May 17, 2023

From the office of:

Idaho Department of Parks and Recreation – Development Bureau
5657 Warm Springs Avenue
Boise, Idaho 83716

Re: IDPR Project No. ARPA 340333
Thousand Springs State Park – Ritter Island Water System
Idaho Department of Parks & Recreation
Hagerman, Idaho

NOTICE OF CHANGES:

This **Addendum No. One** is hereby made a part of the project requirements and contract documents for the referenced project. Be sure to acknowledge this addendum on your Bid/Proposal Form. Failure to do so may subject the bidder to disqualification.

It is the obligation of the General Contractors receiving sub-bids to notify their subcontractors and suppliers of items relating to their bid prior to the bid opening.

GENERAL:

1. Geotechnical Report for Ritter Island Water System, Atlas Technical Consultants, LLC

END OF ADDENDUM NO. ONE

Attachment: Geotech Final Report

LIMITED GEOTECHNICAL INVESTIGATION

RITTER ISLAND WATER LINE REPAIRS

1245 Thousand Springs Grade
Wendell, ID

PREPARED FOR:

Mr. Joel Halfhill
State of Idaho, Department of Parks and Recreation
PO Box 83720
Boise, ID 83720

PREPARED BY:

Atlas Technical Consultants, LLC
484 Eastland Drive South, Suite 103
Twin Falls, ID 83301

May 16, 2023
T221411g

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May 16, 2023

Atlas No. T221411g

Mr. Joel Halfhill
State of Idaho, Department of Parks and Recreation
PO Box 83720
Boise, ID 83720

Subject: Geotechnical Investigation
Ritter Island Water Line Repairs
1245 Thousand Springs Grade
Wendell, ID

Dear Mr. Halfhill:

In compliance with your instructions, Atlas has conducted a soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on June 20, 2022. Data have been analyzed to evaluate pertinent geotechnical conditions. Results of this investigation, together with our recommendations, are to be found in the following report. We have provided a PDF copy for your review and distribution.

Often, questions arise concerning soil conditions because of design and construction details that occur on a project. Atlas would be pleased to continue our role as geotechnical engineers during project implementation.

If you have any questions, please call us at (208) 733-5323.

Respectfully submitted,

PROFESSIONAL ENGINEER LICENSED 18739 5/16/2023 STATE OF IDAHO ETHAN SALOVE

Ethan Salove, PE
Geotechnical Engineer

Elizabeth Brown

Elizabeth Brown, PE
Geotechnical Services Manager

Distribution: Antonio Conti, Ackerman-Estvold (PDF Copy).

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APPENDICES

1. INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design. Information in support of groundwater and stormwater issues pertinent to the practice of Civil Engineering is included. Observations and recommendations relevant to the earthwork phase of the project are also presented. Revisions in plans or drawings for the proposed improvements from those enumerated in this report should be brought to the attention of the soils engineer to determine whether changes in the provided recommendations are required. Deviations from noted subsurface conditions, if encountered during construction, should also be brought to the attention of the soils engineer.

1.1 Project Description

The proposed project is approximately 7.3 miles southwest of the City of Wendell, Gooding County, ID, and occupies a portion of the NE¼SW¼ of Section 8, Township 8 South, Range 14 East, Boise Meridian. This project will consist of replacing an existing water line with two new lines. These water lines are expected to be above grade. The lines are planned to be 2-inch and 6-inch in diameter. Atlas has not been informed of the proposed grading plan.

1.2 Authorization

Authorization to perform this exploration and analysis was given in the form of a written authorization to proceed from Melanie Schuster of State of Idaho, Department of Parks and Recreation to Ethan Salove of Atlas Technical Consultants (Atlas), on June 8, 2022. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between State of Idaho, Department of Parks and Recreation and Atlas. Our scope of services for the proposed development has been provided in our proposal dated June 2, 2022 and repeated below.

1.3 Scope of Investigation

The scope of this investigation included review of geologic literature and existing available geotechnical studies of the area, visual site reconnaissance of the immediate site, subsurface exploration of the site, field and laboratory testing of materials collected, and engineering analysis and evaluation of foundation materials, including anchoring and pipeline support recommendations.

2. SITE DESCRIPTION

2.1 Regional Geology

The subject site is located within the Snake River Canyon, which is located in the central portion of the Snake River Plain. The Snake River Plain consists of a topographic low which trends in the shape of a concave northward zone across the entire southern half of the state of Idaho. The Owyhee Plateau can be thought of as genetically related to the Snake River Plain, yet it now sits as a highland. The Western Snake River Plain sits in a normal-fault bounded graben, and the Eastern Snake River Plain has subsided due to the collapse of rhyolite calderas. The central portion of the plain exhibits features that indicate an area of transition from graben to subsidence. Rocks on the north side of the Snake River consist of Pleistocene flows that erupted from numerous shield volcanoes. Older Pliocene and Miocene basalt flows underly the plain on the southern side of the Snake River. The course of the river is predominately controlled by the contact between the older rocks on the south and younger rocks on the north.

The eastern portion of the site is underlain by “Talus” as mapped by Othberg, Kauffman, Gillerman, and Garwood (2012). These deposits consist of angular pebble, cobble, and boulder sized basalt fragments broken off of near-vertical outcrops.

The western portion of the site is underlain by “Alluvium of Mainstreams” and “Older Alluvium of Mainstreams” as mapped by Othberg and others (2012). These deposits consist of varying sand and gravel mixtures deposited along river channels.

2.2 General Site Characteristics

The existing waterline is approximately 450 feet long and is located on the eastern side of the Snake River Canyon. The upper portion of the line is fed from the northern termination of Sand Springs Creek, which is located near the base of a vertical basalt cliff. A talus slope is present at the base of the cliff that slopes downwards towards two small channels of the Snake River, which are separated by a small island. Slopes below the vertical canyon wall ranged from 3 feet horizontal to 1 foot vertical (3:1) to 1:1. This sloped area was highly vegetated with vines, small trees, and thick brush. Active spring activity was noted near the base of the cliff and intermittently on the talus slope. Currently, the existing water line runs down the canyon wall to supply Ritter Island with irrigation and drinking water. In the eastern portion of the site where the line traverses the slope at the base of the cliff, the water line is supported on stacked basalt rocks. At the base of the slope, the line is supported by shallow saddle foundations. No supports were noted along the portion of the line crossing the small island. The western portion of the line is founded on steel posts.

Regional drainage is toward the Snake River. Stormwater drainage for the site is achieved by both sheet runoff and percolation through surficial soils. Runoff predominates for the steeper slopes while percolation prevails across the gently sloping and near level areas. From the east, intermittent off-site stormwater may drain onto the project site.

3. GEOLOGIC HAZARD ASSESSMENT

This section provides an assessment of the geologic hazards for the site, including the potential for surface fault rupture, liquefaction, seismically induced settlements, landslides, rockfalls, lateral spreading, and flooding.

The hazard evaluation methodology involved one or two steps. First, the potential for occurrence of each type of geologic phenomenon is assessed. If there is a potential for a phenomenon to occur, the second step is to assess whether the phenomenon likely will result in a significant hazard for designated structures. For this evaluation, a significant hazard is defined as one that results in structural damage and threatens life-safety.

3.1 Regional Faults

The site is located within the central portion of the Snake River Plain. The central portion of the plain consists of a topographical low formed by the migration of the North American Plate over the Yellowstone Hotspot. Per a map titled *Geologic Map of the Twin Falls 30 x 60 Minute Quadrange, Idaho* (Othberg and others, 2012), no faults are mapped within the central portion of the plain. The closest faults are located approximately 12 miles to the southwest of the site, and are associated with the Western Snake River Plain. No evidence of faulting was observed during the subsurface exploration.

3.2 Historical Seismicity

According to the USGS earthquakes program, 3 earthquakes have been recorded within 50 miles of the project site ranging in magnitudes from 2.6 to 5.2. The largest of these earthquakes occurred on September 5, 1928 approximately 48 miles to the southwest of the project site and had a magnitude of 5.2. The closest earthquake to the project site occurred on February 6, 2002 approximately 41 miles to the northwest of the project site, and had a magnitude of 2.8.

3.3 Seismically Induced Surface Rupture, Settlements, and Lateral Spreading

Earthquakes generally are caused by a sudden slip or displacement along a zone of weakness, termed a fault, in the Earth's crust. Surface fault rupture, which is a manifestation of the fault displacement at the ground surface, usually is associated with moderate to large-magnitude earthquakes (magnitudes of about 6 or larger) occurring on active faults having mapped traces or zones at the ground surface. The amount of surface fault displacement can be as much as 10 feet (3 meters) or more, depending on the earthquake magnitude and other factors. The displacements associated with surface fault rupture can have devastating effects on structures and lifelines situated astride the zone of rupture.

As mentioned above, there is a lack of moderate to large-magnitude historic earthquakes in the region. It is the opinion of Atlas that the probability of the occurrence of seismically induced surface rupture, settlements, and lateral spreading is negligible.

3.4 Landslides

Landslides are a type of mass movement involving the downslope movement of hillslope materials. The stability of a slope is defined as the ratio of resisting forces and driving forces acting on a slope. Factors affecting slope stability include material composition, slope gradients and height, and the geometry and structure of slope materials. Existing landslide deposits are particularly prone to reactivation because of existing zones of weakness along existing failure surfaces. Additionally, the introduction of water into slopes can cause failure because pore pressures are increased.

Earthquake ground shaking can reduce the stability of a slope and cause sliding or falling of the soil or rock materials composing the slope. During ground shaking, seismic inertia forces are induced within the slope, increasing the loads that the slope materials must sustain to resist landsliding (or rockfalls). If the forces tending to cause landsliding exceed the strength of the materials resisting landsliding, a temporary instability is created that is manifested by lateral or downslope displacement of the slope materials, reducing their ability to resist the forces that cause landsliding.

Possible consequences of landsliding include differential lateral and vertical movements of structures situated within the landslide zone, undermining of structures upslope of the landslide, burial or filling of facilities downslope of the landslide, increased loading against structures in the path of the landslide, and decreased stability of slopes above the landslide.

As discussed in the **General Site Characteristics** section of this report, the site is located within a portion of the Snake River Canyon. If seismic activity were to occur in the vicinity of the site, slope instabilities could be triggered. However, based on the lack of moderate to large-magnitude historic earthquakes in the region, we conclude that the potential for seismically induced landslides at the site is low.

Spring activity is present throughout the canyon walls. These slopes may be prone to failures in areas where hydrostatic forces are present. At this time, the proposed grading for the pipeline has not been developed. Slope instabilities may occur if slopes are over-steepened. Atlas has not performed a numerical slope stability analysis. Once the grading plan has been developed, Atlas must be contacted to determine if additional exploration and analyses is required. Design of retaining walls and other earth retention elements should account for seismically induced earth pressures.

3.5 Rockfalls

Rockfalls are defined as the detachment of rock fragments from steep slopes followed by movement of the material by falling, bouncing, and rolling. Movement of these materials occur very rapidly and may be proceeded by other mass movement events. Rockfalls are generally triggered by climatic or biological events that cause a change in the forces acting on the rock. There are a multitude of conditions that may lead to the initiation of rockfall events including precipitation, freeze/thaw action, bio-disturbance, weathering/erosion of intact rock formations, etc.

The most important factor controlling rockfall trajectory once movement has been initiated is the geometry and composition of the slope. In general, exposed rock formations/large boulders are the most dangerous because the impact of the falling rock is not absorbed by the surface, while soil/talus slopes will absorb more of the impact and reduce the overall kinetic energy of mobilized rock. In addition, the shape of the detached rocks play an important role in the behavior of down-slope movement. Rounded/spherical rocks will have a tendency to roll more easily than blocky/angular rocks.

As stated in the **General Site Characteristics** section, the site is located within a portion of the Snake River Canyon, and the existing line is located at the bottom of a vertical basalt cliff. The basalt cliffs and talus slopes may be prone to rock fall events, particularly during seismic events. <u>A rockfall analysis is outside of our current scope of work. It is anticipated that the waterline will remain as an above-grade line. The exposed line should be protected from rockfall that may occur from the adjacent cliff.</u>

3.6 Flood Waters

As mentioned in the **General Site Characteristics** section, the site is located at the base of the Snake River Canyon. There are areas on the site that could receive stormwater drainage from off-site sources. <u>During continuous and/or high intensity precipitation events, the likelihood of the onsite stream flooding is high.</u> Atlas recommends that FEMA Flood Maps be reviewed to determine the location and severity of flood zones on and near the project site.

4. SOILS EXPLORATION

4.1 Exploration and Sampling Procedures

Field exploration conducted to determine engineering characteristics of subsurface materials included a reconnaissance of the project site and investigation by hand boring. Hand boring sites were located in the field by means of a Global Positioning System (GPS) device and are reportedly accurate to within ten feet. Upon completion of investigation, each hand boring was backfilled with loose excavated materials.

In addition, samples were obtained from representative soil strata encountered. Samples obtained have been visually classified in the field by professional staff, identified according to hand boring number and depth, placed in sealed containers, and transported to our laboratory for additional testing. Subsurface materials have been described in detail on logs provided in the **Appendix**. Results of field and laboratory tests are also presented in the **Appendix**. Atlas recommends that these logs **not** be used to estimate fill material quantities.

4.2 Laboratory Testing Program

Along with our field investigation, a supplemental laboratory testing program was conducted to determine additional pertinent engineering characteristics of subsurface materials necessary in an analysis of anticipated behavior of the proposed structures. Laboratory tests were conducted in accordance with current applicable American Society for Testing and Materials (ASTM) specifications, and results of these tests are to be found in the **Appendix**. The laboratory testing program for this report included: Atterberg Limits Testing – ASTM D4318 and Grain Size Analysis – ASTM C117/C136.

4.3 Soil and Sediment Profile

The profile below represents a generalized interpretation for the project site. Note that on site soils strata, encountered between hand boring locations, may vary from the individual soil profiles presented in the logs, which can be found in the **Appendix**.

Various soils were encountered at ground surface throughout the site. Within hand boring 1, sandy silt soils were encountered. These soils were light brown to brown, slightly moist, and medium stiff to stiff, with fine-grained sand. Within hand boring 2, poorly graded gravel with sand sediments were encountered. These sediments were dark gray to black, saturated, and loose, with fine to coarse-grained sand and fine to coarse gravel. Within hand boring 3, clayey gravel with sand sediments were noted at ground surface. These sediments were brown, wet, and medium dense, with fine to coarse-grained sand and fine to coarse gravel. Lastly within hand boring 4, silt soils were encountered at ground surface and were found to be light brown to tan, dry, and stiff. Minor organics were noted at the surface of hand borings 1 and 4.

Below surficial soils and sediments within hand borings 1 and 2 and at depth in hand boring 1, sandy lean clay soils were noted. These soils were light brown to black, slightly moist to saturated, and soft to stiff, with fine-grained sand and minor fine gravel. The lean clays encountered in hand boring 2 contained decaying organics. Within hand boring 1, silty sands were encountered below sandy lean clays. These sediments were light brown, moist to wet, and medium dense to dense, with fine-grained sand. Within hand boring 2, clayey sands were encountered below sandy lean clays. These clayey sands were dark gray to black, saturated, medium dense, with fine to coarse-grained sand and minor fine gravel.

At depth within hand boring 2, clayey gravel with sand sediments were exposed. These sediments were dark gray to black, saturated, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel. At depth within hand borings 3 and 4, poorly graded sand with gravel sediments were encountered. These sediments were light brown to dark gray, dry to saturated, and medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel. Lean clay was encountered within these sands in hand boring 3.

Competency of test pit sidewalls varied little across the site. In general, fine grained soils remained stable while more granular sediments readily sloughed. However, moisture contents will also affect wall competency with saturated soils having a tendency to readily slough when under load and unsupported.

5. ANCHORING AND PIPELINE SUPPORT RECOMMENDATIONS

Various foundation types have been considered for support of the proposed pipeline. Two requirements must be met in the design of foundations. First, the applied bearing stress must be less than the ultimate bearing capacity of foundation soils to maintain stability. Second, total and differential settlement must not exceed an amount that will produce an adverse behavior of the superstructure. Allowable settlement is usually exceeded before bearing capacity considerations become important; thus, allowable bearing pressure is normally controlled by settlement considerations.

<u>Because of steep slopes and heavy vegetation, investigation could not be performed on the eastern portion of the project site. Further exploration will be required at the time of construction.</u>

5.1 Rock Anchoring System for Canyon Wall

For areas along the canyon wall where intact basalt is present, Atlas recommends that the water lines be supported on rock anchors. The anchors should be advanced a minimum of 5 feet into competent basalt formations. Loose talus must be completely removed. Typical bond stresses for basalt rock to grout interface range from approximately 50 to 450 psi. Pull testing must be performed on the anchors at the time of construction to verify the rock strength.

5.2 Preliminary Micropile Recommendations

For areas below the canyon wall and talus zones, Atlas recommends the water lines be supported on micropiles. Atlas has prepared a <u>preliminary</u> micropile design. Design calculation values for loading capacity, pile size, depth, and other relevant parameters have been included below. This design does not account for any lateral loading of the micropiles. Based on our preliminary design analysis, micropile construction parameters shall consist of the following:

Table 1 – Preliminary Micropile Design Parameters

Parameters	5.0 kip Design Load (Compression)
Minimum Bar Area (in^2)	0.74
Bar Yield Capacity (kips)	47.2
Bonded Length (ft)	10.0
Drill Bit Diameter (in)	4.0
Assumed Grout Body Diameter (in)	5.6

- Micropile bar must consist of a hollow threaded injection bar.
- Grout shall be a neat cement and have a minimum 28-day compressive strength of 4,000 psi.
- Grout must be pressure grouted through the bar during micropile installation.
- During micropile installation, test grout for compressive strength in accordance with ASTM D109 at a frequency of at least one set of three 2-inch grout cubes from each day of operations or per every 10 piles, whichever occurs more frequently. Samples are to be collected directly from the grout plant.
- Group effect of piles shall be analyzed if required by the IBC.
- The geotechnical engineer shall be onsite during pile installation.
- Prior to production micropile installation, load testing of at least one micropile must be performed in accordance with ASTM D3689.
- During production micropile installation, load testing of at least 10 percent of all micropiles must be performed in accordance with ASTM D3689.

Pile layout is to be determined by others. Note that alternate pile sizes and load carrying capacities can be analyzed upon request. <u>The micropile design provided is preliminary and must be finalized prior installation.</u>

6. CONSTRUCTION CONSIDERATIONS

6.1 Earthwork

Excessively organic soils, deleterious materials, or disturbed soils generally undergo high volume changes when subjected to loads, which is detrimental to subgrade behavior in the area of pavements, floor slabs, structural fills, and foundations. Mature trees, brush, and thick grasses with associated root systems were noted at the time of our investigation. It is recommended that organic or disturbed soils, if encountered, be removed to depths of 1 foot (minimum), and wasted or stockpiled for later use. However, in areas where trees are/were present, deeper excavation depths should be anticipated. Stripping depths should be adjusted in the field to assure that the entire root zone or disturbed zone or topsoil are removed prior to placement and compaction of structural fill materials. Exact removal depths should be determined during grading operations by Atlas personnel, and should be based upon subgrade soil type, composition, and firmness or soil stability. If underground storage tanks, underground utilities, wells, or septic systems are discovered during construction activities, they must be decommissioned then removed or abandoned in accordance with governing Federal, State, and local agencies. Excavations developed as the result of such removal must be backfilled with structural fill materials as defined in the **Structural Fill** section.

Atlas should oversee subgrade conditions (i.e., moisture content) as well as placement and compaction of new fill (if required) after native soils are excavated to design grade. Recommendations for structural fill presented in this report can be used to minimize volume changes and differential settlements that are detrimental to the behavior of footings. Sufficient density tests should be performed to properly monitor compaction. For structural fill beneath structures, one in-place density test per lift for every 5,000 square feet is recommended.

6.2 Soft Subgrade Soils

Shallow fine-grained subgrade soils that are high in moisture content should be expected to pump and rut under construction traffic. During periods of wet weather, construction may become very difficult if not impossible. The following recommendations and options have been included for dealing with soft subgrade conditions:

- Track-mounted vehicles should be used to strip the subgrade of root matter and other deleterious debris. Heavy rubber-tired equipment should be prohibited from operating directly on the native subgrade and areas in which structural fill materials have been placed. Construction traffic should be restricted to designated roadways that do not cross, or cross on a limited basis, proposed roadway or parking areas.
- Soft areas can be over-excavated and replaced with granular structural fill.
- Construction roadways on soft subgrade soils should consist of a minimum 2-foot thickness of large cobbles of 4 to 6 inches in diameter with sufficient sand and fines to fill voids. Construction entrances should consist of a 6-inch thickness of clean, 2-inch minimum, angular drain-rock and must be a minimum of 10 feet wide and 30 to 50 feet long. During the construction process, top dressing of the entrance may be required for maintenance.

- Scarification and aeration of subgrade soils can be employed to reduce the moisture content of wet subgrade soils. After stripping is complete, the exposed subgrade should be ripped or disked to a depth of 1½ feet and allowed to air dry for 2 to 4 weeks. Further disking should be performed on a weekly basis to aid the aeration process.
- Alternative soil stabilization methods include use of geotextiles, lime, and cement stabilization. Atlas is available to provide recommendations and guidelines at your request.

6.3 Structural Fill

Soils recommended for use as structural fill are those classified as GW, GP, SW, and SP in accordance with the Unified Soil Classification System (USCS) (ASTM D2487). Use of silty soils (USCS designation of GM, SM, and ML) as structural fill may be acceptable. <u>However, use of silty soils (GM, SM, and ML) as structural fill below footings is prohibited.</u> These materials require very high moisture contents for compaction and require a long time to dry out if natural moisture contents are too high and may also be susceptible to frost heave under certain conditions. Therefore, these materials can be quite difficult to work with as moisture content, lift thickness, and compactive effort becomes difficult to control. <u>If silty soil is used for structural fill, lift thicknesses should not exceed 6 inches (loose), and fill material moisture must be closely monitored at both the working elevation and the elevations of materials already placed.</u> Following placement, silty soils <u>must</u> be protected from degradation resulting from construction traffic or subsequent construction.

Recommended granular structural fill materials, those classified as GW, GP, SW, and SP, should consist of a 6-inch minus select, clean, granular soil with no more than 50 percent oversize (greater than ¾-inch) material and no more than 12 percent fines (passing No. 200 sieve). These fill materials should be placed in layers not to exceed 12 inches in loose thickness. Prior to placement of structural fill materials, surfaces must be prepared as outlined in the **Construction Considerations** section. Structural fill material should be moisture-conditioned to achieve optimum moisture content prior to compaction. For structural fill below footings, areas of compacted backfill must extend outside the perimeter of the footings for a distance equal to the thickness of fill between the bottom of foundation and underlying soils, or 5 feet, whichever is less. All fill materials must be monitored during placement and tested to confirm compaction requirements, outlined below, have been achieved.

Each layer of structural fill must be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557.

The ASTM D1557 test method must be used for samples containing up to 40 percent oversize (greater than ¾-inch) particles. If material contains more than 40 percent but less than 50 percent oversize particles, compaction of fill must be confirmed by proof rolling each lift with a 10-ton vibratory roller (or equivalent) until the maximum density has been achieved. Density testing must be performed after each proof rolling pass until the in-place density test results indicate a drop (or no increase) in the dry density, defined as maximum density or "break over" point. The number of required passes should be used as the requirements on the remainder of fill placement. Material should contain sufficient fines to fill void spaces, and must not contain more than 50 percent oversize particles.

6.4 Backfill of Walls

Backfill materials must conform to the requirements of structural fill, as defined in this report. For wall heights greater than 2.5 feet, the maximum material size should not exceed 4 inches in diameter. Placing oversized material against rigid surfaces interferes with proper compaction, and can induce excessive point loads on walls. Backfill shall not commence until the wall has gained sufficient strength to resist placement and compaction forces. Further, retaining walls above 2.5 feet in height shall be backfilled in a manner that will limit the potential for damage from compaction methods and/or equipment. It is recommended that only small hand-operated compaction equipment be used for compaction of backfill within a horizontal distance equal to the height of the wall, measured from the back face of the wall.

Backfill should be compacted in accordance with the specifications for structural fill, except in those areas where it is determined that future settlement is not a concern, such as planter areas. In nonstructural areas, backfill must be compacted to a firm and unyielding condition.

6.5 Groundwater Control

Groundwater was encountered during the investigation. Excavations below the water table will require a dewatering program. Dewatering will be required prior to placement of fill materials. Placement of concrete can be accomplished through water by the use of a treme. It may be possible to discharge dewatering effluent to remote portions of the site, to a sump, or to a pit. This will essentially recycle effluent, thus eliminating the need to enter into agreements with local drainage authorities. Should the scope of the proposed project change, Atlas should be contacted to provide more detailed groundwater control measures.

Special precautions may be required for control of surface runoff and subsurface seepage. It is recommended that runoff be directed away from open excavations. Silty and clayey soils may become soft and pump if subjected to excessive traffic during time of surface runoff. Ponded water in construction areas should be drained through methods such as trenching, sloping, crowning grades, nightly smooth drum rolling, or installing a French drain system. Additionally, temporary or permanent driveway sections should be constructed if extended wet weather is forecasted.

7. GENERAL COMMENTS

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed pipeline, the site is adequate for the planned construction. When plans and specifications are complete, consultation with Atlas must be arranged as supplementary recommendations may be required. Suitability of subgrade soils and compaction of structural fill materials must be verified by Atlas personnel prior to placement of structural elements. Additionally, monitoring and testing should be performed to verify that suitable materials are used for structural fill and that proper placement and compaction techniques are utilized.

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Appendix I WARRANTY AND LIMITING CONDITIONS

Atlas warrants that findings and conclusions contained herein have been formulated in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology only for the site and project described in this report. These engineering methods have been developed to provide the client with information regarding apparent or potential engineering conditions relating to the site within the scope cited above and are necessarily limited to conditions observed at the time of the site visit and research. Field observations and research reported herein are considered sufficient in detail and scope to form a reasonable basis for the purposes cited above.

Limitations

Because of steep slopes and heavy vegetation, investigation could not be performed on the eastern portion of the project site. Further exploration will be required at the time of construction.

Exclusive Use

This report was prepared for exclusive use of the property owner(s), at the time of the report, and their retained design consultants ("Client"). Conclusions and recommendations presented in this report are based on the agreed-upon scope of work outlined in this report together with the Contract for Professional Services between the Client and Atlas Technical Consultants ("Consultant"). Use or misuse of this report, or reliance upon findings hereof, by parties other than the Client is at their own risk. Neither Client nor Consultant make representation of warranty to such other parties as to accuracy or completeness of this report or suitability of its use by such other parties for purposes whatsoever, known or unknown, to Client or Consultant. Neither Client nor Consultant shall have liability to indemnify or hold harmless third parties for losses incurred by actual or purported use or misuse of this report. No other warranties are implied or expressed.

Report Recommendations are Limited and Subject to Misinterpretation

There is a distinct possibility that conditions may exist that could not be identified within the scope of the investigation or that were not apparent during our site investigation. Findings of this report are limited to data collected from noted explorations advanced and do not account for unidentified fill zones, unsuitable soil types or conditions, and variability in soil moisture and groundwater conditions. To avoid possible misinterpretations of findings, conclusions, and implications of this report, Atlas should be retained to explain the report contents to other design professionals as well as construction professionals.

Since actual subsurface conditions on the site can only be verified by earthwork, note that construction recommendations are based on general assumptions from selective observations and selective field exploratory sampling. Upon commencement of construction, such conditions may be identified that require corrective actions, and these required corrective actions may impact the project budget. Therefore, construction recommendations in this report should be considered preliminary, and Atlas should be retained to observe actual subsurface conditions during earthwork construction activities to provide additional construction recommendations as needed.

Since geotechnical reports are subject to misinterpretation, **do not** separate the soil logs from the report. Rather, provide a copy of, or authorize for their use, the complete report to other design professionals or contractors. Locations of exploratory sites referenced within this report should be considered approximate locations only. For more accurate locations, services of a professional land surveyor are recommended.

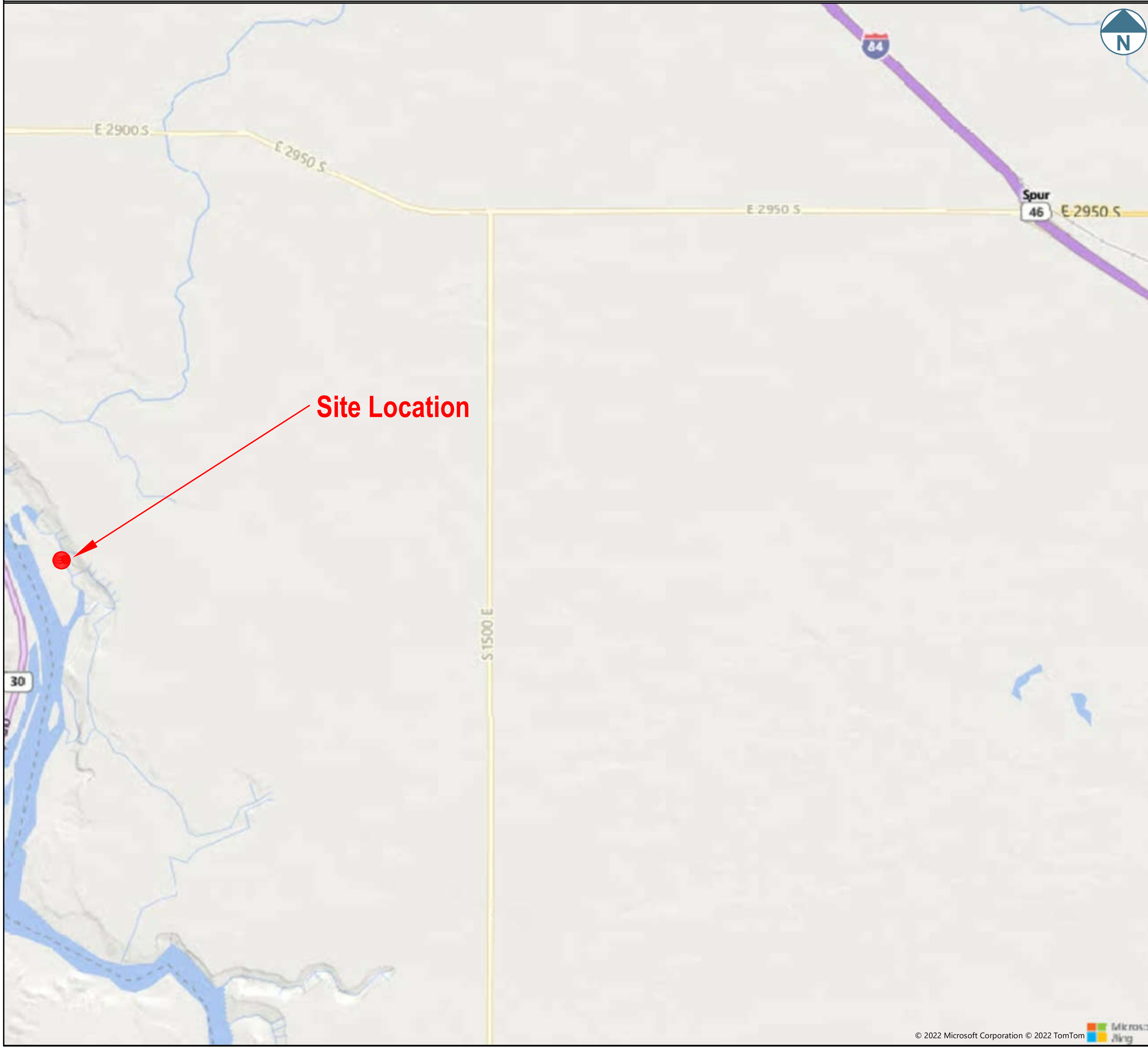
This report is also limited to information available at the time it was prepared. In the event additional information is provided to Atlas following publication of our report, it will be forwarded to the client for evaluation in the form received.

Environmental Concerns

Comments in this report concerning either onsite conditions or observations, including soil appearances and odors, are provided as general information. These comments are not intended to describe, quantify, or evaluate environmental concerns or situations. Since personnel, skills, procedures, standards, and equipment differ, a geotechnical investigation report is not intended to substitute for a geoenvironmental investigation or a Phase II/III Environmental Site Assessment. If environmental services are needed, Atlas can provide, via a separate contract, those personnel who are trained to investigate and delineate soil and water contamination.

Vicinity Map

Figure 1



MAP NOTES:

- Not to Scale

LEGEND

Approximate Site Location

Ritter Island Water Line Repairs
Thousand Springs Grade
Wendell, ID

Modified by: EJS
July 11, 2022
Drawing: T221411g

ATLAS

484 Eastland Drive South, Suite 103
Twin Falls, ID 83301

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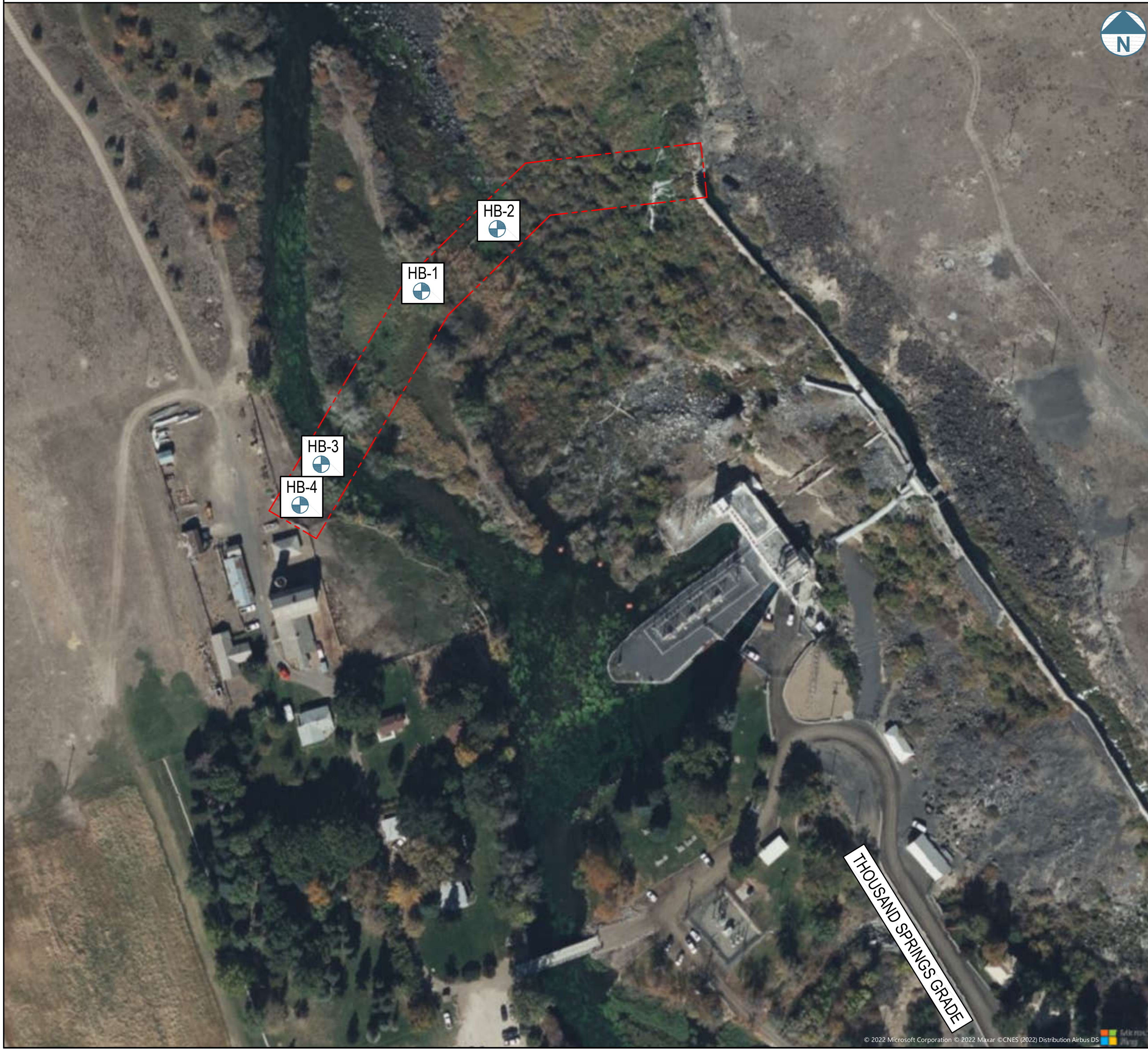
Site Map

Figure 2



NOTES:

- Not to Scale

LEGEND

Approximate Site Boundary

Approximate Atlas Hand Boring Location

Ritter Island Water Line Repairs
Thousand Springs Grade
Wendell, ID

Modified by: EJS
July 11, 2022
Drawing: T221411gg

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Appendix IV GEOTECHNICAL INVESTIGATION TEST PIT LOG

Hand Boring Log #: HB-1
Date Advanced: June 20, 2022
Excavated by: Ethan Salove, PE
Logged by: Ethan Salove, PE

Latitude: 42.744662
Longitude: -114.842530
Depth to Water Table: 4.0 feet bgs
Total Depth: 4.5 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-2.0	Sandy Silt (ML): Light brown to brown, slightly moist, medium stiff to stiff, with fine-grained sand.				
2.0-2.5	Sandy Lean Clay (CL): Light brown, slightly moist, medium stiff to stiff, with fine-grained sand.	GS	2.0-2.5		A
2.5-4.0	Silty Sand (SM): Light brown, moist to wet, medium dense to dense, with fine-grained sand. --Weak calcium carbonate cementation from 3.5 to 4.0 feet bgs.				
4.0-4.5	Sandy Lean Clay (CL): Light brown, saturated, stiff to hard, with fine-grained sand. --Refusal on hard soils at 4.5 feet bgs.				

Notes: See Site Map for test pit location.

Lab Test ID	Moisture (%)	LL	PI	Sieve Analysis (% Passing)				
				#4	#10	#40	#100	#200
A	18.9	29	15	100	98	92	81	55.7

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: HB-2
Date Advanced: June 20, 2022
Excavated by: Ethan Salove, PE
Logged by: Ethan Salove, PE

Latitude: 42.744889
Longitude: -114.842213
Depth to Water Table: 0.0 foot bgs
Total Depth: 4.2 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-0.2	Poorly Graded Gravel with Sand (GP): Dark gray to black, saturated, loose, with fine to coarse-grained sand and fine to coarse gravel.				
0.2-3.0	Sandy Lean Clay (CL): Dark gray to black, saturated, soft to medium stiff, with fine-grained sand and minor fine gravel. --Decomposing organic debris encountered throughout.				
3.0-4.0	Clayey Sand (SC): Dark gray to black, saturated, medium dense, with fine to coarse-grained sand and minor fine gravel.				
4.0-4.2	Clayey Gravel with Sand (GC): Dark gray to black, saturated, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel. --Refusal on gravels/basalt talus at 4.2 feet bgs.				

Notes: See Site Map for test pit location.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: HB-3
Date Advanced: June 20, 2022
Excavated by: Ethan Salove, PE
Logged by: Ethan Salove, PE

Latitude: 42.744092
Longitude: -114.842954
Depth to Water Table: 0.5 foot bgs
Total Depth: 2.0 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-0.5	Clayey Gravel with Sand (GC): Brown, wet, medium dense, with fine to coarse-grained sand and fine to coarse gravel.				
0.5-2.0	Poorly Graded Sand with Clay and Gravel (SP-SC): Gray to dark gray, saturated, medium dense to dense, with fine to medium-grained sand and fine to coarse gravel. --Sidewalls readily caved throughout, resulting in refusal at 2.0 feet bgs.				

Notes: See Site Map for test pit location.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: HB-4
Date Advanced: June 20, 2022
Excavated by: Ethan Salove, PE
Logged by: Ethan Salove, PE

Latitude: 42.744008
Longitude: -114.843069
Depth to Water Table: Not Encountered
Total Depth: 1.9 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-1.5	Silt (ML): Light brown to tan, dry, stiff.				
1.5-1.9	Poorly Graded Sand with Gravel (SP): Light brown, dry, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel. --Refusal on gravels at 1.9 feet bgs.				

Notes: See Site Map for test pit location.

Appendix V GEOTECHNICAL GENERAL NOTES

Unified Soil Classification System			
Major Divisions		**Symbol**	**Soil Descriptions**
Coarse-Grained Soils < 50% passes No.200 sieve	Gravel & Gravelly Soils < 50% coarse	GW	Well-graded gravels; gravel/sand mixtures with little or no fines
		GP	Poorly-graded gravels; gravel/sand mixtures with little or no fines
		GM	Silty gravels; poorly-graded gravel/sand/silt mixtures
		GC	Clayey gravels; poorly-graded gravel/sand/clay mixtures
	Sand & Sandy Soils > 50% coarse fraction	SW	Well-graded sands; gravelly sands with little or no fines
		SP	Poorly-graded sands; gravelly sands with little or no fines
		SM	Silty sands; poorly-graded sand/gravel/silt mixtures
		SC	Clayey sands; poorly-graded sand/gravel/clay mixtures
Fine-Grained Soils > 50% passes No.200 sieve	Silts & Clays LL < 50	ML	Inorganic silts; sandy, gravelly or clayey silts
		CL	Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays
		OL	Organic, low-plasticity clays and silts
	Silts & Clays LL > 50	MH	Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
		CH	Fat clays; high-plasticity, inorganic clays
		OH	Organic, medium to high-plasticity clays and silts
Highly Organic Soils		PT	Peat, humus, hydric soils with high organic content

Relative Density and Consistency Classification	
Coarse-Grained Soils	**SPT Blow Counts (N)**
Very Loose:	< 4
Loose:	4-10
Medium Dense:	10-30
Dense:	30-50
Very Dense:	> 50
Fine-Grained Soils	**SPT Blow Counts (N)**
Very Soft:	< 2
Soft:	2-4
Medium Stiff:	4-8
Stiff:	8-15
Very Stiff:	15-30
Hard:	> 30

Moisture Content and Cementation Classification	
Description	**Field Test**
Dry	Absence of moisture, dry to touch
Slightly Moist	Damp, but no visible moisture
Moist	Visible moisture
Wet	Visible free water
Saturated	Soil is usually below water table
Description	**Field Test**
Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

Particle Size	
Boulders:	> 12 in.
Cobbles:	12 to 3 in.
Gravel:	3 in. to 5 mm
Coarse-Grained Sand:	5 to 0.6 mm
Medium-Grained Sand:	0.6 to 0.2 mm
Fine-Grained Sand:	0.2 to 0.075 mm
Silts:	0.075 to 0.005 mm
Clays:	< 0.005 mm

Acronym List	
GS	grab sample
LL	Liquid Limit
M	moisture content
NP	non-plastic
PI	Plasticity Index
Q_p	penetrometer value, unconfined compressive strength, tsf
V	vane value, ultimate shearing strength, tsf

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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