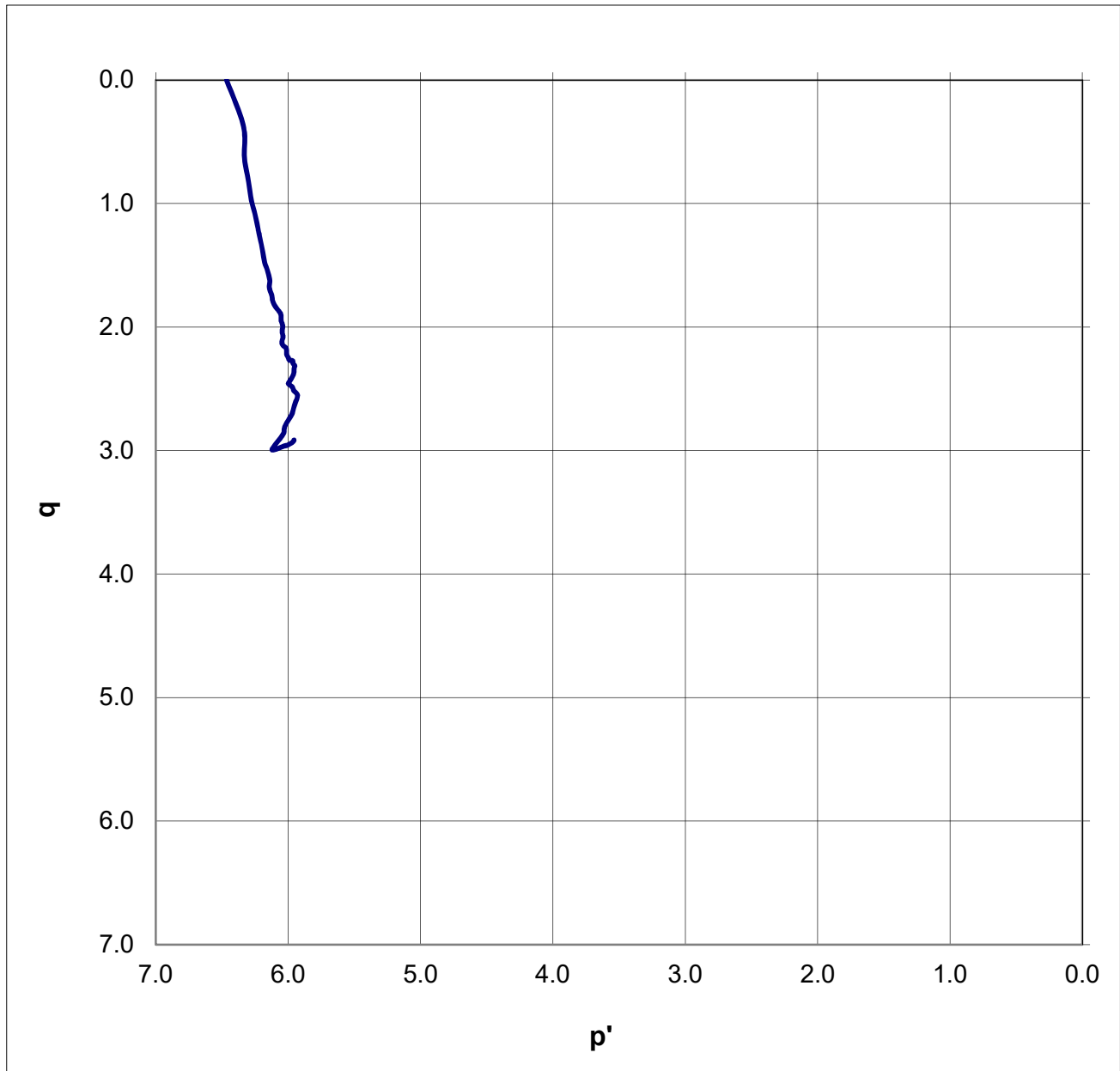




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs. p'





### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
71.58	0.00	5.98	5.98				
72.06	0.03	6.22	5.49				
72.33	0.06	6.48	5.21				
72.55	0.08	6.64	4.99				
72.73	0.11	6.77	4.82				
72.88	0.14	6.86	4.66				
73.02	0.16	6.96	4.52				
73.12	0.18	7.03	4.42				
73.23	0.20	7.10	4.31				
73.32	0.22	7.17	4.21				
73.41	0.24	7.21	4.13				
73.49	0.27	7.27	4.04				
73.56	0.30	7.34	3.97				
73.63	0.33	7.38	3.89				
73.69	0.35	7.42	3.84				
73.75	0.37	7.45	3.78				
73.82	0.40	7.46	3.71				
73.86	0.43	7.47	3.67				
73.91	0.45	7.52	3.62				
73.96	0.48	7.55	3.57				
74.00	0.51	7.60	3.52				
74.05	0.54	7.63	3.47				
74.08	0.56	7.68	3.44				
74.11	0.59	7.70	3.40				
74.16	0.61	7.70	3.36				
74.19	0.63	7.73	3.33				
74.21	0.65	7.75	3.30				
74.24	0.66	7.76	3.27				
74.27	0.70	7.77	3.24				
74.30	0.73	7.75	3.21				
74.33	0.76	7.77	3.18				
74.36	0.79	7.78	3.15				
74.38	0.81	7.81	3.13				
74.41	0.85	7.85	3.10				
74.43	0.86	7.92	3.07				
74.44	0.89	7.97	3.06				
74.46	0.92	7.97	3.04				
74.48	0.93	7.97	3.02				
74.52	0.96	7.97	3.00				
74.55	0.99	7.98	2.97				
74.57	1.01	7.99	2.96				
74.67	1.11	8.00	2.89				
74.75	1.22	8.10	2.83				
74.81	1.31	8.19	2.78				
74.85	1.42	8.34	2.74				
74.90	1.52	8.41	2.69				
74.93	1.61	8.55	2.66				
74.95	1.71	8.63	2.64				
74.98	1.81	8.58	2.61				
75.00	1.92	8.50	2.58				
75.01	2.02	8.49	2.57				
75.02	2.12	8.42	2.55				
75.02	2.12	8.39	2.55				



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 2

---

Date/Time Shear Initiated: 6/14/18 1529  
Date/Time Shear Completed: 6/14/18 1539

### Consolidation Data

---

Length (cm): 11.17  
Diameter (cm): 4.89  
Measured outflow (cm<sup>3</sup>): 3.39  
Area (cm<sup>2</sup>): 18.80  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 210.07  
Dry Density (g/cm<sup>3</sup>): 1.77  
Dry Unit Weight (lb/ft<sup>3</sup>): 110.28  
Equivalent Height of Solids (cm): 7.45  
Porosity (% vol): 33.3  
Void Ratio (e): 0.500  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.97

### Shear Data

---

Effective Consolidation Stress (psi): 12.05  
Total Back Pressure (psi): 71.48  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 13.0  
Effective Minor Stress at Failure (psi): 5.0  
Effective Major Stress at Failure (psi): 18.0  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 2.96  
Strain Rate (%/hr): 18.59

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

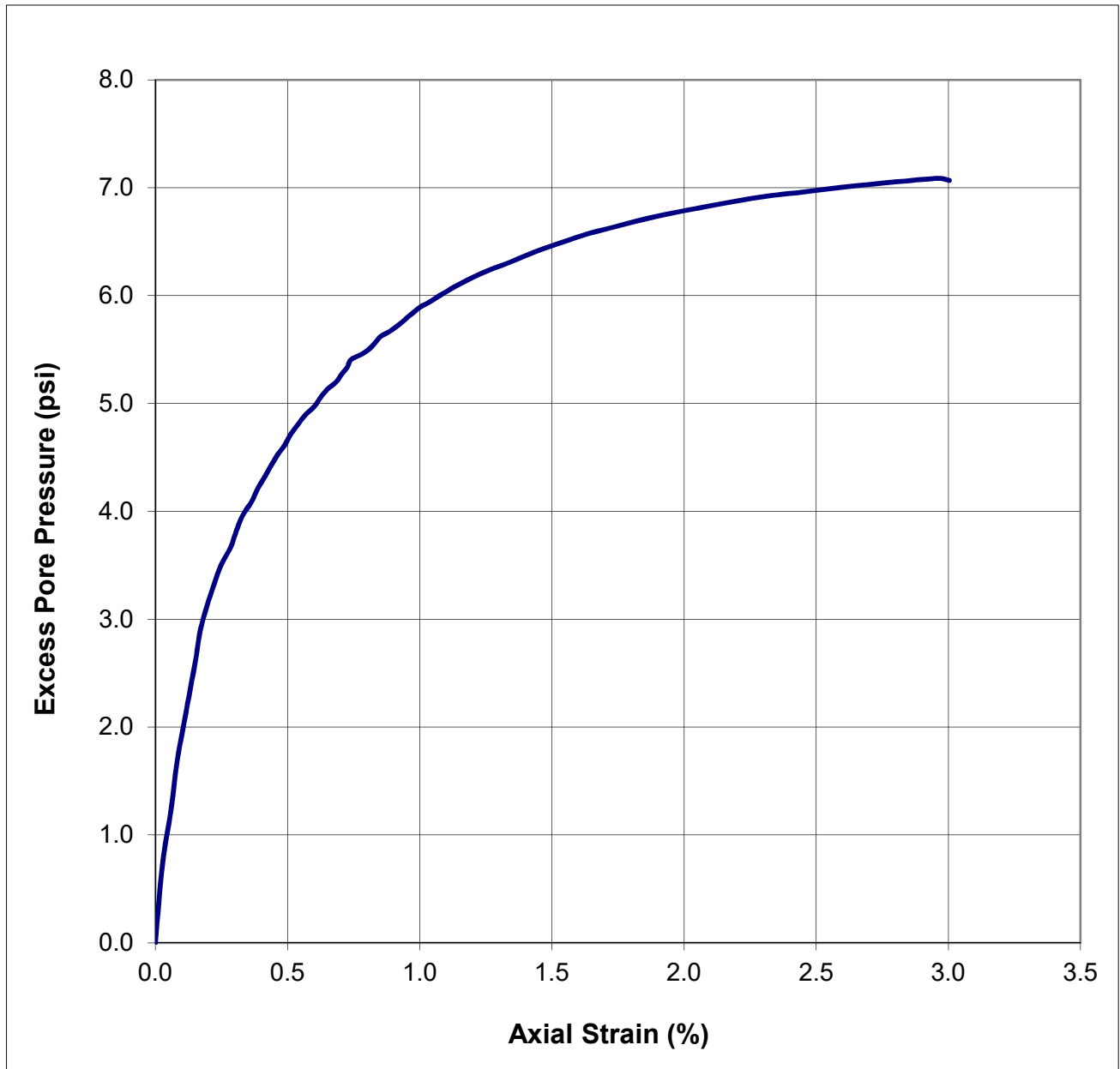
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

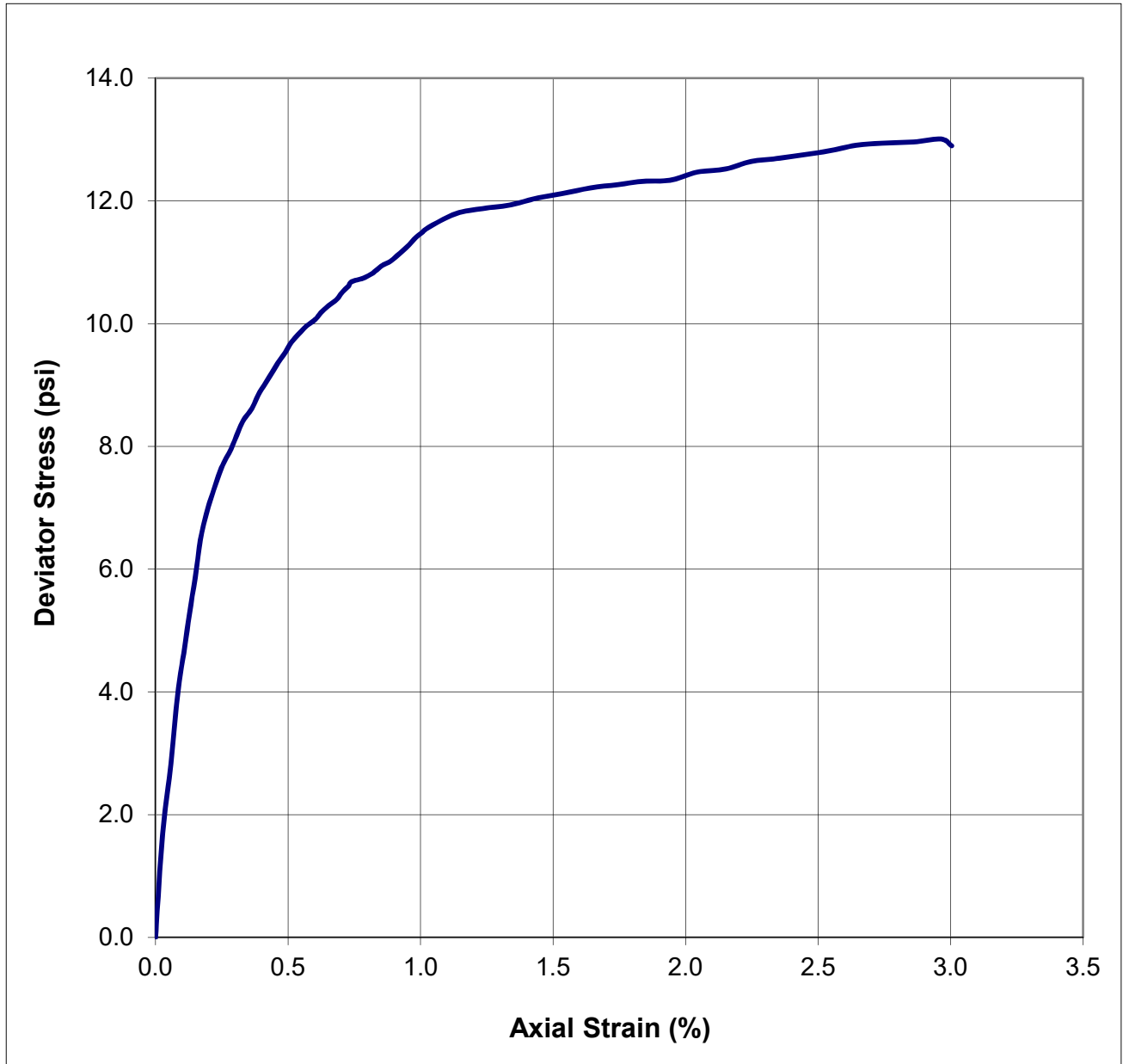




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

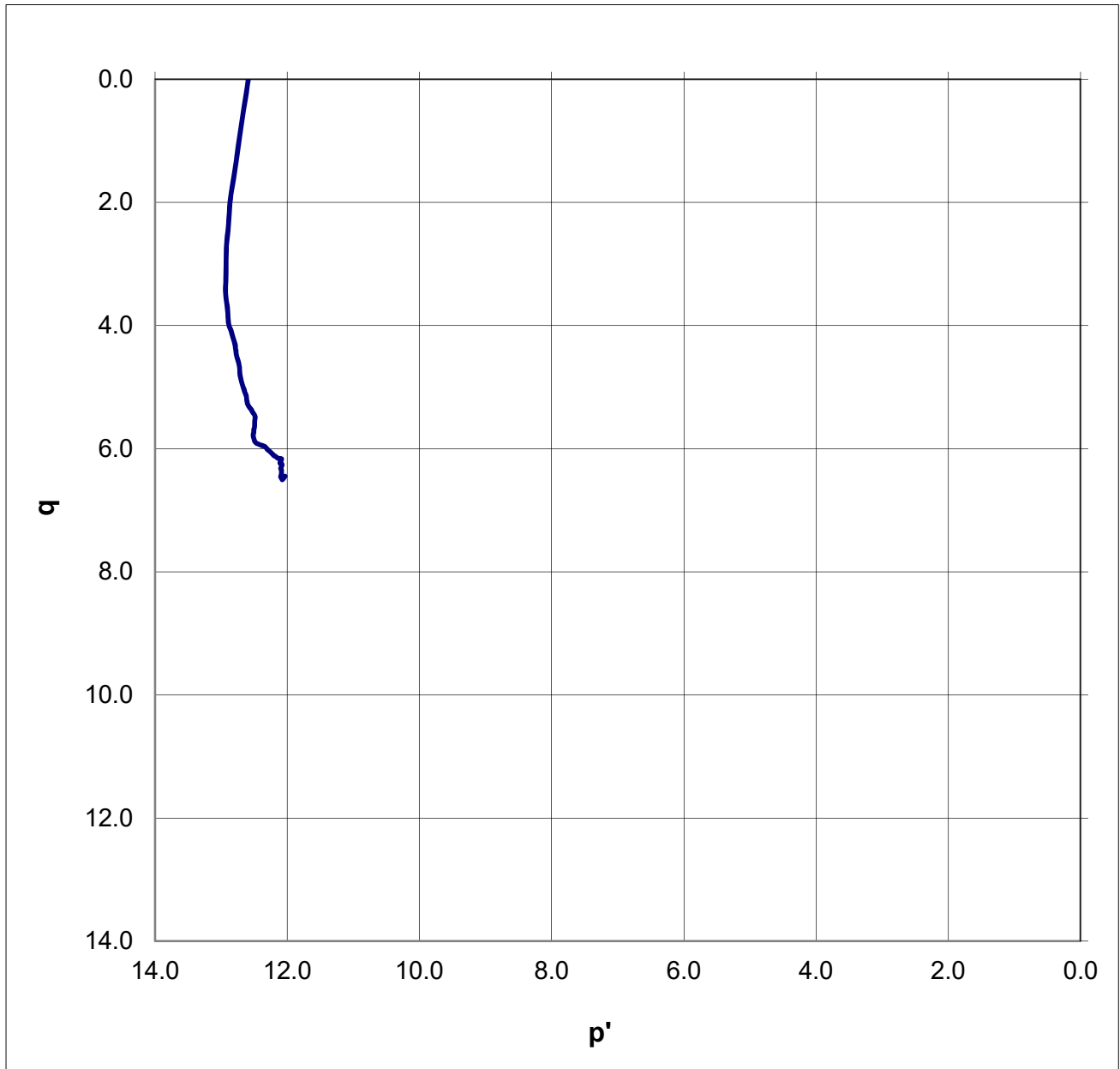




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'







### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
71.48	0.00	12.05	12.05				
72.21	0.03	13.02	11.32				
72.71	0.06	13.67	10.81				
73.15	0.08	14.27	10.37				
73.53	0.11	14.71	9.98				
73.84	0.13	15.08	9.67				
74.13	0.15	15.38	9.39				
74.37	0.17	15.63	9.15				
74.60	0.19	15.87	8.92				
74.80	0.22	16.03	8.72				
74.98	0.25	16.18	8.53				
75.15	0.29	16.32	8.36				
75.31	0.31	16.41	8.20				
75.44	0.33	16.49	8.07				
75.57	0.36	16.56	7.94				
75.69	0.39	16.65	7.82				
75.80	0.41	16.73	7.71				
75.91	0.44	16.79	7.60				
76.01	0.46	16.87	7.49				
76.09	0.49	16.94	7.41				
76.20	0.51	17.01	7.32				
76.29	0.54	17.06	7.23				
76.37	0.57	17.11	7.16				
76.45	0.60	17.15	7.08				
76.53	0.62	17.19	7.01				
76.61	0.65	17.22	6.94				
76.68	0.68	17.27	6.88				
76.75	0.71	17.32	6.80				
76.82	0.73	17.35	6.75				
76.88	0.74	17.36	6.68				
76.94	0.78	17.37	6.63				
76.99	0.81	17.39	6.58				
77.05	0.83	17.40	6.53				
77.10	0.85	17.42	6.48				
77.15	0.89	17.45	6.44				
77.19	0.91	17.50	6.40				
77.23	0.93	17.55	6.36				
77.28	0.96	17.59	6.31				
77.33	0.98	17.66	6.27				
77.38	1.00	17.71	6.23				
77.41	1.03	17.76	6.19				
77.56	1.13	17.84	6.05				
77.69	1.24	17.81	5.93				
77.78	1.34	17.77	5.83				
77.89	1.44	17.77	5.73				
77.97	1.54	17.77	5.65				
78.05	1.64	17.77	5.56				
78.12	1.74	17.76	5.50				
78.18	1.84	17.75	5.43				
78.24	1.94	17.71	5.38				
78.28	2.04	17.80	5.34				
78.33	2.15	17.80	5.28				
78.38	2.25	17.88	5.24				
78.41	2.34	17.89	5.20				
78.44	2.45	17.92	5.17				
78.47	2.54	17.95	5.14				
78.49	2.64	18.01	5.11				
78.52	2.75	18.02	5.08				
78.55	2.86	18.01	5.05				
78.57	2.96	18.04	5.03				
78.55	3.00	17.94	5.04				



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 3

---

Date/Time Shear Initiated: 6/15/18 1339  
Date/Time Shear Completed: 6/15/18 1447

### Consolidation Data

---

Length (cm): 11.20  
Diameter (cm): 4.89  
Measured outflow (cm<sup>3</sup>): 2.78  
Area (cm<sup>2</sup>): 18.80  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 210.68  
Dry Density (g/cm<sup>3</sup>): 1.76  
Dry Unit Weight (lb/ft<sup>3</sup>): 109.96  
Equivalent Height of Solids (cm): 7.45  
Porosity (% vol): 33.5  
Void Ratio (e): 0.505  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 1.82

### Shear Data

---

Effective Consolidation Stress (psi): 24.03  
Total Back Pressure (psi): 71.59  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 26.2  
Effective Minor Stress at Failure (psi): 9.6  
Effective Major Stress at Failure (psi): 35.8  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 7.73  
Strain Rate (%/hr): 13.21

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

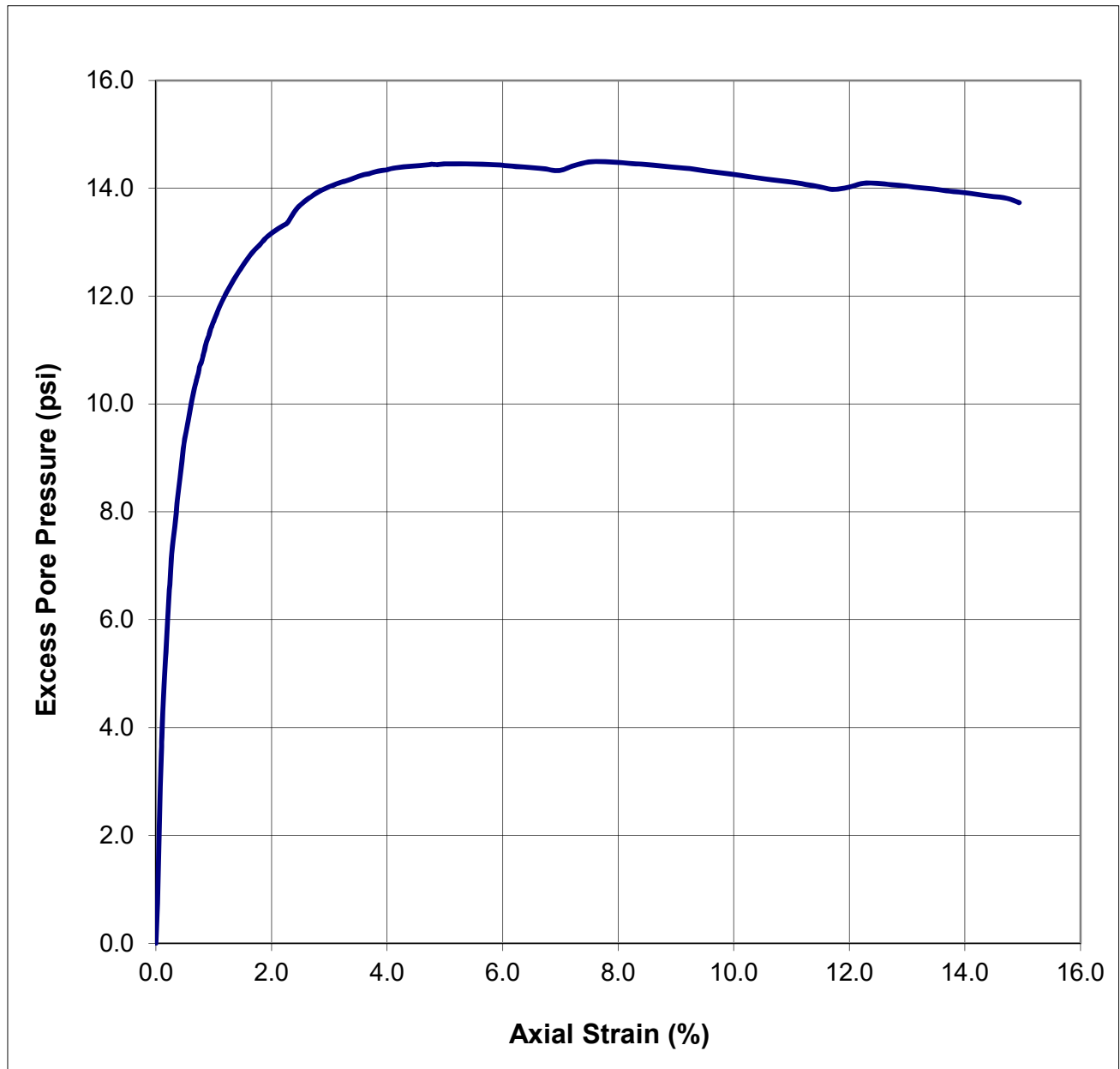
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

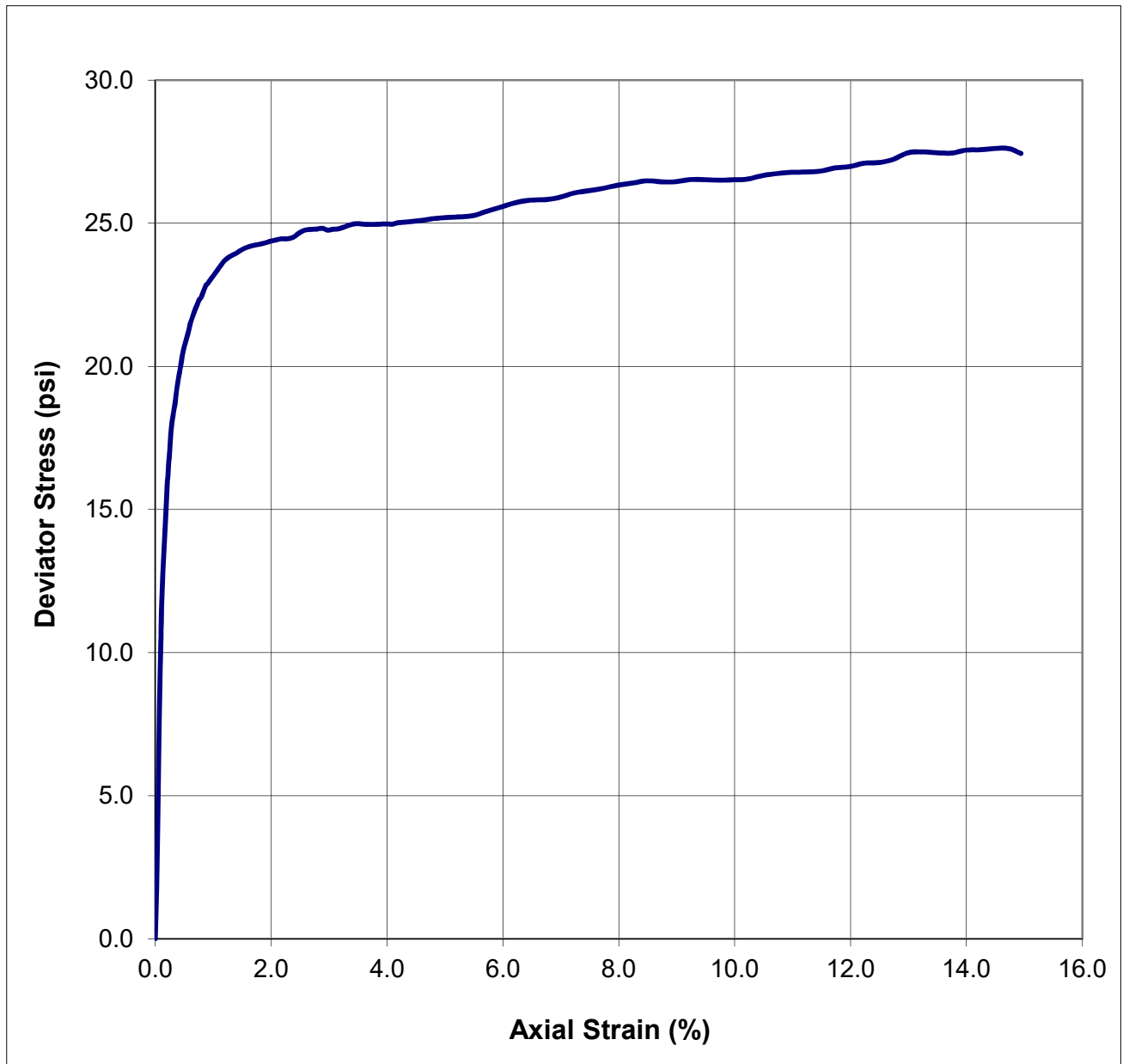




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

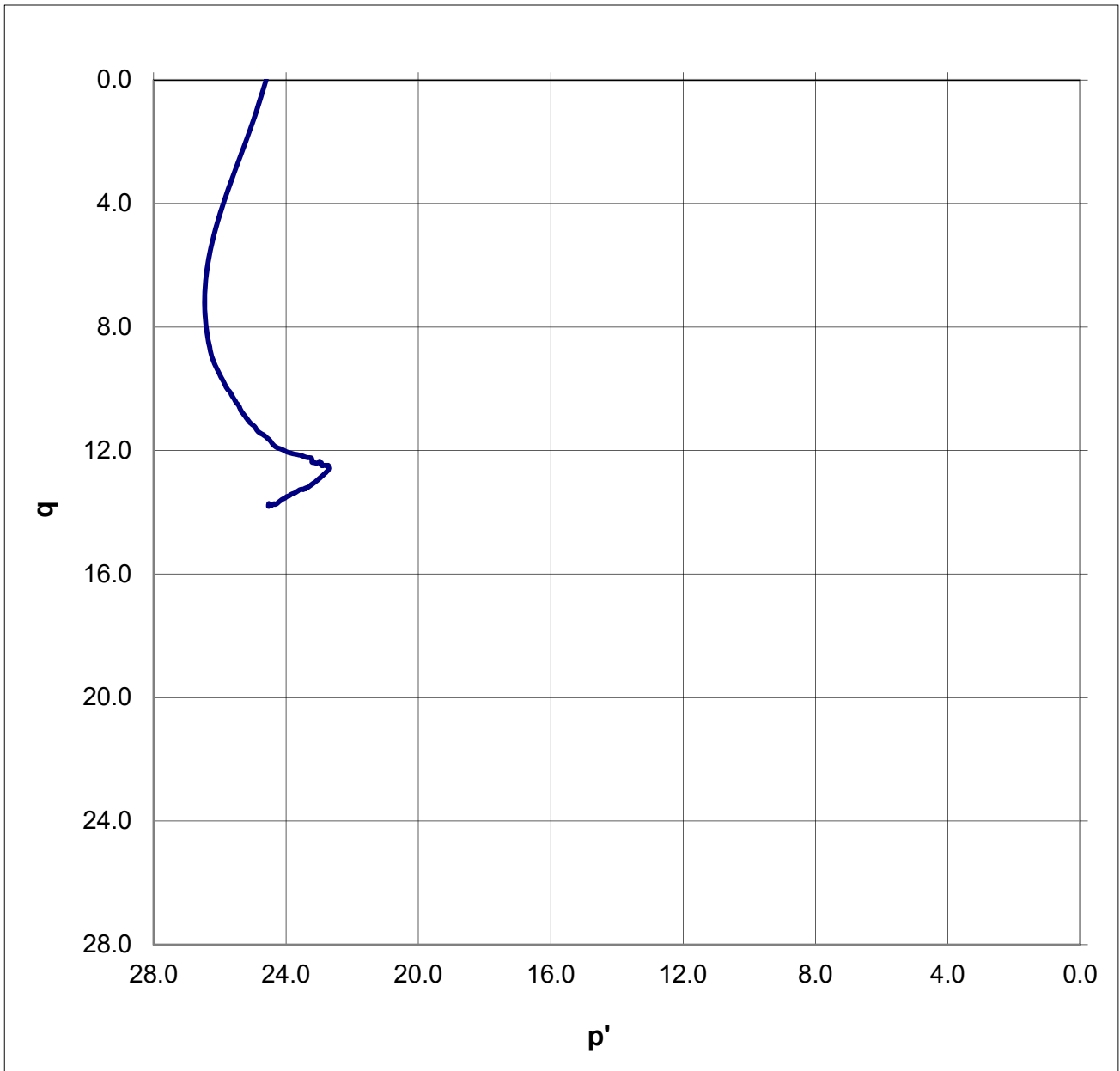




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs. p'





### Data for Consolidated Undrained (CU) Triaxial Shear Testing

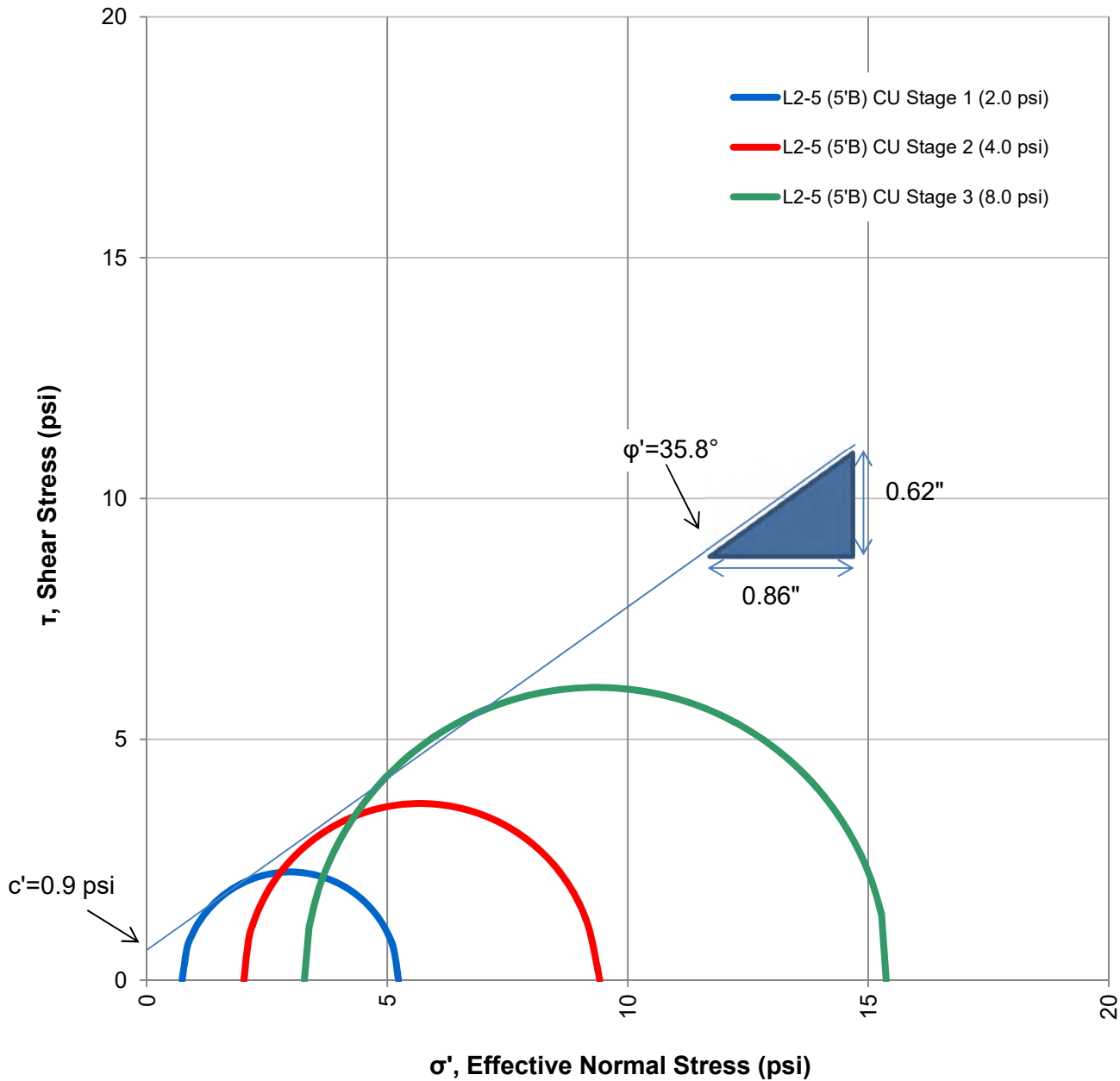
Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
71.59	0.00	24.03	24.03	85.65	3.07	34.80	10.01
72.57	0.03	25.83	23.06	85.69	3.17	34.77	9.96
73.41	0.05	27.55	22.22	85.73	3.28	34.81	9.93
74.26	0.07	29.27	21.36	85.76	3.38	34.84	9.89
75.06	0.09	30.66	20.57	85.80	3.47	34.84	9.85
75.74	0.11	31.70	19.88	85.84	3.57	34.78	9.81
76.35	0.14	32.46	19.27	85.86	3.68	34.74	9.79
76.87	0.17	33.03	18.75	85.89	3.78	34.72	9.76
77.34	0.19	33.49	18.28	85.92	3.88	34.69	9.73
77.76	0.21	33.84	17.85	85.93	3.98	34.69	9.71
78.15	0.23	34.13	17.47	85.96	4.09	34.64	9.68
78.52	0.26	34.39	17.09	85.98	4.18	34.67	9.66
78.84	0.28	34.60	16.77	85.99	4.28	34.68	9.64
79.15	0.31	34.76	16.46	86.00	4.38	34.67	9.63
79.43	0.34	34.87	16.18	86.01	4.48	34.68	9.61
79.69	0.36	34.97	15.92	86.02	4.57	34.69	9.60
79.93	0.38	35.06	15.68	86.02	4.68	34.71	9.59
80.15	0.41	35.13	15.45	86.04	4.78	34.72	9.57
80.38	0.43	35.21	15.23	86.03	4.87	34.74	9.57
80.58	0.46	35.24	15.02	86.04	4.97	34.75	9.56
80.77	0.47	35.29	14.83	86.04	5.23	34.76	9.54
80.94	0.50	35.34	14.66	86.04	5.47	34.78	9.53
81.11	0.53	35.38	14.49	86.04	5.71	34.93	9.52
81.28	0.56	35.41	14.31	86.02	5.97	35.08	9.52
81.42	0.58	35.47	14.17	86.00	6.23	35.25	9.52
81.56	0.60	35.52	14.03	85.98	6.47	35.33	9.52
81.70	0.63	35.54	13.90	85.95	6.74	35.34	9.52
81.83	0.65	35.56	13.76	85.92	6.98	35.43	9.53
81.94	0.68	35.59	13.65	86.01	7.23	35.59	9.53
82.07	0.71	35.61	13.52	86.08	7.49	35.69	9.55
82.18	0.74	35.62	13.41	86.09	7.73	35.78	9.56
82.29	0.76	35.61	13.29	86.07	7.98	35.90	9.57
82.38	0.79	35.61	13.20	86.05	8.24	35.99	9.59
82.49	0.81	35.62	13.09	86.04	8.49	36.09	9.60
82.58	0.84	35.65	12.99	86.00	8.73	36.07	9.63
82.67	0.86	35.66	12.90	85.98	8.99	36.09	9.64
82.76	0.88	35.66	12.81	85.96	9.24	36.18	9.65
82.84	0.91	35.64	12.73	85.92	9.49	36.20	9.68
82.92	0.93	35.62	12.66	85.88	9.75	36.21	9.71
83.00	0.95	35.61	12.57	85.85	10.00	36.24	9.72
83.08	0.98	35.60	12.49	85.81	10.24	36.30	9.75
83.34	1.08	35.60	12.22	85.78	10.49	36.44	9.77
83.58	1.18	35.64	11.98	85.74	10.74	36.53	9.79
83.79	1.29	35.59	11.76	85.71	10.98	36.58	9.81
83.96	1.38	35.52	11.58	85.67	11.24	36.62	9.83
84.13	1.49	35.47	11.40	85.62	11.49	36.68	9.85
84.28	1.58	35.40	11.24	85.57	11.73	36.80	9.87
84.42	1.68	35.31	11.09	85.61	11.98	36.89	9.92
84.53	1.78	35.23	10.97	85.69	12.24	37.03	9.93
84.65	1.88	35.15	10.84	85.69	12.48	37.07	9.95
84.74	1.98	35.11	10.74	85.66	12.73	37.20	9.98
84.82	2.09	35.06	10.65	85.64	12.98	37.46	10.00
84.89	2.18	35.03	10.57	85.60	13.23	37.52	10.03
84.96	2.28	34.95	10.49	85.58	13.48	37.51	10.05
85.13	2.38	34.92	10.41	85.54	13.74	37.52	10.08
85.25	2.47	34.98	10.33	85.51	13.99	37.64	10.09
85.35	2.57	35.02	10.27	85.48	14.23	37.68	10.12
85.43	2.68	34.99	10.21	85.44	14.48	37.75	10.14
85.51	2.78	34.95	10.16	85.41	14.73	37.77	10.16
85.56	2.88	34.92	10.10	85.33	14.94	37.67	10.23
85.61	2.98	34.80	10.05				

# Mohr's Circles: Effective

## L2-5 (5'B) CU



**Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:**  
cohesion ( $c'$ )(psi) = 0.9  
friction angle ( $\phi'$ )( $^\circ$ ) = 35.8

<sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Remolded or Initial Sample Properties

Initial Mass (g): 410.32  
Length (cm): 11.51  
Diameter (cm): 4.91  
Area (cm<sup>2</sup>): 18.97  
Volume (cm<sup>3</sup>): 218.37  
Dry Mass (g): 366.98  
Dry Density (g/cm<sup>3</sup>): 1.68  
Dry Unit Weight (lb/ft<sup>3</sup>): 104.92  
Equivalent Height of Solids (cm): 7.30  
Water Content (% g/g): 11.8  
Water Content (% vol): 19.8  
Water Content Based On:  Cuttings  Whole Specimen  
Porosity (% vol): 36.6  
Void Ratio (e): 0.577  
Saturation (%): 54.3

### Test and Sample Conditions

Height to Diameter Ratio: 2.3  
Largest Particle Dimension (approx.) (cm): 0.475  
Diameter to Largest Particle Ratio (approx.): 10.35  
Visual Description of Sample: Silt-Consolidated  
USCS Classification: NA  
Plastic Limit: NA  
Liquid Limit: NA  
Sample Preparation:  In situ sample, extruded  Remolded Sample  
Trimming Procedure: NA  
Split: NA  
Percent Coarse Material (%): <5%  
Particle Density (g/cm<sup>3</sup>): 2.65  Assumed  Measured  
B-Value Post Saturation: 0.97  
Method for Specimen Saturation:  Dry  Wet

Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines





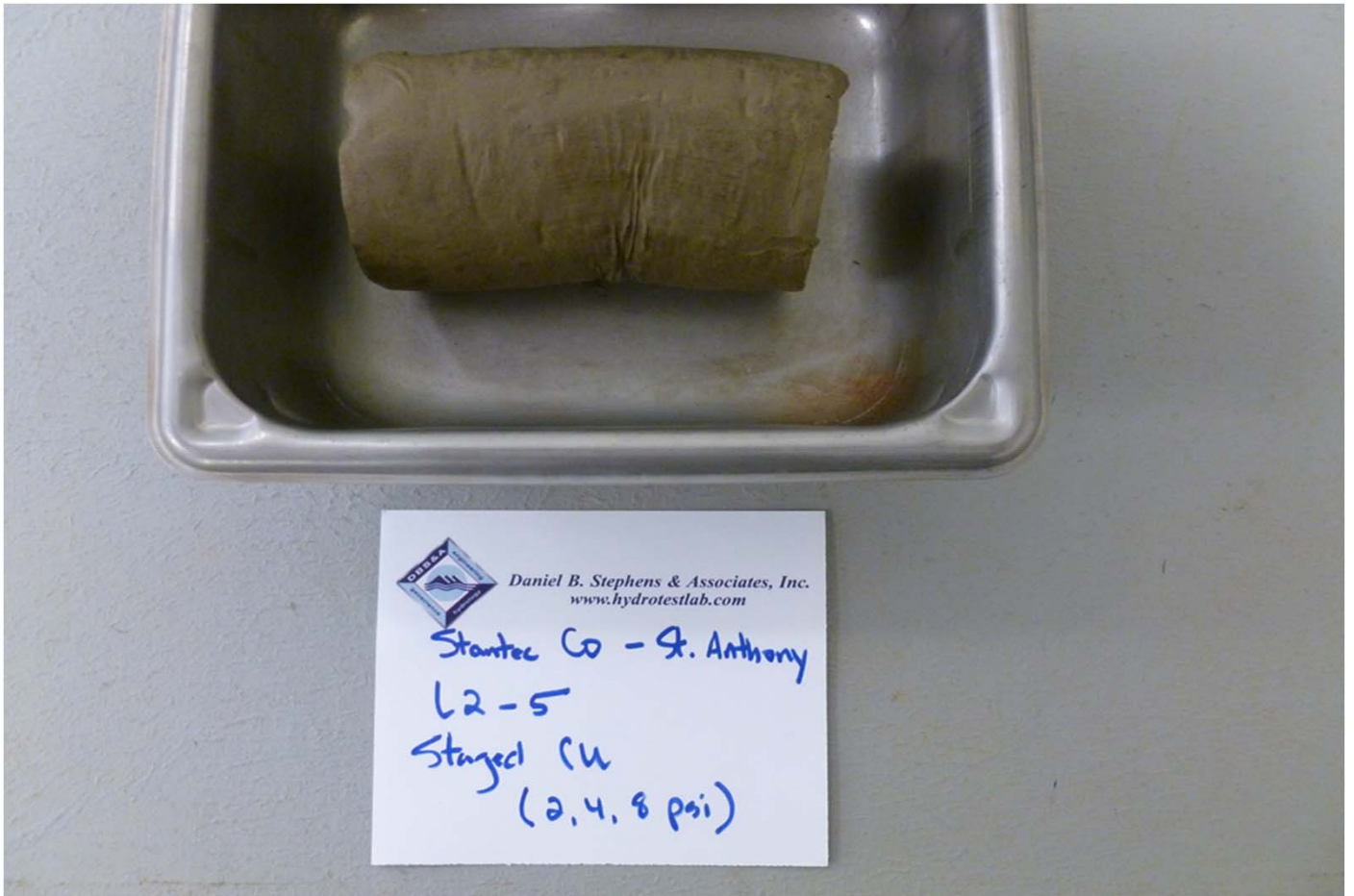
## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

### Photograph of Failure





## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 1

---

Date/Time Shear Initiated: 6/14/18 1205  
Date/Time Shear Completed: 6/14/18 1210

### Consolidation Data

---

Length (cm): 11.49  
Diameter (cm): 4.91  
Measured outflow (cm<sup>3</sup>): 0.513  
Area (cm<sup>2</sup>): 18.97  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 217.85  
Dry Density (g/cm<sup>3</sup>): 1.68  
Dry Unit Weight (lb/ft<sup>3</sup>): 105.16  
Equivalent Height of Solids (cm): 7.30  
Porosity (% vol): 36.4  
Void Ratio (e): 0.573  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.16

### Shear Data

---

Effective Consolidation Stress (psi): 1.97  
Total Back Pressure (psi): 80.68  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 4.5  
Effective Minor Stress at Failure (psi): 0.7  
Effective Major Stress at Failure (psi): 5.2  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 1.88  
Strain Rate (%/hr): 37.08

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

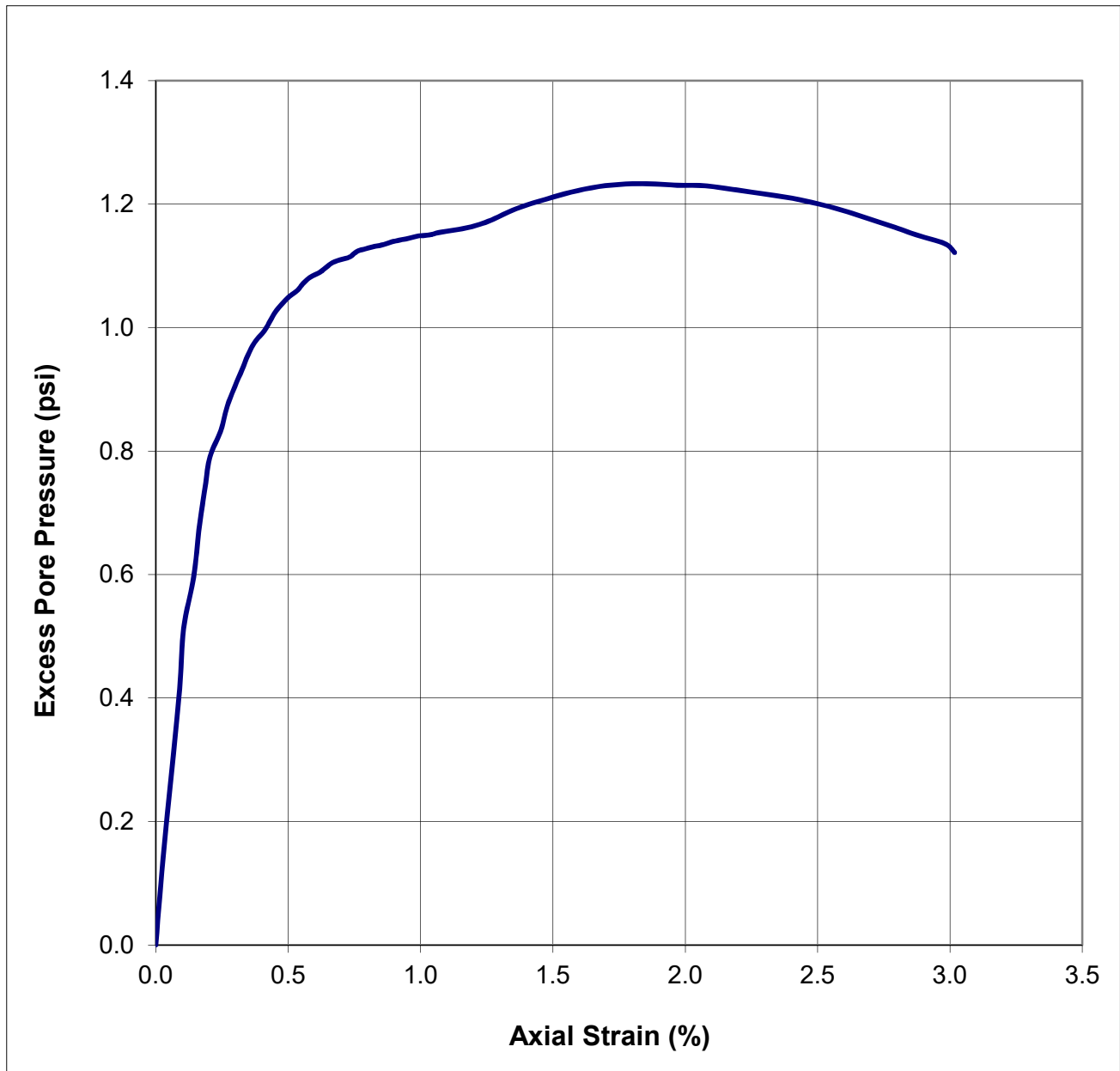
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

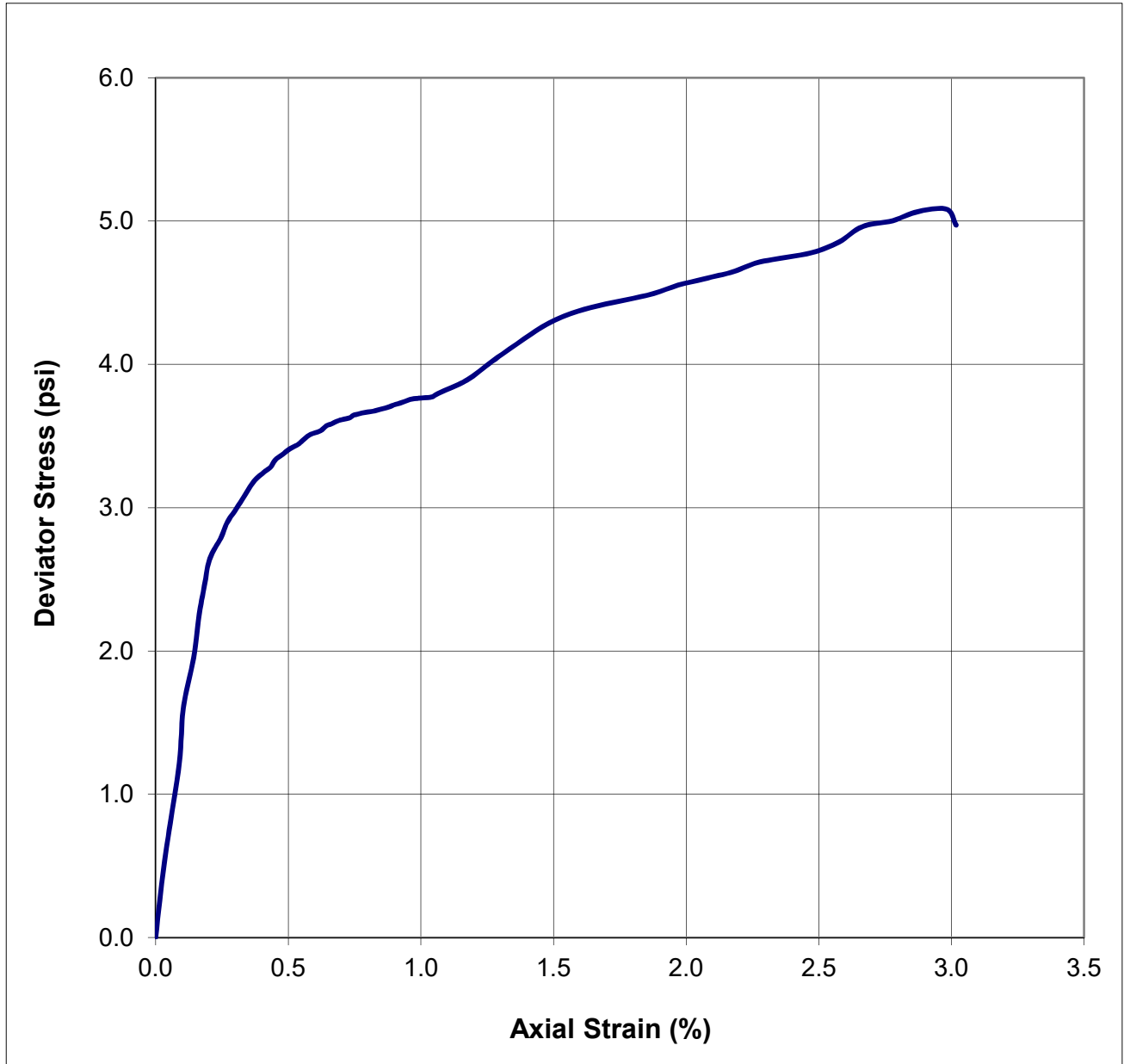




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

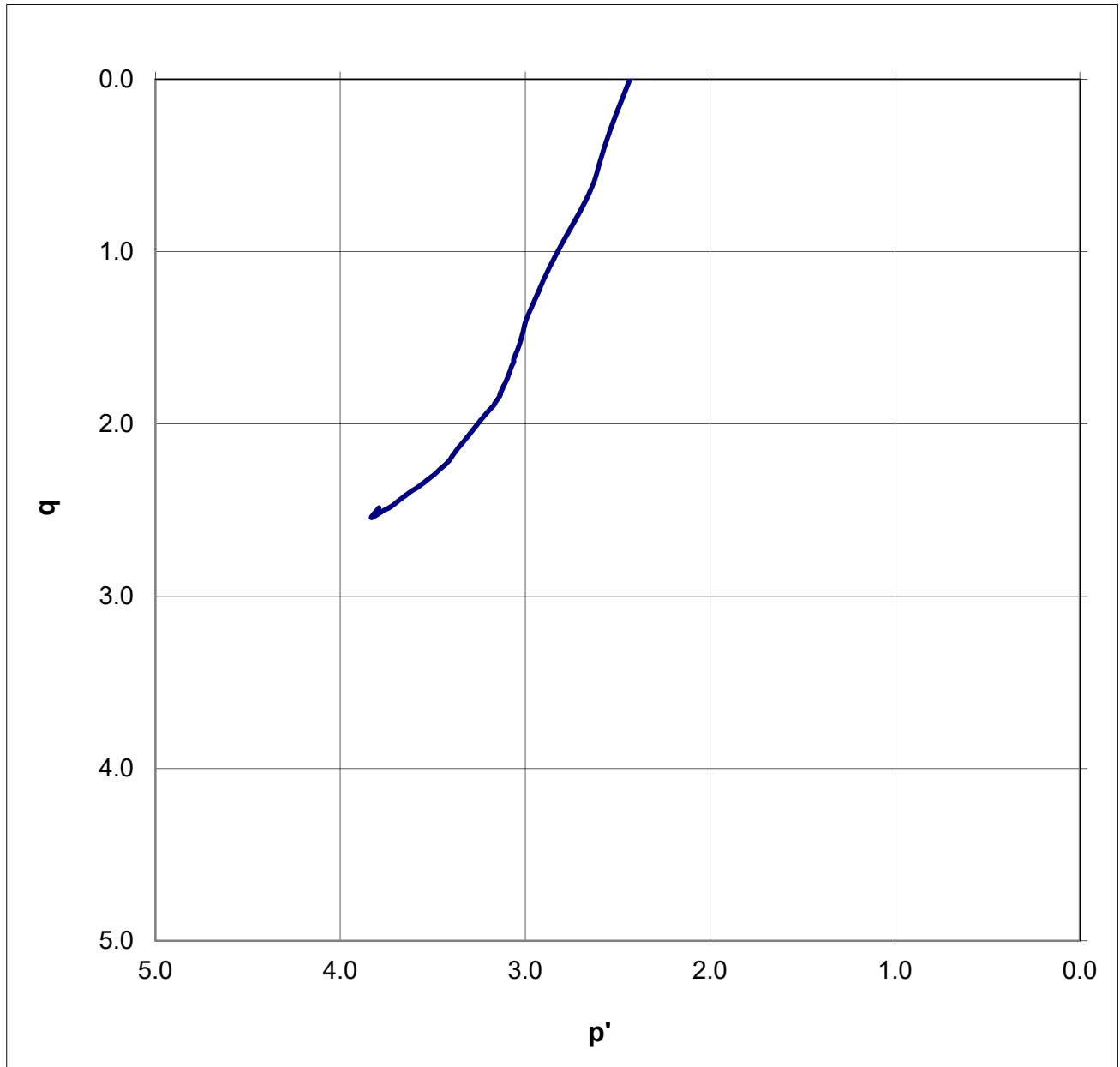




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'





**Data for Consolidated Undrained (CU) Triaxial Shear Testing**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

**Raw Data**

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
80.68	0.00	1.97	1.97				
80.84	0.03	2.31	1.81				
80.98	0.06	2.57	1.68				
81.10	0.09	2.79	1.56				
81.20	0.11	3.07	1.46				
81.28	0.14	3.33	1.37				
81.36	0.16	3.54	1.30				
81.42	0.18	3.69	1.24				
81.47	0.20	3.82	1.18				
81.52	0.25	3.93	1.14				
81.56	0.27	3.99	1.10				
81.59	0.30	4.04	1.07				
81.62	0.33	4.09	1.04				
81.64	0.35	4.14	1.01				
81.66	0.37	4.19	0.99				
81.68	0.41	4.23	0.98				
81.70	0.43	4.24	0.96				
81.71	0.45	4.28	0.95				
81.72	0.48	4.30	0.93				
81.73	0.50	4.33	0.92				
81.74	0.54	4.35	0.91				
81.75	0.55	4.37	0.90				
81.76	0.58	4.40	0.89				
81.77	0.62	4.42	0.88				
81.78	0.64	4.44	0.87				
81.79	0.66	4.45	0.87				
81.79	0.69	4.47	0.86				
81.80	0.73	4.48	0.86				
81.80	0.74	4.50	0.85				
81.81	0.76	4.50	0.84				
81.81	0.79	4.51	0.84				
81.81	0.82	4.51	0.84				
81.82	0.85	4.52	0.84				
81.82	0.87	4.53	0.83				
81.82	0.90	4.55	0.83				
81.83	0.93	4.56	0.83				
81.83	0.96	4.58	0.82				
81.83	0.99	4.58	0.82				
81.83	1.01	4.59	0.82				
81.83	1.04	4.59	0.82				
81.84	1.06	4.61	0.81				
81.85	1.17	4.70	0.81				
81.86	1.26	4.80	0.80				
81.88	1.36	4.92	0.78				
81.89	1.47	5.04	0.76				
81.90	1.57	5.11	0.75				
81.91	1.67	5.15	0.74				
81.92	1.77	5.18	0.73				
81.92	1.88	5.23	0.74				
81.91	1.97	5.29	0.74				
81.91	2.07	5.33	0.74				
81.91	2.18	5.39	0.74				
81.90	2.27	5.46	0.75				
81.90	2.38	5.50	0.75				
81.89	2.48	5.54	0.76				
81.88	2.58	5.63	0.77				
81.86	2.67	5.75	0.78				
81.85	2.78	5.80	0.80				
81.83	2.87	5.88	0.81				
81.82	2.98	5.91	0.83				
81.81	3.02	5.81	0.84				



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 2

---

Date/Time Shear Initiated: 6/14/18 1446  
Date/Time Shear Completed: 6/14/18 1501

### Consolidation Data

---

Length (cm): 11.43  
Diameter (cm): 4.91  
Measured outflow (cm<sup>3</sup>): 1.608  
Area (cm<sup>2</sup>): 18.97  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 216.76  
Dry Density (g/cm<sup>3</sup>): 1.69  
Dry Unit Weight (lb/ft<sup>3</sup>): 105.70  
Equivalent Height of Solids (cm): 7.30  
Porosity (% vol): 36.1  
Void Ratio (e): 0.565  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 1.49

### Shear Data

---

Effective Consolidation Stress (psi): 4.01  
Total Back Pressure (psi): 80.54  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 7.3  
Effective Minor Stress at Failure (psi): 2.0  
Effective Major Stress at Failure (psi): 9.4  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 0.97  
Strain Rate (%/hr): 12.11

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

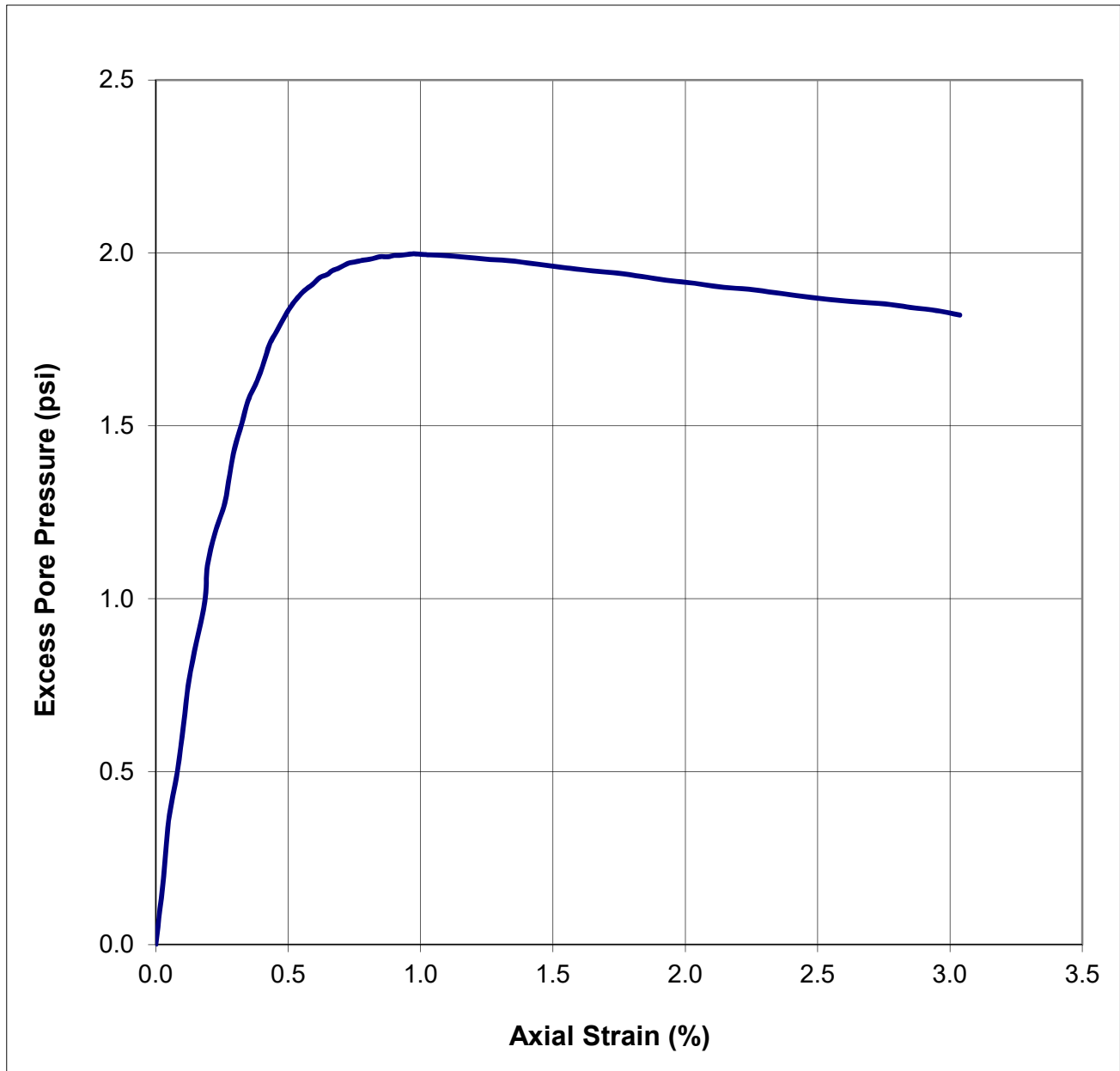
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain



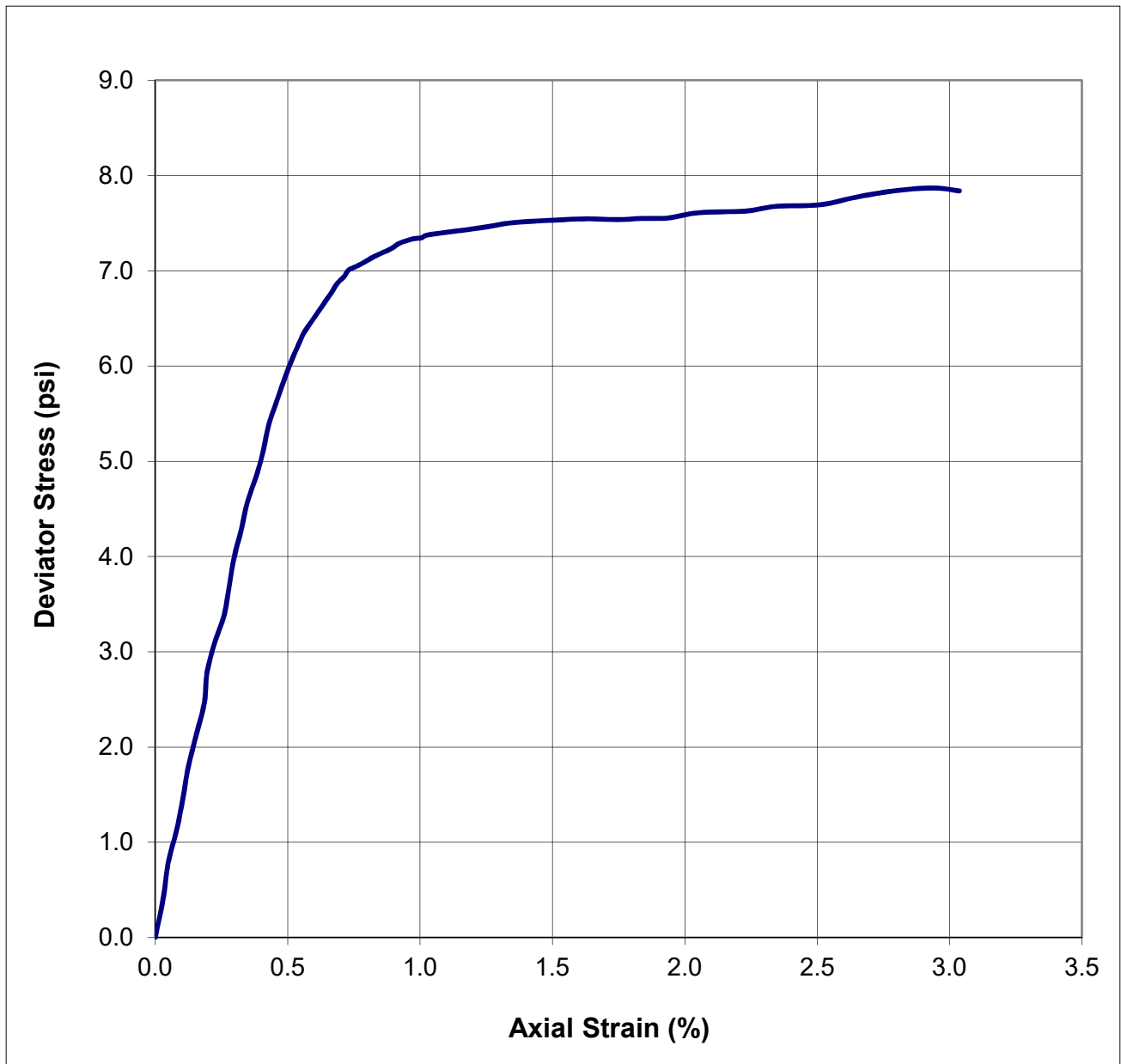




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

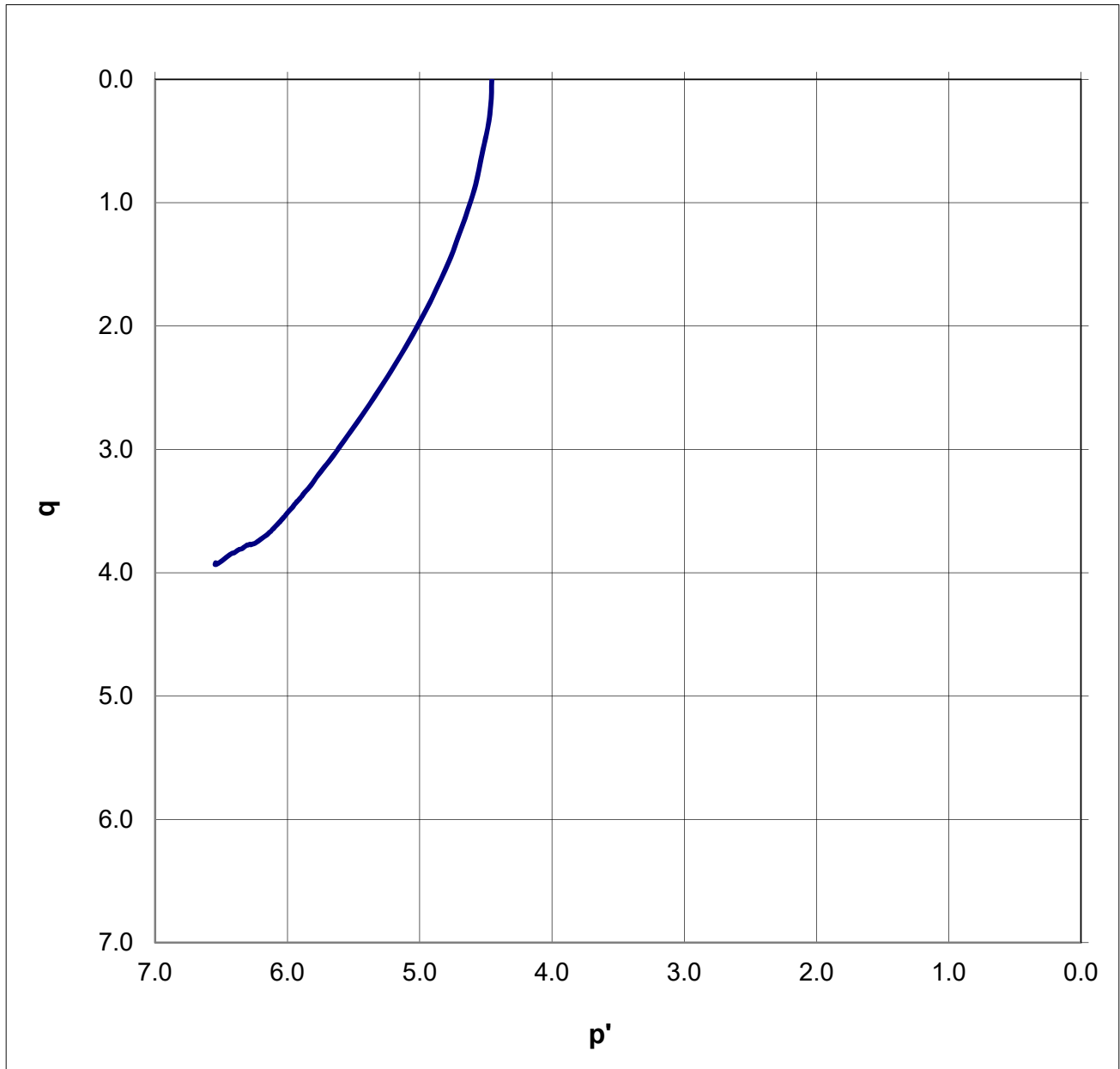




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'





**Data for Consolidated Undrained (CU) Triaxial Shear Testing**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

**Raw Data**

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
80.54	0.00	4.01	4.01				
80.74	0.03	4.23	3.81				
80.90	0.05	4.43	3.65				
81.04	0.08	4.65	3.51				
81.18	0.10	4.84	3.38				
81.30	0.12	5.04	3.25				
81.42	0.15	5.26	3.13				
81.54	0.19	5.49	3.02				
81.64	0.20	5.70	2.91				
81.73	0.22	5.91	2.82				
81.82	0.26	6.12	2.73				
81.90	0.28	6.34	2.65				
81.98	0.30	6.57	2.58				
82.05	0.33	6.79	2.51				
82.12	0.35	7.02	2.44				
82.17	0.38	7.24	2.38				
82.23	0.41	7.46	2.33				
82.28	0.43	7.67	2.28				
82.32	0.46	7.86	2.24				
82.36	0.49	8.05	2.20				
82.39	0.51	8.19	2.17				
82.41	0.54	8.34	2.15				
82.43	0.56	8.48	2.13				
82.45	0.59	8.58	2.11				
82.47	0.62	8.68	2.09				
82.48	0.65	8.78	2.08				
82.49	0.67	8.84	2.07				
82.50	0.69	8.93	2.06				
82.51	0.71	8.99	2.05				
82.51	0.73	9.05	2.05				
82.52	0.76	9.09	2.04				
82.52	0.79	9.12	2.04				
82.53	0.82	9.17	2.03				
82.53	0.84	9.20	2.03				
82.53	0.88	9.24	2.03				
82.54	0.90	9.27	2.02				
82.54	0.92	9.31	2.02				
82.54	0.95	9.33	2.02				
82.54	0.97	9.35	2.02				
82.54	1.01	9.37	2.02				
82.54	1.03	9.39	2.02				
82.53	1.14	9.44	2.02				
82.53	1.24	9.49	2.03				
82.52	1.33	9.54	2.04				
82.51	1.43	9.56	2.04				
82.50	1.54	9.59	2.05				
82.49	1.64	9.61	2.06				
82.48	1.74	9.61	2.07				
82.47	1.84	9.63	2.08				
82.46	1.93	9.64	2.09				
82.46	2.04	9.70	2.09				
82.44	2.14	9.73	2.11				
82.44	2.24	9.74	2.11				
82.43	2.34	9.80	2.12				
82.42	2.44	9.81	2.13				
82.41	2.54	9.84	2.14				
82.40	2.63	9.91	2.15				
82.40	2.75	9.97	2.15				
82.39	2.85	10.02	2.16				
82.38	2.95	10.04	2.17				
82.36	3.04	10.02	2.18				



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 3

Date/Time Shear Initiated: 6/15/18 1315  
Date/Time Shear Completed: 6/15/18 1345

### Consolidation Data

Length (cm): 11.44  
Diameter (cm): 4.91  
Measured outflow (cm<sup>3</sup>): 1.356  
Area (cm<sup>2</sup>): 18.97  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 217.01  
Dry Density (g/cm<sup>3</sup>): 1.69  
Dry Unit Weight (lb/ft<sup>3</sup>): 105.57  
Equivalent Height of Solids (cm): 7.30  
Porosity (% vol): 36.2  
Void Ratio (e): 0.567  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.80

### Shear Data

Effective Consolidation Stress (psi): 7.99  
Total Back Pressure (psi): 80.73  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 12.2  
Effective Minor Stress at Failure (psi): 3.3  
Effective Major Stress at Failure (psi): 15.4  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 1.13  
Strain Rate (%/hr): 29.86

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

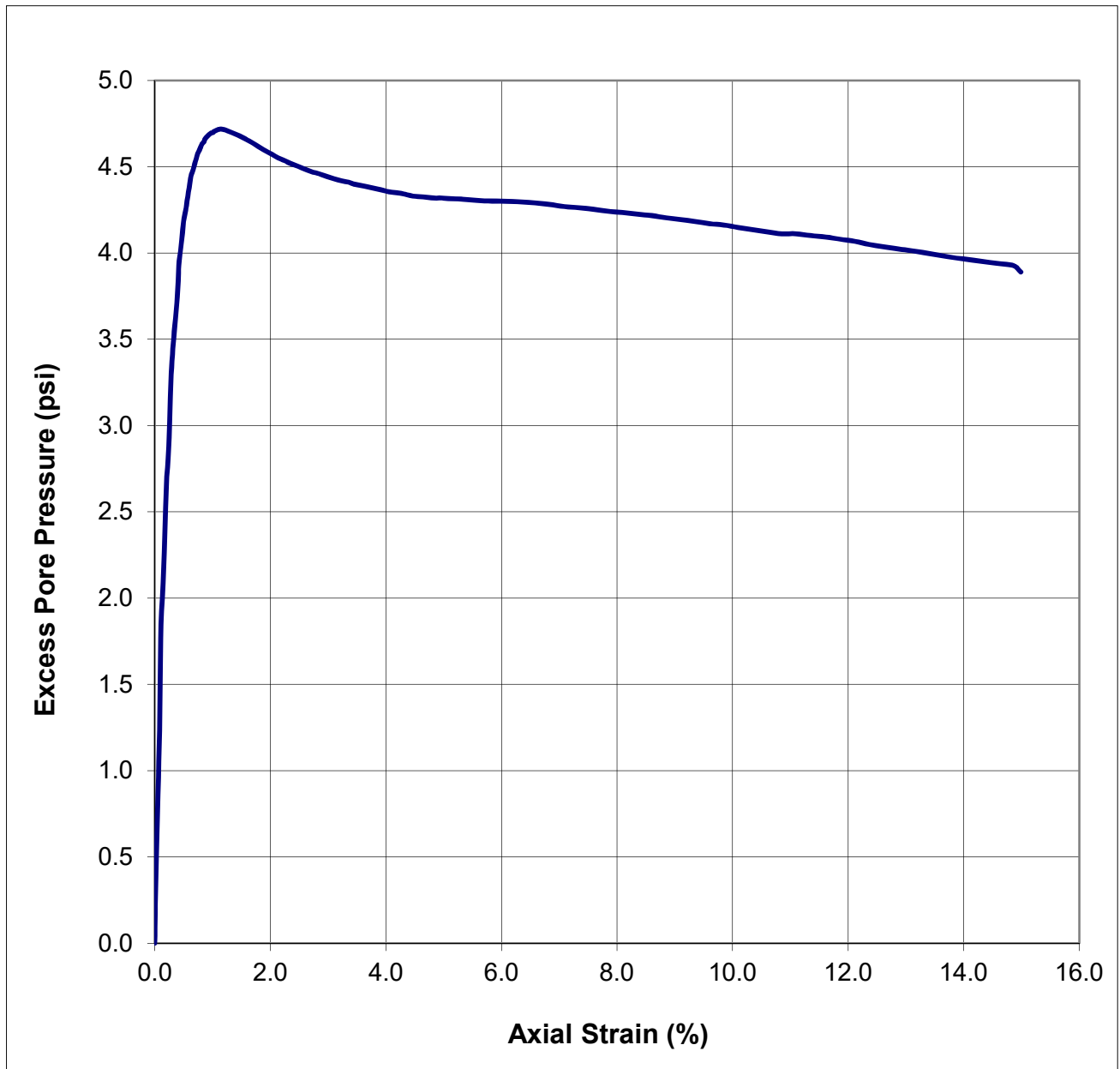
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

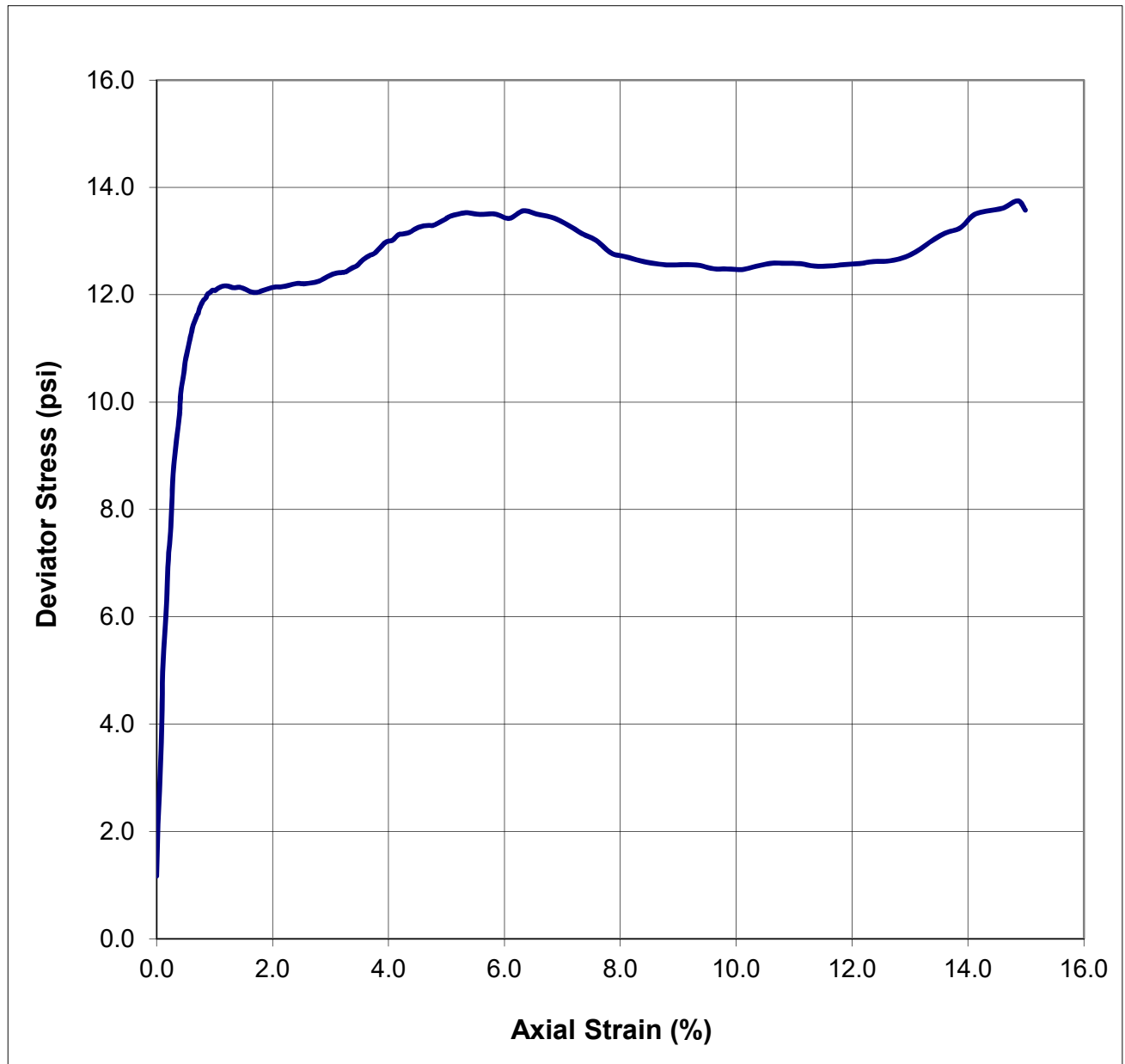




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

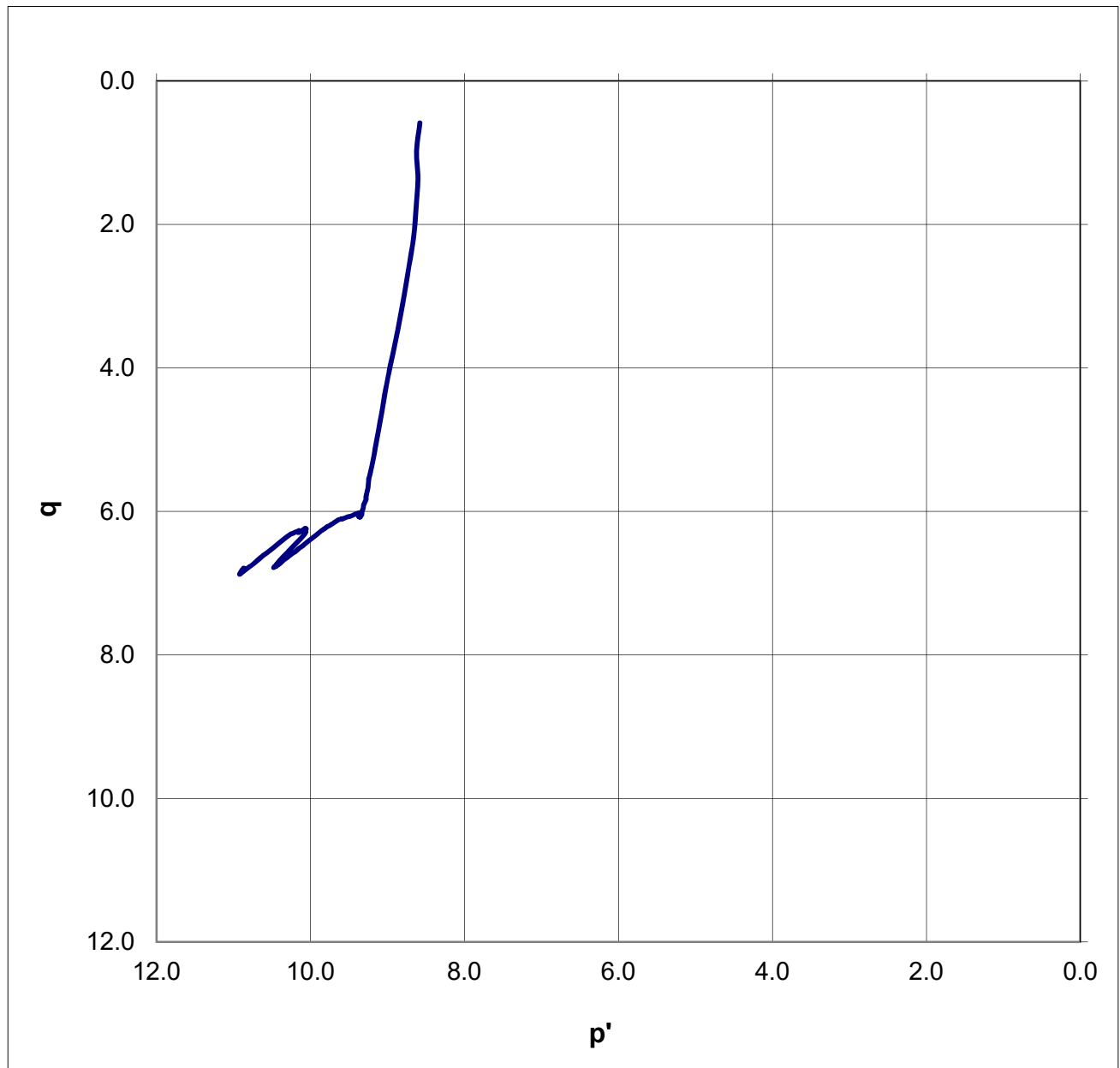




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs. p'





### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

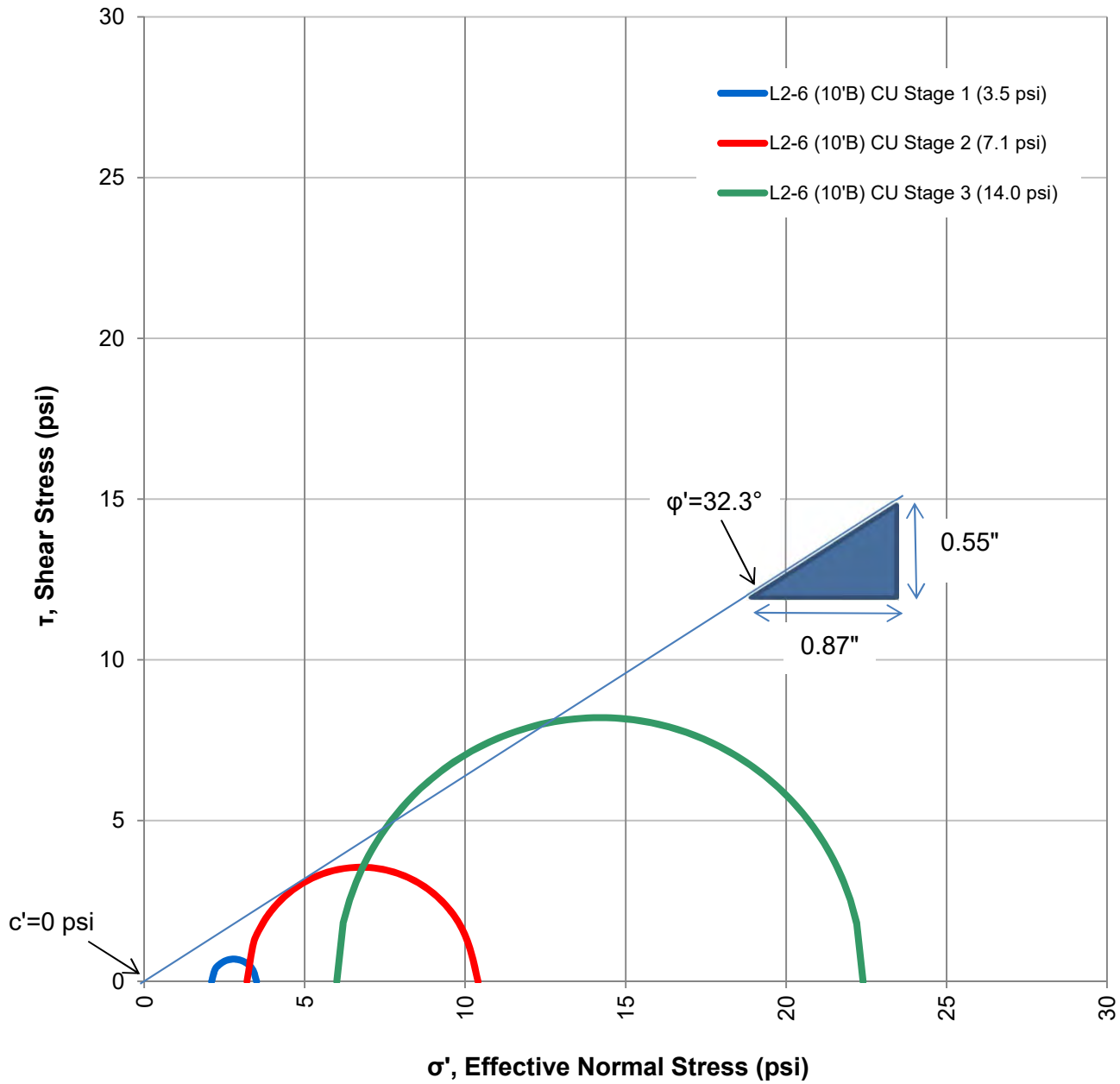
#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
80.73	0.00	9.16	7.99	85.15	3.15	15.98	3.57
81.08	0.02	9.59	7.65	85.14	3.26	16.00	3.57
81.49	0.05	9.97	7.24	85.14	3.35	16.07	3.58
81.88	0.08	10.42	6.84	85.12	3.45	16.13	3.59
82.25	0.09	10.85	6.47	85.12	3.55	16.24	3.60
82.57	0.11	11.29	6.15	85.11	3.66	16.33	3.60
82.87	0.15	11.70	5.85	85.10	3.76	16.39	3.61
83.14	0.18	12.07	5.58	85.10	3.86	16.50	3.62
83.38	0.20	12.41	5.34	85.09	3.96	16.61	3.63
83.58	0.24	12.72	5.14	85.08	4.07	16.65	3.63
83.77	0.26	13.00	4.95	85.08	4.17	16.76	3.64
83.94	0.28	13.24	4.78	85.07	4.25	16.77	3.64
84.10	0.30	13.47	4.62	85.06	4.37	16.81	3.65
84.24	0.33	13.65	4.48	85.06	4.47	16.89	3.66
84.36	0.36	13.84	4.36	85.05	4.57	16.93	3.66
84.48	0.39	13.99	4.24	85.05	4.67	16.95	3.66
84.58	0.41	14.14	4.14	85.05	4.77	16.96	3.67
84.68	0.42	14.27	4.04	85.04	4.87	17.02	3.67
84.76	0.46	14.39	3.96	85.04	4.97	17.07	3.67
84.84	0.48	14.51	3.88	85.04	5.07	17.14	3.67
84.91	0.50	14.61	3.81	85.04	5.33	17.21	3.68
84.97	0.53	14.71	3.75	85.03	5.58	17.18	3.69
85.03	0.56	14.80	3.69	85.03	5.84	17.20	3.69
85.08	0.58	14.85	3.64	85.03	6.08	17.12	3.69
85.13	0.61	14.91	3.59	85.02	6.33	17.26	3.70
85.17	0.63	14.98	3.55	85.02	6.58	17.20	3.70
85.21	0.66	15.04	3.51	85.01	6.82	17.15	3.71
85.24	0.69	15.08	3.48	85.00	7.09	17.03	3.72
85.27	0.72	15.11	3.45	84.99	7.34	16.87	3.73
85.30	0.74	15.16	3.42	84.98	7.59	16.75	3.74
85.32	0.76	15.21	3.40	84.97	7.84	16.53	3.75
85.33	0.79	15.24	3.39	84.96	8.09	16.46	3.75
85.36	0.81	15.27	3.36	84.95	8.35	16.39	3.76
85.37	0.85	15.29	3.35	84.94	8.60	16.35	3.77
85.38	0.86	15.32	3.33	84.93	8.85	16.34	3.78
85.39	0.89	15.35	3.32	84.92	9.10	16.35	3.79
85.41	0.92	15.35	3.31	84.91	9.35	16.35	3.80
85.42	0.95	15.38	3.30	84.90	9.60	16.30	3.81
85.42	0.98	15.38	3.30	84.89	9.85	16.30	3.82
85.42	1.01	15.37	3.29	84.87	10.10	16.31	3.84
85.43	1.02	15.38	3.29	84.86	10.35	16.38	3.85
85.44	1.13	15.43	3.28	84.85	10.61	16.44	3.86
85.44	1.22	15.44	3.28	84.84	10.85	16.45	3.87
85.42	1.32	15.43	3.29	84.84	11.10	16.45	3.87
85.41	1.43	15.45	3.31	84.83	11.35	16.41	3.88
85.39	1.54	15.43	3.33	84.82	11.62	16.42	3.89
85.38	1.63	15.40	3.34	84.81	11.85	16.46	3.90
85.36	1.74	15.41	3.36	84.79	12.12	16.49	3.91
85.33	1.83	15.47	3.38	84.78	12.36	16.55	3.93
85.32	1.93	15.51	3.40	84.76	12.61	16.57	3.94
85.30	2.03	15.56	3.42	84.75	12.87	16.64	3.95
85.28	2.14	15.59	3.44	84.74	13.10	16.76	3.96
85.26	2.25	15.62	3.46	84.73	13.37	16.98	3.98
85.25	2.34	15.66	3.47	84.71	13.61	17.14	3.99
85.23	2.44	15.70	3.48	84.70	13.87	17.25	4.00
85.22	2.54	15.70	3.50	84.69	14.11	17.50	4.01
85.21	2.64	15.73	3.51	84.68	14.37	17.59	4.03
85.19	2.74	15.76	3.52	84.66	14.60	17.65	4.03
85.19	2.84	15.80	3.53	84.65	14.86	17.80	4.05
85.17	2.94	15.88	3.54	84.62	14.99	17.66	4.08
85.16	3.05	15.95	3.56				



# Mohr's Circles: Effective

## L2-6 (10'B) CU



**Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:**  
 cohesion ( $c'$ )(psi) = 0  
 friction angle ( $\phi'$ )( $^\circ$ ) = 32.3

<sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Remolded or Initial Sample Properties

Initial Mass (g): 365.40  
Length (cm): 11.35  
Diameter (cm): 4.81  
Area (cm<sup>2</sup>): 18.15  
Volume (cm<sup>3</sup>): 205.89  
Dry Mass (g): 320.37  
Dry Density (g/cm<sup>3</sup>): 1.56  
Dry Unit Weight (lb/ft<sup>3</sup>): 97.14  
Equivalent Height of Solids (cm): 6.66  
Water Content (% g/g): 14.1  
Water Content (% vol): 21.9  
Water Content Based On:  Cuttings  Whole Specimen  
Porosity (% vol): 41.3  
Void Ratio (e): 0.703  
Saturation (%): 53.0

### Test and Sample Conditions

Height to Diameter Ratio: 2.4  
Largest Particle Dimension (approx.) (cm): 0.475  
Diameter to Largest Particle Ratio (approx.): 10.12  
Visual Description of Sample: Clayey Silt-Brittle  
USCS Classification: NA  
Plastic Limit: NA  
Liquid Limit: NA  
Sample Preparation:  In situ sample, extruded  Remolded Sample  
Trimming Procedure: NA  
Split: NA  
Percent Coarse Material (%): <5%  
Particle Density (g/cm<sup>3</sup>): 2.65  Assumed  Measured  
B-Value Post Saturation: 0.96  
Method for Specimen Saturation:  Dry  Wet

Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



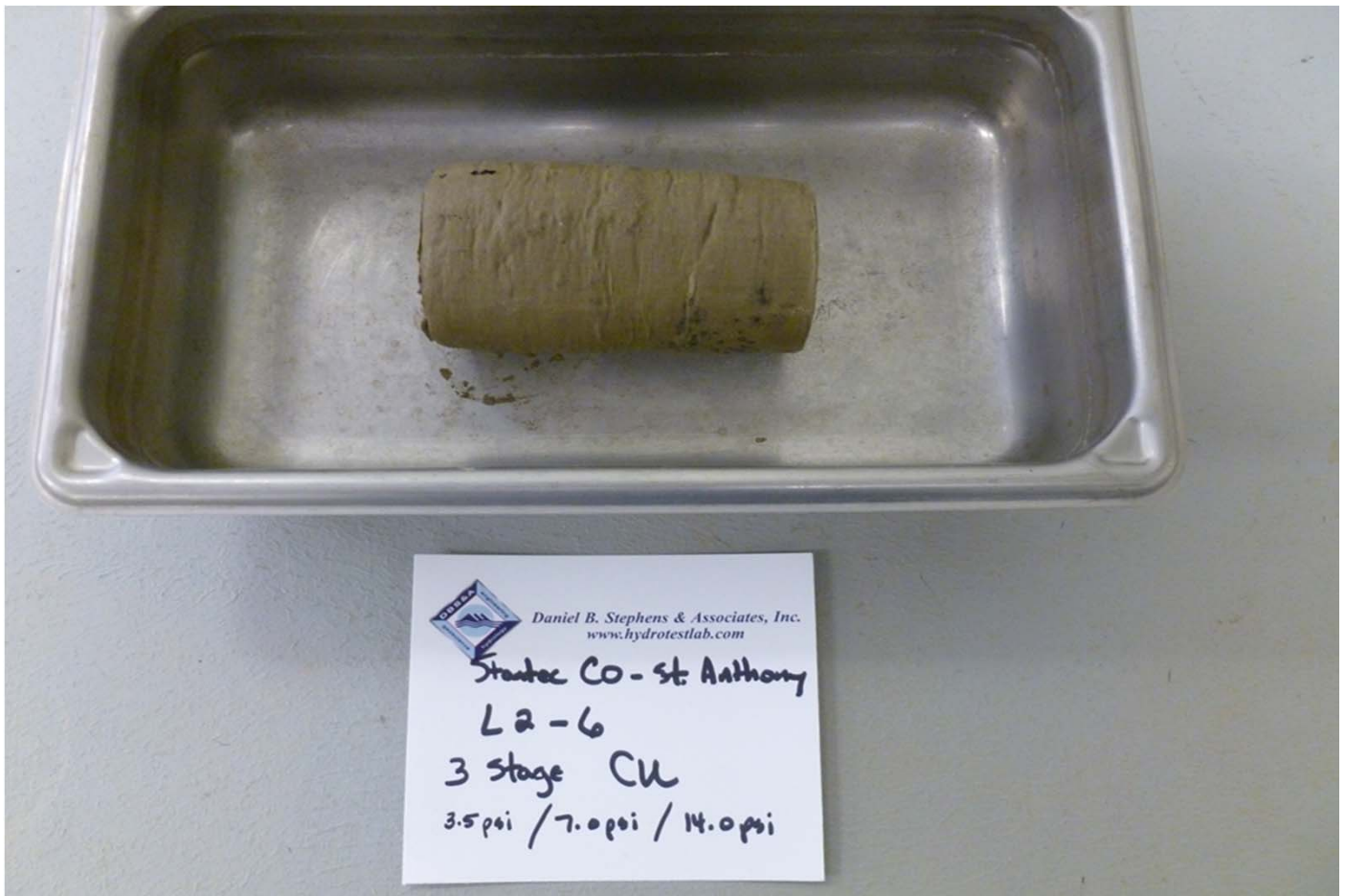
## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

### Photograph of Failure





## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 1

---

Date/Time Shear Initiated: 6/6/18 1513  
Date/Time Shear Completed: 6/6/18 1514

### Consolidation Data

---

Length (cm): 11.21  
Diameter (cm): 4.81  
Measured outflow (cm<sup>3</sup>): 2.46  
Area (cm<sup>2</sup>): 18.15  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 203.43  
Dry Density (g/cm<sup>3</sup>): 1.57  
Dry Unit Weight (lb/ft<sup>3</sup>): 98.32  
Equivalent Height of Solids (cm): 6.66  
Porosity (% vol): 40.6  
Void Ratio (e): 0.683  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.32

### Shear Data

---

Effective Consolidation Stress (psi): 3.48  
Total Back Pressure (psi): 81.60  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 1.4  
Effective Minor Stress at Failure (psi): 2.1  
Effective Major Stress at Failure (psi): 3.5  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 0.69  
Strain Rate (%/hr): 57.0

#### Test Notes:

Test was halted prior to reaching a maximum target of 3% strain, after a reduction in deviator stress was recorded. Failure was interpreted as the peak deviator stress achieved.

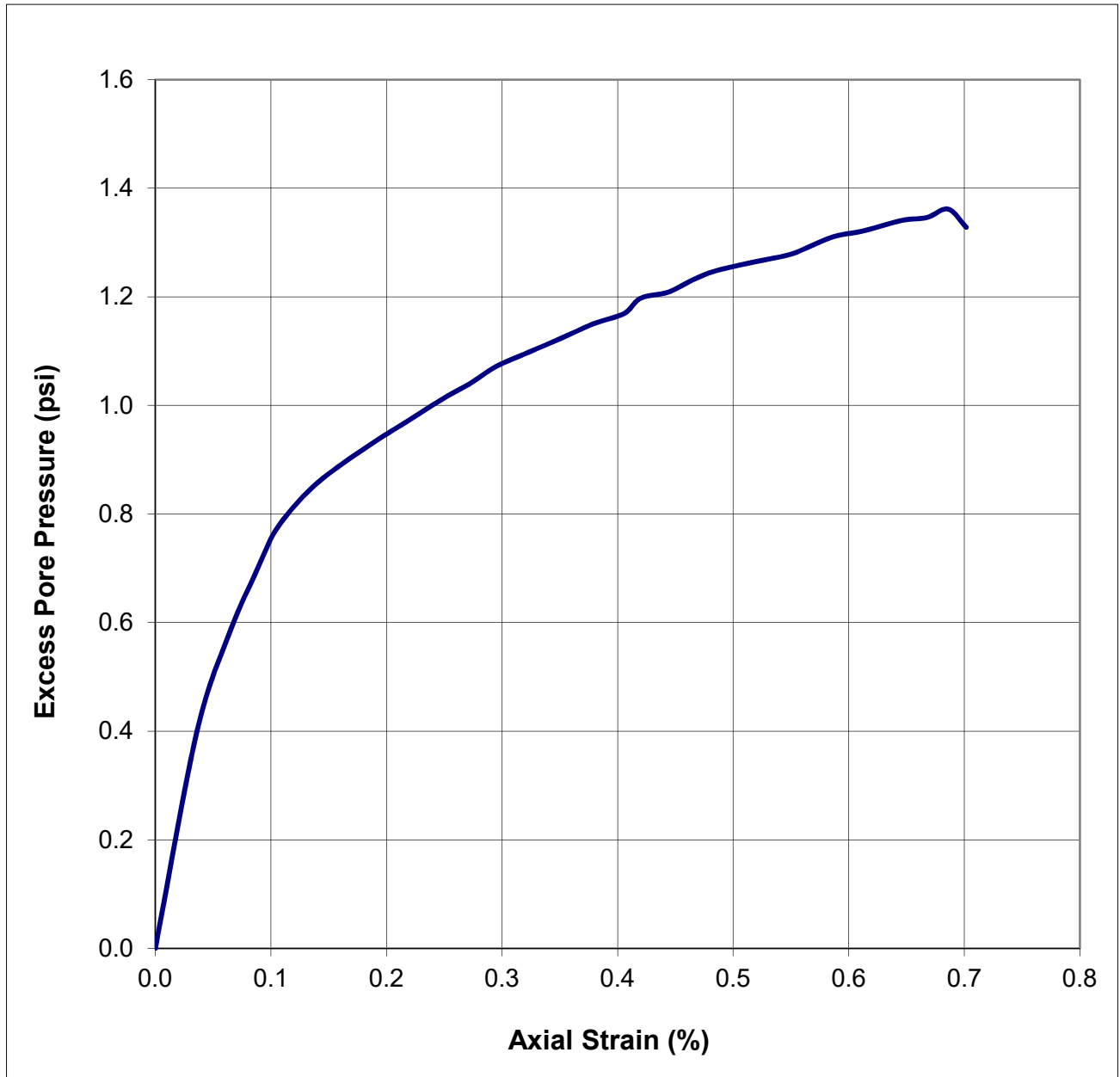
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

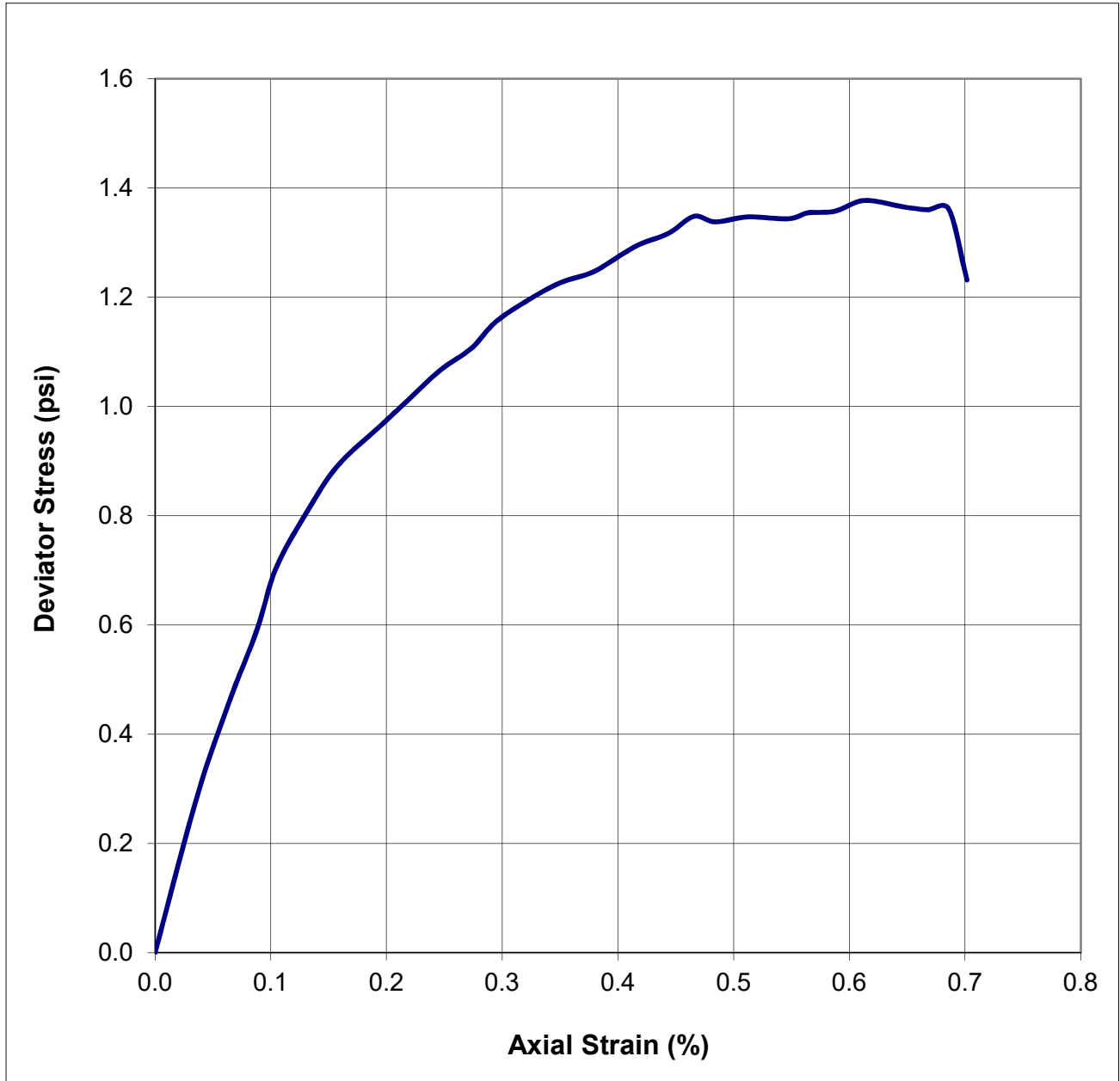




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

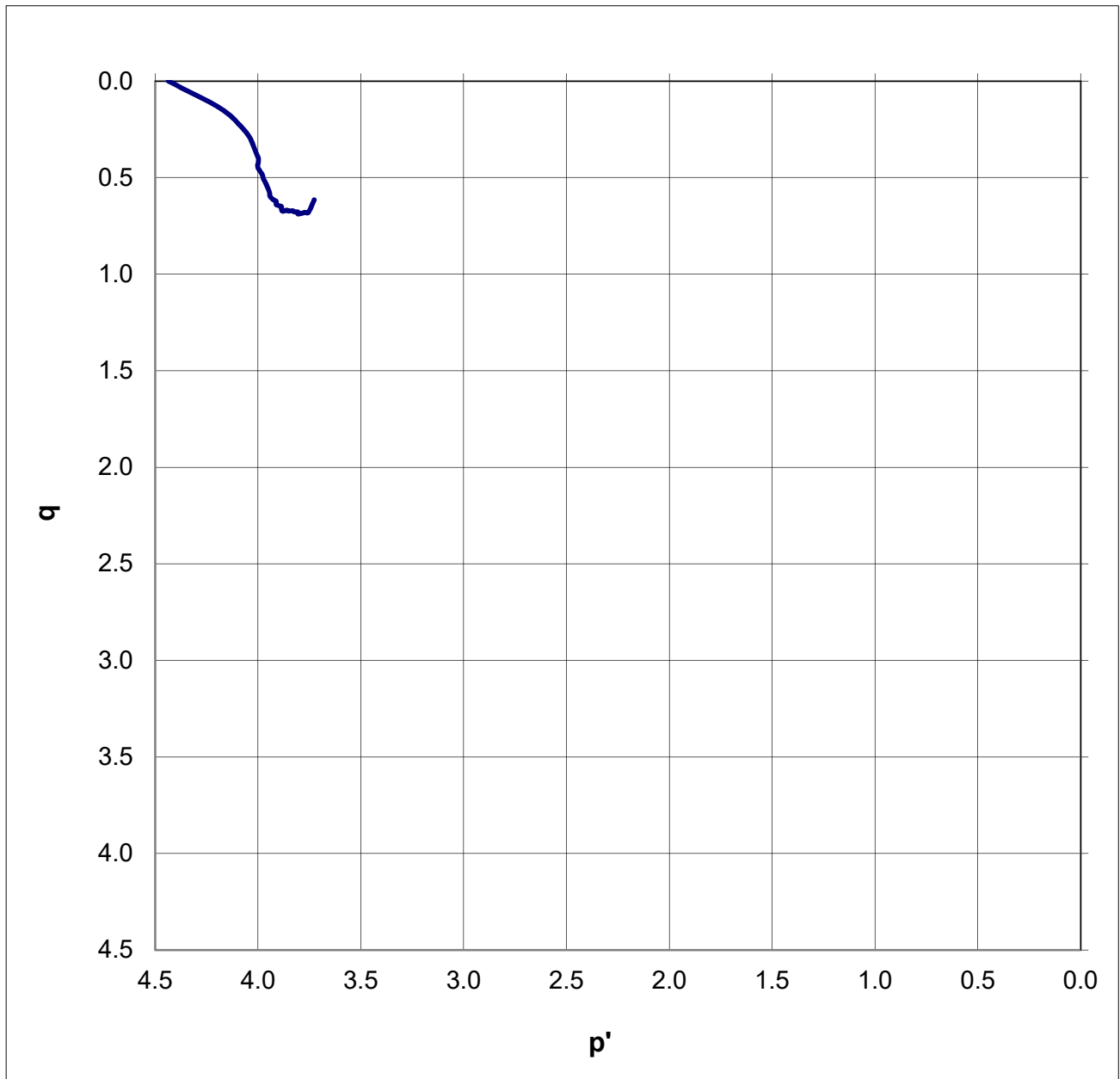




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'





**Data for Consolidated Undrained (CU) Triaxial Shear Testing**

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

**Raw Data**

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
81.60	0.00	3.48	3.48				
82.00	0.04	3.37	3.08				
82.18	0.06	3.36	2.90				
82.29	0.09	3.38	2.79				
82.37	0.10	3.41	2.71				
82.44	0.13	3.45	2.64				
82.48	0.16	3.49	2.60				
82.54	0.19	3.51	2.54				
82.57	0.22	3.52	2.51				
82.60	0.25	3.54	2.47				
82.64	0.27	3.55	2.44				
82.67	0.29	3.57	2.41				
82.69	0.32	3.58	2.39				
82.72	0.35	3.59	2.36				
82.75	0.38	3.58	2.33				
82.77	0.41	3.60	2.31				
82.79	0.42	3.58	2.28				
82.81	0.44	3.59	2.27				
82.83	0.47	3.60	2.25				
82.84	0.48	3.57	2.24				
82.86	0.51	3.57	2.22				
82.87	0.55	3.55	2.21				
82.89	0.56	3.55	2.19				
82.91	0.59	3.53	2.17				
82.92	0.61	3.54	2.16				
82.94	0.65	3.51	2.14				
82.94	0.67	3.50	2.14				
82.96	0.69	3.48	2.12				
82.92	0.70	3.39	2.16				





## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 2

---

Date/Time Shear Initiated: 6/7/18 825  
Date/Time Shear Completed: 6/7/18 841

### Consolidation Data

---

Length (cm): 11.20  
Diameter (cm): 4.81  
Measured outflow (cm<sup>3</sup>): 2.60  
Area (cm<sup>2</sup>): 18.15  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 203.30  
Dry Density (g/cm<sup>3</sup>): 1.58  
Dry Unit Weight (lb/ft<sup>3</sup>): 98.38  
Equivalent Height of Solids (cm): 6.66  
Porosity (% vol): 40.5  
Void Ratio (e): 0.682  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 0.5

### Shear Data

---

Effective Consolidation Stress (psi): 7.06  
Total Back Pressure (psi): 81.58  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 7.1  
Effective Minor Stress at Failure (psi): 3.2  
Effective Major Stress at Failure (psi): 10.3  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 3.02  
Strain Rate (%/hr): 11.1

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

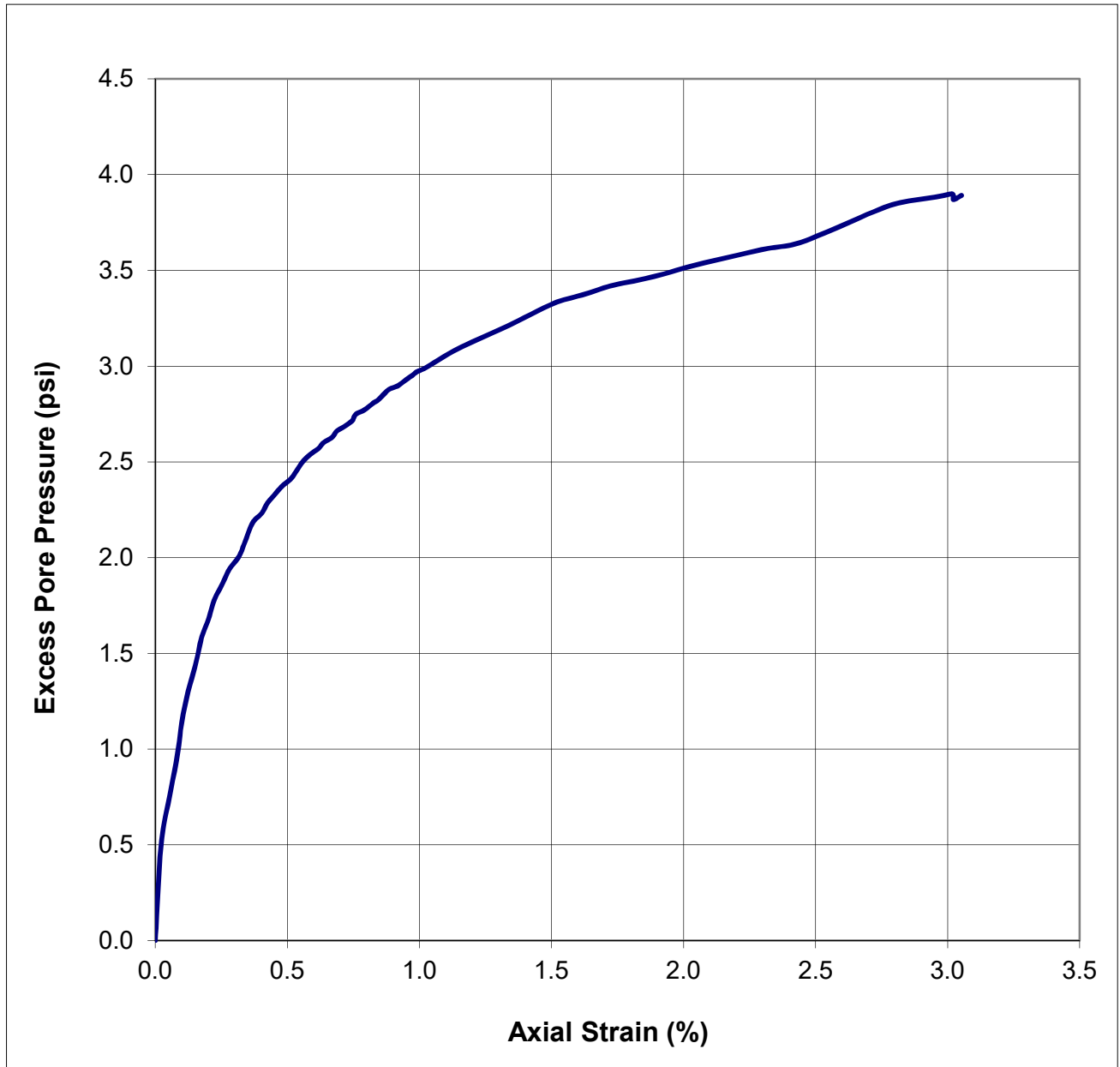
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

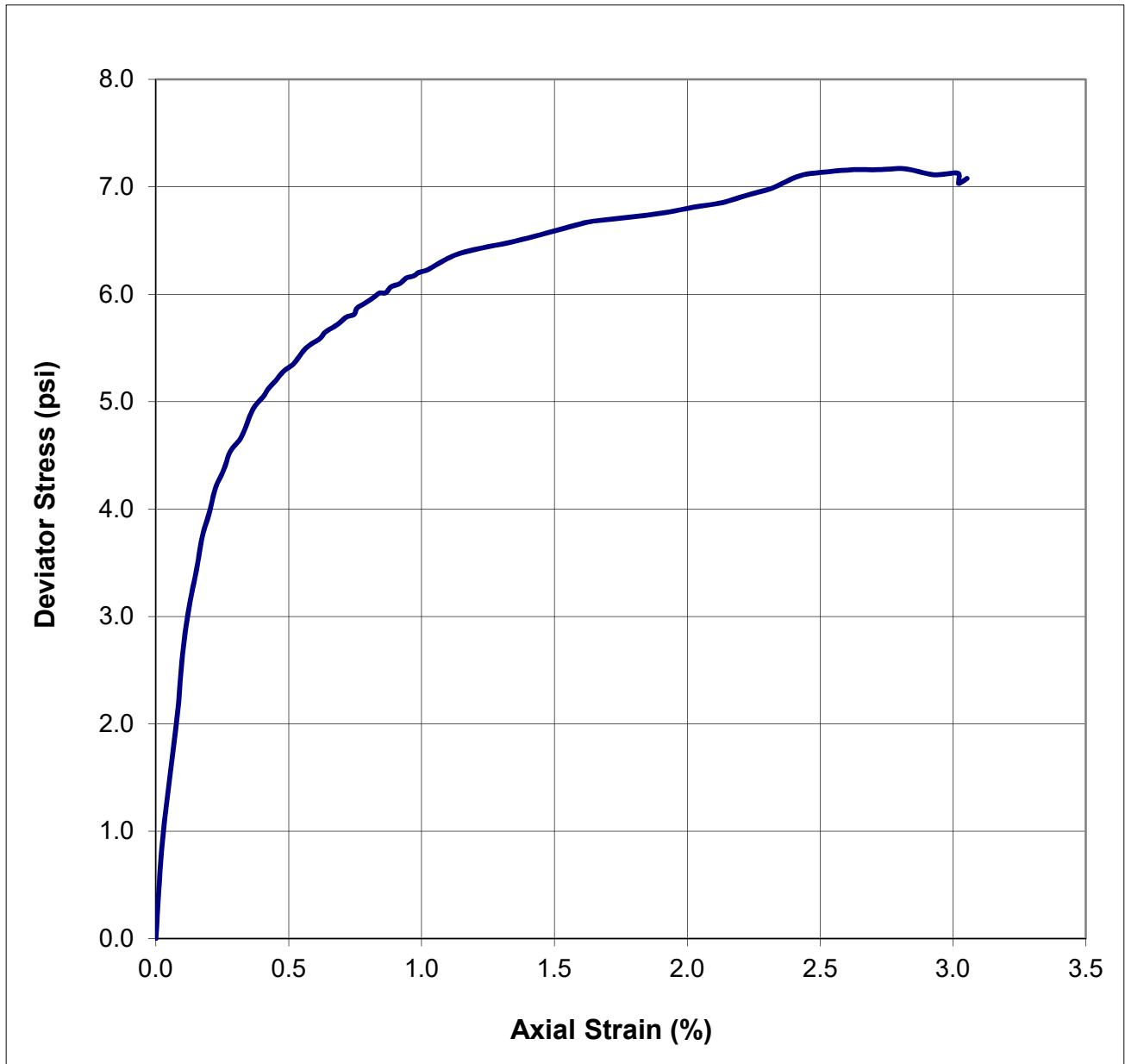




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain

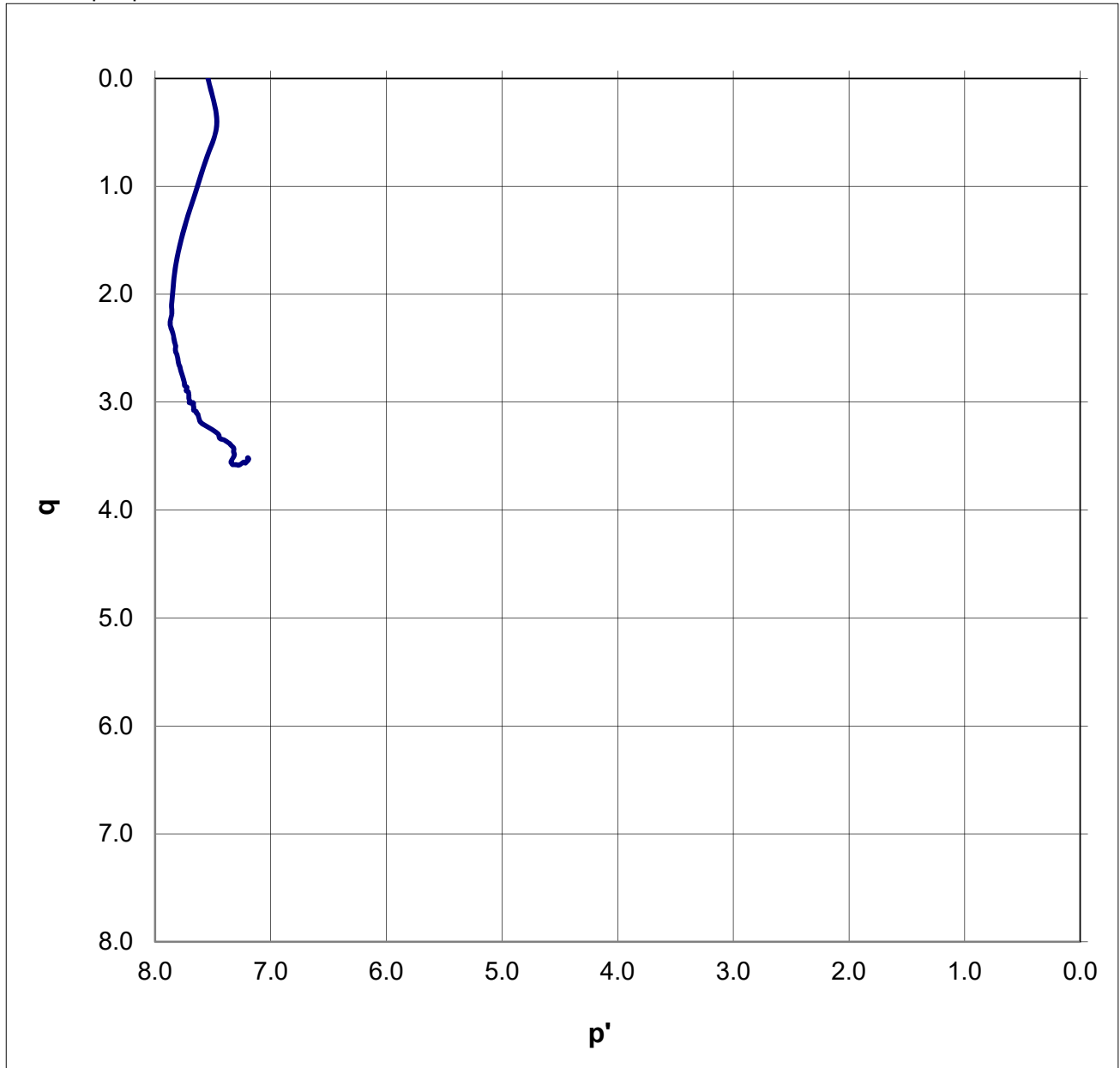




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'





### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
81.58	0.00	7.06	7.06	85.47	3.02	10.24	3.18
82.08	0.02	7.40	6.57	85.45	3.02	10.23	3.20
82.33	0.05	7.86	6.31	85.47	3.05	10.26	3.18
82.54	0.08	8.24	6.10				
82.72	0.10	8.57	5.92				
82.88	0.12	8.84	5.76				
83.02	0.15	9.06	5.62				
83.16	0.18	9.23	5.48				
83.26	0.20	9.35	5.37				
83.36	0.22	9.47	5.28				
83.44	0.25	9.55	5.19				
83.52	0.28	9.65	5.12				
83.58	0.32	9.70	5.05				
83.65	0.34	9.73	4.98				
83.71	0.35	9.78	4.92				
83.77	0.37	9.82	4.86				
83.81	0.40	9.86	4.82				
83.86	0.42	9.89	4.77				
83.91	0.45	9.92	4.72				
83.95	0.48	9.95	4.67				
83.99	0.52	9.97	4.63				
84.04	0.54	10.00	4.59				
84.08	0.56	10.02	4.54				
84.12	0.59	10.04	4.51				
84.15	0.62	10.06	4.48				
84.18	0.64	10.09	4.44				
84.21	0.67	10.11	4.41				
84.24	0.69	10.10	4.38				
84.26	0.72	10.14	4.35				
84.29	0.75	10.13	4.32				
84.32	0.76	10.16	4.29				
84.35	0.79	10.19	4.26				
84.38	0.83	10.21	4.23				
84.40	0.84	10.22	4.21				
84.43	0.87	10.19	4.18				
84.46	0.89	10.22	4.15				
84.47	0.92	10.23	4.13				
84.50	0.94	10.26	4.11				
84.53	0.97	10.25	4.08				
84.55	0.99	10.26	4.06				
84.57	1.02	10.26	4.03				
84.65	1.12	10.31	3.95				
84.72	1.23	10.30	3.87				
84.78	1.33	10.28	3.80				
84.85	1.42	10.27	3.73				
84.91	1.52	10.27	3.67				
84.95	1.62	10.29	3.62				
85.00	1.72	10.27	3.57				
85.03	1.82	10.26	3.54				
85.06	1.93	10.26	3.49				
85.10	2.03	10.26	3.45				
85.13	2.13	10.26	3.41				
85.16	2.22	10.30	3.38				
85.19	2.32	10.33	3.34				
85.22	2.42	10.41	3.31				
85.27	2.53	10.42	3.28				
85.33	2.63	10.42	3.27				
85.38	2.72	10.40	3.24				
85.43	2.82	10.37	3.21				
85.45	2.93	10.30	3.19				
85.48	3.02	10.30	3.17				



## Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

### Stage 3

Date/Time Shear Initiated: 6/7/18 1254  
Date/Time Shear Completed: 6/7/18 1437

### Consolidation Data

Length (cm): 11.08  
Diameter (cm): 4.81  
Measured outflow (cm<sup>3</sup>): 4.85  
Area (cm<sup>2</sup>): 18.15  
Area Determined by Method:  A  B  
Volume (cm<sup>3</sup>): 201.04  
Dry Density (g/cm<sup>3</sup>): 1.59  
Dry Unit Weight (lb/ft<sup>3</sup>): 99.48  
Equivalent Height of Solids (cm): 6.66  
Porosity (% vol): 39.9  
Void Ratio (e): 0.663  
Time to 50% Primary Consol. (t<sub>50</sub>) (min): 2.06

### Shear Data

Effective Consolidation Stress (psi): 14.01  
Total Back Pressure (psi): 81.60  
Failure Criterion: Peak  
Deviator Stress at Failure (psi): 16.3  
Effective Minor Stress at Failure (psi): 6.0  
Effective Major Stress at Failure (psi): 22.4  
Membrane Correction Required/Applied:  Yes  No  
Axial Strain (ε) at Failure (%): 11.74  
Strain Rate (%/hr): 8.7

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

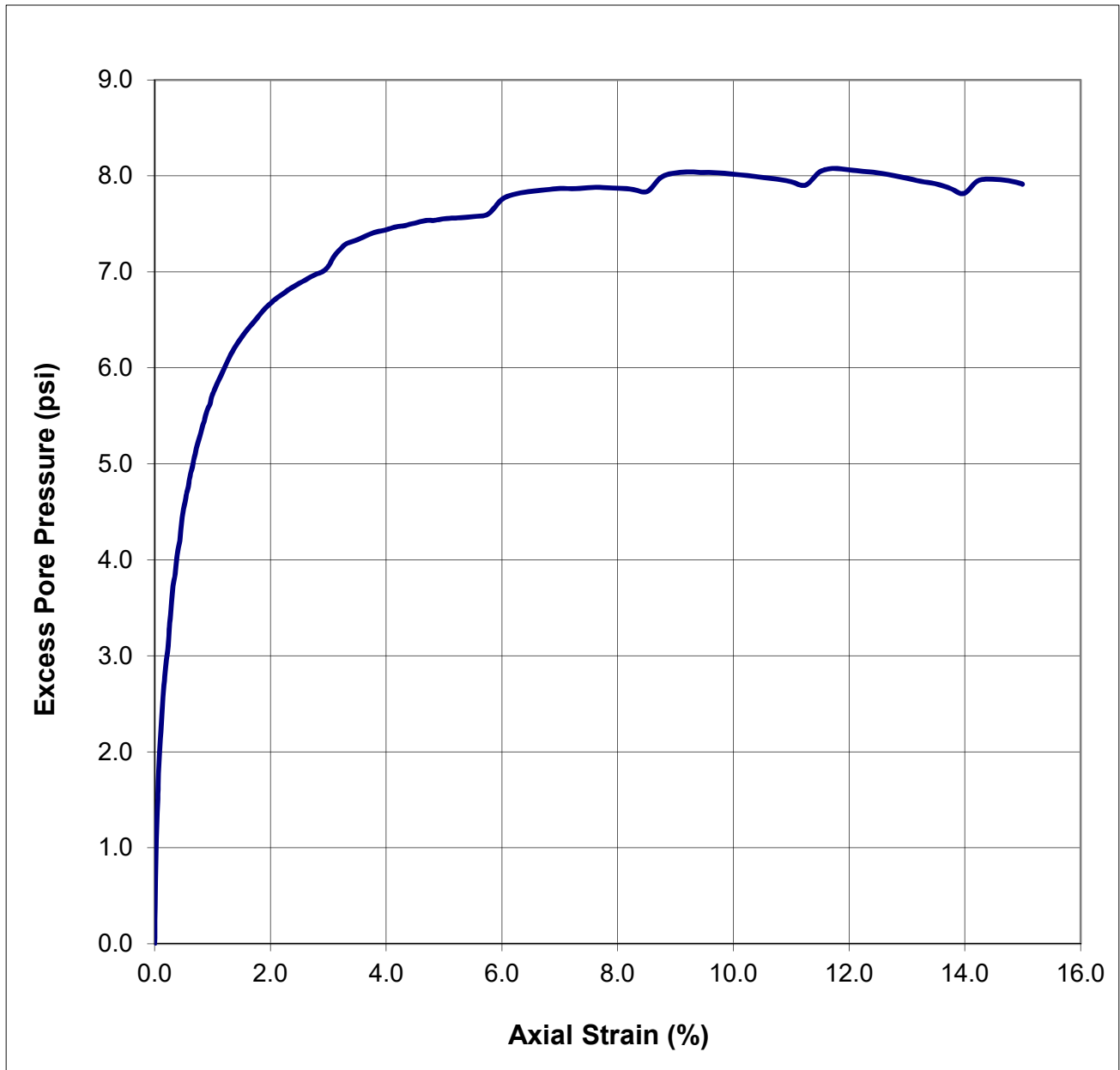
Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Excess Pore Pressure vs. Axial Strain

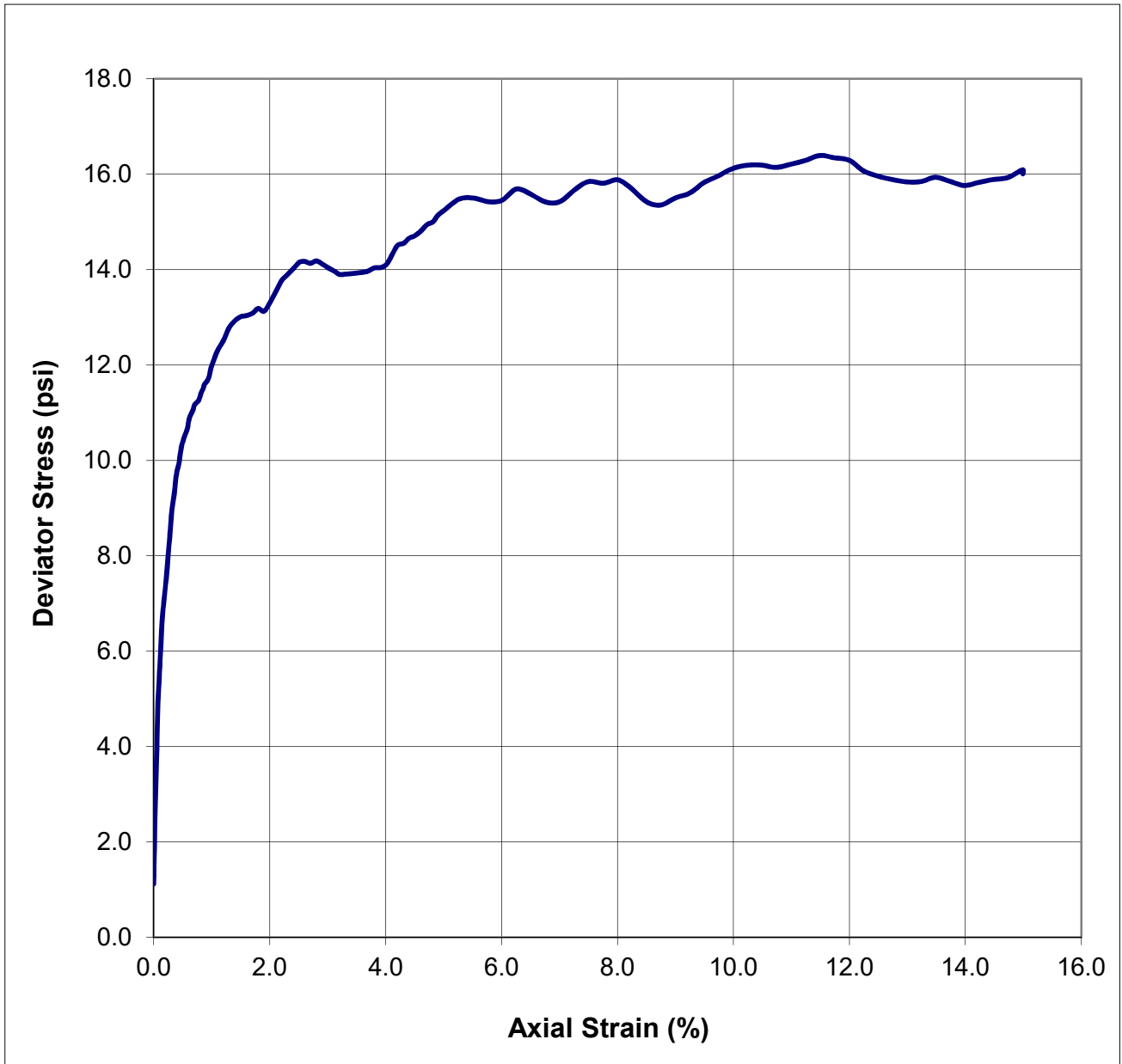




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of Deviator Stress vs. Axial Strain



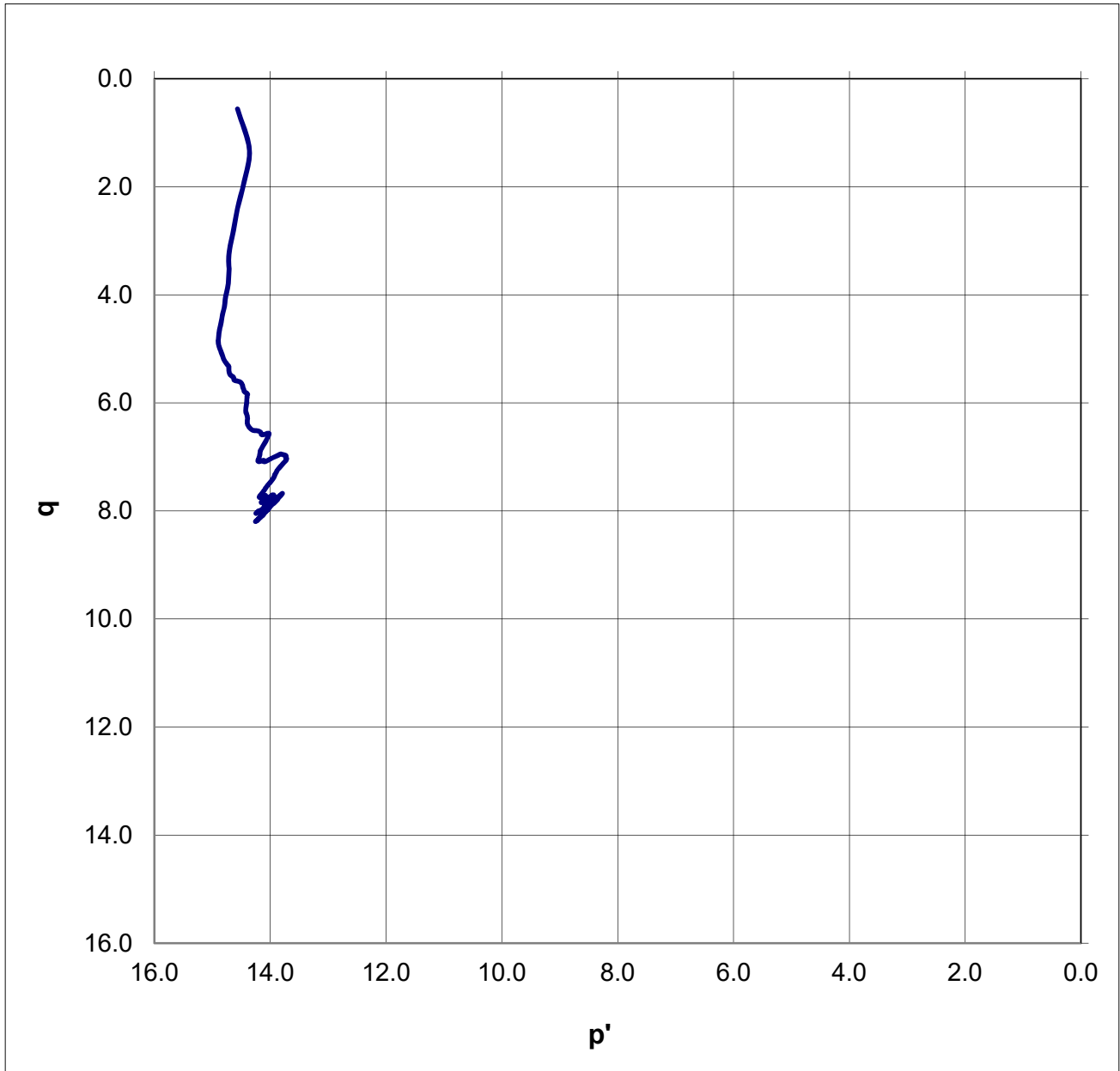




### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
Job Number: DB18.1151.00  
Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)  
Project Name: St. Anthony Geotech Investigation  
PO Number: 233001076-DBS

Plot of q vs.p'





### Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc  
 Job Number: DB18.1151.00  
 Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)  
 Project Name: St. Anthony Geotech Investigation  
 PO Number: 233001076-DBS

#### Raw Data

Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)	Pore Pressure (psi)	Axial Strain (%)	Effective Major Stress (psi)	Effective Minor Stress (psi)
81.60	0.00	15.13	14.01	88.77	3.11	20.88	6.91
82.55	0.02	15.67	13.05	88.84	3.21	20.77	6.88
83.06	0.05	16.36	12.54	88.90	3.31	20.75	6.84
83.43	0.07	16.96	12.17	88.92	3.40	20.74	6.83
83.74	0.10	17.41	11.85	88.94	3.51	20.73	6.80
83.99	0.13	17.78	11.60	88.96	3.60	20.71	6.77
84.20	0.14	18.05	11.38	88.99	3.70	20.71	6.74
84.39	0.18	18.23	11.19	89.02	3.81	20.75	6.71
84.56	0.20	18.42	11.02	89.03	3.91	20.74	6.70
84.72	0.24	18.62	10.86	89.05	4.02	20.78	6.67
84.90	0.25	18.84	10.71	89.06	4.11	20.95	6.65
85.06	0.28	19.00	10.58	89.08	4.21	21.14	6.63
85.20	0.30	19.19	10.46	89.08	4.31	21.16	6.62
85.33	0.32	19.35	10.34	89.10	4.41	21.25	6.59
85.46	0.36	19.52	10.23	89.11	4.50	21.28	6.57
85.57	0.37	19.65	10.12	89.13	4.61	21.35	6.55
85.69	0.40	19.77	10.02	89.14	4.71	21.47	6.53
85.80	0.43	19.84	9.92	89.14	4.81	21.52	6.52
85.91	0.45	19.89	9.82	89.15	4.91	21.65	6.50
86.01	0.47	19.94	9.73	89.16	5.02	21.73	6.48
86.10	0.49	19.99	9.64	89.17	5.27	21.93	6.45
86.20	0.52	20.02	9.54	89.18	5.52	21.90	6.41
86.29	0.55	20.03	9.46	89.21	5.76	21.80	6.37
86.37	0.58	20.05	9.38	89.36	6.01	21.80	6.35
86.44	0.60	20.11	9.31	89.42	6.25	22.00	6.31
86.51	0.62	20.16	9.24	89.44	6.50	21.87	6.28
86.57	0.65	20.17	9.18	89.46	6.76	21.68	6.26
86.64	0.67	20.16	9.11	89.47	7.01	21.65	6.23
86.71	0.70	20.20	9.04	89.47	7.26	21.89	6.21
86.77	0.72	20.17	8.98	89.48	7.50	22.03	6.19
86.82	0.74	20.14	8.93	89.48	7.76	21.97	6.16
86.87	0.77	20.13	8.87	89.48	8.01	22.02	6.14
86.93	0.80	20.15	8.82	89.46	8.26	21.81	6.13
86.99	0.82	20.18	8.76	89.44	8.51	21.53	6.12
87.04	0.85	20.21	8.70	89.59	8.75	21.47	6.11
87.09	0.87	20.24	8.66	89.63	8.99	21.59	6.10
87.14	0.89	20.23	8.61	89.64	9.25	21.69	6.08
87.19	0.93	20.23	8.56	89.64	9.49	21.90	6.08
87.23	0.96	20.28	8.52	89.64	9.73	22.02	6.07
87.27	0.97	20.34	8.47	89.62	9.99	22.18	6.06
87.32	1.00	20.39	8.42	89.61	10.24	22.24	6.06
87.47	1.10	20.57	8.27	89.59	10.49	22.24	6.06
87.60	1.21	20.65	8.14	89.57	10.73	22.19	6.05
87.72	1.29	20.78	8.01	89.54	10.99	22.26	6.05
87.83	1.40	20.82	7.89	89.51	11.25	22.34	6.05
87.92	1.51	20.80	7.79	89.64	11.49	22.45	6.06
88.00	1.60	20.74	7.70	89.68	11.74	22.39	6.05
88.08	1.71	20.71	7.62	89.67	12.00	22.35	6.06
88.14	1.80	20.73	7.55	89.65	12.24	22.14	6.07
88.22	1.90	20.59	7.46	89.64	12.48	22.03	6.07
88.28	2.01	20.71	7.40	89.61	12.74	21.96	6.08
88.33	2.10	20.86	7.34	89.58	12.99	21.92	6.09
88.37	2.20	21.04	7.29	89.55	13.24	21.94	6.10
88.42	2.31	21.13	7.23	89.52	13.48	22.03	6.10
88.45	2.41	21.20	7.18	89.47	13.75	21.96	6.12
88.49	2.50	21.29	7.14	89.42	13.98	21.90	6.14
88.52	2.60	21.27	7.10	89.55	14.23	21.98	6.15
88.55	2.70	21.18	7.05	89.57	14.49	22.05	6.16
88.58	2.80	21.19	7.01	89.56	14.73	22.09	6.17
88.61	2.90	21.09	6.97	89.52	14.98	22.29	6.20
88.66	3.00	20.99	6.95	89.52	14.99	22.21	6.20

# **Laboratory Tests and Methods**



## Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D7928, ASTM D6913, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488
Standard Proctor Compaction:	ASTM D698
Coarse Fraction (Gravel) Correction (calc):	ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6
Consolidated Undrained Triaxial:	ASTM D4767
Cohesion & Friction Angle:	Das, Braja M. 2002. Principles of Geotechnical Engineering. Chp. 11: Shear Strength of Soil. Brooks/Cole, Pacific Grove, CA
Mohr's Circles:	ASTM D4767; Das, Braja M. 2002. Principles of Geotechnical Engineering. Chp. 11: Shear Strength of Soil. Brooks/Cole, Pacific Grove, CA

# **Attachment G. Analytical Laboratory Testing Reports**



# Gross Alpha Case Narrative

---

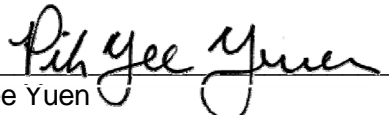
## Stantec Consulting Services

St. Anthony Geotechnical Investigation – 233001076

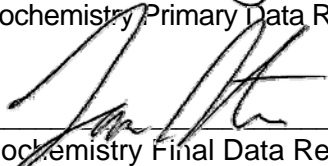
Work Order Number: 1804492

1. This report consists of the analytical results for 17 soil samples received by ALS on 04/23/2018.
2. These samples were prepared according to the current revisions of SOP 702 and SOP 736.
3. The samples were analyzed for gross alpha activity by gas flow proportional counting according to the current revision of SOP 724. The analyses were completed on 05/17/2018. Gross alpha results are referenced to  $^{241}\text{Am}$ .
4. The analysis results for these samples are reported on a 'Dry Weight' basis in units of pCi/gram.
5. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
\_\_\_\_\_  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

5/23/18  
Date

  
\_\_\_\_\_  
Radiochemistry Final Data Reviewer

5/29/18  
Date

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

**Client Name:** Stantec Consulting Services

**Client Project Name:** St. Anthony Geotechnical Investigation

**Client Project Number:** 233001076

**Client PO Number:** 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05



ALS Environmental

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Chain-of-Custody

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME <b>St. Anthony Geotechnical Investigation</b>	SITE ID <b>St. Anthony Mine</b>	SAMPLER <b>Microsoft Excel Spreadsheet</b>	PAGE <b>1</b> of <b>1</b>
PROJECT No. <b>233001076</b>	EDD FORMAT	DISPOSAL <b>BY LAB</b> or RETURN	PARAMETER/METHOD REQUEST FOR ANALYSIS
COMPANY NAME <b>Stantec Consulting Services</b>	BILL TO COMPANY	A <b>Ra-226 (EPA 901.1)</b>	
SEND REPORT TO <b>Cameron Fritz</b>	INVOICE ATTN TO	B <b>Uranium (EPA 901.1)</b>	
ADDRESS <b>3325 S Timberline Rd #150</b>	ADDRESS	C <b>Thorium-230 (EPA 901.1)</b>	
CITY / STATE / ZIP <b>Fort Collins, CO 80525</b>	CITY / STATE / ZIP	D <b>Gross alpha (EPA 901.1)</b>	
PHONE <b>(970) 212-2759</b>	PHONE	E	
FAX	FAX	F	
E-MAIL <b>Cameron.fritz@stantec.com</b>	E-MAIL	G	
		H	
		I	
		J	

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	A	B	C	D	E	F	G	H	I	J	SEE NOTES SECTION
1	P1-2 20'	Soil	4/19/18	11:00am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	P1-2 40'	Soil	4/19/18	11:30am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	P1-2 60'	Soil	4/11/18	2:30 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	P2-1 10'	Soil	4/14/18	4:15 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5	P2-1 20'	Soil	4/14/18	4:25 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
6	P2-2 10'	Soil	4/15/18	8:30am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
7	P4-3 5'	Soil	4/16/18	12:10 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
8	P4-5 5'	Soil	4/16/18	10:00am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
9	P4-5 15'	Soil	4/16/18	10:10am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10	P4-9 20'	Soil	4/15/18	1:30 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
11	P4-9 30'	Soil	4/15/18	1:50 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12	BW-1 10'	Soil	4/18/18	9:35 am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
RECEIVED BY	<i>Cameron Fritz</i>	Cameron Fritz	4/18/18	4:00 pm
RELINQUISHED BY	<i>Emily Lyons</i>	Emily Lyons	4/23/18	0900
RECEIVED BY				
RELINQUISHED BY				
RECEIVED BY				

\*Time Zone (Circle): EST CST (MS) PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

REPORT LEVEL / QC REQUIRED	Summary (Standard QC)	X
	LEVEL II (Standard QC)	
	LEVEL III (Sig QC + forms)	
	LEVEL IV (Sig QC + forms + raw)	
PRESERVATION KEY	1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other	





**ALS Environmental**

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

**Chain-of-Custody**

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
 Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME	St. Anthony Geotechnical Investigation	TURNAROUND TIME	SAMPLER
PROJECT No.	233001076	SITE ID	St. Anthony Mine
COMPANY NAME	Stantec Consulting Services	EDD FORMAT	Microsoft Excel Spreadsheet
SEND REPORT TO	Cameron Fritz	PURCHASE ORDER	
ADDRESS	3325 S Timberline Rd #150	BILL TO COMPANY	Stantec Consulting Services
CITY / STATE / ZIP	Fort Collins, CO 80525	INVOICE ATTN TO	Jason Cumbers
PHONE	(970) 212-2754	ADDRESS	3325 S Timberline Rd #150
FAX		CITY / STATE / ZIP	Fort Collins, CO 80526
E-MAIL	cameron.fritz@stantec.com	PHONE	(970) 212-2755
		FAX	
		E-MAIL	jason.cumbers@stantec.com

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	PARAMETER/METHOD REQUEST FOR ANALYSIS										SEE NOTES SECTION				
								A	B	C	D	E	F	G	H	I	J					
13	BW-4 5'	S	4/18/18	12:00pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
14	BW-4 15'	S	4/18/18	12:15pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15	BW-3 10'	S	4/18/18	12:50pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
16	BW-2 5'	S	4/18/18	1:45pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
17	BW-2 20'	S	4/18/18	2:05pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

\*Time Zone (Circle): EST CST (AST) PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

Form 2029

RELINQUISHED BY	Cameron Fritz	SIGNATURE	Cameron Fritz	PRINTED NAME	Cameron Fritz	DATE	4/18/18	TIME	7:00 pm
RECEIVED BY	Emily Lyons	SIGNATURE	Emily Lyons	PRINTED NAME	Emily Lyons	DATE	4-23-18	TIME	0900
RELINQUISHED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RECEIVED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RELINQUISHED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RECEIVED BY		SIGNATURE		PRINTED NAME		DATE		TIME	

REPORT LEVEL / QC REQUIRED

Summary (Standard QC)	
LEVEL II (Standard QC)	X
LEVEL III (SIG QC + forms)	
LEVEL IV (SIG QC + forms + raw)	

4 of 29

PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



**ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: Stantec

Workorder No: 1804492

Project Manager: LPS

Initials: GM Date: 4.23.18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	NO
Cooler #: <u>1</u> <u>2</u>			
Temperature (°C): <u>Amb</u> <u>Amb</u>			
No. of custody seals on cooler: <u>0</u> <u>0</u>			
External µR/hr reading: <u>9</u>			
Background µR/hr reading: <u>9</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)			

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

---

---

---

---

---

---

---

---

---

---

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 4/24/18

FROM: (907) 947-2225  
CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 36.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

**(US)**

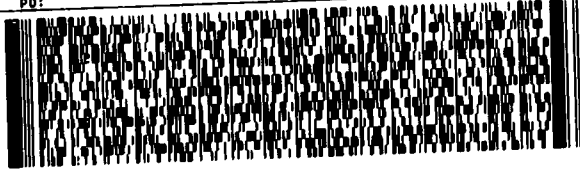
(800) 443-1511

REF:

DEPT:

INV:

PO:



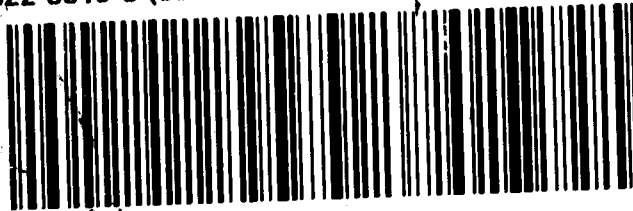
**FedEx  
Ground**



1 of 2  
TRK# **7805 9618 7711**  
## MASTER ##

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: (907) 947-2225  
CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 18.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

55211/0132/0106

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

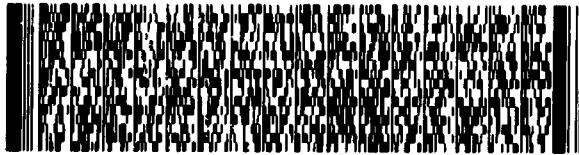
**(US)**

(800) 443-1511

REF:

INU:

DEPT:



**FedEx  
Ground**



13111201260110

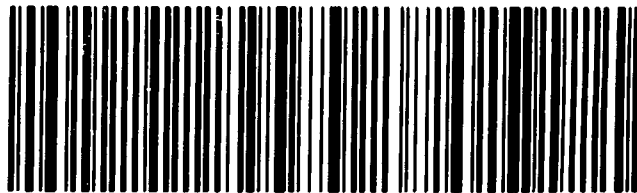
2 of 2

MPS# **7805 9618 7722**

Mstr# 7805 9618 7711

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722



# Gross Alpha by GFPC

PAI 724 Rev 12

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AB180514-1MB

Sample Matrix: SOIL

Prep Batch: AB180514-1

Final Aliquot: 1.50 g

Prep SOP: PAI 702 Rev 21

QCBatchID: AB180514-1-1

Result Units: pCi/g

Date Collected: 14-May-18

Run ID: AB180514-1A

File Name: ABC0517E

Date Prepared: 14-May-18

Count Time: 45 minutes

Date Analyzed: 17-May-18

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	0.02 +/- 0.18	0.51	3	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AB180514-1LCS

Sample Matrix: SOIL

Prep Batch: AB180514-1

Final Aliquot: 2.50 g

Prep SOP: PAI 702 Rev 21

QCBatchID: AB180514-1-1

Result Units: pCi/g

Date Collected: 14-May-18

Run ID: AB180514-1A

File Name: ABC0517E

Date Prepared: 14-May-18

Count Time: 45 minutes

Date Analyzed: 17-May-18

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
12587-46-1	GROSS ALPHA	16.9 +/- 3.0	0.4	15.06	112	70 - 130	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Matrix Spike Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 20'
Lab ID:	1804492-10MS

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 15-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 3.07 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517D

CASNO	Target Nuclide	Matrix Spike	Sample Results	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
12587-46-1	GROSS ALPHA	22.6	7.0	0.5	14.7	106	70 - 130	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
N - Matrix Spike Recovery outside control limits  
P - Matrix Spike Recovery within control limits  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

MDC - Sample specific Minimum Detectable Concentration

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

ALS -- Fort Collins

LIMS Version: 6.862

Page 1 of 1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5DUP

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 14-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.503 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517C

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
12587-46-1	GROSS ALPHA	2.1 +/-	1.5	2.1	U	4.9 +/-	2.1	2.0		1.11	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: AB1804492-1



# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 20'
Lab ID:	1804492-1

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 09-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.501 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	48.2 +/- 9.6	2.2	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 40'
Lab ID:	1804492-2

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 09-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.516 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.3 +/- 2.1	1.8	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 60'
Lab ID:	1804492-3

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 11-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.510 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	3.7 +/- 1.7	1.7	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 10'
Lab ID:	1804492-4

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 14-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.514 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	10.5 +/- 3.2	2.1	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 14-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.512 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.1 +/- 1.5	2.1	3	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Duplicate Results

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Field ID:</b>	P2-1 20'
<b>Lab ID:</b>	1804492-5DUP

**Sample Matrix:** SOIL  
**Prep SOP:** PAI 702 Rev 21  
**Date Collected:** 14-Apr-18  
**Date Prepared:** 14-May-18  
**Date Analyzed:** 17-May-18

**Prep Batch:** AB180514-1  
**QCBatchID:** AB180514-1-1  
**Run ID:** AB180514-1A  
**Count Time:** 30 minutes  
**Report Basis:** Dry Weight

**Final Aliquot:** 0.503 g  
**Prep Basis:** Dry Weight  
**Moisture(%):** NA  
**Result Units:** pCi/g  
**File Name:** ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	4.9 +/- 2.1	2.0	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.  
W - DER is greater than Warning Limit of 1.42  
D - DER is greater than Control Limit of 2.13

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

**Data Package ID:** AB1804492-1

**Date Printed:** Wednesday, May 23, 2018

**ALS -- Fort Collins**  
LIMS Version: 6.862

Page 1 of 1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-2 10'
Lab ID:	1804492-6

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 15-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.512 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.7 +/- 1.5	1.7	3	NA	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-3 5'
Lab ID:	1804492-7

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 16-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 2.07 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.8 +/- 1.6	0.7	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1



# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 5'
Lab ID:	1804492-8

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 16-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 3.03 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	65 +/- 11	1	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 15'
Lab ID:	1804492-9

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 16-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 3.07 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	67 +/- 11	1	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 20'
Lab ID:	1804492-10

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 15-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 3.03 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	7.0 +/- 1.5	0.4	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 30'
Lab ID:	1804492-11

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 15-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.501 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	4.8 +/- 2.1	2.1	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-1 10'
Lab ID:	1804492-12

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.501 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.0 +/- 2.5	2.1	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 5'
Lab ID:	1804492-13

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.513 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.0 +/- 2.3	2.6	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 15'
Lab ID:	1804492-14

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 18-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 45 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.508 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517E

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.6 +/- 2.5	2.2	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-3 10'
Lab ID:	1804492-15

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 18-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.507 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	3.3 +/- 1.9	2.2	3	NA	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1804492-1



# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-2 5'
Lab ID:	1804492-16

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QC Batch ID: AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.505 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.4 +/- 2.2	1.9	3	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# Gross Alpha by GFPC

PAI 724 Rev 12

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-2 20'
Lab ID:	1804492-17

Sample Matrix: SOIL  
Prep SOP: PAI 702 Rev 21  
Date Collected: 18-Apr-18  
Date Prepared: 14-May-18  
Date Analyzed: 17-May-18

Prep Batch: AB180514-1  
QCBatchID: AB180514-1-1  
Run ID: AB180514-1A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.503 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.2 +/- 1.6	2.3	3	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1



# Isotopic Thorium Case Narrative

---

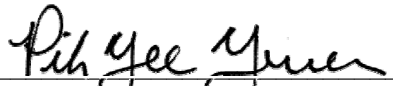
## Stantec Consulting Services

St. Anthony Geotechnical Investigation – 233001076


Work Order Number: 1804492

1. This report consists of the analytical results for 17 soil samples received by ALS on 04/23/2018.
2. These samples were prepared according to the current revisions of SOP 773, SOP 777, and SOP 736.
3. The samples were analyzed for the presence of isotopic thorium according to the current revision of SOP 714. The analyses were completed on 05/10/2018.
4. The isotopic analysis results for these samples are reported on a 'Dry Weight' basis in units of pCi/gram.
5. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
\_\_\_\_\_  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

5/23/18  
Date

  
\_\_\_\_\_  
Radiochemistry Final Data Reviewer

5/29/18  
Date

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

**Client Name:** Stantec Consulting Services

**Client Project Name:** St. Anthony Geotechnical Investigation

**Client Project Number:** 233001076

**Client PO Number:** 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05



# ALS Environmental

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
 Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME <b>St. Anthony Geotechnical Investigation</b>	SAMPLER	PAGE <b>1</b> of <b>1</b>
PROJECT No. <b>233001076</b>	SITE ID <b>St. Anthony Mine</b>	DISPOSAL <b>BY LAB</b> or RETURN
COMPANY NAME <b>Stantec Consulting Services</b>	EDD FORMAT <b>Microsoft Excel Spreadsheet</b>	PARAMETER/METHOD REQUEST FOR ANALYSIS
SEND REPORT TO <b>Cameron Fritz</b>	BILL TO COMPANY <b>Stantec Consulting Services</b>	<b>A</b> <b>Pb-226 (EPA 901.1)</b>
ADDRESS <b>3325 S Timberline Rd #150</b>	INVOICE ATTN TO <b>Jason Cumbers</b>	<b>B</b> <b>Uranium (EPA 901.1)</b>
CITY / STATE / ZIP <b>Fort Collins, CO 80525</b>	ADDRESS <b>3325 S Timberline Rd #150</b>	<b>C</b> <b>Thorium-230 (EPA 901.1)</b>
PHONE <b>(970) 212-2759</b>	CITY / STATE / ZIP <b>Fort Collins, CO 80526</b>	<b>D</b> <b>Gross alpha (EPA 901.1)</b>
FAX	PHONE <b>(970) 212-2755</b>	<b>E</b>
E-MAIL <b>Cameron.fritz@stantec.com</b>	FAX	<b>F</b>
	E-MAIL <b>Jason.cumbers@stantec.com</b>	<b>G</b>
		<b>H</b>
		<b>I</b>
		<b>J</b>

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	A	B	C	D	E	F	G	H	I	J	SEE NOTES SECTION
1	P1-2 20'	Soil	4/19/18	11:00am		N/A		✓	✓	✓	✓							
2	P1-2 40'	Soil	4/19/18	11:30am		N/A		✓	✓	✓	✓							
3	P1-2 60'	Soil	4/11/18	2:30 pm		N/A		✓	✓	✓	✓							
4	P2-1 10'	Soil	4/14/18	4:15 pm		N/A		✓	✓	✓	✓							
5	P2-1 20'	Soil	4/14/18	4:25 pm		N/A		✓	✓	✓	✓							
6	P2-2 10'	Soil	4/15/18	8:30am		N/A		✓	✓	✓	✓							
7	P4-3 5'	Soil	4/16/18	12:10 pm		N/A		✓	✓	✓	✓							
8	P4-5 5'	Soil	4/16/18	10:00am		N/A		✓	✓	✓	✓							
9	P4-5 15'	Soil	4/16/18	10:10am		N/A		✓	✓	✓	✓							
10	P4-9 20'	Soil	4/15/18	1:30pm		N/A		✓	✓	✓	✓							
11	P4-9 30'	Soil	4/15/18	1:50pm		N/A		✓	✓	✓	✓							
12	BW-1 10'	Soil	4/18/18	9:35am		N/A		✓	✓	✓	✓							

\*Time Zone (Circle): EST CST MST PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
RECEIVED BY	<i>Cameron Fritz</i>	Cameron Fritz	4/18/18	4:00 pm
RELINQUISHED BY	<i>Emily Lyons</i>	Emily Lyons	4/23/18	0900
RECEIVED BY				
RELINQUISHED BY				
RECEIVED BY				

Form 2029

REPORT LEVEL / QC REQUIRED	Summary (Standard OC)	X
	LEVEL II (Standard OC)	
	LEVEL III (Sig OC + forms)	
	LEVEL IV (Sig OC + forms + raw)	

3 of 28

PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



**ALS Environmental**

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

**Chain-of-Custody**

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
 Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME	St. Anthony Geotechnical Investigation	TURNAROUND TIME	SAMPLER
PROJECT No.	233001076	SITE ID	St. Anthony Mine
COMPANY NAME	Stantec Consulting Services	EDD FORMAT	Microsoft Excel Spreadsheet
SEND REPORT TO	Cameron Fritz	PURCHASE ORDER	
ADDRESS	3325 S Timberline Rd #150	BILL TO COMPANY	Stantec Consulting Services
CITY / STATE / ZIP	Fort Collins, CO 80525	INVOICE ATTN TO	Jason Cumbers
PHONE	(970) 212-2754	ADDRESS	3325 S Timberline Rd #150
FAX		CITY / STATE / ZIP	Fort Collins, CO 80526
E-MAIL	cameron.fritz@stantec.com	PHONE	(970) 212-2755
		FAX	
		E-MAIL	jason.cumbers@stantec.com

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	PARAMETER/METHOD REQUEST FOR ANALYSIS										SEE NOTES SECTION				
								A	B	C	D	E	F	G	H	I	J					
13	BW-4 5'	S	4/18/18	12:00pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
14	BW-4 15'	S	4/18/18	12:15pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15	BW-3 10'	S	4/18/18	12:50pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
16	BW-2 5'	S	4/18/18	1:45pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
17	BW-2 20'	S	4/18/18	2:05pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

\*Time Zone (Circle): EST CST (AST) PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

Form 2029

RELINQUISHED BY	Cameron Fritz	SIGNATURE	Cameron Fritz	PRINTED NAME	Cameron Fritz	DATE	4/18/18	TIME	7:00 pm
RECEIVED BY	Emily Lyons	SIGNATURE	Emily Lyons	PRINTED NAME	Emily Lyons	DATE	4-23-18	TIME	0900
RELINQUISHED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RECEIVED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RELINQUISHED BY		SIGNATURE		PRINTED NAME		DATE		TIME	
RECEIVED BY		SIGNATURE		PRINTED NAME		DATE		TIME	

REPORT LEVEL / QC REQUIRED

Summary (Standard QC)	
LEVEL II (Standard QC)	X
LEVEL III (SIG QC + forms)	
LEVEL IV (SIG QC + forms + raw)	

4 of 28

PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



**ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: Stantec

Workorder No: 1804492

Project Manager: LPS

Initials: GM Date: 4.23.18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	NO
Cooler #: <u>1</u> <u>2</u>			
Temperature (°C): <u>Amb</u> <u>Amb</u>			
No. of custody seals on cooler: <u>0</u> <u>0</u>			
External µR/hr reading: <u>9</u>			
Background µR/hr reading: <u>9</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)			

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

---

---

---

---

---

---

---

---

---

---

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date:  4/24/18

FROM: CAMERON FRITZ (907) 947-2225  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 36.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

**(US)**

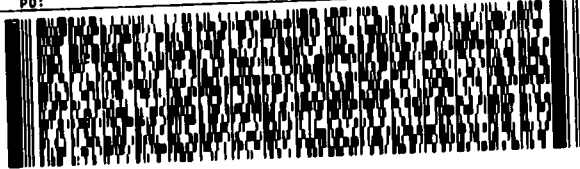
(800) 443-1511

REF:

DEPT:

INV:

PO:



**FedEx  
Ground**



1 of 2  
TRK# **7805 9618 7711**  
## MASTER ##

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711





FROM: (907) 947-2225  
CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 18.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

55211/0132/0106

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

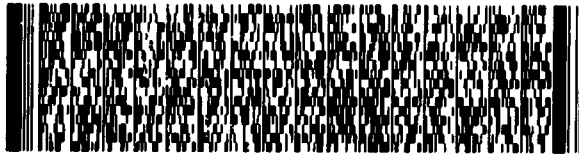
**(US)**

(800) 443-1511

REF:

IN:

DEPT:



**FedEx  
Ground**



131112012601111

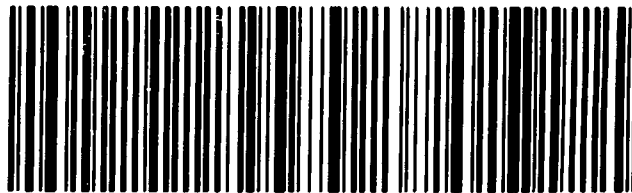
2 of 2

MPS# **7805 9618 7722**

Mstr# 7805 9618 7711

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722



# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AS180430-2MB

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 01-May-18  
Date Prepared: 01-May-18  
Date Analyzed: 10-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes

Final Aliquot: 2.00 g  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	-0.002 +/- 0.022	0.039	0.2	NA	U

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.301	1.50	pCi/g	65.2	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit

M - Requested MDC not met.  
B - Analyte concentration greater than MDC.  
B3 - Analyte concentration greater than MDC but less than Requested MDC.  
DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Laboratory Control Sample(s)

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Lab ID:</b> AS180430-2LCS	<b>Sample Matrix:</b> SOIL	<b>Prep Batch:</b> AS180430-2	<b>Final Aliquot:</b> 2.00 g
	<b>Prep SOP:</b> PAI 777 Rev 12	<b>QCBatchID:</b> AS180430-2-1	<b>Result Units:</b> pCi/g
	<b>Date Collected:</b> 01-May-18	<b>Run ID:</b> AS180430-2TH	<b>File Name:</b> Spectrum #1
	<b>Date Prepared:</b> 01-May-18	<b>Count Time:</b> 1000 minutes	
	<b>Date Analyzed:</b> 10-May-18		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	2.63 +/- 0.42	0.04	2.464	107	85 - 121	P

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.301	1.48	pCi/g	64.3	30 - 110 %	

### Comments:

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

**Data Package ID:** TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5DUP

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 14-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.539 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
14269-63-7	Th-230	1.15 +/-	0.23	0.13		1.05 +/-	0.21	0.13		0.325	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 20'
Lab ID:	1804492-1

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 09-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.542 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	16.6 +/- 2.6	0.1	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.498	6.47	pCi/g	76.2	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 40'
Lab ID:	1804492-2

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 09-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.554 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.11 +/- 0.23	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.302	5.60	pCi/g	67.5	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 60'
Lab ID:	1804492-3

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 11-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.512 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.99 +/- 0.22	0.15	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.990	5.53	pCi/g	61.5	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 10'
Lab ID:	1804492-4

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 14-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.538 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	4.11 +/- 0.69	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.557	5.68	pCi/g	66.3	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1



# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 14-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.538 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.15 +/- 0.23	0.13	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.562	6.10	pCi/g	71.3	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins  
Work Order Number: 1804492  
Client Name: Stantec Consulting Services  
ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5DUP

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 14-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.539 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.05 +/- 0.21	0.13	0.2	NA	

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.533	6.20	pCi/g	72.7	30 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.  
W - DER is greater than Warning Limit of 1.42  
D - DER is greater than Control Limit of 2.13

### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

ALS -- Fort Collins  
LIMS Version: 6.862

Page 1 of 1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-2 10'
Lab ID:	1804492-6

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 15-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.586 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.89 +/- 0.19	0.13	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.850	5.54	pCi/g	70.5	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-3 5'
Lab ID:	1804492-7

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.590 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.60 +/- 0.29	0.13	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.800	5.45	pCi/g	69.8	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 5'
Lab ID:	1804492-8

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.541 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	19.5 +/- 3.1	0.1	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.514	5.82	pCi/g	68.4	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 15'
Lab ID:	1804492-9

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.517 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	15.4 +/- 2.4	0.1	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.906	6.44	pCi/g	72.3	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 20'
Lab ID:	1804492-10

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 15-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.582 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	2.51 +/- 0.42	0.12	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.913	6.43	pCi/g	81.2	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 30'
Lab ID:	1804492-11

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 15-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.510 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.93 +/- 0.20	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	9.028	6.5	pCi/g	72.1	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1



# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-1 10'
Lab ID:	1804492-12

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.567 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.90 +/- 0.20	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.116	5.11	pCi/g	62.9	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 5'
Lab ID:	1804492-13

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.532 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.20 +/- 0.24	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.658	5.92	pCi/g	68.4	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 15'
Lab ID:	1804492-14

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.533 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.90 +/- 0.20	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.631	5.99	pCi/g	69.4	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-3 10'
Lab ID:	1804492-15

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.507 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.85 +/- 0.19	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	9.078	6.46	pCi/g	71.2	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-2 5'
Lab ID:	1804492-16

Sample Matrix: SOIL  
Prep SOP: PAI 777 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 01-May-18  
Date Analyzed: 09-May-18

Prep Batch: AS180430-2  
QCBatchID: AS180430-2-1  
Run ID: AS180430-2TH  
Count Time: 1000 minutes  
Report Basis: Dry Weight

Final Aliquot: 0.514 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.78 +/- 0.18	0.14	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.963	6.6	pCi/g	73.7	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

# Isotopic Thorium by Alpha Spectroscopy

PAI 714 Rev 13

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-2 20'
Lab ID:	1804492-17

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 10-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.515 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.64 +/- 0.17	0.16	0.2	NA	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.943	5.14	pCi/g	57.4	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1



# Metals

## Case Narrative

---

### **Stantec Consulting Services**

St. Anthony Geotechnical Investigation -- 233001076

Work Order Number: 1804492

1. This report consists of 17 soil samples.
2. The samples were received intact at ambient temperature by ALS on 04/23/18
3. The samples were prepared and analyzed based on SW-846, 3<sup>rd</sup> Edition procedures.

For analysis by ICP-MS, the samples were digested following method 3050B and the current revision of SOP 806.

4. Analysis by ICP-MS followed method 6020A and the current revision of SOP 827.
5. All standards and solutions are NIST traceable and were used within their recommended shelf life.
6. The samples were prepared and analyzed within the established hold times.

All in house quality control procedures were followed, as described below.

7. General quality control procedures.
  - A preparation (method) blank and laboratory control sample were digested and analyzed with the samples in this digestion batch.
  - The preparation (method) blank associated with this digestion batch was below the reporting limit for the requested analyte.
  - All laboratory control sample criteria were met.
  - All initial and continuing calibration blanks were below the reporting limit for the requested analyte.



- All initial and continuing calibration verifications were within the acceptance criteria for the requested analyte.
- The interference check samples associated with Method 6020A were analyzed.

8. Matrix specific quality control procedures.

Sample 1804492-1 was designated as the quality control sample for this analysis.

Similarity of matrix and therefore relevance of the QC results should not be automatically inferred for any sample other than the native sample selected for QC.

- A matrix spike and matrix spike duplicate were digested and analyzed with this batch. All acceptance criteria for accuracy were met.
- Matrix spike recoveries could not be evaluated for the following analyte:

<u>Analyte</u>	<u>Sample ID</u>
Uranium	-1

The concentration of this analyte in the native sample was greater than four times the concentration of matrix spike added during the digestion. When sample concentration is that much greater than the spike added, spike recoveries may not be accurate. The laboratory control sample indicates that the digestion and analysis were in control.

- A sample duplicate and matrix spike duplicate were digested and analyzed with this batch. All acceptance criteria for precision were met with the following exception:

<u>Analyte</u>	<u>Sample ID</u>
Uranium	-1MS/MSD

The associated sample results are flagged for duplicate failure. Where spike duplicate precision was outside control limits only the duplicate page shows the flag.

- A serial dilution was analyzed with this ICP batch. All acceptance criteria were met.

9. It is a standard practice that samples for ICP-MS are analyzed at a dilution.





The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Emily Lyons  
Emily Lyons  
Inorganics Primary Data Reviewer

5/21/18  
Date

[Signature]  
Inorganics Final Data Reviewer

5/29/18  
Date



### **Inorganic Data Reporting Qualifiers**

The following qualifiers are used by the laboratory when reporting results of inorganic analyses:

- Result qualifier -- If the analyte was analyzed for but not detected a "U" is entered.
- QC qualifier -- Specified entries and their meanings are as follows:
  - E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
  - M - Duplicate injection precision was not met.
  - N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
  - Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.
  - \* - Duplicate analysis (relative percent difference) not within control limits.
  - S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

**Client Name:** Stantec Consulting Services

**Client Project Name:** St. Anthony Geotechnical Investigation

**Client Project Number:** 233001076

**Client PO Number:** 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05



# ALS Environmental

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
 Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME <b>St. Anthony Geotechnical Investigation</b>	SAMPLER	PAGE <b>1</b> of <b>1</b>
PROJECT No. <b>233001076</b>	SITE ID <b>St. Anthony Mine</b>	DISPOSAL <b>BY LAB</b> or RETURN
COMPANY NAME <b>Stantec Consulting Services</b>	EDD FORMAT <b>Microsoft Excel Spreadsheet</b>	PARAMETER/METHOD REQUEST FOR ANALYSIS
SEND REPORT TO <b>Cameron Fritz</b>	BILL TO COMPANY <b>Stantec Consulting Services</b>	<b>A</b> <b>Pb-226 (EPA 901.1)</b>
ADDRESS <b>3325 S Timberline Rd #150</b>	INVOICE ATTN TO <b>Jason Cumbers</b>	<b>B</b> <b>Uranium (EPA 901.1)</b>
CITY / STATE / ZIP <b>Fort Collins, CO 80525</b>	ADDRESS <b>3325 S Timberline Rd #150</b>	<b>C</b> <b>Thorium-230 (EPA 901.1)</b>
PHONE <b>(970) 212-2759</b>	CITY / STATE / ZIP <b>Fort Collins, CO 80526</b>	<b>D</b> <b>Gross alpha (EPA 901.1)</b>
FAX	PHONE <b>(970) 212-2755</b>	<b>E</b>
E-MAIL <b>Cameron.fritz@stantec.com</b>	FAX	<b>F</b>
	E-MAIL <b>Jason.cumbers@stantec.com</b>	<b>G</b>
		<b>H</b>
		<b>I</b>
		<b>J</b>

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	A	B	C	D	E	F	G	H	I	J	SEE NOTES SECTION
1	P1-2 20'	Soil	4/19/18	11:00am		N/A		✓	✓	✓	✓							
2	P1-2 40'	Soil	4/19/18	11:30am		N/A		✓	✓	✓	✓							
3	P1-2 60'	Soil	4/11/18	2:30 pm		N/A		✓	✓	✓	✓							
4	P2-1 10'	Soil	4/14/18	4:15 pm		N/A		✓	✓	✓	✓							
5	P2-1 20'	Soil	4/14/18	4:25 pm		N/A		✓	✓	✓	✓							
6	P2-2 10'	Soil	4/15/18	8:30am		N/A		✓	✓	✓	✓							
7	P4-3 5'	Soil	4/16/18	12:10 pm		N/A		✓	✓	✓	✓							
8	P4-5 5'	Soil	4/16/18	10:00am		N/A		✓	✓	✓	✓							
9	P4-5 15'	Soil	4/16/18	10:10am		N/A		✓	✓	✓	✓							
10	P4-9 20'	Soil	4/15/18	1:30pm		N/A		✓	✓	✓	✓							
11	P4-9 30'	Soil	4/15/18	1:50pm		N/A		✓	✓	✓	✓							
12	BW-1 10'	Soil	4/18/18	9:35am		N/A		✓	✓	✓	✓							

\*Time Zone (Circle): EST CST MST PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
RECEIVED BY	<i>Cameron Fritz</i>	Cameron Fritz	4/18/18	4:00 pm
RELINQUISHED BY	<i>Emily Lyons</i>	Emily Lyons	4/23/18	0900
RECEIVED BY				
RELINQUISHED BY				
RECEIVED BY				

Form 2029

REPORT LEVEL / QC REQUIRED	Summary (Standard OC)	LEVEL II (Standard OC)	LEVEL III (Sig OC + forms)	LEVEL IV (Sig OC + forms + raw)
X				

6 of 18

PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



**ALS Environmental**

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

**Chain-of-Custody**

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
 Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME <b>St. Anthony Geotechnical Investigation</b>		SITE ID <b>St. Anthony Mine</b>		SAMPLER		PAGE <b>1</b> of <b>1</b>		DISPOSAL <b>(BY LAB)</b>		RETURN																											
PROJECT No. <b>233001076</b>		EDD FORMAT <b>Microsoft Excel Spreadsheet</b>		PURCHASE ORDER		PARAMETER/METHOD REQUEST FOR ANALYSIS		A <b>Radium-226 (EPA 901.1)</b>		B <b>Uranium (EPA 901.1)</b>																											
COMPANY NAME <b>Stantec Consulting Services</b>		BILL TO COMPANY <b>Jason Cumbers</b>		INVOICE ATTN TO <b>Jason Cumbers</b>		C <b>Thorium-230 (EPA 901.1)</b>		D <b>Gross Alpha (EPA 901.1)</b>		E																											
SEND REPORT TO <b>Cameron Fritz</b>		ADDRESS <b>3325 S Timberline Rd #150</b>		CITY/STATE/ZIP <b>Fort Collins, CO 80526</b>		F		G		H																											
CITY/STATE/ZIP <b>Fort Collins, CO 80525</b>		PHONE <b>(970) 212-2754</b>		PHONE <b>(970) 212-2755</b>		I		J		SEE NOTES SECTION																											
PHONE <b>(970) 212-2754</b>		FAX		FAX		K		L		M																											
E-MAIL <b>cameron.fritz@stantec.com</b>		E-MAIL <b>jason.cumbers@stantec.com</b>		E-MAIL		N		O		P																											
LAB ID		FIELD ID		MATRIX		SAMPLE DATE		SAMPLE TIME		# OF BOTTLES		PRESERVATIVE		QC		A		B		C		D		E		F		G		H		I		J		SEE NOTES SECTION	
<b>13</b>		<b>BW-4 5'</b>		<b>S</b>		<b>4/18/18</b>		<b>12:00pm</b>				<b>N/A</b>						<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>					
<b>14</b>		<b>BW-4 15'</b>		<b>S</b>		<b>4/18/18</b>		<b>12:15pm</b>				<b>N/A</b>						<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>					
<b>15</b>		<b>BW-3 10'</b>		<b>S</b>		<b>4/18/18</b>		<b>12:50pm</b>				<b>N/A</b>						<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>					
<b>16</b>		<b>BW-2 5'</b>		<b>S</b>		<b>4/18/18</b>		<b>1:45pm</b>				<b>N/A</b>						<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>					
<b>17</b>		<b>BW-2 20'</b>		<b>S</b>		<b>4/18/18</b>		<b>2:05pm</b>				<b>N/A</b>						<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>		<b>✓</b>					

\*Time Zone (Circle): EST CST (AST) PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

SIGNATURE		PRINTED NAME		DATE		TIME	
<i>Cameron Fritz</i>		Cameron Fritz		4/18/18		7:00 pm	
<i>Emily Lyons</i>		Emily Lyons		4-23-18		0900	
RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY

REPORT LEVEL / QC REQUIRED	Summary (Standard QC)	LEVEL II (Standard QC)	LEVEL III (Sig QC + forms)	LEVEL IV (Sig QC + forms + raw)
	X			
PRESERVATION KEY				
1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other				



**ALS Environmental - Fort Collins**  
**CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: Stantec

Workorder No: 1804492

Project Manager: LPS

Initials: GM Date: 4.23.18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	NO
Cooler #: <u>1</u> <u>2</u>			
Temperature (°C): <u>Amb</u> <u>Amb</u>			
No. of custody seals on cooler: <u>0</u> <u>0</u>			
External µR/hr reading: <u>9</u>			
Background µR/hr reading: <u>9</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)			

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

---

---

---

---

---

---

---

---

---

---

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 4/24/18

FROM: CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

(907) 947-2225

SHIP DATE: 19APR18  
ACTWGT: 36.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

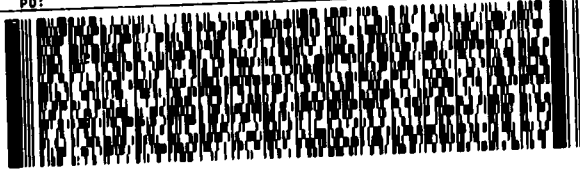
**FORT COLLINS CO 80524**

**(US)**

(800) 443-1511  
INV:  
PO:

REF:

DEPT:



**FedEx  
Ground**



1 of 2  
TRK# **7805 9618 7711**  
## MASTER ##

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: (907) 947-2225  
CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 18.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

55211/0132/0106

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

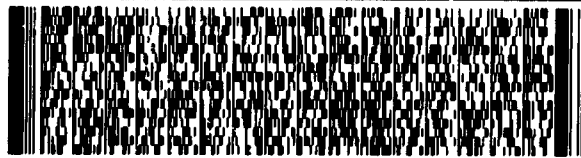
**(US)**

(800) 443-1511

REF:

INU:

DEPT:



**FedEx  
Ground**



13111201260110

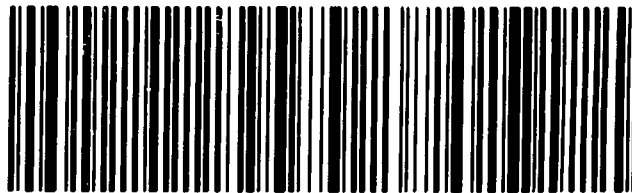
2 of 2

MPS# **7805 9618 7722**

Mstr# 7805 9618 7711

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722





# Total URANIUM

## Method SW6020 Revision A

### Sample Results

**Lab Name:** ALS -- Fort Collins  
**Client Name:** Stantec Consulting Services  
**Client Project ID:** St. Anthony Geotechnical Investigation 233001076  
**Work Order Number:** 1804492      **Final Volume:** 100 ml  
**Reporting Basis:** Dry Weight      **Matrix:** SOIL  
**Prep Method:** SW3050B      **Result Units:** UG/KG  
**Analyst:** Amanda J. Lynn

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	RptLimit/ LOQ/LOD	Flag	Sample Aliquot
P1-2 20'	1804492-1	04/09/2018	04/26/2018	04/27/2018	9.0	10	36000	11		1.025 g
P1-2 40'	1804492-2	04/09/2018	04/26/2018	04/27/2018	6.0	10	3700	9.9		1.073 g
P1-2 60'	1804492-3	04/11/2018	04/26/2018	04/27/2018	11.4	10	530	11		1.021 g
P2-1 10'	1804492-4	04/14/2018	04/26/2018	04/27/2018	10.3	10	1000	10		1.074 g
P2-1 20'	1804492-5	04/14/2018	04/26/2018	04/27/2018	8.9	10	2000	11		1.002 g
P2-2 10'	1804492-6	04/15/2018	04/26/2018	04/27/2018	9.5	10	1000	11		1.045 g
P4-3 5'	1804492-7	04/16/2018	04/26/2018	04/27/2018	6.8	10	1600	10		1.038 g
P4-5 5'	1804492-8	04/16/2018	04/26/2018	04/27/2018	3.9	10	29000	9.6		1.08 g
P4-5 15'	1804492-9	04/16/2018	04/26/2018	04/27/2018	6.7	10	24000	10		1.058 g
P4-9 20'	1804492-10	04/15/2018	04/26/2018	04/27/2018	2.1	10	5300	9.7		1.057 g
P4-9 30'	1804492-11	04/15/2018	04/26/2018	04/27/2018	8.3	10	580	11		1.001 g
BW-1 10'	1804492-12	04/18/2018	04/26/2018	04/27/2018	4.4	10	480	9.6		1.084 g
BW-4 5'	1804492-13	04/18/2018	04/26/2018	04/27/2018	3.2	10	550	10		1.025 g
BW-4 15'	1804492-14	04/18/2018	04/26/2018	04/27/2018	5.4	10	610	9.9		1.063 g
BW-3 10'	1804492-15	04/18/2018	04/26/2018	04/27/2018	4.7	10	510	10		1.047 g
BW-2 5'	1804492-16	04/18/2018	04/26/2018	04/27/2018	2.2	10	520	9.8		1.041 g
BW-2 20'	1804492-17	04/18/2018	04/26/2018	04/27/2018	4.2	10	460	10		1.018 g

**Comments:**

1. ND or U = Not Detected at or above the client requested detection limit.

**Data Package ID:** IM1804492-1

# ICPMS Metals

Method SW6020A

Method Blank

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: IP180426-3MB

Sample Matrix: SOIL

% Moisture: N/A

Date Collected: N/A

Date Extracted: 26-Apr-18

Date Analyzed: 27-Apr-18

Prep Method: SW3050 Rev B

Prep Batch: IP180426-3

QCBatchID: IP180426-3-1

Run ID: IM180426-10A8

Cleanup: NONE

Basis: N/A

File Name: 096SMPL\_

Sample Aliquot: 1 g

Final Volume: 100 ml

Result Units: UG/KG

Clean DF: 1

CASNO	Target Analyte	DF	Result	Result Qualifier	Reporting Limit	DL
7440-61-1	URANIUM	10	10	U	10	

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018

ALS -- Fort Collins

Page 1 of 1

LIMS Version: 6.862

# ICPMS Metals

## Method SW6020A

### Laboratory Control Sample

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: IM180426-3LCS

Sample Matrix: SOIL

% Moisture: N/A

Date Collected: N/A

Date Extracted: 04/26/2018

Date Analyzed: 04/27/2018

Prep Method: SW3050B

Prep Batch: IP180426-3

QCBatchID: IP180426-3-1

Run ID: IM180426-10A8

Cleanup: NONE

Basis: N/A

File Name: 097SMPL\_

Sample Aliquot: 1 g

Final Volume: 100 ml

Result Units: UG/KG

Clean DF: 1

CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7440-61-1	URANIUM	1000	941	10		94	80 - 120%

Data Package ID: *IM1804492-1*

# ICPMS Metals

Method SW6020A

## Matrix Spike And Matrix Spike Duplicate

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'	Sample Matrix: SOIL	Prep Batch: IP180426-3	Sample Aliquot: 1.025 g
LabID: 1804492-1MS	% Moisture: 9.0	QCBatchID: IP180426-3-1	Final Volume: 100 ml
	Date Collected: 09-Apr-18	Run ID: IM180426-10A8	Result Units: UG/KG
	Date Extracted: 26-Apr-18	Cleanup: NONE	File Name: 101SMPL_
	Date Analyzed: 27-Apr-18	Basis: Dry Weight	
	Prep Method: SW3050 Rev B		

CASNO	Target Analyte	Sample Result	Samp Qual	MS Result	MS Qual	Reporting Limit	Spike Added	MS % Rec.	Control Limits
7440-61-1	URANIUM	36000		35100		10.7	1070	-88	75 - 125%

Field ID: P1-2 20'	Sample Matrix: SOIL	Prep Batch: IP180426-3	Sample Aliquot: 1.025 g
LabID: 1804492-1MSD	% Moisture: 9.0	QCBatchID: IP180426-3-1	Final Volume: 100 ml
	Date Collected: 09-Apr-18	Run ID: IM180426-10A8	Result Units: UG/KG
	Date Extracted: 26-Apr-18	Cleanup: NONE	File Name: 102SMPL_
	Date Analyzed: 27-Apr-18	Basis: Dry Weight	
	Prep Method: SW3050 Rev B		

CASNO	Target Analyte	MSD Result	MSD Qual	Spike Added	MSD % Rec.	Reporting Limit	RPD Limit	RPD
7440-61-1	URANIUM	49300	*	1070	1229	10.7	20	

Data Package ID: IM1804492-1

# ICPMS Metals

## Method SW6020

### Duplicate Sample Results

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Field ID:</b>	P1-2 20'
<b>Lab ID:</b>	1804492-1D

**Sample Matrix:** SOIL  
**% Moisture:** 9.0  
**Date Collected:** 04/09/2018  
**Date Extracted:** 04/26/2018  
**Date Analyzed:** 04/27/2018

**Prep Batch:** IP180426-3  
**QCBatchID:** IP180426-3-1  
**Run ID:** IM180426-10A8  
**Cleanup:** NONE  
**Basis:** Dry Weight  
**File Name:** 100SMPL\_

**Sample Aliquot:** 1.024 g  
**Final Volume:** 100 ml  
**Result Units:** UG/KG  
**Clean DF:** 1

CASNO	Target Analyte	Sample Result	Samp Qual	Duplicate Result	Dup Qual	Reporting Limit	Dilution Factor	RPD	RPD Limit
7440-61-1	URANIUM	36000		36300		10.7	10	1	20

**Data Package ID:** *IM1804492-1*

# ICPMS Metals

Method SW6020

Serial Dilution

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 20'
Lab ID:	1804492-1L

Run ID: IM180426-10A8

Date Analyzed: 27-Apr-18

Result Units: mg/l

CASNO	Target Analyte	Sample Result	Samp Qual	SD Result	SD Qual	EPA Qualifier	%D
7440-61-1	URANIUM	0.0337		0.0338			0

Data Package ID: *IM1804492-1*

Date Printed: Monday, May 21, 2018

ALS -- Fort Collins

Page 1 of 1

LIMS Version: 6.862

# URANIUM

## Method SW6020

### Calibration Verifications

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Run ID: IM180426-10A8

Result Units: MG/L

Lab ID	Verification Type	Date Analyzed	Time Analyzed	Spike Added	Result	Reporting Limit	Result Qualifier	% Rec.	Control Limits
ICV	Initial Calibration	4/26/2018	17:57	0.002	0.00194	0.00001	N/A	97	90 - 110
CCV1	Continuing Calibration	4/26/2018	18:24	0.001	0.000921	0.00001	N/A	92	90 - 110
CCV2	Continuing Calibration	4/26/2018	19:29	0.001	0.000926	0.00001	N/A	93	90 - 110
CCV3	Continuing Calibration	4/26/2018	20:20	0.001	0.000935	0.00001	N/A	93	90 - 110
CCV4	Continuing Calibration	4/26/2018	21:10	0.001	0.000929	0.00001	N/A	93	90 - 110
CCV5	Continuing Calibration	4/26/2018	21:57	0.001	0.000938	0.00001	N/A	94	90 - 110
CCV6	Continuing Calibration	4/26/2018	22:21	0.001	0.000937	0.00001	N/A	94	90 - 110
CCV7	Continuing Calibration	4/26/2018	23:02	0.001	0.000932	0.00001	N/A	93	90 - 110
CCV8	Continuing Calibration	4/26/2018	23:47	0.001	0.000930	0.00001	N/A	93	90 - 110
CCV9	Continuing Calibration	4/27/2018	0:31	0.001	0.000933	0.00001	N/A	93	90 - 110
CCV10	Continuing Calibration	4/27/2018	1:22	0.001	0.000941	0.00001	N/A	94	90 - 110
CCV11	Continuing Calibration	4/27/2018	2:03	0.001	0.000931	0.00001	N/A	93	90 - 110
CCV12	Continuing Calibration	4/27/2018	2:42	0.001	0.000930	0.00001	N/A	93	90 - 110

Data Package ID: *IM1804492-1*

Date Printed: Monday, May 21, 2018

ALS -- Fort Collins

Page 1 of 1

LIMS Version: 6.862

**URANIUM**  
**Method SW6020**  
**Calibration Blanks**

**Lab Name:** ALS -- Fort Collins

**Work Order Number:** 1804492

**Client Name:** Stantec Consulting Services

**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

**Run ID:** IM180426-10A8

**Result Units:** MG/L

Lab ID	Verification Type	Date Analyzed	Time Analyzed	Result	Reporting Limit	Flag
ICB	Initial Calibration	4/26/2018	18:03	0.00001	0.00001	U
CCB1	Continuing Calibration	4/26/2018	18:30	0.00001	0.00001	U
CCB2	Continuing Calibration	4/26/2018	19:35	0.00001	0.00001	U
CCB3	Continuing Calibration	4/26/2018	20:25	0.00001	0.00001	U
CCB4	Continuing Calibration	4/26/2018	21:16	0.00001	0.00001	U
CCB5	Continuing Calibration	4/26/2018	22:03	0.00001	0.00001	U
CCB6	Continuing Calibration	4/26/2018	22:27	0.00001	0.00001	U
CCB7	Continuing Calibration	4/26/2018	23:08	0.00001	0.00001	U
CCB8	Continuing Calibration	4/26/2018	23:53	0.00001	0.00001	U
CCB9	Continuing Calibration	4/27/2018	0:37	0.00001	0.00001	U
CCB10	Continuing Calibration	4/27/2018	1:27	0.00001	0.00001	U
CCB11	Continuing Calibration	4/27/2018	2:09	0.00001	0.00001	U
CCB12	Continuing Calibration	4/27/2018	2:48	0.00001	0.00001	U

**Data Package ID:** *IM1804492-1*





# Gamma Spectroscopy Case Narrative

---

## Stantec Consulting Services

St. Anthony Geotechnical Investigation – 233001076

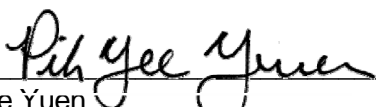
Work Order Number: 1804492

1. The following report consists of analytical results for 17 soil samples received by ALS on 04/23/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 05/18/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

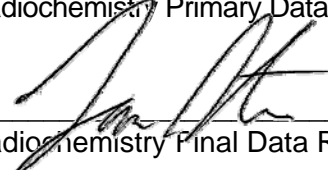


7. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of +/- 15% of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
8. The requested detection limit was not met for samples 1804492-1, -1DUP, -5, -8, and -9. The reported activity exceeds the achieved MDC. The results are submitted without further qualification. The results are flagged with an "M3" qualifier on the final reports.
9. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
\_\_\_\_\_  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

5/23/18  
Date

  
\_\_\_\_\_  
Radiochemistry Final Data Reviewer

5/29/18  
Date

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

---

**OrderNum:** 1804492

**Client Name:** Stantec Consulting Services

**Client Project Name:** St. Anthony Geotechnical Investigation

**Client Project Number:** 233001076

**Client PO Number:** 233001076-ALS2

---

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05



# ALS Environmental

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME <b>St. Anthony Geotechnical Investigation</b>	SAMPLER <b>St. Anthony Mine</b>	PAGE <b>1</b> of <b>1</b>
PROJECT No. <b>233001076</b>	DISPOSAL <b>BY LAB</b> or RETURN	PARAMETER/METHOD REQUEST FOR ANALYSIS
COMPANY NAME <b>Stantec Consulting Services</b>	<b>Pa-226 (EPA 90.1.1)</b>	
SEND REPORT TO <b>Cameron Fritz</b>	<b>Uranium (EPA 90.1.1)</b>	
ADDRESS <b>3325 S Timberline Rd #150</b>	<b>Thorium-230 (EPA 90.1.1)</b>	
CITY / STATE / ZIP <b>Fort Collins, CO 80525</b>	<b>Gross alpha (EPA 90.1.1)</b>	
PHONE <b>(970) 212-2759</b>		
FAX		
E-MAIL <b>Cameron.fritz@stantec.com</b>		

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	A	B	C	D	E	F	G	H	I	J	SEE NOTES SECTION
1	P1-2 20'	Soil	4/19/18	11:00am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	P1-2 40'	Soil	4/19/18	11:30am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	P1-2 60'	Soil	4/11/18	2:30 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	P2-1 10'	Soil	4/14/18	4:15 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5	P2-1 20'	Soil	4/14/18	4:25 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
6	P2-2 10'	Soil	4/15/18	8:30am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
7	P4-3 5'	Soil	4/16/18	12:10 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
8	P4-5 5'	Soil	4/16/18	10:00am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
9	P4-5 15'	Soil	4/16/18	10:10 am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10	P4-9 20'	Soil	4/15/18	1:30 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
11	P4-9 30'	Soil	4/15/18	1:50 pm		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12	BW-1 10'	Soil	4/18/18	9:35 am		N/A		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

REPORT LEVEL / QC REQUIRED	Summary (Standard OC)	LEVEL II (Standard OC)	LEVEL III (Sig OC + forms)	LEVEL IV (Sig OC + forms + raw)
	X			

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
RECEIVED BY	<i>Cameron Fritz</i>	Cameron Fritz	4/18/18	4:00 pm
RELINQUISHED BY	<i>Emily Lyons</i>	Emily Lyons	4/23/18	0900
RECEIVED BY				
RELINQUISHED BY				
RECEIVED BY				

Time Zone (Circle): EST CST MST PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter  
PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



# ALS Environmental

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.  
Turnaround time for samples received Saturday will be calculated beginning from the next business day.

ALS WORKORDER #  
**1804497**

PROJECT NAME	St. Anthony Geotechnical Investigation	TURNAROUND TIME	SAMPLER	PAGE	1	of	1
PROJECT No.	233001076	SITE ID	St. Anthony Mine	DISPOSAL	(BY LAB)	or	RETURN
COMPANY NAME	Stantec Consulting Services	EDD FORMAT	Microsoft Excel Spreadsheet	PARAMETER/METHOD REQUEST FOR ANALYSIS			
SEND REPORT TO	Cameron Fritz	PURCHASE ORDER		A	Radium-226 (EPA 901.1)		
ADDRESS	3325 S Timberline Rd #150	BILL TO COMPANY	Stantec Consulting Services	B	Uranium (EPA 901.1)		
CITY / STATE / ZIP	Fort Collins, CO 80525	INVOICE ATTN TO	Jason Cumbers	C	Thorium-230 (EPA 901.1)		
PHONE	(970) 212-2754	ADDRESS	3325 S Timberline Rd #150	D	Gross Alpha (EPA 901.1)		
FAX		CITY / STATE / ZIP	Fort Collins, CO 80526	E			
E-MAIL	cameron.fritz@stantec.com	PHONE	(970) 212-2755	F			
		FAX		G			
		E-MAIL	jason.cumbers@stantec.com	H			
				I			
				J			

LAB ID	FIELD ID	MATRIX	SAMPLE DATE	SAMPLE TIME	# OF BOTTLES	PRESERVATIVE	QC	A	B	C	D	E	F	G	H	I	J	SEE NOTES SECTION
13	BW-4 5'	S	4/18/18	12:00pm		N/A		✓	✓	✓	✓							
14	BW-4 15'	S	4/18/18	12:15pm		N/A		✓	✓	✓	✓							
15	BW-3 10'	S	4/18/18	12:50pm		N/A		✓	✓	✓	✓							
16	BW-2 5'	S	4/18/18	1:45pm		N/A		✓	✓	✓	✓							
17	BW-2 20'	S	4/18/18	2:05pm		N/A		✓	✓	✓	✓							

\*Time Zone (Circle): EST CST (AST) PST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

Form 2029

RELINQUISHED BY	<i>Cameron Fritz</i>	SIGNATURE	PRINTED NAME	DATE	TIME
RECEIVED BY			Cameron Fritz	4/18/18	7:00 pm
RELINQUISHED BY			Emily Lyons	4-23-18	0900
RECEIVED BY					
RELINQUISHED BY					
RECEIVED BY					

5 of 29

PRESERVATION KEY 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaOH/ZnAcetate 6-NaHSO4 7-4°C 8-Other



**ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: Stantec

Workorder No: 1804492

Project Manager: LPS

Initials: GM Date: 4.23.18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	NO
Cooler #: <u>1</u> <u>2</u>			
Temperature (°C): <u>Amb</u> <u>Amb</u>			
No. of custody seals on cooler: <u>0</u> <u>0</u>			
External µR/hr reading: <u>9</u>			
Background µR/hr reading: <u>9</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)			

DOT Survey/ Acceptance Information

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

---

---

---

---

---

---

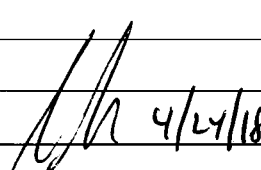
---

---

---

---

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date:  4/24/18

FROM: CAMERON FRITZ (907) 947-2225  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 36.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

**(US)**

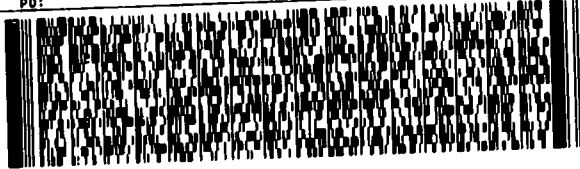
(800) 443-1511

REF:

DEPT:

INV:

PO:



**FedEx  
Ground**



1 of 2  
TRK# **7805 9618 7711**  
## MASTER ##

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: (907) 947-2225  
CAMERON FRITZ  
718 MARIGOLD LN  
FORT COLLINS CO 80526  
US

SHIP DATE: 19APR18  
ACTWGT: 18.00 LB  
CAD: 006993643/SSFE1904  
DIMMED: 15 X 12 X 12 IN

55211/0132/0106

TO

**ALS ENVIRONMENTAL  
225 COMMERCE DR**

**FORT COLLINS CO 80524**

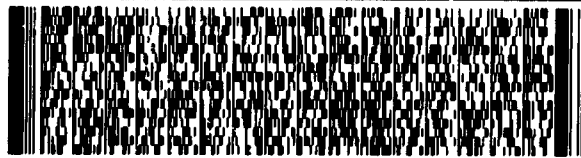
**(US)**

(800) 443-1511

REF:

INU:

DEPT:



**FedEx  
Ground**



13111201260110

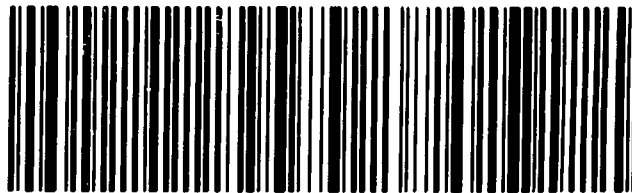
2 of 2

MPS# **7805 9618 7722**

Mstr# 7805 9618 7711

**80524**

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722





# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: GS180502-2MB	Sample Matrix: SOIL	Prep Batch: GS180502-2	Final Aliquot: 215 g
Library: RA226.LIB	Prep SOP: PAI 739 Rev 12	QCBatchID: GS180502-2-1	Result Units: pCi/g
	Date Collected: 02-May-18	Run ID: GS180502-2A	File Name: 180883d03
	Date Prepared: 02-May-18	Count Time: 30 minutes	
	Date Analyzed: 17-May-18		

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.10 +/- 0.17	0.30	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
M - Requested MDC not met.  
B - Analyte concentration greater than MDC.  
B3 - Analyte concentration greater than MDC but less than Requested MDC.  
DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: GS180502-2LCS	Sample Matrix: SOIL	Prep Batch: GS180502-2	Final Aliquot: 215 g
Library: RA226.LIB	Prep SOP: PAI 739 Rev 12	QCBatchID: GS180502-2-1	Result Units: pCi/g
	Date Collected: 02-May-18	Run ID: GS180502-2A	File Name: 180592d09
	Date Prepared: 02-May-18	Count Time: 30 minutes	
	Date Analyzed: 18-May-18		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	454 +/- 53	3	468.3	97.0	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 20'
Lab ID:	1804492-1DUP

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 09-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 182 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180673d02

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	11.5 +/-	1.5	0.6	M3,G	16.1 +/-	2.0	0.7	M3,G	1.84	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
W - DER is greater than Warning Limit of 1.42  
D - DER is greater than Control Limit of 2.13  
LT - Result is less than Request MDC, greater than sample specific MDC  
M - Requested MDC not met.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS, Matrix Spike Recovery within control limits.  
N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty  
DER - Duplicate Error Ratio  
BDL - Below Detection Limit  
NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 20'
Lab ID:	1804492-1

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 09-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 167 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180692d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	11.5 +/- 1.5	0.6	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Field ID:</b>	P1-2 20'
<b>Lab ID:</b>	1804492-1DUP

**Library:** RA226.LIB

**Sample Matrix:** SOIL  
**Prep SOP:** PAI 739 Rev 12  
**Date Collected:** 09-Apr-18  
**Date Prepared:** 02-May-18  
**Date Analyzed:** 17-May-18

**Prep Batch:** GS180502-2  
**QCBatchID:** GS180502-2-1  
**Run ID:** GS180502-2A  
**Count Time:** 30 minutes  
**Report Basis:** Dry Weight

**Final Aliquot:** 182 g  
**Prep Basis:** Dry Weight  
**Moisture(%):** NA  
**Result Units:** pCi/g  
**File Name:** 180673d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	16.1 +/- 2.0	0.7	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.  
W - DER is greater than Warning Limit of 1.42  
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

**Data Package ID:** GSS1804492-1

**Date Printed:** Wednesday, May 23, 2018

**ALS -- Fort Collins**

Page 1 of 1

LIMS Version: 6.862

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 40'
Lab ID:	1804492-2

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 09-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 199 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180881d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.25 +/- 0.30	0.48	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P1-2 60'
Lab ID:	1804492-3

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 11-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 180 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180539d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.31 +/- 0.28	0.38	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 10'

Lab ID: 1804492-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 14-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QC Batch ID: GS180502-2-1

Run ID: GS180502-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 188 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180599d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	3.85 +/- 0.58	0.47	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1804492-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-1 20'
Lab ID:	1804492-5

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 14-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 184 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180584d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.25 +/- 0.31	0.54	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P2-2 10'
Lab ID:	1804492-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 15-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QC Batch ID: GS180502-2-1

Run ID: GS180502-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 195 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180594d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.91 +/- 0.21	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-3 5'
Lab ID:	1804492-7

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 18-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 201 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 181104d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	2.15 +/- 0.41	0.49	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 5'
Lab ID:	1804492-8

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 231 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180693d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	29.5 +/- 3.6	0.8	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-5 15'
Lab ID:	1804492-9

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 16-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 213 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180674d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	18.6 +/- 2.3	0.7	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 halfives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 20'
Lab ID:	1804492-10

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 15-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 246 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180882d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	3.14 +/- 0.48	0.39	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	P4-9 30'
Lab ID:	1804492-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 15-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QC Batch ID: GS180502-2-1

Run ID: GS180502-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 196 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180540d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.26 +/- 0.27	0.38	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

## PAI 713 Rev 14

### Sample Results

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Field ID:</b>	BW-1 10'
<b>Lab ID:</b>	1804492-12

**Library:** RA226.LIB

<b>Sample Matrix:</b> SOIL	<b>Prep Batch:</b> GS180502-2	<b>Final Aliquot:</b> 204 g
<b>Prep SOP:</b> PAI 739 Rev 12	<b>QCBatchID:</b> GS180502-2-1	<b>Prep Basis:</b> Dry Weight
<b>Date Collected:</b> 18-Apr-18	<b>Run ID:</b> GS180502-2A	<b>Moisture(%):</b> NA
<b>Date Prepared:</b> 02-May-18	<b>Count Time:</b> 30 minutes	<b>Result Units:</b> pCi/g
<b>Date Analyzed:</b> 18-May-18	<b>Report Basis:</b> Dry Weight	<b>File Name:</b> 180607d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.76 +/- 0.22	0.35	0.5	NA	

#### Comments:

##### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
 Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
 Y2 - Chemical Yield outside default limits.  
 LT - Result is less than Requested MDC, greater than sample specific MDC.  
 M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
 M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
 SI - Nuclide identification and/or quantitation is tentative.  
 TI - Nuclide identification is tentative.  
 R - Nuclide has exceeded 8 half-lives.  
 G - Sample density differs by more than 15% of LCS density.

##### Abbreviations:

TPU - Total Propagated Uncertainty  
 MDC - Sample specific Minimum Detectable Concentration  
 BDL - Below Detection Limit  
 DL - Decision Level

**Data Package ID:** GSS1804492-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 5'
Lab ID:	1804492-13

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 202 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180600d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.15 +/- 0.27	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-4 15'
Lab ID:	1804492-14

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 207 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180585d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.81 +/- 0.25	0.46	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-3 10'
Lab ID:	1804492-15

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 209 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180595d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.83 +/- 0.20	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID:	BW-2 5'
Lab ID:	1804492-16

Library: RA226.LIB

Sample Matrix: SOIL  
Prep SOP: PAI 739 Rev 12  
Date Collected: 18-Apr-18  
Date Prepared: 02-May-18  
Date Analyzed: 17-May-18

Prep Batch: GS180502-2  
QCBatchID: GS180502-2-1  
Run ID: GS180502-2A  
Count Time: 30 minutes  
Report Basis: Dry Weight

Final Aliquot: 222 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: 180694d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.73 +/- 0.22	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.  
SI - Nuclide identification and/or quantitation is tentative.  
TI - Nuclide identification is tentative.  
R - Nuclide has exceeded 8 half-lives.  
G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1804492-1

# Gamma Spectroscopy Results

## PAI 713 Rev 14

### Sample Results

**Lab Name:** ALS -- Fort Collins  
**Work Order Number:** 1804492  
**Client Name:** Stantec Consulting Services  
**ClientProject ID:** St. Anthony Geotechnical Investigation 233001076

<b>Field ID:</b>	BW-2 20'
<b>Lab ID:</b>	1804492-17

**Library:** RA226.LIB

<b>Sample Matrix:</b> SOIL	<b>Prep Batch:</b> GS180502-2	<b>Final Aliquot:</b> 215 g
<b>Prep SOP:</b> PAI 739 Rev 12	<b>QCBatchID:</b> GS180502-2-1	<b>Prep Basis:</b> Dry Weight
<b>Date Collected:</b> 18-Apr-18	<b>Run ID:</b> GS180502-2A	<b>Moisture(%):</b> NA
<b>Date Prepared:</b> 02-May-18	<b>Count Time:</b> 30 minutes	<b>Result Units:</b> pCi/g
<b>Date Analyzed:</b> 17-May-18	<b>Report Basis:</b> Dry Weight	<b>File Name:</b> 180675d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.82 +/- 0.23	0.42	0.5	NA	

#### Comments:

##### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
 Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
 Y2 - Chemical Yield outside default limits.  
 LT - Result is less than Requested MDC, greater than sample specific MDC.  
 M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
 M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.  
 SI - Nuclide identification and/or quantitation is tentative.  
 TI - Nuclide identification is tentative.  
 R - Nuclide has exceeded 8 half-lives.  
 G - Sample density differs by more than 15% of LCS density.

##### Abbreviations:

TPU - Total Propagated Uncertainty  
 MDC - Sample specific Minimum Detectable Concentration  
 BDL - Below Detection Limit  
 DL - Decision Level

**Data Package ID:** GSS1804492-1