Date: February 15, 2023
File: CD22068A

Travis Frei
Facility Management Contract Officer
Idaho Transportation Department
11331 W Chinden Blvd.
Boise, ID 83714

RE: **Geotechnical Engineering Evaluation**
Powell Maintenance Building
U.S. Highway 12
Idaho County, Idaho

Greetings:

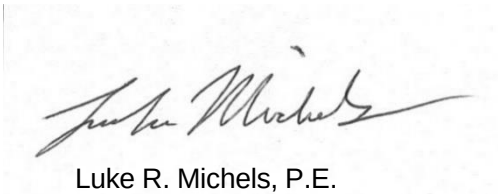
STRATA is pleased to provide geotechnical recommendations for the proposed Maintenance Building project planned at the Powell Maintenance Yard located at latitude 46°52'14.1'' and longitude 114°70'14.1" in Idaho County, Idaho. The purpose of our geotechnical engineering evaluation was to obtain subsurface information at the site and provide geotechnical opinions and recommendations to assist project planning, design, and construction. We accomplished our geotechnical services referencing our authorized proposal, dated October 27, 2022.

Our geotechnical recommendations presented herein must be read and implemented in their entirety; portions or individual sections of our report cannot be relied upon without the supporting text. The following report provides specific geotechnical recommendations for earthwork activities, shallow foundation design, concrete slab-on-grade floors, retaining wall design parameters, and pavement design.

Project construction success will depend, in part, upon the design team and contractor following our report recommendations, the contractor adhering to good construction practices, and the owner and/or contractor providing the necessary construction monitoring, testing, and geotechnical consultation to verify the work has been accomplished as recommended herein. Geotechnical continuity is an imperative part of the geotechnical design process, as it allows the geotechnical engineer-of-record to confirm soil conditions and potentially address changed conditions rapidly during construction. Therefore, we strongly recommend the Idaho Transportation Department (ITD) retain STRATA to provide geotechnical construction monitoring, testing, and consultation services to verify conditions encountered, and to ensure our report recommendations are being followed. If, for some reason, we are not provided the opportunity to provide geotechnical continuity during construction, we cannot be responsible for designer or contractor errors, omissions, or report misinterpretations.

We appreciate the opportunity to assist ITD with this project and look forward to our continued involvement during the construction phase. We strive to provide quality, innovative, and timely geoprofessional services.

Sincerely,
STRATA



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Geotechnical Engineering Evaluation
Powell Maintenance Building
U.S. Highway 12
Idaho County, Idaho

Prepared For:
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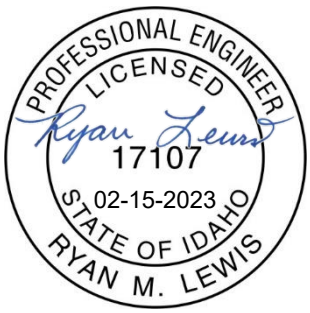

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Powell Maintenance Building
U.S. Highway 12
Idaho County, Idaho

SCOPE OF SERVICE

We accomplished the following services referencing our authorized proposal, dated October 27, 2022:

1. Coordinated with ITD to delineate exploration schedules, locations, utility issues, cleanup expectations, site access issues, and other exploration-specific considerations.
2. Conducted a site visit to establish and mark proposed exploration locations prior to public and private utility locating.
3. Contacted the Idaho Digline utility notification center prior to exploration to identify known public utilities within 50 feet of proposed boring locations (required by Idaho state law).
4. Subcontracted a private utility locator to perform ground penetrating radar (GPR) and electromagnetic (EM) utility locating within 50 feet of boring locations prior to our subsurface investigation.
5. Subcontracted a trailer-mounted drill rig and operator to advance 9 exploratory borings at the site up to 38 feet below the ground surface. Two (2) planned borings (B-6 and B-7) could not be advanced due to the presence of boulders in the surficial undocumented fill. Boring locations are illustrated on Plate 1, *Exploration Location Plan*. STRATA collected Standard Penetration Test (SPT) soil samples at 2.5- to 5.0-foot intervals, extending to each boring's termination depth. Strata also pushed relatively undisturbed Shelby tube samples at select locations when soil conditions allowed.
6. Observed 4 test pits excavated up to 5 feet below the existing ground surface by an ITD supplied track hoe and operator. STRATA obtained bulk samples of the subgrade during test pit exploration.
7. Logged the subsurface profiles, visually described, and classified the soil encountered referencing the *Unified Soil Classification System* (USCS). Prior to departing the site, we staked/painted and labeled each location following exploration activities to assist future surveying. Additionally, we documented exploration locations using a commercially available global positioning system (GPS) device and confirmed by measuring from existing site features.
8. Accomplished laboratory testing on samples obtained during fieldwork referencing *ASTM International*, AASHTO, or ITD test standards. Laboratory test results were used to assist soil classification and characterize soil engineering parameters. Laboratory testing included:

    - Grain size evaluations
    - In-place moisture content
    - Atterberg limits
    - In-situ unit weight
    - pH/resistivity/sulfate content
    - Direct Shear
    - Idaho R-Value
    - Moisture-density relationship (modified Proctor)

9. Reviewed the design team's development documents and provided geotechnical design and construction recommendations for:

    - Earthwork
    - Shallow foundation design
    - Concrete slab-on-grade floors

- Pavement Section Design
- Soil parameters for Retaining Walls
- Additional Services Recommended

10. Prepared a draft geotechnical engineering evaluation, including exploration logs, laboratory test results, and related visual aids.
11. After receiving draft report review comments, we incorporated feedback and issue this stamped report deliverable.

PROJECT UNDERSTANDING

ITD is planning to construct a new maintenance building and make other site improvements at their Powell Yard facility. Miller Stauffer Architects has been selected to provide architectural design services and DCI Engineers has been selected to provide structural engineering design services for the project. You requested STRATA provide this report with geotechnical design recommendations to assist civil and structural design progression. We base our project understanding on the following:

- Our telephone and electronic mail conversations with Travis Frei and Tony Pirc, with ITD;
- Our telephone conversations with Micheal Walker, with Miller Stauffer Architects;
- Our telephone and electronic mail conversations with Kelly Andersen, P.E., S.E., with DCI Engineers;
- Reviewing the *Site Plan* document provided by Miller Stauffer dated August 10, 2022;
- Reviewing the design drawings for the previous maintenance building provided by ITD, dated April 25, 1962 and July 27, 1998;
- Reviewing the *Materials Phase IV Report* for the Powell Equipment Storage Building dated May 24, 2016; and
- Our previous experience with similar soil conditions near the project site.

Existing Site Conditions

The Powell Maintenance Yard is located on Lochsa Road in the Nez Perce-Clearwater National Forest on U.S. 12 approximately 10 miles southwest of the Montana border. The area surrounding the maintenance yard is heavily wooded with a creek flowing north to south along the east edge of the property. Lochsa Road is the only portion of the site that is paved (asphalt), with the immediate surrounding area of buildings on the site surfaced with gravel fill. The site generally slopes downward to the south, with approximately 30 feet of elevation change between the north and south ends of the existing parking area. There is approximately 3 feet of elevation change within the proposed maintenance building footprint. There is an approximately 35,000 square foot parking/driving area east of the current vehicle storage building and south of the proposed maintenance building. on the northwest and southwest corners of the site exist several overnight bunk houses for ITD employees. On the east side of the site is an approximately 7,500 square foot salt shed for winter road maintenance.

Proposed Construction

The project includes constructing an approximately 8,000 square foot vehicle maintenance building, an approximately 1,500 square foot fuel and power island, a 275 lineal foot retaining

wall wrapping around the west and north sides of the vehicle maintenance building, and approximately 55,000 square feet of new asphalt pavement.

The new building is located within the footprint of the previous maintenance building that has already been removed. Although we could not verify during exploration, it is our understanding that underground storage tanks have been removed and backfilled on the east end of the proposed building. The previous building was a slab-on-grade structure constructed on spread footings bearing 2 feet, 8 inches below grade. The burial depth of the previously removed underground storage tanks is unknown. The new building will be a single-story, slab-on-grade, steel-framed structure supported by a conventional shallow foundation system consisting of continuous spread and isolated column footings. Based on preliminary structural loading information provided by DCI Engineers, maximum column loads are anticipated to be on the order of 132 kips and maximum wall loads are anticipated to be 2 kips per lineal foot.

The new fuel and power island will be located approximately 150 feet west of the salt shed. Per our conversations with DCI Engineers, the new island will be founded on a concrete slab-on-grade with bearing pressures less than 500 pounds per square foot (psf).

The new retaining wall will be a cast in place concrete wall with heights up to 8 feet. Stormwater will be routed to an existing drainage ditch along U.S. Highway 12.

FIELD AND LABORATORY EVALUATION

Site Exploration

We evaluated subsurface conditions within the proposed building addition footprint by advancing nine (9) exploratory borings (B-1, B-1A, B-2, B-3, B-4, B-5, B-8, B-9, and B-10) and four (4) test pits on November 15th and 16th, 2022. Planned borings B-6 and B-7 could not be advanced due to boulders within the surficial undocumented fill. Plate 1, *Exploration Location Plan,* illustrates the approximate boring locations documented in the field with a commercially available GPS unit.

We advanced borings at the site between 5.5 and 38.0 feet below the existing ground surface using a G-2400 trailer-mounted drill rig equipped with 7-inch outside-diameter hollow-stem augers. Soil samples were obtained in the borings at 2.5- to 5.0-foot intervals via standard penetration testing (SPT) using 2-inch- and 3-inch diameter split spoon samplers. We advanced the SPT samplers 18 inches with a 140-pound hammer falling 30 inches. We obtained the SPT N-value by counting the number of hammer blows required to advance the sampler over the interval from 6 to 18 inches. The blow counts for each 6-inch sampler segment are presented on the boring logs. The SPT N-values reported on the boring logs are not corrected for overburden pressure, the larger diameter of the modified California sampler, or dilation effects on the sampler.

We observed ITD staff excavate test pits at the site between 4.5- to 5.0-feet below the existing ground surface using a Caterpillar 306 CR Mini Excavator equipped with an 18-inch-wide bucket. The excavator was supplied and operated by ITD personnel.

Mr. Steve Litalien, E.I. visually described, classified, and logged the subsurface conditions encountered during exploration referencing the USCS. Appendix A presents exploration logs and a USCS explanation, which should be used to help interpret soil terms used throughout this report and on the exploration logs.

Following exploration completion, we loosely backfilled borings and test pits with on-site cuttings finished approximately level with the surrounding ground surface. The test pits were

loosely compacted utilizing the mini excavator. STRATA staked and/or labeled the boring/test pit locations prior to departing the site.

Subsurface Conditions

General

In general, we encountered undocumented fill overlying native sand in all borings and test pits with the exception of TP-4, which was terminated within undocumented fill due to refusal on boulders. In the six borings drilled within the previous building footprint (B-1 through B-5, and B-1A) we encountered 0.8 to 3.5 feet of well-graded sand with silt and gravel (SW-SM) fill over the native silty sand with gravel (SM), extending to the maximum depth of all borings. In the 2 borings and 1 test pit (B-9, B-10, and TP-1) explored north of the former and proposed building footprint, we encountered 0.2 to 0.6 feet of gravel surfacing classifying as silty sand with gravel (SM) underlain by native sand. In the general driving areas west and east of the proposed and former building footprint (B-8 and TP-2) we encountered 0.1 to 1.5 feet of gravel surfacing visually classifying as poorly graded gravel with silt and sand (GP-GM). The gravel surfacing was underlain by native sand in B-8 and remnant topsoil over native sand in TP-2. In the area east of the salt shed (TP-3) we encountered 4.5 feet of undocumented fill derived from topsoil overlaying native sand. In the proposed fuel island area, we were unable to advance the two proposed borings (B-6 and B-7) due to boulders within the undocumented fill. In the test pit excavated southwest of the proposed fuel island (TP-4), we encountered 4.5-feet of undocumented fill before refusal on boulders.

Undocumented Fill – Previous Building Footprint

We encountered undocumented fill in all borings located in the previous maintenance building footprint (B-1, B-1A, B-2, B-3, B-4, B-5). The fill classified as well graded sand with silt and gravel (SW-SM) according to the ASTM classification system. The fill was brown and gray and moist, with an in-situ moisture content of 8.3 percent. Penetration resistance values in the undocumented fill were 10 blows per foot, indicating a loose stratum. We measured a fines content (percent passing the No. 200 sieve) of 11.3 percent. Atterberg limits testing indicated the fill is non-plastic.

Undocumented Fill – North of Proposed Building

North of the proposed and previous building footprint we encountered undocumented fill in both borings and the test pit (B-9, B-10, TP-1) extending to 0.5-feet below existing grade. The undocumented fill consisted of gravel surfacing that classified as silty sand with gravel (SM) according to the ASTM classification system. The fill was brown to gray and moist, with an in-situ moisture content of 16.3 percent. We measured a fines content of 13.9 percent and Atterberg limits testing indicated the fill is non-plastic.

Undocumented Fill – Fuel Island Area

In the large parking/driving area to the west of the salt shed where the proposed fuel island will be, we encountered undocumented fill in TP-4 extending to 4.5-feet below existing grade. The undocumented fill visually classified as poorly graded gravel with silt and sand (GP-GM) according to ASTM D2488. The fill contained cobbles and boulders which increased in size as depth increased. Asphalt and concrete debris were also observed throughout the fill. The total depth of the undocumented fill in this area is unknown.

Undocumented Fill – General Driving Areas

In the general driving areas to the west and east of the previous maintenance building footprint we encountered 0.1 to 1.5 feet of undocumented fill consisting of gravel surfacing.

The gravel surfacing encountered in B-8 and TP-2 visually classified as a poorly graded gravel with silt and sand (GP-GM) according to ASTM D2488. The gravel fill was described as brown or gray and moist.

Undocumented Fill – East of Salt Shed

Undocumented fill was encountered east of the salt shed in TP-3 and extended to 4.5 feet below existing grade. The undocumented fill was derived from topsoil and visually classified as silty sand with gravel (SM) according to ASTM D2488. The fill was dark brown to black, moist, and contained roots and other organic material. We measured an organic content of 5.1% in a sample of the undocumented fill obtained from TP-3.

Topsoil

A 1-foot layer of remnant topsoil was encountered below the undocumented fill in TP-2 from 1.5 to 2.5 feet below ground surface. The topsoil visually classified as silt with sand (ML) according to ASTM D2488. The topsoil was dark brown to black and moist based on visual observations noted in the field. Roots and other organic material were observed in the remnant topsoil layer.

Native Sand

Native sand was encountered below the remnant topsoil or undocumented fill in each boring and test pit except for TP-4 and extended to the boring termination depths (5.5 to 38 feet). The native sand classified as silty sand with gravel (SM) or silty sand (SM) according to the ASTM classification system. The gravel content within the native sand varied inconsistently relative to both depth below ground surface and boring location. The native sand was described as brown and gray, and moist to wet, with in-situ moisture contents above the groundwater table ranging from 5.2 to 24.4 percent. Penetration resistance values in the sand ranged from 2 to 11 blows per foot in layers with lower gravel content, indicating a very loose to medium dense soil stratum, while penetration resistance values ranged from 13 to over 50 blows per foot in the interbedded layers of native sand with higher gravel content. We measured a fines content in the native sand between 32.4 and 46 percent. Atterberg limits testing indicated that the native sand is non-plastic. Moisture-density relationship testing (modified Proctor, AASHTO T180 on the sand resulted in a corrected maximum dry density of 134.3 pounds per cubic foot (pcf), with an optimum moisture content of 6.8-percent. R-value testing on the native sand indicated the native sand has an Idaho IT-8 R-value of 50. Direct shear testing resulted in an internal friction angle of 33.5 degrees. We measured in-situ dry densities of 104.3 and 114.7 pounds per cubic foot (pcf) in relatively undisturbed samples of the native sand.

Groundwater

Groundwater was encountered at the time of drilling in three of the previous building footprint borings: B-2, B-3 and B-5. Depth to groundwater ranged from 20.0 to 21.5 feet below the existing ground surface. Groundwater can vary with seasonal changes in irrigation, infiltration, precipitation, and adjacent site developments. Groundwater is common as small, nuisance seeps and springs in the subsurface primarily associated with subsurface water conduits (utilities) and seasonal runoff management facilities.

Bedrock

Bedrock was not encountered at any of the boring or test pit locations within the depths explored. Based on our research on past explorations and review of available well logs in the

area, we do not anticipate bedrock will be encountered within the upper 50-feet of the soil profile.

Subsurface Variability

Exploratory borings and test pits only allow observation of a relatively small sample of the subsurface conditions at the site. Variations may exist between and beyond exploration locations. Such variations will not be apparent until construction and may impact project schedules and costs. Where such variations exist, it may affect the opinions and recommendations presented in this report as well as construction timing and costs and we must be contacted to review the encountered conditions and our recommendations to make any necessary revisions.

Laboratory Testing

We performed laboratory testing on select soil samples collected in the field referencing *ASTM International* (ASTM), AASHTO, and ITD test standards. We used laboratory test results to verify soil classification and to estimate soil engineering properties. Laboratory testing included grain size evaluations, in-situ moisture content and unit weight, Atterberg limits, pH/resistivity/sulfate content, moisture-density relationship curve (modified Proctor), direct shear, and R-value testing. Index laboratory test results are presented on exploratory logs in Appendix A. Graphical test results are provided in Appendix B.

GEOTECHNICAL OPINIONS AND RECOMMENDATIONS

We present the following geotechnical recommendations to assist project planning, design, and construction for the Powell Maintenance Building project planned in Idaho County, Idaho. We based our geotechnical recommendations on our experience with similar soil and geologic conditions, findings from our field and laboratory evaluation, geotechnical engineering analyses, and our understanding of the proposed construction. If development plans change, we should be contacted to review the project modifications and revise our recommendations as necessary.

General Project Considerations Discussion

Based on our field and laboratory evaluation, our opinion is the project site is suitable for the proposed construction, provided our recommendations are incorporated into project plans and specifications, and are followed and verified during construction.

Undocumented fill associated with previous site development was encountered in each boring and test pit. Remnant topsoil was also encountered in the proposed pavement area east of the salt shed and could be encountered at other parts of the site The undocumented fill and topsoil (remnant or surficial) is not suitable to support foundations or slabs (interior and exterior). All undocumented fill and topsoil should be removed below foundations and slabs. The undocumented fill used as gravel surfacing north of the proposed building footprint and in the general driving areas along with the undocumented fill used as backfill in the previous building footprint may be repurposed as *Structural Fill* used in the soil improvement areas below footings or in embankment fill areas provided it meets the requirements outlined in Table 1 below. The undocumented fill encountered east of the salt shed, the undocumented fill encountered in the fuel island area, and the on-site native sand does not meet the requirements of Table 1 below and cannot be used as *Structural Fill.*

The native sand is loose within the foundation depths and will differentially settle under variable loading conditions. In an effort to minimize differential settlement, a 3-foot-thick

Structural Fill soil improvement must be placed and compacted below building foundations, including continuous and isolated footings. Similarly, a 1-foot thick soil improvement zone is required below interior slabs-on-grade and the fuel island slab-on-grade.

Earthwork

Site and Subgrade Preparation

We recommend topsoil, defined as soil containing greater than 3 percent vegetation and organics by weight (per ASTM D2974), and undocumented fill be removed below any planned improvement, structure, or soil embankment area.

We encountered undocumented fill and/or remnant topsoil extending to depths between 0.1- and 4.5 feet in every boring and test pit. The undocumented fill in the fuel island area is likely deeper than 4.5 feet. Undocumented fill has a variable density and can result in excessive total and differential settlement of structures over time due to soil consolidation, which is extremely variable and difficult to predict in granular soil. Therefore, we recommend topsoil and undocumented fill be removed to expose undisturbed native sand. We recommend undocumented fill removal extend a minimum 5 lateral feet outside foundations and interior slabs and a minimum 3 lateral feet outside exterior hardscapes and pavements. If there are areas where the excavation required for undocumented fill removal extends deeper than 5-feet, the excavation should extend a minimum 1-foot laterally for every 1-foot of vertical depth (i.e. 7-foot excavation requires fill removal extend 7 feet beyond the foundation, slab, or pavement).

Following topsoil stripping and undocumented fill removal, we recommend 12 inches of the resulting surface be scarified, moisture-conditioned to within 3 percent of optimum moisture content, and re-compacted to the requirements presented in this report's *Soil Product Specifications and Required Compaction* section. Recompacting the subgrade will require moisture-conditioning and soil processing. Such subgrade preparations can often help identify areas susceptible to subgrade pumping and rutting. Pumping or rutting subgrade areas should be removed to a depth of 12 inches below the subgrade elevation as discussed in this report's *Wet Weather, Wet Soil Construction and Over-excavations* section. After the subgrade has been moisture-conditioned, compacted, and reviewed by STRATA, *Structural Fill* or separation fabric placement may commence.

Pavement Area and Hardscapes Subgrade Preparation

We understand project costs may prohibit complete undocumented fill removal beneath new asphalt pavement areas and hardscapes (sidewalks, etc.) planned for the new maintenance building and fuel island. ITD may elect to leave the undocumented fill provided they accept the risks associated with reduced pavement performance due to settlement, and an associated increase in pavement maintenance. **Constructing pavements over undocumented fill is not without risk of settlement, ponding, increased weathering, cracking, and long-term distress.** We provide the following relative risk summary for potential settlement within the proposed parking area:

- Low Risk – Complete removal and replacement of undocumented fill with compacted *Structural Fill* meeting the requirements outlined in Table 1 below.

- Moderate Risk – Partial removal of undocumented fill within pavement areas. Removal of upper 18 inches of fill, scarification and re-compaction of resulting surface, followed

by placement of a geotextile separation fabric and compacted *Structural Fill* to achieve construction grades.

- High Risk – No removal of undocumented fill within pavement areas. Scarification and re-compaction of the upper 12 inches of on-site fill followed by placement of geotextile separation fabric and compacted *Structural Fill* to achieve construction grades.

We recommend ITD communicate the desired pavement subgrade preparation method (i.e. low, moderate, or high risk option) to perspective earthwork contractors during the bidding phase.

After STRATA has reviewed and approved the subgrades within the pavement footprint, we recommend the contractor place a woven or nonwoven geotextile separation fabric between the subgrade soil and the supporting *Crushed Aggregate Base* layer. Refer to this report's *Geotextile Applications* section for additional information.

Soil Improvements – Footings

The following section applies to new continuous or isolated column footings. We recommend the contractor place a 3.0-foot-thick layer of *Structural Fill* below new footings. This soil improvement below new footings is necessary to maintain acceptable project settlement tolerances (<1.0-inch total settlement and <0.5-inch differential settlement). Based on our exploration, removal of native soil will be required to construct the 3-foot-thick soil improvement below footings. Although it may aid in subgrade compaction, a separation fabric is not required between the *Structural Fill* and recompacted native sand below the footings.

Interior Slab and Fuel Island Slab Subgrade Preparation

Following topsoil and undocumented fill removal, we recommend the resulting native sand be scarified, moisture conditioned, and re-compacted per the above *Site and Subgrade Preparation* section of this report. Although it may aid in subgrade compaction, a separation fabric is not required between the *Structural Fill* and recompacted native sand below slabs.

Excavation Characteristics

We anticipate the on-site undocumented fill and native sand may be excavated using conventional excavation techniques. The earthwork contractor should plan to remove boulders ranging from 1-foot to 1.8 feet in the fuel island area. In general, slopes and excavations must be excavated, shored and/or braced in accordance with the *Occupational Safety and Health Administration* (OSHA) regulations and codes. The on-site soil is classified as a "C" type soil according to OSHA requirements. As such, we recommend provisions be made to allow temporary excavations of soil to be sloped back to at least 1.5H:1V (horizontal to vertical) or as otherwise determined to be safe according to the selected contractor's competent person. Ultimately, the selected contractor is responsible for site safety and determining appropriate excavation stability. We recommend temporary slopes deeper than 20 feet be designed by a qualified engineer licensed in the State of Idaho.

Excavations must be planned carefully, allowing water collection points and utilizing conventional sumps and pumps to remove nuisance water from runoff, precipitation or groundwater seeps. If soil excavations are not immediately backfilled, they may degrade when exposed to water and require over excavation and replacement with *Structural Fill*. We recommend construction activities and excavation backfilling be performed as rapidly as possible to reduce the potential for subgrades to degrade under construction traffic.

The on-site native soil is moderately moisture-sensitive and susceptible to disturbance when moist or wet. Soil disturbance will negatively impact the soil's performance below slabs, pavements, and foundations. *Disturbed and/or uncompacted soil shall not be allowed below any structure.* Equipment with large tracks, lugs or having toothed buckets has a significant potential to disturb the site soil prior to or following compaction. Rubber-tired transport vehicles should not access prepared subgrades unless the subgrade is sufficiently stiff to allow construction traffic without disturbance. We recommend project earthwork specifications specifically outline that the contractor is required to maintain the subgrade in a compacted condition and protect subgrades from construction traffic disturbance after they have been prepared and meet compaction requirements.

Soil Product Specifications and Required Compaction

Soil Products and Re-use

We recommend any fill placed below foundations and slabs to meet site grades comprise *Structural Fill* meeting the requirements presented in Table 1. The undocumented fill used as gravel surfacing north of the proposed building footprint and in the general driving areas along with the undocumented fill used as backfill in the previous building footprint may be repurposed as *Structural Fill* provided it meets the requirements outlined in Table 1 below. The undocumented fill encountered east of the salt shed, the undocumented fill encountered in the fuel island area, the on-site topsoil, and the on-site native sand does not meet *Structural Fill* requirements specified in Table 1 below, but may be used as *Non-Structural Fill* in landscaping areas.

Table 1. Soil Specifications and Allowable Use

Soil Fill Product	Allowable Use	Material Specifications
Non-Structural Fill	• Any area that will not contain structures (typically landscape areas)	Soil must be classified as GP, GM, GW, GC SP, SM, SW, SC, CL or ML according to the USCS. Soil may not contain particles larger than 12 inches in median diameter. Soil must be reasonably free from deleterious substances such as wood, metal, plastic, waste, etc.
Structural Fill[1]	• Soil improvement below foundations and slabs • Embankment fills • Foundation and retaining wall backfill beyond foundation drainage course. • Over-excavations • Utility trench backfill above bedding course for underground pipe	Soil must meet the requirements for "Aggregate for Granular Subbase" from *Section 703.11* in the ITD SSHC[2]. Soil must contain less than 3% organics and vegetation by weight (per ASTM D2974) Soil must contain less than 3% wood, metal, plastic, or other deleterious substances (quantity can be approximated by the geotechnical engineer-of-record).
Crushed Aggregate Base	• Slab-on-grade aggregate • Pavement support aggregate • Structural Fill uses	Must meet "3/4-inch B" nominal maximum size aggregate gradation requirement specified in Table 703.04-1 from *Section 703 – Aggregates* of ITD SSHC.[2]
Pipe Bedding Course	• Utility pipe bedding	Must meet "Size No. 1", "Size No. 2a" or "Size No. 2b" Coarse Aggregate gradation requirements specified in Table 703.02-6 – from *Section 703 – Aggregates* of ITD SSHC.[2].
Drainage Course	• Foundation drains	Must meet "Size No. 4", or "Size No. 5" Coarse Aggregate gradation requirements specified in Table 703.02-6 – from *Section 703 – Aggregates* of ITD SSHC.[2].
Unsatisfactory Soil	• **NONE**	Soil classified as CH, MH, OH, OL or PT may not be used at the project site. Any soil type not maintaining moisture contents within 3% of optimum during compaction is unsatisfactory soil.[3]

1. The undocumented fill used as gravel surfacing north of the proposed building footprint and in the general driving areas along with the undocumented fill used as backfill in the previous building footprint within the planned construction depths generally meets the intent of our recommendations for *Structural Fill*.
2. The 2018 version of *Idaho Transportation Department (ITD) Standard Specifications for Highway Construction (SSHC)*
3. Unsatisfactory soil that is wetted or dried to within 3% of optimum moisture may be used as *Structural Fill*, providing other criteria are met for appropriate *Structural Fill* use per Table 1 above.

Compaction

Table 2 summarizes soil product compaction requirements in designated project areas.

Table 2. Required Soil Products for Designated Project Areas

Project Area	Required Soil Product	Compaction Requirement
Subgrades beneath foundations, slabs, and pavements	12 inches of native soil (scarified and recompacted)	95%[1]
Soil improvement below footings and slabs	Structural Fill	95%[2]
Embankments below structures (including foundations and slabs), wall backfill, and utility trench backfill	Structural Fill	95%[2]
Directly beneath pavements, slabs, and hardscapes	Crushed Aggregate Base	95%[2]
Over-excavations caused by wet weather and/or wet soil conditions	Structural Fill	95%[2]
Landscaped areas	Non-Structural Fill	85%[1]

1. Reference American Association of State Highway and Transportation Officials (AASHTO) T180.
2. Reference Idaho IT-74, *Idaho Standard Method of Test for Vibratory Spring-Load Compaction for Coarse Granular Material*.

Place soil products over subgrades that have been reviewed and approved by the Geotechnical Engineer of Record. Never place soil products over frozen, saturated, or soft subgrades. Soil products must be moisture conditioned to within 3 percent of the optimum moisture content and placed in maximum 12-inch-thick, loose lifts. The contractor is responsible for selecting compaction equipment suitable for achieving compaction. If the contractor is unable to achieve the specified compaction requirements listed in Table 2 using the selected compaction equipment, a lift thickness reduction may be required.

Coarse Soil Conditions

ITD recommends granular subbase (*Structural Fill)* and *Crushed Aggregate Base* be compacted according to Idaho IT-74, *Idaho Standard Method of Test for Vibratory Spring-Load Compaction for Coarse Granular Material*.

Alternatively, ITD recommends on-site or imported soil products that contain more than 10 percent retained on the 3-inch sieve or more than 30 percent particles retained on the ¾-inch sieve be compacted per *Section 205.03.F.2* in the ITD SSHC.

Wet Weather, Wet Soil Construction and Over-excavations

We strongly recommend earthwork construction take place during dry weather conditions. In soft or wet soil areas and during wet weather conditions, earthwork contractors must be familiar with the hazards of using rubber-tired equipment, which exerts a point load on the subgrade. Staggering wheel paths, using tracked equipment to traverse exposed subgrades and other techniques are important processes that reduce the potential for subgrade pumping, rutting, and contractor rework.

Earthwork should not be performed immediately after rainfall, or until soil can dry sufficiently to allow construction traffic without disturbing the subgrade. Potential disturbance may require isolated removal and replacement during construction. We recommend any soil exhibiting pumping, rutting, weaving, or otherwise exhibiting unstable performance be moisture-

conditioned to within 3 percent of the optimum moisture content and recompacted to *Structural Fill* requirements, or removed. If moisture-conditioning is impractical or may create project delays, the soil should be removed to undisturbed native soil using smooth-blade equipment and *Structural Fill* placed to desired grades. We recommend the "over-excavation" process occur as follows:

1. STRATA and/or the selected contractor should identify and delineate unstable subgrade soil conditions. STRATA must review the affected area and provide the contractor and the design team feedback to help facilitate the over-excavation process.
2. After attempting proper moisture conditioning, remove unstable areas using smooth-blade equipment to a minimum depth of 1.0 foot below the subgrade surface. Extend the over-excavation a minimum of 2.0 feet laterally beyond the delineated unstable area.
3. STRATA shall verify the over-excavation base consists of undisturbed native soil or documented embankment fill.
4. A geotextile fabric may be placed over the verified over-excavation base to assist soil stabilization efforts. Refer to this report's *Geotextile Applications* section for additional information.
5. Place *Structural Fill* in the over-excavation to desired grades in accordance with the *Soil Product Specifications and Required Compaction* report section.

In some instances, a 1.0-foot-deep over-excavation may not be sufficient to expose suitable native soil; additional over-excavation depth may be needed. Further, areas may require a woven or nonwoven geotextile fabric to assist remediation. We recommend STRATA be present to observe all over-excavations to verify they have been constructed according to the above criteria, but also to provide immediate on-site feedback and discussion with the project team regarding soft soil conditions to help facilitate the construction schedule.

Utility Trench Construction

Loose soil must be removed from the base of utility trenches prior to placing pipe bedding course. Based on our observations during exploration, loose soil and sloughing will be likely at the base of utility trenches. In addition, groundwater in utility trenches can be present during wet weather conditions and standing water must be removed from the utility trench base before placing pipe bedding course. We recommend bedding course and trench backfill be placed according to ITD's *Standard Drawing No. 601-1*.

Geotextile Applications

Nonwoven or woven geotextiles should meet requirements outlined in the subgrade separation geotextile property requirements provided in *Section 718.07* of the ITD SSHC.

Geotextiles shall be applied directly on approved subgrade, taut, overlapped at least 18 inches or otherwise placed according to manufacturers' recommendations. When used for over-excavation applications, geotextile fabric must completely separate native soil from *Structural Fill*. STRATA should be consulted to review geotextile applications, soil reinforcement methods, or other subgrade improvement alternatives during construction.

Geotextile fabrics may be useful in situations with soft, pumping, and rutting subgrade soil conditions, but cannot be used to reduce or eliminate the risk of undocumented fill settlement associated with fill compression/consolidation or debris decay.

Foundation Design

General Requirements

If our recommendations are followed, the foundation design criteria presented herein can be applied to project foundations, assuming the loading conditions stated in our *Proposed Construction* report section are accurate. We recommend any foundation for the proposed structures bear on a minimum 3-foot layer of compacted *Structural Fill* above recompacted native sand as discussed in our *Earthwork* report section. We recommend *Structural Fill* subgrades remain in a compacted condition during foundation preparations, construction of concrete formwork, and reinforcing steel placement. All foundation bearing surfaces should be free of loose soil and debris and be compacted to the requirements listed in Table 2.

Design Parameters

Based on preparing the foundation bearing soil units as described herein, the following items provide our recommended shallow foundation design parameters:

- Maximum allowable bearing pressure: 2,500 pounds per square foot (psf)
  - Minimum continuous wall footing width: 1.5 feet
  - Minimum isolated column footing width: 3.0 feet
  - Maximum 30 percent increase allowed for short term load increases such as wind or seismic.
- Estimated foundation vertical settlement:
  - Total settlement: Less than 1.0 inch.
  - Differential settlement: Less than 0.5 inches over 30 lateral feet
- Lateral load resistance:
  - Foundation base friction coefficient (nominal, **unfactored** value):
    - 0.40 for foundations cast directly on *Structural Fill* soil.
- Footing embedment:
  - Bottom of exterior footings must extend at least 30 inches below the final, exterior ground surface to help protect against frost action.
  - Bottom of interior footings located within heated buildings must extend at least 12 inches below the top of slab to meet the provided maximum allowable bearing pressure.

Corrosivity

Based on laboratory test results, the soil at the site maintains a basic pH (8.54) and has severe corrosivity potential (resistivity = 828 ohms-cm). We recommend all foundations and utility conduits have appropriate corrosion protection and the design team adhere to all code-minimum steel reinforcement clearances. Sulfate content testing indicates a negligible (47.2 mg/kg dry) capacity for sulfate attack of concrete. Type I/II Portland Cement Concrete is used commonly in the area without known concrete-soil reaction impacts.

Seismicity

From the subsurface soil conditions encountered in the borings and information provided in Table 630.04.01.1 in the *ITD Materials Manual*, our opinion is a Seismic Site Class “D” should be used for the structural design of the building and retaining wall.

Based on the project site location, Figures 630.04.01.1, 630.04.01.2, and 630.04.01.3 in the *ITD Materials Manual* and Tables 630.04.02.1 and 630.04.02.2 in the *ITD Materials Manual*, we recommend the seismic parameters presented in Table 3 be used for design.

Table 3. Seismic Design Criteria

Period (seconds)	Standard Acceleration Coefficients for Site Class B (g)	Site Factor for Site Class D	Spectral Acceleration Parameters for Site Class D (g)
0.0 (Peak)	PGA = 0.09	F_{PGA} = 1.6	A_s = 0.144 (PGA * F_{PGA})
0.2 (Short)	S_S = 0.20	F_a = 1.6	S_{MS} = 0.32 (F_a*S_S)
1.0	S_1 = 0.07	F_v = 2.4	S_{M1} = 0.168 (F_v*S_1)

Based on the subsurface conditions encountered, our opinion is liquefaction potential and seismic-induced settlement at the site is low.

Foundation Drainage

We recommend foundation stem walls and retaining walls be backfilled with *Structural Fill* to prevent pore water pressure build up against the structures. We also recommend that a foundation drain be placed at the lowest bearing elevation around the perimeter of foundations and walls and daylighted at an appropriate disposal area. An example foundation drainage system is presented on Plate 2, *Foundation and Wall Drain Schematic.* Roof drains should never be connected to foundation drains.

Concrete Slab-on-Grade Floors

We recommend concrete slab-on-grade floors (including the fuel island slab) be supported by *Crushed Aggregate Base* placed and compacted over a minimum 12 inches of *Structural Fill* meeting the requirements in Table 1. The *Structural Fill* should extend to recompacted native sand. The recommendations provided in this section assume compacted *Structural Fill* subgrades below the *Crushed Aggregate Base* will be prepared per the *Earthwork* report section. The slab's supporting *Crushed Aggregate Base* should be constructed once the majority of under slab plumbing and utilities are completed.

Floor slabs must be designed for the anticipated use and equipment or storage loading conditions. If at least 4 inches of *Crushed Aggregate Base* is used below slabs, we recommend concrete slab design utilize an allowable modulus of subgrade reaction (k) of 250 pounds per cubic inch (pci).

Moisture Protection

Interior floor slabs may be susceptible to moisture migration caused by subsurface capillary action and vapor pressure. Moisture migration through floor slabs can break down a floor covering, its adhesive, or cause various other floor covering performance problems. Specifically, STRATA has participated in numerous projects where inadequate vapor protection caused significant damage to moisture-susceptible flooring systems. Often, these moisture problems were associated with either no moisture protection below the slab or, alternatively, un- or inadequately sealed sub slab penetrations that allowed vapor migration and damage the flooring system. Plumbing penetrations are notoriously problematic for under slab vapor protection.

Vapor retarders must consist of thick, puncture-proof polyethylene sheeting placed

immediately below the floor slab. An example of this material is Stego Wrap Vapor Barrier a 15-mil retarder. Alternatively, the vapor barrier may be covered with an additional 2-inch-thick layer of clean, coarse sand placed between the *Crushed Aggregate Base* and the concrete slab-on-grade floors, if the *Crushed Aggregate Base* and slabs are placed with a waterproofing system in-place. Vapor barrier installation options are outlined in Figure 1.

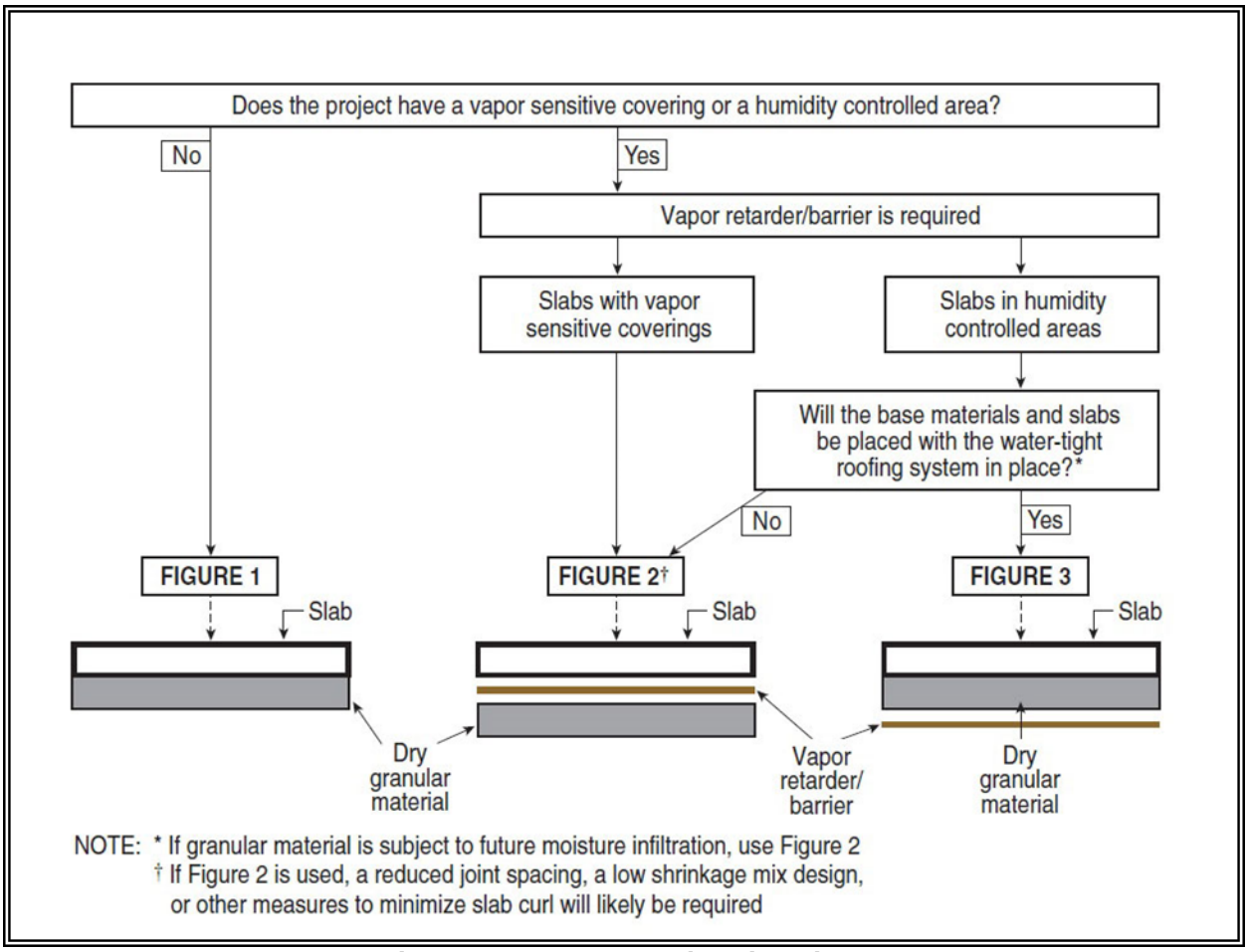


Figure 1: Vapor Retarder Flowchart

(Adapted from Figure 3-1 of ACI 302.1R-04)

Form stakes, piping, or other sub-slab penetrations must never penetrate the vapor retarder. Carefully design and construct any vapor retarder penetrations to reduce vapor transport through such penetrations. Even if these recommendations are used, water vapor migration through the concrete floor slab is still possible. Floor covering should be selected accordingly and, when practical, flooring manufacturers should be consulted regarding moisture barriers, their location and product warranties. Manufacturer's recommendations should be strictly followed. Where vapor retarders are utilized, the flooring and concrete slab contractors, as well as the plastic sheeting manufacturer, should be consulted regarding additional slab cure time requirements and/or the potential for slab curling.

Ultimately, the location of the vapor retarder should be carefully considered by the project design team. ASTM E1643 and American Concrete Institute (ACI) Committee 302 are 2 publications that provide considerations for vapor retarder locations. Studies have shown that decreased water cement ratios, higher strength concrete and good construction finishing practices significantly decrease any negative impacts associated with the above options for

vapor retarder locations.

Exterior Slabs

Non-critical exterior slabs may be supported on either undisturbed native sand or existing undocumented fill after the vegetation, topsoil, and root zone have been removed. Critical exterior slabs, such as those at entrances, will likely require some additional subgrade preparation as described below. As previously indicated, the undocumented fill encountered on the site could result in excessive settlement of exterior slabs. To reduce this risk, we recommend removing the undocumented fill beneath critical exterior slabs down to native sand, then replacing it with *Structural Fill* compacted per the requirements in Table 2.

Lateral Earth Pressures

We recommend foundations and retaining walls be backfilled using *Structural Fill* conforming to *Section 703.11 "Aggregate for Granular Subbase"* of the latest edition of the ITD SSHC. Lateral earth pressures will be realized from retained soil behind the structures as well as any surcharge from equipment, vehicle traffic, or material placed adjacent to walls. Based on the topographic map provided by Miller Stauffer Architects, we anticipate foundation stem walls and the retaining wall will have a close to horizontal backslope. We recommend lateral earth pressures for foundation and retaining walls be estimated using the following equivalent fluid pressures (EFP) from Table 4.

Table 4: *Structural Fill* - Parameters for Retaining Wall and Foundation Wall Design

Parameter	Horizontal Backfill
Unit Weight (moist, compacted)	130 pcf
Friction Angle	34°
Active Earth Pressure, K_a	0.28
Equivalent Active Fluid Pressure for walls free to rotate at the top	36 pcf
At-Rest Earth Pressure, K_o	0.44
Equivalent At-Rest Fluid Pressure for walls restrained at the top	57 pcf
Passive Earth Pressure, K_p	3.50
Equivalent Passive Fluid Pressure for walls free to rotate at the top	455 pcf

The equivalent fluid pressures provided in Table 4 are for above-groundwater conditions, assuming fully drained conditions and no hydrostatic forces acting on the wall. These parameters also assume the wall is vertical and there is no friction acting between the wall and backfill material. The earth pressures provided in Table 6 are nominal, unfactored values; the wall design engineer should apply appropriate factors for wall design.

For walls that cannot tolerate lateral movement, we recommend they be designed utilizing at-rest equivalent earth pressures. Lateral surcharge pressures due to equipment, vehicle traffic, slopes, storage loads, etc. have not been included in the above lateral earth pressure

recommendations. A lateral earth pressure coefficient of 0.44, acting over the entire below-grade wall height should be used to estimate the lateral surcharge loads from equipment, vehicle traffic, and adjacent foundations behind and above walls. Surcharge pressures must be added to the at-rest EFP recommended above.

The passive earth pressure provided in Table 4 also assumes the retaining wall rotates the amount required to fully mobilize the passive resistance, or H/100 for granular soil conditions, where H is defined as the height of the wall.

Fill, debris and loose soil should be removed before placing backfill behind walls. Care should be taken to avoid over compaction of the backfill behind the walls so that the walls are not displaced or damaged. Only light hand operated compaction equipment should be used within 5 feet of backfilled walls.

Pavement Section Design

STRATA performed pavement design analyses referencing the ITD Gravel Equivalency (GE) method. For our design, we utilized a subgrade support ITD R-Value of 50 and estimate a traffic index (T.I.) of 7.5, which corresponds to approximately 220,000 ESALs to account for the snowplows, maintenance vehicles, equipment transport vehicles, and passenger vehicles expected to access the pavement over a 20-year design life. Table 5 describes our flexible pavement section design.

Table 5. Flexible Pavement Section Design

Pavement Section Material	Recommended Thickness (inches)	Material Specifications
Asphalt Concrete Pavement	4.0	Asphalt concrete meeting ITD Superpave, SP2 or SP3 mix standards specified in Table 405.02-1 from *Section 405 – Superpave Hot Mix Asphalt* of ITD SSHC. We recommend asphalt concrete be placed in two, 2-inch thick lifts rather than a single, 4-inch thick lift.
Crushed Aggregate Base	9.0	"3/4-inch B" nominal maximum size aggregate gradation requirement specified in Table 703.04-1 from *Section 703 – Aggregates* of ITD SSHC
Geotextile Fabric	N/A	Nonwoven or woven subgrade separation geotextile meeting *Section 718.07 of the ITD SSHC*.

We recommend ITD's most recent Asphalt special provisions and memos be referenced along with *Section 405 – Superpave Hot Mix Asphalt* of the ITD SSHC.

Pavement Maintenance and Drainage

We recommend crack maintenance be accomplished on all pavement surfaces every 3 to 5 years to reduce the potential for surface water infiltration into the underlying pavement subgrade. Slurry seals and chip seals can extend flexible pavement life and reduce water infiltration to the subgrade. As asphalt pavements age, brittle/thermal cracking, and isolated areas of distress and deterioration are normal and commensurate with pavement design assumptions. Pavement maintenance and reducing water to pavement subgrades will slow pavement distress and may extend pavement life beyond 20 years.

Surface and subgrade drainage are extremely important to the performance of the pavement section. Therefore, we recommend the subgrade, *Aggregate Base Course* and pavement

surfaces slope at no less than 2 percent to an appropriate stormwater disposal system or other appropriate location that does not impact adjacent buildings or properties. Surface irrigation water crossings, ponded water or other water infiltrating the pavement surface must be avoided to the maximum extent practical. Pavement performance will depend upon achieving adequate drainage throughout the section and especially at the subgrade. Water that ponds at the pavement subgrade surface reduces pavement support, can induce heaving during the freeze-thaw process and create pavement distress.

ADDITIONAL RECOMMENDED SERVICES

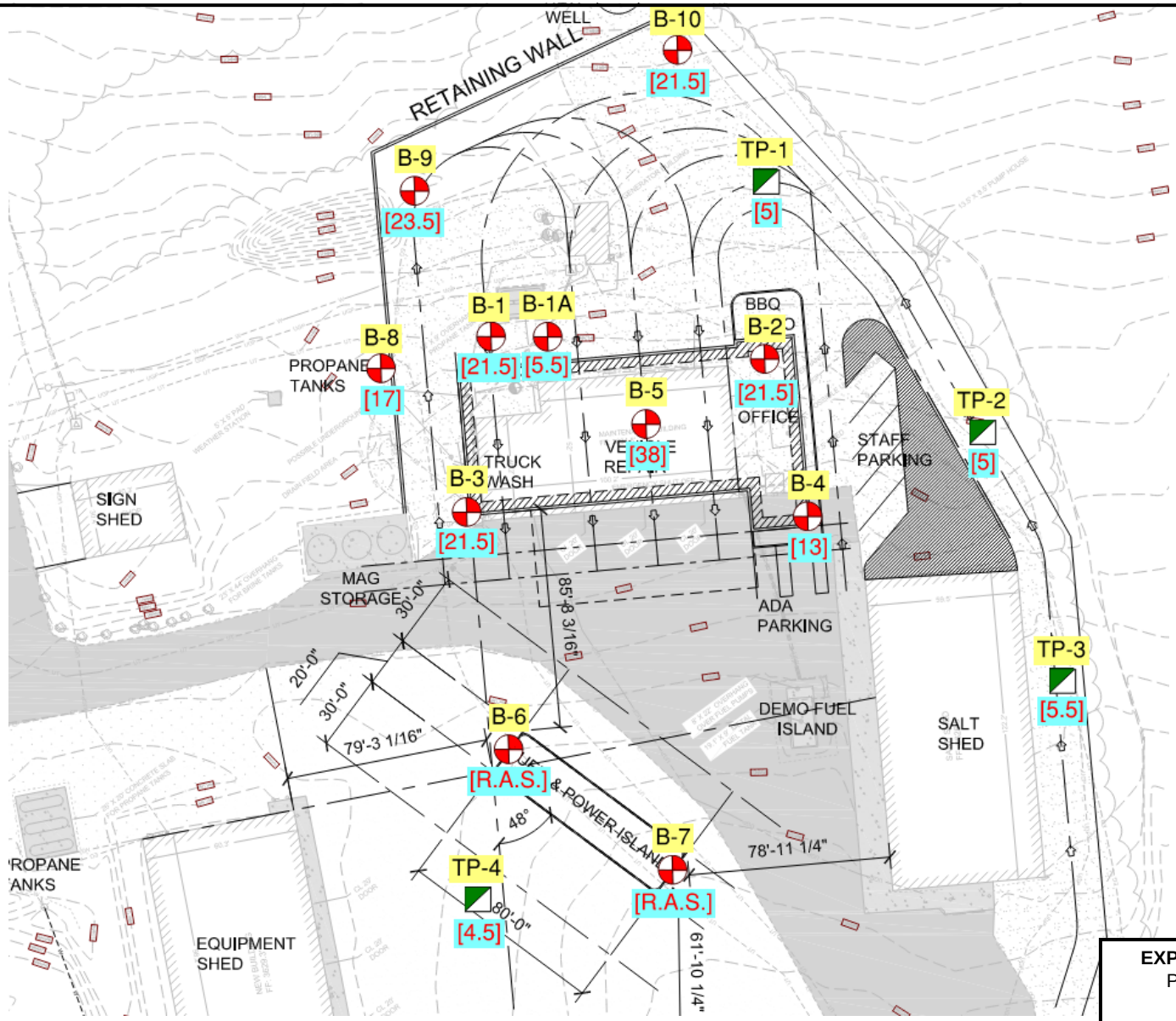
The information contained in this report is based on our understanding of the planned construction, anticipated structural loads, and site grades. Changes in final slab and foundation elevations, slab and footing configuration, structural loads, site geometry, and actual subsurface conditions can alter our opinions and design recommendations. Therefore, we recommend STRATA provide geotechnical continuity through final project planning and design as individual design aspects become available. We further recommend STRATA be retained to review the structural engineer's foundation design to verify our recommendations have been correctly interpreted. Further, verification of the subsurface conditions during construction is an important part of the geotechnical design process. We recommend you retain STRATA to be on-site during undocumented fill removal and subgrade preparations to verify the conditions encountered during exploration are exposed during construction and our recommendations are followed.

EVALUATION LIMITATIONS

This report has been prepared to assist project planning, design and construction for the Powell Maintenance Building project planned at ITD's Powell Yard in Idaho County, Idaho. Our services consist of professional opinions and recommendations provided in accordance with generally accepted geotechnical engineering principles and practices as they exist at this time, and in the area of this report. This report has been prepared specifically for this project and exclusively for the use of the Idaho Transportation Department and the project design team. We do not authorize its use by firms other than the design team, as a reference document to support the design process. The geotechnical recommendations provided herein are based on the premise that STRATA will continue our project involvement to observe and document our recommendations are implemented during construction, and to confirm conditions between exploration locations. This acknowledgement is in lieu of any express or implied warranty.

The following plates and appendices accompany this report:

Plate 1:	Exploration Location Plan
Plate 2:	Foundation and Wall Drain Schematic
Appendix A:	USCS Explanation and Exploratory Logs
Appendix B:	Laboratory Test Results



LEGEND

B-1	**Boring (B) location.**	**[R.A.S]**	**Refusal At Surface**
TP-1	**Test Pit (TP) location.**	**[10]**	**Exploration depth (in feet).**

EXPLORATION LOCATION PLAN
Powell Maintenance Building
Highway 12
Idaho County, Idaho

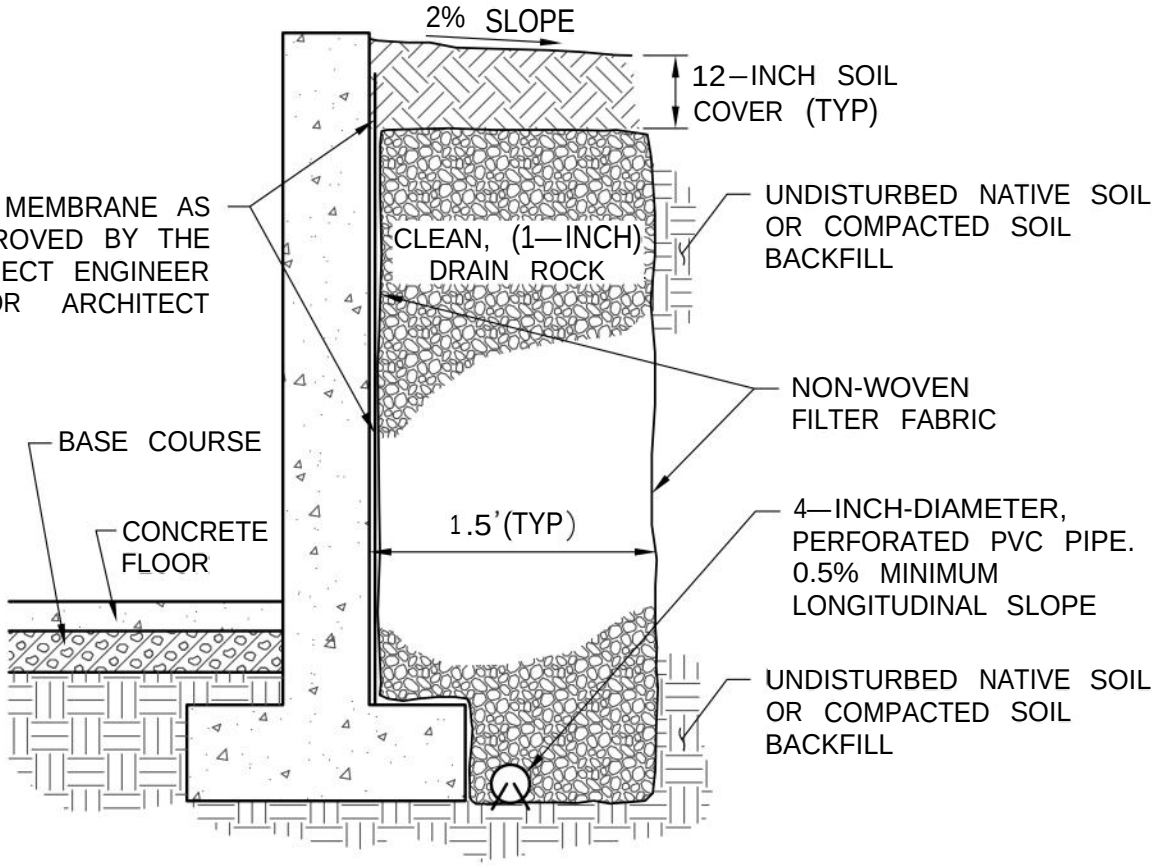
STRATA

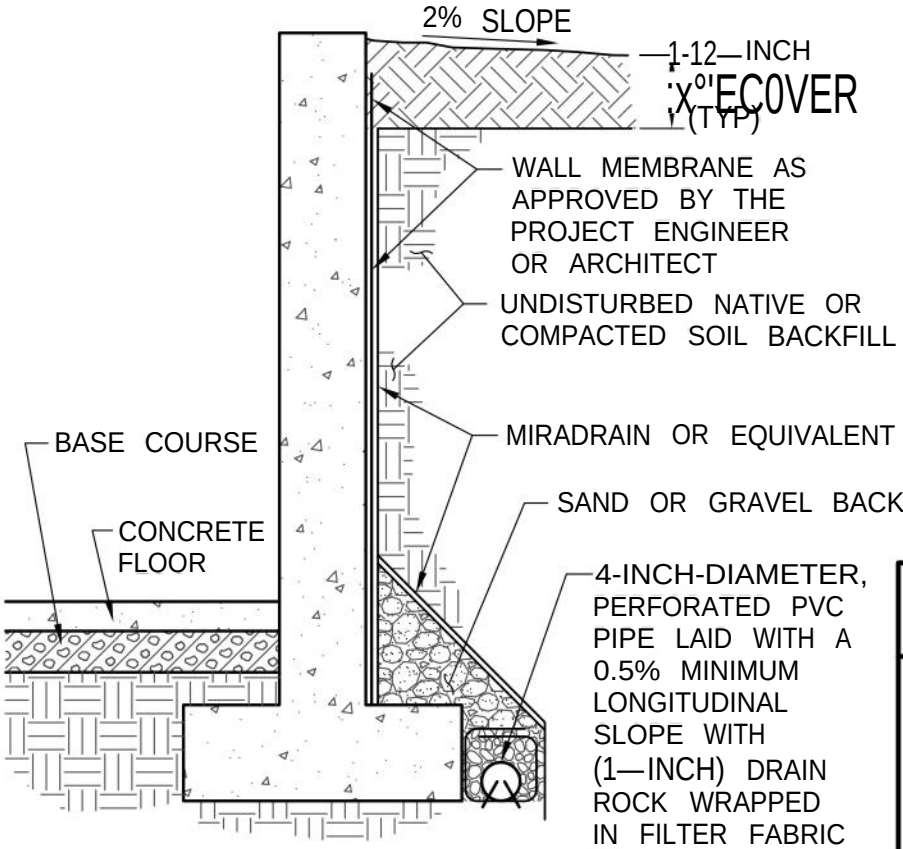
CD22068A	Plate 1

Base Image Reference: *Project Site Plan* document provided by Miller Stauffer, dated August 12, 2022.

NOTE:

THIS DRAWINGS' CROSS-SECTIONS MAY BE USED FOR GRAVITY WALLS. THIS IS NOT A STRUCTURAL DETAIL.





NOTE:

REFER TO MANUFACTURER'S SPECIFICATIONS AND TEXT OF REPORT FOR INFORMATION REGARDING DRAINAGE SYSTEM, WALL DESIGN AND RELATED GEOTECHNICAL CONSIDERATIONS.

INFORMATIONAL ONLY (NOT TO SCALE)

FOUNDATION AND WALL DRAIN SCHEMATIC

STRATA

CD22068A

PLATE 2

Appendix A

Exploration Logs and
USCS Explanation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% COARSE FRACTION RETAINED #4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES
				GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH >12% FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	SANDS >50% COARSE FRACTION PASSES #4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES		SW	WELL-GRADED SANDS, GRAVELY SANDS
				SP	POORLY GRADED SANDS, GRAVELY SANDS
		SANDS WITH >12% FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND CLAY MIXTURES
FINE GRAINED SOIL 50% OR MORE PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC		ML	INORGANIC SILTS, SANDY OR CLAYEY SILTS
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAYS
		ORGANIC		OL	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC		MH	INORGANIC SILTS, MICACEOUS SILTS, PLASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		ORGANIC		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOIL

SHORTHAND NOTATION

SPT - STANDARD PENETRATION TEST
PL - PLASTIC LIMIT
LL - LIQUID LIMIT
PI - PLASTICITY INDEX
MC - MOISTURE CONTENT
DD - DRY DENSITY
WD - WET DENSITY
UC - UNCONFINED COMPRESSION
OC - ORGANIC CONTENT
BGS - BELOW GROUND SURFACE
N.E. - NOT ENCOUNTERED

MATERIAL DESCRIPTION CONTACT

——— DISTINCT SOIL LAYER CONTACT WITHIN SOIL PROFILE

- - - - - - APPROXIMATE SOIL LAYER CONTACT WITHIN SOIL PROFILE

NOTES

1. MIXED UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS ARE USED TO INDICATE DUAL SOIL CLASSIFICATIONS.
2. THE SPT N-VALUE, REPORTED IN BLOWS PER FOOT, IS THE SUM OF THE NUMBER OF BLOWS REQUIRED TO DRIVE THE STANDARD SPLIT SPOON SAMPLER A DISTANCE OF 12-INCHES AFTER AN INITIAL 6-INCHES OF PENETRATION. IF A TOTAL OF 50 BLOWS ARE INSUFFICIENT TO ADVANCE ANY OF THE THREE 6-INCH INTERVALS, THE PENETRATION DEPTH AFTER 50 BLOWS IS ALSO REPORTED.

BORING LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	STANDARD 2-INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER
	MODIFIED CALIFORNIA 3-INCH OUTSIDE DIAMETER SAMPLER
	ROCK CORE
	SHELBY TUBE 3-INCH OUTSIDE DIAMETER SAMPLER

ADDITIONAL MATERIAL SYMBOLS

GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
	AC	ASPHALT CONCRETE
	CC	PORTLAND CEMENT CONCRETE
	TS	TOPSOIL
	FL	FILL

TEST PIT LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
BG	BAGGIE SAMPLE
	BULK SAMPLE
RG	RING SAMPLE

GROUNDWATER SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	GROUNDWATER LEVEL AT TIME OF DRILLING
	GROUNDWATER LEVEL AT END OF DRILLING
	GROUNDWATER LEVEL 24 HOURS AFTER DRILLING COMPLETION
04-10-18	DATE OF GROUNDWATER READING

EXPLORATION LOG KEY - SOIL

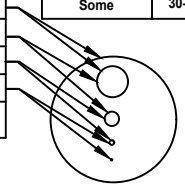
STRATA

GRAIN SIZE

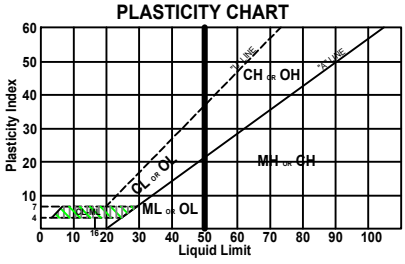
DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12"	>12"	Larger than basketball-size.
Cobbles		3" - 12"	3" - 12"	Fist-size to basketball-size.
Gravel	coarse	3/4" - 3"	3/4" - 3"	Thumb-sized to fist sized.
	fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized.
Sand	coarse	#10 - #4	0.079 - 0.19"	Rock salt-sized to pea-sized.
	medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock salt-sized.
	fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized.
Fines		Passing #200	<0.0029"	Flour-sized and smaller.

MODIFIERS

DESCRIPTION	%
Trace	<5
Few	5-10
Little	15-25
Some	30-45



PLASTICITY CHART



STRATIFICATION

DESCRIPTION	THICKNESS
Parting	1/16 - 1/4"
Lense	1/4 - 4"
Layer	4 - 12"

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness.
Frequent	More than one per foot of thickness.

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to touch.
Moist	Slightly damp, some apparent moisture.
Wet	Saturated, visible free water, soil is below water table.

APPARENT RELATIVE DENSITY OF COARSE-GRAINED SOIL

APPARENT DENSITY	SPT blows/ft	CALIFORNIA SAMPLER blows/ft	D & M SAMPLER blows/ft	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	0-4	<4	<5	0-15	Easily penetrated with 1/2" reinforcing rod pushed by hand.
Loose	5-10	5-12	5-15	15-35	Difficult to penetrate with 1/2" reinforcing rod pushed by hand.
Medium Dense	11-30	12-35	15-40	35-65	Easily penetrated a foot with 1/2" reinforcing rod driven with 5-lb hammer.
Dense	31-50	35-60	40-70	65-85	Difficult to penetrate a foot with 1/2" reinforcing rod driven with 5-lb hammer.
Very Dense	>50	>60	>70	85-100	Penetrated only a few inches with 1/2" reinforcing rod driven with 5-lb hammer.

CONSISTENCY FINE-GRAINED SOIL

		TORVANE	POCKET PENETROMETER	
CONSISTENCY	SPT blows/ft	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by thumb. Extrudes between thumb and finger when squeezed in hand.
Soft	2-3	0.125-0.25	0.25-0.5	Penetrated about 1/4 inch by thumb with moderate effort. Molded by strong finger pressure.
Firm	4-7	0.25-0.5	0.5-1.0	Penetrated about 1/4 inch by thumb with moderate effort. Molded by strong finger pressure.
Stiff	8-14	0.5-1.0	1.0-2.0	Indented about 1/2 inch by thumb only with great effort.
Very Stiff	15-30	1.0-2.0	2.0-4.0	Readily indented with difficulty by thumbnail.
Hard	>30	>2.0	>4.0	Indented with difficulty by thumbnail.

REACTION WITH HCl

None	No visible reaction.
Weak	Some reaction, with bubbles forming slowly.
Strong	Violent reaction, with bubbles forming immediately.

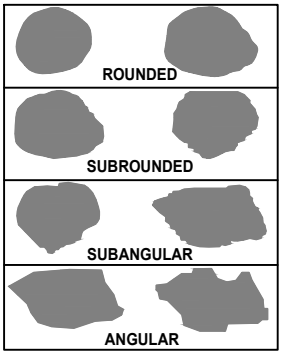
CEMENTATION

Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

STRUCTURE

Stratified	Alternating layers of varying material or color with layers at least 1/4" thick; note thickness.
Laminated	Alternating layers of varying material or color with layers at least 1/2" thick; note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small macular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soil, such as small lenses or sand scattered through a mass of clay; note thickness.
Homogeneous	Same color and thickness throughout.

PARTICLE SHAPE



EXPLORATION LOG KEY - SOIL

STRATA

Project: CD22068A - Powell Maintenance Building		STRATA	**Boring:** B-1
Client: Idaho Transportation Department	**Drill Rig:** G-2400		
Date Drilled: 11-16-2022	**Borehole Diameter:** 7.0"		
Depth to Groundwater: N.E.	**Logged By:** S. Litalien		

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Gray, moist, medium dense, fine to coarse rounded to subangular. Gravel surfacing.	SW-SM											Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist to wet, loose to very dense, fine to coarse rounded to subangular.			18	20 12 11	23							
				18	2 3 5	8		16					
5				14	2 2 3	5							
				7	4 50/3.0"	50+							Higher gravel content from 7.5-17 feet BGS.
10		SM		13	11 6 14	20		9.4					
15				18	22 24 13	37							
20				0	4 3 2	5							Attempted Shelby tube, could not penetrate.
	Borehole Terminated at 21.5 Feet.												Latitude: 46.52147 Longitude: -114.70158

Project: CD22068A - Powell Maintenance Building		STRATA	**Boring:** B-1A
Client: Idaho Transportation Department	**Drill Rig:** G-2400		
Date Drilled: 11-16-2022	**Borehole Diameter:** 7.0"		
Depth to Groundwater: N.E.	**Logged By:** S. Litalien		

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Gray, moist, fine to coarse rounded to subangular. Gravel surfacing.	SW-SM											Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, fine to coarse rounded to subangular.	SM											
5				6	6 6 7	13		17.6	104.3				
	Borehole Terminated at 5.5 Feet.												Latitude: 46.52147 Longitude: -114.70158

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-16-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: 20' | **Logged By:** S. Litalien

STRATA

Boring: B-2

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Brown, moist, very loose to loose, fine to coarse rounded to subangular. Fill placed in previous building footprint.	SW-SM		13	3 4 6	10		8.3					Note: BGS = Below Ground Surface
				3	4 2 2	4							
5	**Silty Sand with Gravel (SM)** - Brown, moist to wet, very loose to dense, fine to coarse rounded to subangular. Layers of higher gravel content throughout.			10	2 2 2	4		13.7					
				13	2 1 3	4							
10		SM		13	15 16 20	36							Higher gravel content from 10-11.5 feet BGS.
15				18	3 4 2	6		24.7					
20				18	2 2 4	6							Water Level Measured 11-16-22

Borehole Terminated at 21.5 Feet.

Latitude: 46.52141
Longitude: -114.70125

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-16-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: 20' | **Logged By:** S. Litalien

STRATA

Boring: B-3

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Brown, moist, loose, fine to coarse rounded to subangular. Fill placed in previous building footprint.	SW-SM		11	2 2 4	6							Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, loose to dense, fine to coarse rounded to subangular. Layers of higher gravel content throughout.			8	3 3 3	6							
5				18	2 3 5	8							
				18	1 3 2	5		17.3					
10		SM		15	9 4 3	7							
15				15	15 17 21	38		11.8					Higher gravel content from 15-16.5 feet BGS.
20				9	2 3 6	9							Water Level Measured 11-16-22

Borehole Terminated at 21.5 Feet.

Latitude: 46.52131
Longitude: -114.70163

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-16-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Boring: **B-4**

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Brown, moist, loose, fine rounded to subangular. Fill placed in previous building footprint.	SW-SM											Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, loose to dense, fine to coarse rounded to subangular. Layers of higher gravel content throughout.			13	2 2 4	6							
				18	2 2 3	5		16.9					
5		SM			2 2 4	6							
				18	2 4 6	10							
10				12	7 26 15	41		8.4					Higher gravel content from 10-13 feet BGS.
	Borehole Terminated at 13.0 Feet.												Auger refusal at 13.0 feet BGS, due to suspected cobble or boulder.

Latitude: 46.52133
Longitude: -114.70119

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-16-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: 21.5' | **Logged By:** S. Litalien

STRATA

Boring: B-5

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Well-Graded Sand with Silt and Gravel (SW-SM)** - Moist, loose, fine rounded to subangular. Fill placed in previous building footprint.	SW-SM											Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, very loose to very dense, fine to coarse rounded to subangular. Layers of higher gravel content throughout.			18	4 4 5	9							
				7	2 3 2	5							pH = 8.54 Sulfate = 47.2 mg/kg dry Resistivity = 828 ohms-cm
5					3 3 3	6		16.1					
				18	2 2 2	4							
10				12	4 12 25	37							
		SM											Higher gravel content from 10-16.5 feet BGS.
15				18	24 21 31	52		6					
20				9	2 3 6	9							Water Level Measured 11-16-22
25				18	9 10 9	19							

Project: CD22068A - Powell Maintenance Building		STRATA	**Boring:**
Client: Idaho Transportation Department	**Drill Rig:** G-2400		**B-5**
Date Drilled: 11-16-2022	**Borehole Diameter:** 7.0"		
Depth to Groundwater: 21.5'	**Logged By:** S. Litalien		

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
30	**Silty Sand with Gravel (SM)** - Brown, moist, very loose to very dense, fine to coarse rounded to subangular. Layers of higher gravel content throughout. *(continued)*	SM		18	17 17 25	42							Higher gravel content from 25-31.5 feet BGS.
35				12	5 6 4	10							
	Borehole Terminated at 38.0 Feet.												Note: BGS = Below Ground Surface Latitude: 46.5214 Longitude: -114.70136

Project: CD22068A - Powell Maintenance Building		STRATA	**Boring:**
Client: Idaho Transportation Department	**Drill Rig:** G-2400		**B-8**
Date Drilled: 11-15-2022	**Borehole Diameter:** 7.0"		
Depth to Groundwater: N.E.	**Logged By:** S. Litalien		

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Poorly Graded Gravel with Silt and Sand (GP-GM)** - Gray, moist, medium dense, fine rounded to subangular. Gravel surfacing.	GP-GM		18	8 7 10	17							Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, loose to medium dense, fine to coarse rounded to subangular. Layers of higher gravel content.												
				18	4 4 5	9		14.7					
5				18	4 4 7	11							
		SM		18	9 10 13	23							Higher gravel content from 7.5-17 feet BGS.
10				18	25 10 18	28		5.2					
15				18	15 15 7	22							Minimal recovery in Shelby tube.
	Borehole Terminated at 17.0 Feet.												Latitude: 46.52145 Longitude: -114.7018

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-15-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Boring: **B-9**

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Silty Sand with Gravel (SM)** - Gray, moist, loose, fine rounded to subrounded. Gravel surfacing.	SM		18	4 3 3	6		16.3					Remarks Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Light brown to gray, moist, very loose to medium dense, fine to coarse subrounded to angular. Layers of higher gravel content.			14	2 2 2	4							
5				18	3 3 4	7							
		SM		18	2 2 6	8		17					
10				18	9 4 1	5							
15				18	22 15 11	26		7.3					Higher gravel content from 15-16.5 feet BGS.
	Silty Sand (SM) - Brown, moist, medium dense. Fine to coarse gravel scattered throughout.												
20		SM						8.7	114.7	46	0	0	
				13	2 5 6	11							
	Borehole Terminated at 23.5 Feet.												Latitude: 46.52162 Longitude: -114.70171

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Drill Rig:** G-2400

Date Drilled: 11-15-2022 | **Borehole Diameter:** 7.0"

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Boring: **B-10**

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Silty Sand with Gravel (SM)** - Brown to gray, moist, medium dense, fine to coarse rounded to subangular. Gravel surfacing.	SM		18	10 8 7	15							Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, very loose to dense, fine to coarse. Layers of higher gravel content.			14	3 3 6	9							
5				3	4 4 5	9		14.5					
				18	2 3 4	7							
10		SM		18	3 2 2	4							
15				18	33 27 18	45							Higher gravel content from 15-16.5 feet BGS.
	Silty Sand (SM) - Brown, moist to wet, very loose to loose. Fine to coarse gravel scattered throughout.												
20		SM		18	1 1 1	2		23.5					
25				18	2 3 7	10							

Borehole Terminated at 26.5 Feet.

Latitude: 46.52177
Longitude: -114.70142

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Backhoe:** CAT 306

Date Excavated: 11-15-2022 | **Bucket Width:** 18.0

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Test Pit:

TP-1

Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0	**Fill - Silty Sand with Gravel (SM)** - Gray, moist, fine to coarse rounded to subangular. Gravel surfacing.	SM							13.9	0	0	Note: BGS = Below Ground Surface
	Silty Sand with Gravel (SM) - Brown, moist, fine to coarse rounded to subangular. Cobbles present throughout.	SM					8.6		32.4	0	0	
5	Terminated at 5.0 Feet.											

Latitude: 46.52169
Longitude: -114.701353

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Backhoe:** CAT 306

Date Excavated: 11-15-2022 | **Bucket Width:** 18.0

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Test Pit:

TP-2

Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks Note: BGS = Below Ground Surface
0	**Fill - Poorly Graded Gravel with Silt and Sand (GP-GM)** - Brown, moist, fine to coarse rounded to subangular.	GP-GM										
	Topsoil - Silt with Sand (ML) - Dark brown to black, moist. Roots and organics scattered throughout. Remnant topsoil.	ML										
	Silty Sand with Gravel (SM) - Brown, moist, fine to coarse rounded to subangular.	SM					16.8		38	0	0	Idaho T-8 R-Value = 50
5	Terminated at 5.0 Feet.											

Latitude: 46.52138
Longitude: -114.70087

Project: CD22068A - Powell Maintenance Building

Client: Idaho Transportation Department | **Backhoe:** CAT 306

Date Excavated: 11-15-2022 | **Bucket Width:** 18.0

Depth to Groundwater: N.E. | **Logged By:** S. Litalien

STRATA

Test Pit:

TP-3

Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks Note: BGS = Below Ground Surface
0	**Fill - Silty Sand with Gravel (SM)** - Dark brown to black, moist, fine to coarse rounded to subangular. Derived from topsoil, organics and roots throughout.	SM										Organic Content = 5.1%
5	**Silty Sand with Gravel (SM)** - Light brown, moist, fine to coarse rounded to subangular.	SM	BG									
	Terminated at 5.5 Feet.											

Latitude: 46.5211
Longitude: -114.70071

Project: CD22068A - Powell Maintenance Building		STRATA	**Test Pit:**
Client: Idaho Transportation Department	**Backhoe:** CAT 306		**TP-4**
Date Excavated: 11-15-2022	**Bucket Width:** 18.0		
Depth to Groundwater: N.E.	**Logged By:** S. Litalien		

Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks Note: BGS = Below Ground Surface
0	**Fill - Poorly Graded Gravel with Silt and Sand (GP-GM)** - Moist, fine to coarse rounded to subangular. Boulders, asphalt fragments, and debris throughout.	GP-GM										Excavator refused at 4.5 feet BGS due to boulders.

Terminated at 4.5 Feet.

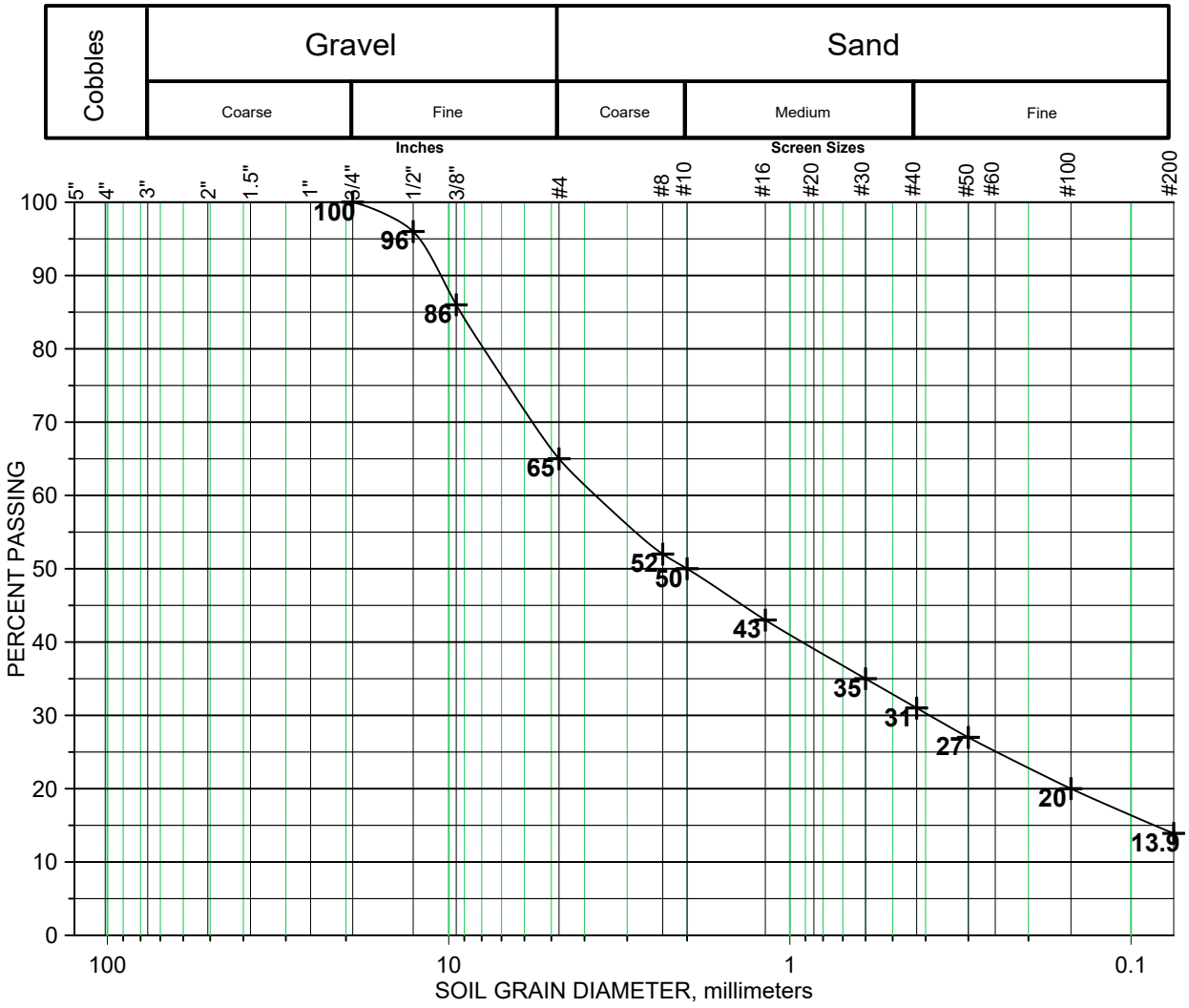
Latitude: 46.52083
Longitude: -114.70164

Appendix B

Laboratory Test Results

SIEVE ANALYSIS
ASTM D6913 (Method A)

Project: Powell Maintenance Building
Project Number: CD22068A
Client: Idaho Transportation Department
Sample Number: 41454
Sample Location: TP-1 @ 0-0.5'
Sample Classification: Silty Sand with Gravel (SM)
Date Tested: 12/06/22 By: D. Taylor
ASTM D4318 - Atterberg Limits
LL = NV, PI = NP



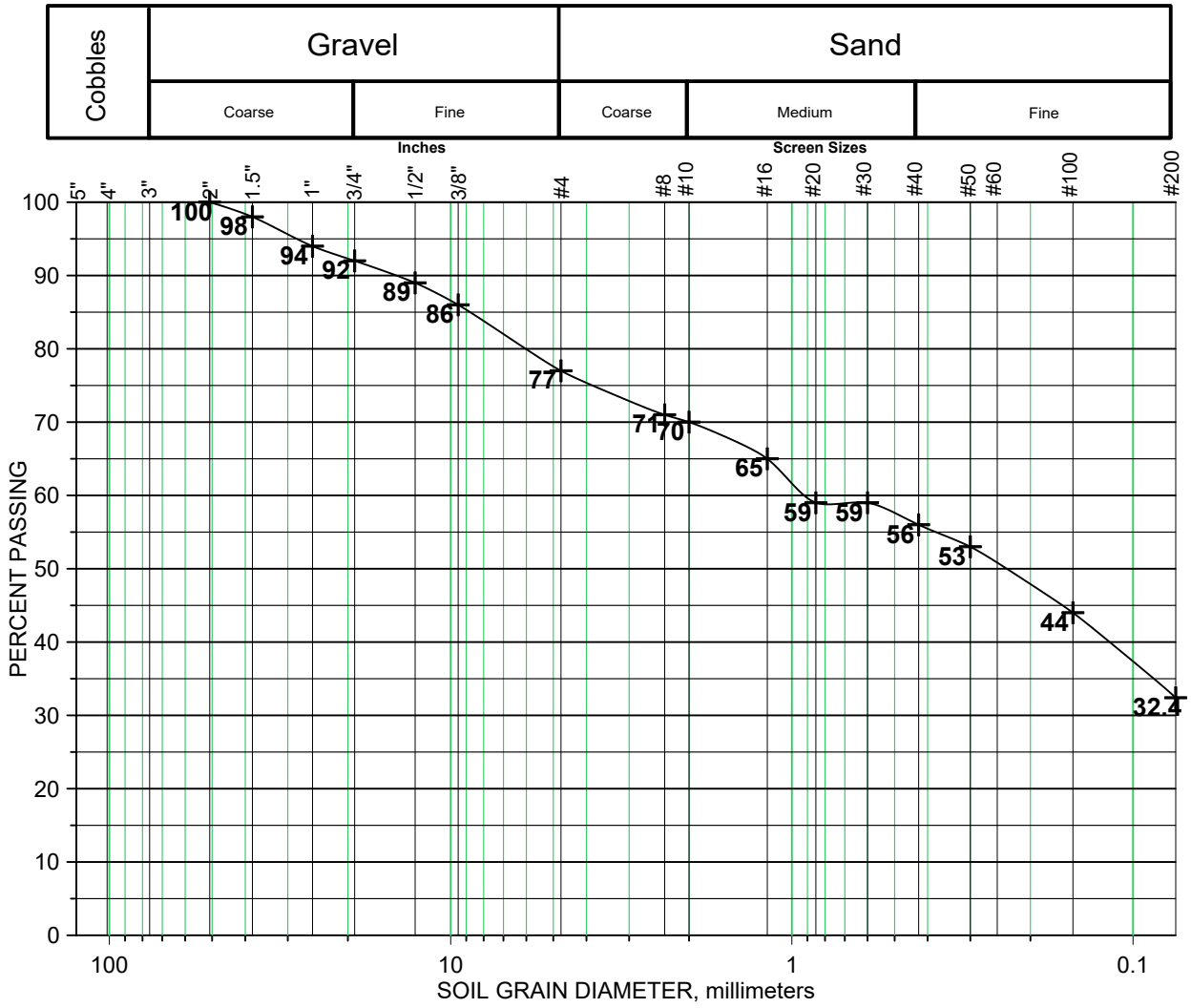
Reviewed By: _____

Luke Michels, P.E.
Engineering Services Manager

STRATA

SIEVE ANALYSIS
ASTM D6913 (Method A)

Project: Powell Maintenance Building
Project Number: CD22068A
Client: Idaho Transportation Department
Sample Number: 41453
Sample Location: TP-1 @ 0.5-3'
Sample Classification: Silty Sand with Gravel (SM)
Date Tested: 12/06/22 By: D. Taylor
ASTM D4318 - Atterberg Limits
LL = NV, PI = NP

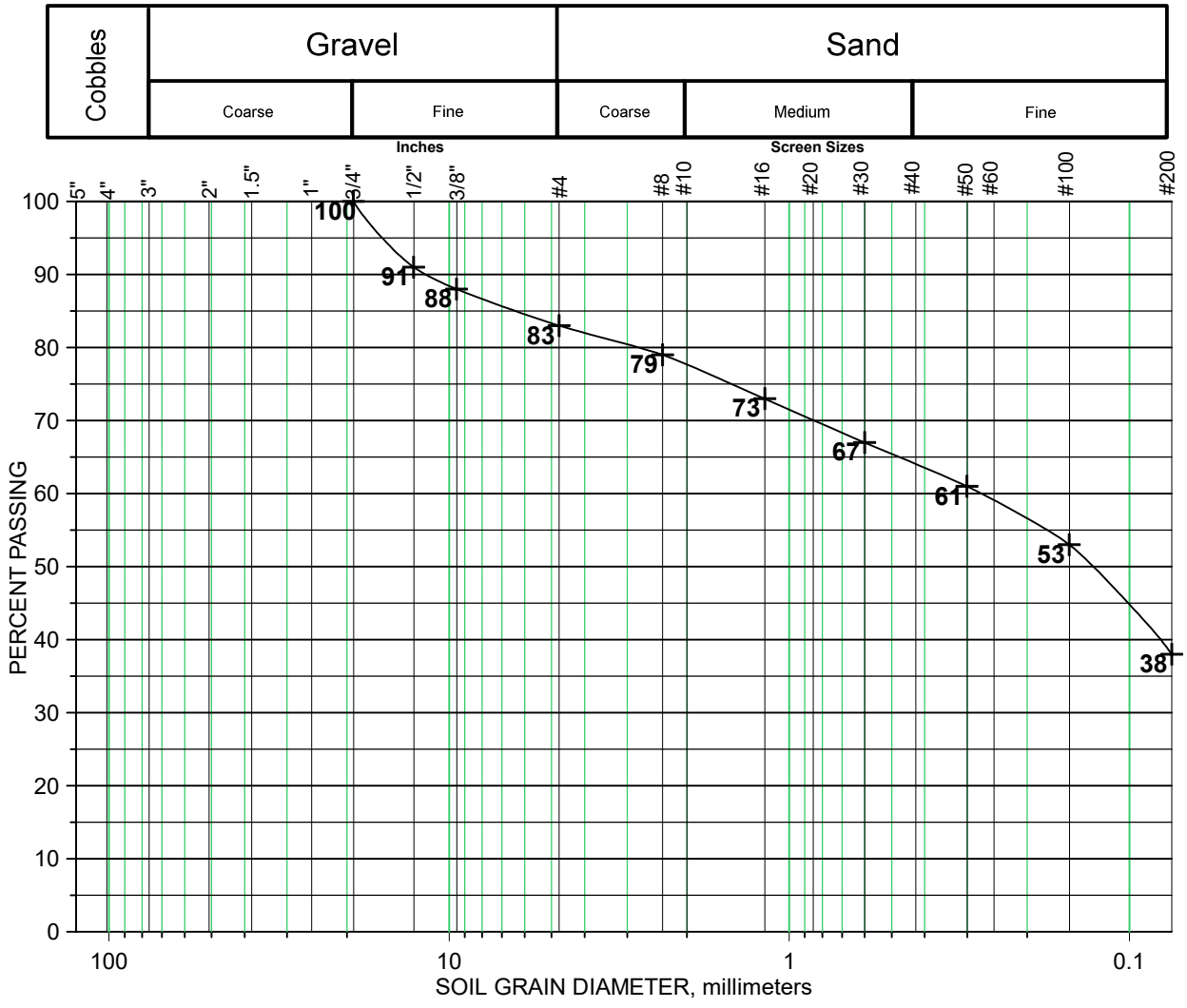


Reviewed By: _____
Luke Michels, P.E.
Engineering Services Manager

STRATA

SIEVE ANALYSIS
ASTM D6913 (Method A)

Project: Powell Maintenance Building
Client: Idaho Transportation Department
Project Number: CD22068A
Sample Number: BL221539
Sample Location: TP-2 @ 2.5'-5'
Sample Classification: Silty Sand with Gravel (SM)
Moisture Content: 16.8%
Date Tested: 12/2022 By: D. Bjorum

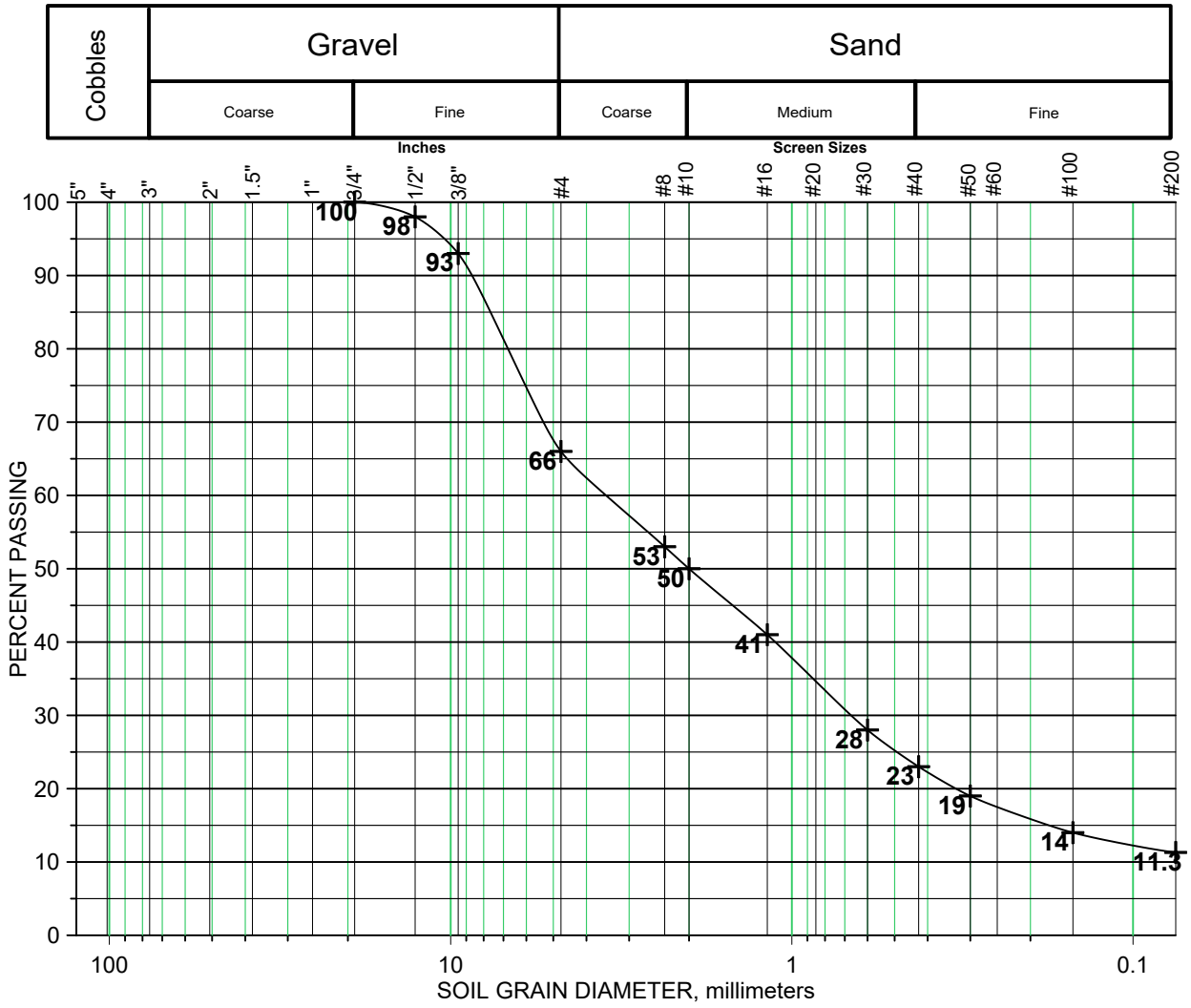


Reviewed By: _____
Barry Miller, P.E., P.G.

STRATA

SIEVE ANALYSIS
ASTM D6913 (Method A)

Project: Powell Maintenance Building
Project Number: CD22068A
Client: Idaho Transportation Department
Sample Number: 41455
Sample Location: Bulk West of B-4
Sample Classification: Well Graded Sand with Silt and Gravel (SW-SM)
Date Tested: 12/06/22 By: D. Taylor
ASTM D4318 - Atterberg Limits
LL = NV, PI = NP



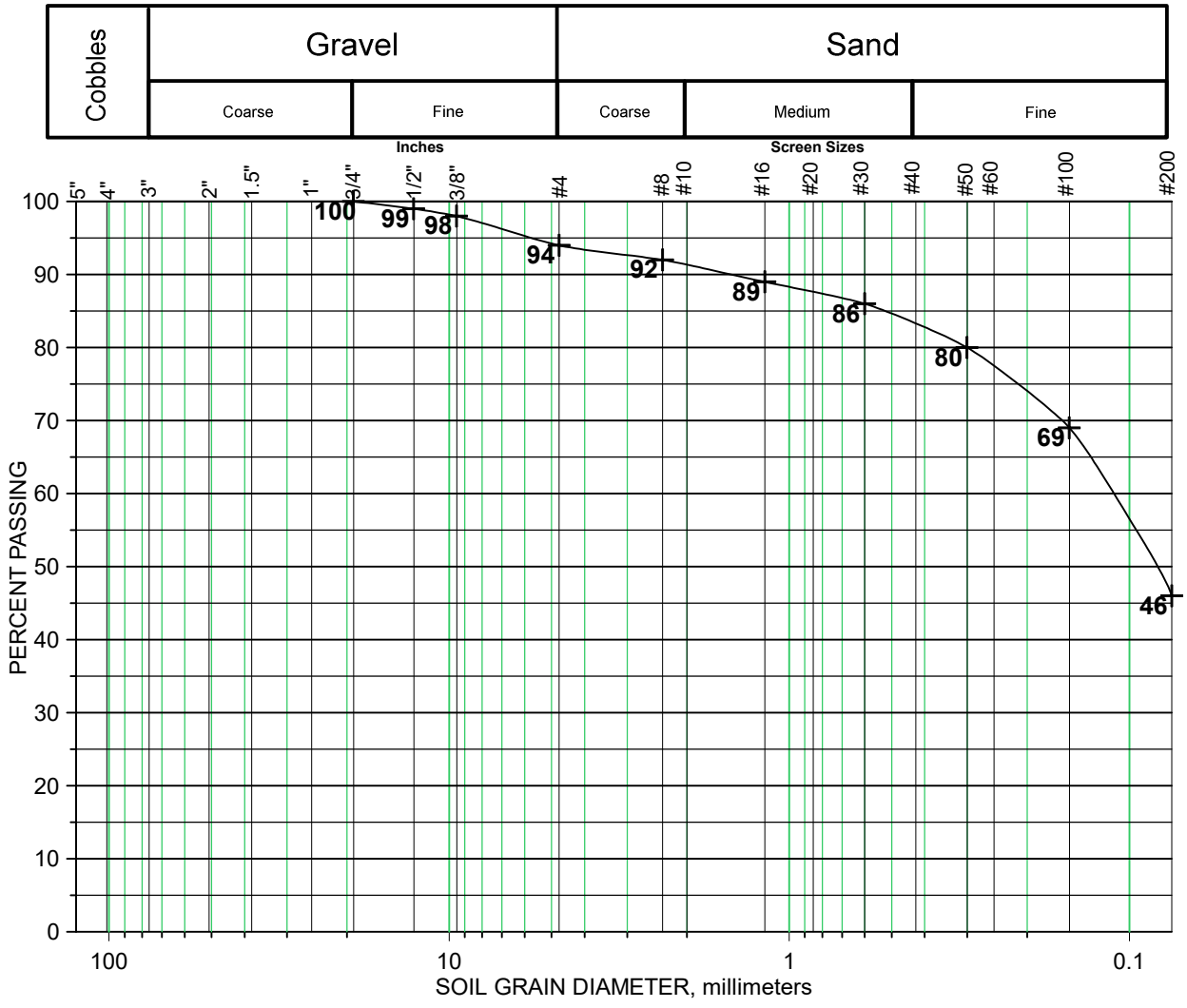
Reviewed By: _____

Luke Michels, P.E.
Engineering Services Manager

STRATA

SIEVE ANALYSIS
ASTM D6913 (Method A)

Project: Powell Maintenance Building
Project Number: CD22068A
Client: Idaho Transportation Department
Sample Number: BL221538
Sample Location: B-9 @ 20'-22'
Sample Classification: Silty Sand (SM)
Moisture Content: 8.7%
Date tested: 12/14/2022 By: D. Wheeler



Reviewed By: _____
Barry Miller, P.E., P.G.

STRATA

MOISTURE-DENSITY RELATIONSHIP CURVE
AASHTO T180

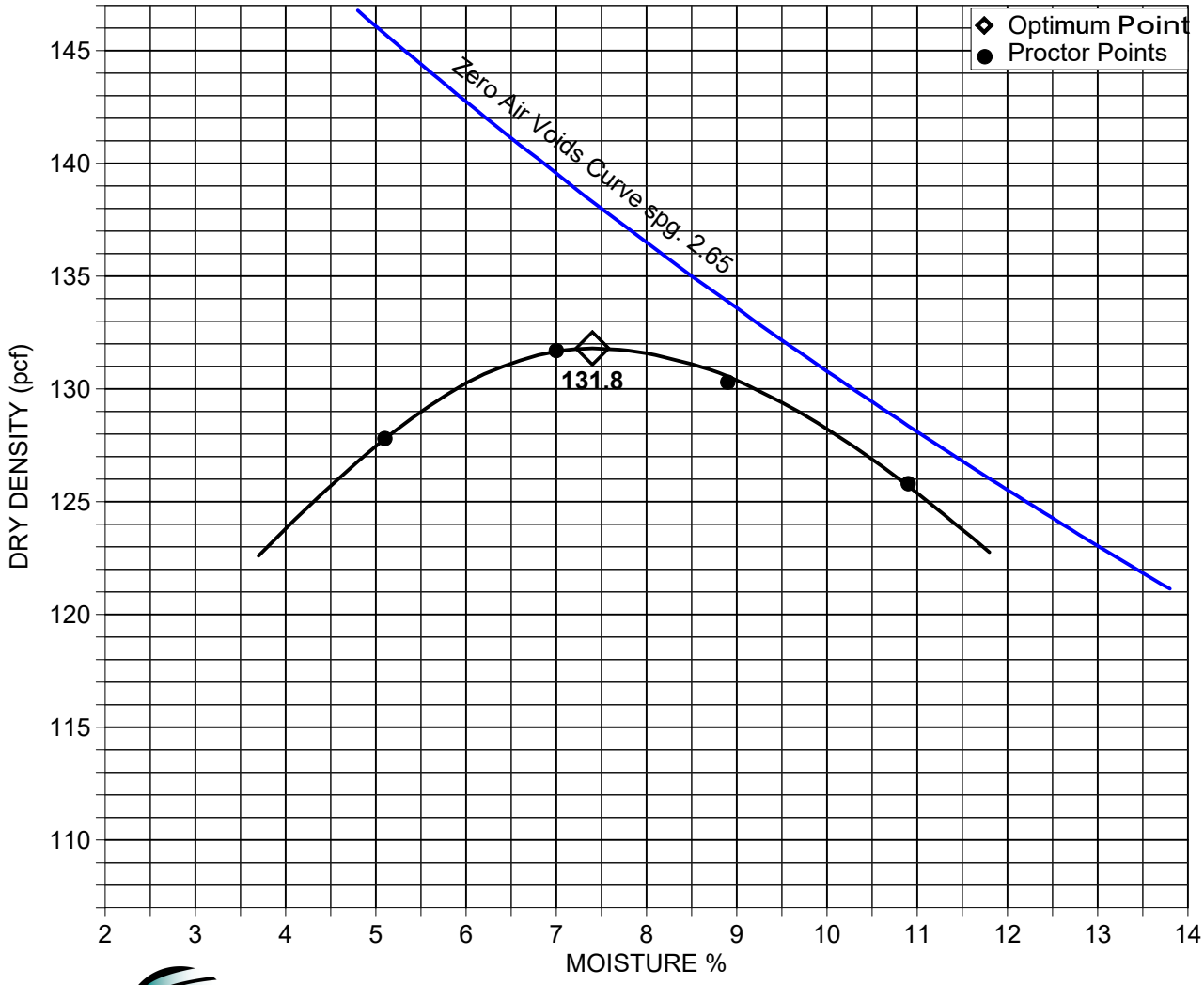
Project: Powell Maintenance Building
Client: Idaho Transportation Department
Project Number: CD22068A
Sample Number: 41453
Sample Location: TP-1, 0.5-3'
Sample Classification: Silty Sand with Gravel (SM)
Date Sampled: 11/15/2022 - 11/16/2022
Date Tested: 12/9/2022 Tested By: D. Taylor
Soil Tempered: No
Rammer Type: Manual

GRADING ANALYSIS

SCREEN SIZE	% PASSING	AS TESTED
6 inch		
3 inch		
2 inch		
3/4 inch	91	100
3/8 inch		
#4 screen		

Maximum Dry Density, pcf : 131.8
Optimum Moisture Content, %: 7.4

Corrected Dry Density, pcf: 134.3
Corrected Moisture Content, %: 6.8
*Coarse Aggregate Correction, %: 9.1
Bulk Specific Gravity (assumed): 2.65



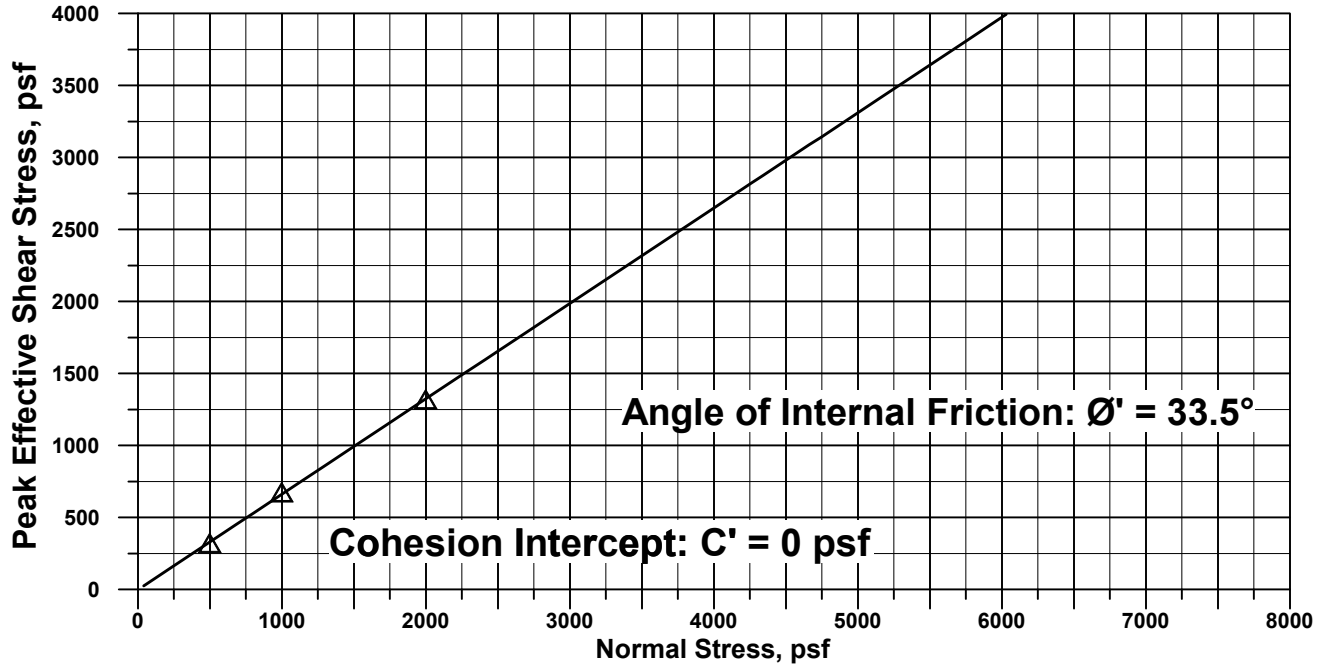
STRATA

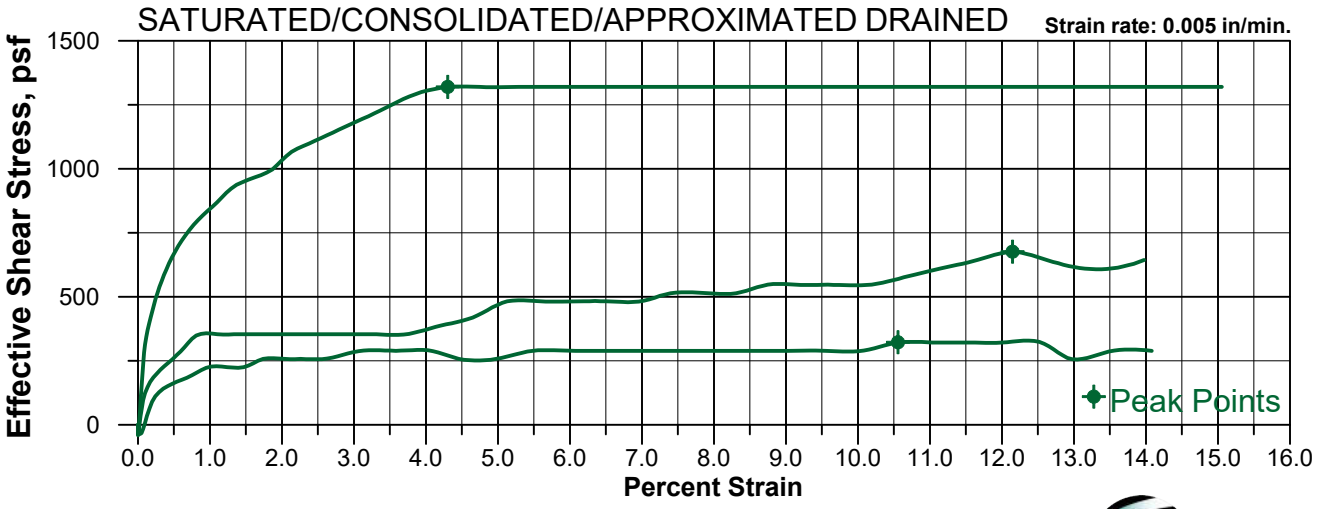
Reviewed By: _____

DIRECT SHEAR
ASTM D 3080

Project: Powell Maintenance Building
Client: Idaho Transportation Department
Sample Location: B-1A @ 4'-4.5'
Sample Classification: Silty Sand with Gravel (SM)
Moisture: 17.6%
Dry Unit Weight: 104.3 pcf

Project Number: CD22068A
Sample Number: BL221537
Date Tested: 12/18/2022
By: D. Bjorum





Reviewed By: _____
Barry Miller, P.G., P.E.

STRATA

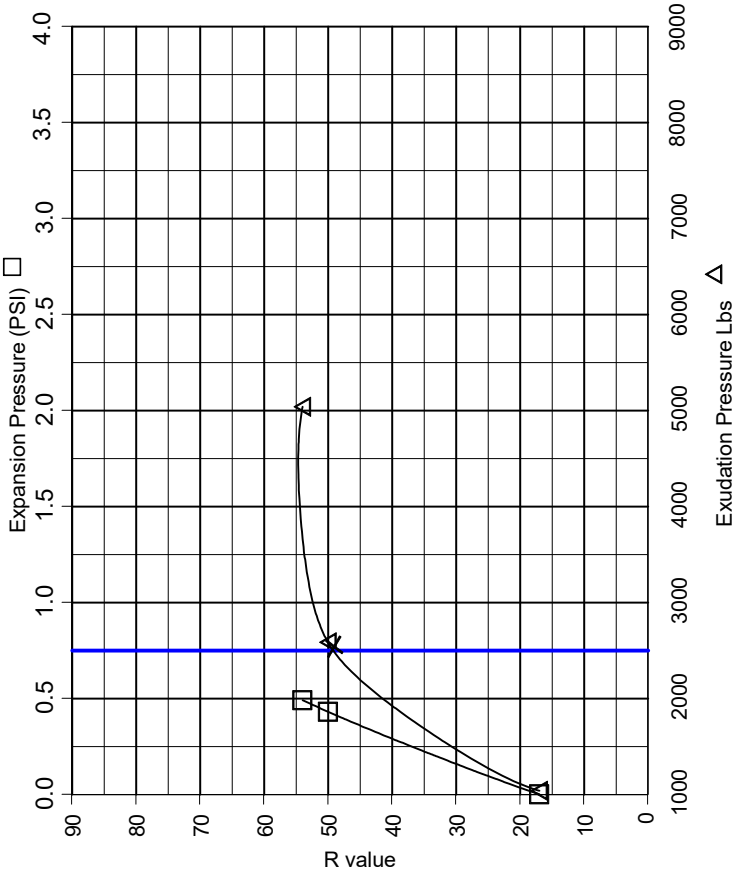
R-VALUE
Idaho T-8

Project: Powell Maintenance Building
Client: Idaho Transportation Department
Project Number: CD22068A
Sample Number: BL221539
Sample Location: TP-2 @ 2.5'-5.0'
Sample Classification: Silty Sand with Gravel (SM)
Date Tested: 12/7/2022
Tested By: V. Barinaga

R VALUE DATA			
Percolation: None	Point 1	Point 2	Point 3
Exudation, PSI	83	206	401
Dry Density, PCF	109.4	107.7	108.7
Moisture Content, %	17.6	14.8	13.1
Exp. Pressure, PSI	0.00	0.43	0.49

SOIL CONSTANTS

R-VALUE: 50



GRADATION: AASHTO T-11, T27		
SCREEN SIZE	AS RECEIVED % PASSING	AS TESTED % PASSING
4"		
3"		
2"		
1"		
3/4"	100	100
1/2"		
3/8"		
No. 4		
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

Reviewed By: _____

STRATA

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

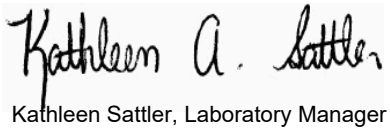
Client:	Strata, Inc. - CdA	Work Order:	WCK1006
Address:	1016 W. Hayden Avenue	Project:	CD22068A
	Hayden, ID 83835	Reported:	12/22/2022 10:01
Attn:	Luke Michels		

Analytical Results Report

Sample Location:	B-5; 2.5-3'		
Lab/Sample Number:	WCK1006-01	Collect Date:	11/16/22 12:00
Date Received:	11/28/22 10:31	Collected By:	Steve Litalien
Matrix:	Soil		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
% Solids	87.6	%	0.100	11/29/22 12:00	IG	SM 2540 G	
Sulfate	47.2	mg/kg dry	11.4	12/22/22 1:32	BKP	EPA 300.0	
pH	8.54	pH Units	0.982	11/29/22 10:06	ILG	EPA 9045D	
Resistivity	828	ohms-cm	1.00	11/29/22 10:37	ILG	ASTM G 57a	

Authorized Signature,



Kathleen Sattler, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Quality Control Data

Inorganics

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BCL0704 - Anions										
Blank (BCL0704-BLK1)					Prepared & Analyzed: 12/21/2022					
Sulfate	ND		0.100	mg/kg wet						
LCS (BCL0704-BS1)					Prepared & Analyzed: 12/21/2022					
Sulfate	4.32		0.100	mg/kg wet	4.00		108	90-110		
Matrix Spike (BCL0704-MS1)		**Source: WCK0744-01**			Prepared: 12/21/2022 Analyzed: 12/22/2022					
Sulfate	466		10.4	mg/kg dry	417	29.3	105	90-110		
Matrix Spike (BCL0704-MS2)		**Source: WCK1055-01**			Prepared: 12/21/2022 Analyzed: 12/22/2022					
Sulfate	472		10.7	mg/kg dry	430	13.1	107	90-110		
Matrix Spike Dup (BCL0704-MSD1)		**Source: WCK0744-01**			Prepared: 12/21/2022 Analyzed: 12/22/2022					
Sulfate	451		10.4	mg/kg dry	417	29.3	101	90-110	3.37	25
Matrix Spike Dup (BCL0704-MSD2)		**Source: WCK1055-01**			Prepared: 12/21/2022 Analyzed: 12/22/2022					
Sulfate	445		10.7	mg/kg dry	430	13.1	101	90-110	5.72	25

ANATEK LABS

Chain of Custody Record

Anatek La
1282 Alturas Drive, Moscow I
504 E Sprague Ste D, Spokane

WCK1006

Due: 12/12/22

Company Name: STRATA	Project Manager: Luke Michels
Address: 1016 W. Hayden Ave.	Project Name & # : CD22068A
City: Hayden State: ID Zip: 83835	Purchase Order #:
Phone: 208-772-2428	Sampler Name & Phone: Steve Litalien; 208-818-7535
Email Address(es): lmichels@stratageotech.com	

Turn Arou

Please refer to
www.anateklabs.com/pricing-lists

✓ Normal
__Next Day*
__2nd Day*
__Other*_____

__Phone
✓ Email

*All rush order requests must have prior approval

List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	Preservative:	# of Containers	Sample Volume	pH/ASTM 4972	Resistivity ASTM G 187	Sulfate EPA 300.0
	B-5; 2.5'-3'	11-16-22; 1200	Soil		1	0.5	X	X	X

Note Special Instructions/Comments

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
No VOC Head Space?	Y	N
Cooler?	Y	N
Ice/Ice Packs Present?	Y	N

Temperature (°C): 18.2° IR2
Number of Containers: 1 bag
Shipped Via: hd
Preservative: NAT
Date & Time: 11-28-22 1033
Inspected By: BM

	Printed Name	Signature	Company	Date	Time
Relinquished by	Steve Litalien		STRATA	11-28-22	10:30
Received by	Brook Boyer		Anatek	11-28-22	1031
Relinquished by					
Received by					
Relinquished by					
Received by					

Samples submitted to Anatek Labs may be subcontacted to other accredited labs if necessary. This message serves as notice of this possibility. Subcontracted analyses will be clearly noted on the analytical report.