Geotechnical Engineering Report
of
Law Enforcement Buildings
701 Northgate Mile
Idaho Falls, ID

Prepared for:

City of Idaho Falls – Police Department
PO Box 50220
Idaho Falls, ID 83402

MTI File Number E190182g

Captain Royce Clements
City of Idaho Falls – Police Department
PO Box 50220
Idaho Falls, ID 83402
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Re: Geotechnical Engineering Report
Law Enforcement Buildings
701 Northgate Mile
Idaho Falls, ID

In compliance with your instructions, MTI has conducted a soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on 13 September 2019. 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. MTI would be pleased to continue our role as geotechnical engineers during project implementation. Additionally, MTI can provide materials testing and special inspection services during construction of this project. If you will advise us of the appropriate time to discuss these engineering services, we will meet with you at your convenience.

MTI appreciates this opportunity to be of service to you and looks forward to working with you in the future. If you have questions, please call (208) 529-8242.

Respectfully Submitted,
Materials Testing & Inspection

PROFESSIONAL ENGINEER
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CHRIS A. PARK

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cc: Bryce Johnson, City of Idaho Falls (PDF Copy)

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INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design of structures as defined in the 2015 International Building Code (IBC). 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 structures 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.

Project Description

The proposed development is in the central portion of the City of Idaho Falls, Bonneville County, ID, and occupies a portion of the N½SE¼ of Section 18, Township 2 North, Range 38 East, Boise Meridian. This project will consist of construction of two law enforcement buildings without basement levels, to be developed with concrete tilt-up panel walls, spread/continuous footings, and concrete floor slabs on approximately 7.5 acres. One building is expected to be a 2-story, 20,000 square-foot office building, and the other is expected to be a single-story, 30,800 square-foot support building. Total settlements are limited to 1 inch. Loads of up to 4,000 pounds per lineal foot for wall footings, and column loads of up to 50,000 pounds were assumed for settlement calculations. Additionally, assumptions have been made for traffic loading of pavements. MTI has not been informed of the proposed grading plan.

Authorization

Authorization to perform this exploration and analysis was given in the form of a written authorization to proceed from Mayor Rebecca Casper of the City of Idaho Falls to Chris Park of Materials Testing and Inspection (MTI), on 15 September 2019. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between City of Idaho Falls and MTI. Our scope of services for the proposed development has been provided in our proposal dated 14 August 2019 and repeated below.

Purpose

The purpose of this Geotechnical Engineering Report is to determine various soil profile components and their engineering characteristics for use by either design engineers or architects in:

- Preparing or verifying suitability of foundation design and placement
- Preparing site drainage designs
- Indicating issues pertaining to earthwork construction
- Preparing light and moderate duty pavement section design requirements

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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.

Warranty and Limiting Conditions

MTI 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.

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 Materials Testing and Inspection ("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, MTI 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 MTI should be retained to observe actual subsurface conditions during earthwork construction activities to provide additional construction recommendations as needed.

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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 MTI 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, MTI can provide, via a separate contract, those personnel who are trained to investigate and delineate soil and water contamination.

SITE DESCRIPTION

Site Access

Access to the site may be gained via Highway 20 to the Holmes Avenue exit (Exit 310). Proceed south on Holmes Avenue approximately 1.4 miles to its intersection with Northgate Mile. From this intersection, proceed southwest 0.3 mile to the site which occupies the northwest side of the street. Presently the site exists as a stockyard and auction facility. The location is depicted on site map plates included in the **Appendix**.

Regional Geology

The subject site is located in the northeastern portion of the Snake River Plain. Sediments deposited here were derived from Cretaceous sediments from the Caribou and Snake River Ranges, which are immediately northeast and east of the East Snake River Flood Plains, and composes the underlying horizons throughout the region. Surficial sediments were deposited as mixed alluvium sediments during the Tertiary Period (1.6 to 66 million years ago). These sediments generally consist of gravels with cobbles and sand lenses with fine gravels intermixed and underlying sandy silts, silty clays, and lean clays which have in the ensuing period been weakly to moderately indurated. These sediments were deposited in a variety of geologic environments that existed along the northeastern margin of the ancestral eastern Snake River Plain. Since their deposition, these formations have gradually been eroded away from the Idaho Falls Valley (Alt and Hyndman, 1998).

General Site Characteristics

This proposed development consists of approximately 7.5 acres of relatively level terrain. The site has been occupied by a livestock auction facility since 1936 and includes an auction building with associated offices and restaurant. Wooden livestock pens with concrete slabs-on-grade cover the north portion of the site and a portion

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of the site south of the existing offices is covered with asphalt pavement. Throughout the remainder of the site, surficial materials consist of silty gravels with sand fill and silt with gravel fill. Minor vegetation primarily consists of weeds and native grass varieties typical of arid to semi-arid environments. In addition to sanitary sewer and storm sewer services on the site, most of the existing livestock pens are supplied with running water. An existing retaining wall lies along a portion of the southeast boundary of the site. US Highway 26 (Northgate Mile) and two site access roads lay at the top of the retained material. Solid basalt rock is visible at the surface of the access roads, and along the toe of a portion of the retaining wall.

Regional drainage is southwest toward the Snake River. Stormwater drainage for the site is achieved by both sheet runoff and percolation through surficial soils. Runoff to stormwater catch basins predominates for the northern portion of the site, while percolation prevails in the southern portion. From the east, intermittent off-site stormwater may drain onto the project site. Stormwater collected in catch basins runs to the municipal stormwater system.

Regional Site Climatology and Geochemistry

According to the Western Regional Climate Center, the average precipitation for the Idaho Falls area is on the order of 10 to 12 inches per year, with an annual snowfall of approximately 78 inches and a range from 29 to 150 inches. The monthly mean daily temperatures range from 14°F to 87°F, with daily extremes ranging from -51°F to 100°F. Winds are generally from the north or south-southwest with an annual average wind speed of approximately 9 miles per hour. Soils and sediments in the area are primarily derived from siliceous materials and exhibit low electro-chemical potential for corrosion of metals or concretes. Local aggregates are generally appropriate for Portland cement and lime cement mixtures. Surface water, groundwater, and soils in the region typically have pH levels ranging from 7.2 to 8.2.

Seismic Site Evaluation

Geoseismic Setting

Soils on site are classed as Site Class D in accordance with Chapter 20 of the American Society of Civil Engineers (ASCE) publication ASCE/SEI 7-10. Structures constructed on this site should be designed per IBC requirements for such a seismic classification. Our investigation did not reveal hazards resulting from potential earthquake motions including: slope instability, liquefaction, and surface rupture caused by faulting or lateral spreading.

Seismic Design Parameter Values

The United States Geological Survey National Seismic Hazard Maps (2008), includes a peak ground acceleration map. The map for 2% probability of exceedance in 50 years in the Western United States in standard gravity (g) indicates that a peak ground acceleration of 0.249 is appropriate for the project site based on a Site Class D.

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The following section provides an assessment of the earthquake-induced earthquake loads for the site based on the Risk-Targeted Maximum Considered Earthquake (MCE_R). The MCE_R spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, are adjusted for site class effects as required by the 2015 IBC. Design spectral response acceleration parameters as presented in the 2015 IBC are defined as a 5% damped design spectral response acceleration at short periods, S_{DS}, and at 1-second period, S_{D1}.

The USGS National Seismic Hazards Mapping Project includes a program that provides values for ground motion at a selected site based on the same data that were used to prepare the USGS ground motion maps. The maps were developed using attenuation relationships for soft rock sites; the source model, assumptions, and empirical relationships used in preparation of the maps are described in Petersen and others (1996).

Seismic Design Values

Seismic Design Parameter	Design Value
Site Class	D "Stiff Soil"
S_s	0.459 (g)
S_1	0.155 (g)
F_a	1.433
F_v	2.179
S_{Ms}	0.658 (g)
S_{M1}	0.338 (g)
S_{DS}	0.438 (g)
S_{D1}	0.225 (g)

SOILS EXPLORATION

Exploration and Sampling Procedures

Field exploration conducted to determine engineering characteristics of subsurface materials included a reconnaissance of the project site and investigation by test pit. Test pit sites were located in the field by means of a Global Positioning System (GPS) device and are reportedly accurate to within five feet. Upon completion of investigation, each test pit was backfilled with loose excavated materials. Re-excavation and compaction of these test pit areas are required prior to construction of overlying structures.

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 test pit 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**. MTI recommends that these logs **not** be used to estimate fill material quantities.

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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 on the accompanying logs located in the **Appendix**. The laboratory testing program for this report included: Atterberg Limits Testing – ASTM D4318 and Grain Size Analysis – ASTM C117/C136.

Soil and Sediment Profile

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

Concrete slabs were noted at the surface of test pits 1 through 4, and asphalt pavement was noted at the surface of test pit 7. Various fill materials were noted below the slabs and pavement, and at the surface of the remainder of the site. These fill materials were primarily gravels with various amounts of silt and sand, though silty sand and poorly graded sand fill were also noted. The fill was generally brown to dark brown, slightly moist, and medium dense to dense/hard, with fine to coarse-grained sand and 2-inch-minus gravel. Debris was noted in some of the fill material including minor wood, minor wire, and a significant amount of wood chips in test pits 4, 5, and 6 (respectively).

Silty sand was observed below the fill materials in most test pits. The silty sand was brown, slightly moist, and medium dense to dense, with fine-grained sand. Similar native soils included poorly graded sand in test pit 2, poorly graded sand with gravel in test pit 6, and stiff to very stiff sandy silt in test pit 7. Poorly graded gravels with sand were next encountered below the native sandy sediments and to depth in test pits 1, 3, and 5. These gravels were brown, slightly moist, and medium dense to dense, with fine to coarse-grained sand, fine to coarse gravels, and 12-inch-minus cobbles. Weak calcium carbonate cementation was noted throughout the gravels in test pit 2. Poorly graded sands observed to depth in test pit 2 were gray, slightly moist, and loose to medium dense, with fine to medium-grained sand. Silty sand was encountered to depth in test pits 4 and 7. These silty sands were brown, slightly moist, and medium dense, with fine to medium-grained sand. Test pit 6 was terminated in basalt rock which was dark gray, slightly weathered, widely fractured, and strong.

During excavation, test pit sidewalls were generally stable. However, moisture contents will affect wall competency with saturated soils having a tendency to readily slough when under load and unsupported.

Volatile Organic Scan

No environmental concerns were identified prior to commencement of the investigation. Therefore, soils obtained during on-site activities were not assessed for volatile organic compounds by portable photoionization detector. Samples obtained during our exploration activities exhibited no odors or discoloration typically associated with this type of contamination. No groundwater was encountered.

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SITE HYDROLOGY

Existing surface drainage conditions are defined in the **General Site Characteristics** section. Information provided in this section is limited to observations made at the time of the investigation. Either regional or local ordinances may require information beyond the scope of this report.

Groundwater

During this field investigation, groundwater was not encountered in test pits advanced to a maximum depth of 12.5 feet bgs. Soil moistures in the test pits were generally dry to slightly moist. Relatively deep groundwater is likely near the project site because of its topography and elevation above the Snake River. According to Idaho Department of Water Resources well log data within approximately ½-mile of the project site, static groundwater was measured at a depth of 153 feet bgs. For construction purposes, groundwater depth can be assumed to remain greater than 20 feet bgs throughout the year.

Soil Infiltration Rates

Soil permeability, which is a measure of the ability of a soil to transmit a fluid, was tested in the field. For this report, an estimation of infiltration is also presented using generally recognized values for each soil type and gradation. Of soils comprising the generalized soil profile for this study, sandy silt soils will commonly exhibit infiltration rates from 2 to 4 inches per hour. Silty sand sediments usually display rates of 4 to 8 inches per hour. Poorly graded sand and gravel sediments typically exhibit infiltration values in excess of 12 inches per hour; though calcium carbonate cementation may reduce this value. Infiltration rates through basalt rock can be highly variable, ranging from nearly zero to greater than 6 inches per hour in some cases. Movement of water through the basalt may be more characteristic of fracture flow.

Infiltration Testing

Infiltration testing was conducted using a 15-inch diameter pvc pipe in the area where stormwater disposal facilities are anticipated (near test pit 4). The test location was presoaked prior to testing. Pre-soaking increases soil moistures, which allows the tested soils to reach a saturated condition more readily during testing. Saturation of the tested soils is desirable in order to isolate the vertical component of infiltration by inhibiting horizontal seepage during testing.

On 16 September 2019, testing was on conducted within silty sand sediments at a depth of 10.2 feet bgs in test pit 4. A stabilized infiltration rate of 1 inch per hour was obtained during testing. MTI recommends a design infiltration rate of 0.5 inch per hour. The reason for the decreased infiltration rate is to account for long term saturation of the soils and the potential for less permeable soils to settle into the bottom of the infiltration facilities. MTI recommends that all infiltration facilities be constructed in accordance with the local municipality requirements.

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FOUNDATION, SLAB, AND PAVEMENT DISCUSSION AND RECOMMENDATIONS

Various foundation types have been considered for support of the proposed structure. 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.

Considering subsurface conditions and the proposed construction, it is recommended that the structure be founded upon conventional spread footings and continuous wall footings. Total settlements should not exceed 1 inch if the following design and construction recommendations are observed.

Foundation Design Recommendations

Based on data obtained from the site and test results from various laboratory tests performed, MTI recommends the following guidelines for the net allowable soil bearing capacity:

Soil Bearing Capacity

Footing Depth	ASTM D1557 Subgrade Compaction	Net Allowable Soil Bearing Capacity
Footings must bear on competent, undisturbed, native **sandy silt, silty sand, poorly graded sand, poorly graded gravel with sand**, or compacted structural fill. Existing fill materials must be completely removed from below foundation elements.[1] Excavation depths ranging from roughly 0.7 to 2.6 feet bgs should be anticipated to expose proper bearing soils.[2]	Not Required for Native Soil 95% for Structural Fill	2,000 lbs/ft^2 A ⅓ increase is allowable for short-term loading, which is defined by seismic events or designed wind speeds.
Footings must bear on **at least 12 inches of compacted structural fill**. Structural fill should bear competent, undisturbed, native sandy silt, silty sand, poorly graded sand, or poorly graded gravel with sand. Existing fill materials must be completely removed from below foundation elements.[1] Excavation depths ranging from roughly 0.7 to 2.6 feet bgs should be anticipated to expose proper bearing soils.[2]	Not Required for Native Soil 95% for Structural Fill	2,500 lbs/ft^2 A ⅓ increase is allowable for short-term loading, which is defined by seismic events or designed wind speeds.

[1]It will be required for MTI personnel to verify the bearing soil suitability for each structure at the time of construction.
[2]Depending on the time of year construction takes place, the subgrade soils may be unstable because of high moisture contents. If unstable conditions are encountered, over-excavation and replacement with granular structural fill and/or use of geotextiles may be required.

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The following sliding frictional coefficient values should be used: 1) 0.35 for footings bearing on native sandy silt soils and silty sand sediments and 2) 0.45 for footings bearing on native poorly graded sands, native poorly graded gravels with sand, and granular structural fill. A passive lateral earth pressure of 350 pounds per square foot per foot (psf/ft) should be used for sandy silt and silty sand soils. For native poorly graded sands, native poorly graded gravels with sand, and compacted sandy gravel fill, a passive lateral earth pressure of 496 psf/ft should be used.

Footings should be proportioned to meet either the stated soil bearing capacity or the 2015 IBC minimum requirements. Total settlement should be limited to approximately 1 inch, and differential settlement should be limited to approximately ½ inch. Objectionable soil types encountered at the bottom of footing excavations should be removed and replaced with structural fill. Excessively loose or soft areas that are encountered in the footings subgrade will require over-excavation and backfilling with structural fill. To minimize the effects of slight differential movement that may occur because of variations in the character of supporting soils and seasonal moisture content, MTI recommends continuous footings be suitably reinforced to make them as rigid as possible. For frost protection, the bottom of external footings should be 30 inches below finished grade. Based on the soil types encountered onsite, foundation drains are not needed.

Floor Slab-on-Grade

Uncontrolled fill, some of which contained debris, was encountered in portions of the site. MTI recommends that these fill materials be removed to a depth of at least 1½ feet below existing grade. If fill materials remain after excavation, the exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The excavated fill materials can be replaced in accordance with the **Structural Fill** section. Once final grades have been determined, MTI is available to provide additional recommendations.

Organic, loose, or obviously compressive materials must be removed prior to placement of concrete floors or floor-supporting fill. In addition, the remaining subgrade should be treated in accordance with guidelines presented in the **Earthwork** section. Areas of excessive yielding should be excavated and backfilled with structural fill. Fill used to increase the elevation of the floor slab should meet requirements detailed in the **Structural Fill** section. Fill materials must be compacted to a minimum 95 percent of the maximum dry density as determined by ASTM D1557.

A free-draining granular mat should be provided below slabs-on-grade to provide drainage and a uniform and stable bearing surface. This should be a minimum of 4 inches in thickness and properly compacted. The mat should consist of a sand and gravel mixture, complying with Idaho Standards for Public Works Construction (ISPWC) specifications for ¾-inch (Type 1) crushed aggregate. The granular mat should be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D1557. A moisture-retarder should be placed beneath floor slabs to minimize potential ground moisture effects on moisture-sensitive floor coverings. The moisture-retarder should be at least 15-mil in thickness and have a permeance of less than 0.01 US perms as determined by ASTM E96. Placement of the moisture-retarder will require special consideration with regard to effects on the slab-on-grade and should adhere to recommendations outlined in the ACI 302.1R and ASTM E1745 publications. Upon request, MTI can provide further consultation regarding installation.

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Recommended Pavement Sections

MTI has made assumptions for traffic loading variables based on the character of the proposed construction. The Client shall review and understand these assumptions to make sure they reflect intended use and loading of pavements both now and in the future. Based on experience with soils in the region, a subgrade California Bearing Ratio (CBR) value of 5 has been assumed for near-surface silty sand and sandy silt soils on site. The following are minimum thickness requirements for assured pavement function. Depending on site conditions, additional work, e.g. soil preparation, may be required to support construction equipment. These have been listed within the **Soft Subgrade Soils** section.

Flexible Pavement Sections

The American Association of State Highway and Transportation Officials (AASHTO) design method has been used to calculate the following pavement sections. Calculation sheets provided in the **Appendix** indicate the soils constant, traffic loading, traffic projections, and material constants used to calculate the pavement sections. MTI recommends that materials used in the construction of asphaltic concrete pavements meet requirements of the ISPWC Standard Specification for Highway Construction. Construction of the pavement section should be in accordance with these specifications and should adhere to guidelines recommended in the section on **Construction Considerations**.

AASHTO Flexible Pavement Specifications

Pavement Section Component[1]	Driveways and Parking Light Duty	Driveways and Parking Moderate Duty
Asphaltic Concrete	2.5 Inches	3.0 Inches
Crushed Aggregate Base	4.0 Inches	4.0 Inches
Structural Subbase	8.0 Inches	10.0 Inches
Compacted Subgrade	See **Pavement Subgrade Preparation** Section	See **Pavement Subgrade Preparation** Section

[1]It will be required for MTI personnel to verify subgrade competency at the time of construction.

Asphaltic Concrete: Asphalt mix design shall meet the requirements of ISPWC, Section 810 Class III plant mix. Materials shall be placed in accordance with ISPWC Standard Specifications for Highway Construction.

Aggregate Base: Material complying with ISPWC Standards for Crushed Aggregate Materials.

Structural Subbase: Granular structural fill material complying with the requirements detailed in the **Structural Fill** section of this report except that the maximum material diameter is no more than $^{2}/_{3}$ the component thickness. Gradation and suitability requirements shall be per ISPWC Section 801, Table 1.

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Pavement Subgrade Preparation

Uncontrolled fill, some of which contained debris, was encountered in portions of the site. MTI recommends that these fill materials be removed to a depth of at least 1½ feet below existing grade. If fill materials remain after excavation, the exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The excavated fill materials can be replaced in accordance with the **Structural Fill** section. Once final grades have been determined, MTI is available to provide additional recommendations.

Common Pavement Section Construction Issues

The subgrade upon which above pavement sections are to be constructed must be properly stripped, compacted (if indicated), inspected, and proof-rolled. Proof rolling of subgrade soils should be accomplished using a heavy rubber-tired, fully loaded, tandem-axle dump truck or equivalent. Verification of subgrade competence by MTI personnel at the time of construction is required. Fill materials on the site must demonstrate the indicated compaction prior to placing material in support of the pavement section. MTI anticipated that pavement areas will be subjected to moderate traffic. MTI does not anticipate pumping material to become evident during compaction, but silty subgrade soils near and above optimum moisture contents may tend to pump. Pumping or soft areas must be removed and replaced with structural fill.

Fill material and aggregates, as well as compacted native subgrade soils, in support of the pavement section must be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D698 for flexible pavements and by ASTM D1557 for rigid pavements. If a material placed as a pavement section component cannot be tested by usual compaction testing methods, then compaction of that material must be approved by observed proof rolling. Minor deflections from proof rolling for flexible pavements are allowable. Deflections from proof rolling of rigid pavement support courses should not be visually detectable.

MTI recommends that rigid concrete pavement be provided for heavy garbage receptacles. This will eliminate damage caused by the considerable loading transferred through the small steel wheels onto asphaltic concrete. Rigid concrete pavement should consist of Portland Cement Concrete Pavement (PCCP) generally adhering to ITD specifications for Urban Concrete. PCCP should be 6 inches thick on a 4-inch drainage fill course (see **Floor Slab-on-Grade** section), and should be reinforced with welded wire fabric. Control joints must be on 12-foot centers or less.

CONSTRUCTION CONSIDERATIONS

Recommendations in this report are based upon structural elements of the project being founded on competent, native sandy silt, silty sand, poorly graded sand, poorly graded gravel with sand, or compacted structural fill. Structural areas should be stripped to an elevation that exposes these soil types.

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

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fills, and foundations. 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. Stripping depths should be adjusted in the field to assure that the entire root zone or disturbed zone are removed prior to placement and compaction of structural fill materials. Exact removal depths should be determined during grading operations by MTI 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.

MTI 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, pavements, and floor slabs. Sufficient density tests should be performed to properly monitor compaction. For structural fill beneath building structures, one in-place density test per lift for every 5,000 square feet is recommended. In parking and driveway areas, this can be decreased to one test per lift for every 10,000 square feet.

Dry Weather

If construction is to be conducted during dry seasonal conditions, many problems associated with soft soils may be avoided. However, some rutting of subgrade soils may be induced by shallow groundwater conditions related to springtime runoff or irrigation activities during late summer through early fall. Solutions to problems associated with soft subgrade soils are outlined in the **Soft Subgrade Soils** section. Problems may also arise because of lack of moisture in native and fill soils at time of placement. This will require the addition of water to achieve near-optimum moisture levels. Low-cohesion soils exposed in excavations may become friable, increasing chances of sloughing or caving. Measures to control excessive dust should be considered as part of the overall health and safety management plan.

Wet Weather

If construction is to be conducted during wet seasonal conditions (commonly from mid-November through May), problems associated with soft soils must be considered as part of the construction plan. During this time of year, fine-grained soils such as silts and clays will become unstable with increased moisture content, and eventually deform or rut. Additionally, constant low temperatures reduce the possibility of drying soils to near optimum conditions.

Soft Subgrade Soils

Shallow fine-grained subgrade soils that are high in moisture content should be expected to pump and rut under construction traffic. Throughout construction, soft areas may develop after the existing concrete is removed and heavy rubber tired equipment drives over the site. In addition, areas where significant water service leakage has occurred will likely have soft subgrade soils due to of moisture infiltration and will be prone to pumping

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and rutting. 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 and used to remove the existing concrete slabs and to perform any other necessary excavations. 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. MTI is available to provide recommendations and guidelines at your request.

Frozen Subgrade Soils

Prior to placement of structural fill materials or foundation elements, frozen subgrade soils must either be allowed to thaw or be stripped to depths that expose non-frozen soils and wasted or stockpiled for later use. Stockpiled materials must be allowed to thaw and return to near-optimal conditions prior to use as structural fill.

The onsite, shallow silty soils are susceptible to frost heave during freezing temperatures. For exterior flatwork and other structural elements, adequate drainage away from subgrades is critical. Compaction and use of structural fill will also help to mitigate the potential for frost heave. Complete removal of frost susceptible soils for the full frost depth, followed by replacement with a non-frost susceptible structural fill, can also be used to mitigate the potential for frost heave. MTI is available to provide further guidance/assistance upon request.

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. However, use of silty soils (GM, SM, and ML) as structural fill below footings is prohibited. 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. If silty soil is used for structural fill, lift

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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. Following placement, silty soils must 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, as outlined below:

- Below Structures and Rigid Pavements: A minimum of 95 percent of the maximum dry density as determined by ASTM D1557.
- Below Flexible Pavements: A minimum of 92 percent of the maximum dry density as determined by ASTM D1557 or 95 percent of the maximum dry density as determined by ASTM D698.

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.

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.

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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.

Excavations

Shallow excavations that do not exceed 4 feet in depth may be constructed with side slopes approaching vertical. Below this depth, it is recommended that slopes be constructed in accordance with Occupational Safety and Health Administration (OSHA) regulations, Section 1926, Subpart P. Based on these regulations, on-site soils are classified as type "C" soil, and as such, excavations within these soils should be constructed at a maximum slope of 1½ feet horizontal to 1 foot vertical (1½:1) for excavations up to 20 feet in height. Excavations in excess of 20 feet will require additional analysis. Note that these slope angles are considered stable for short-term conditions only, and will not be stable for long-term conditions.

During the subsurface exploration, test pit sidewalls generally exhibited little indication of collapse; however, minor sloughing of fill materials and native granular sediments from test pit sidewalls was observed. For deep excavations, native granular sediments cannot be expected to remain in position. These materials are prone to failure and may collapse, thereby undermining upper soil layers. This is especially true when excavations approach depths near the water table. Care must be taken to ensure that excavations are properly backfilled in accordance with procedures outlined in this report.

Groundwater Control

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 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.

General Comments

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed structures, the site is adequate for the planned construction. When plans and specifications are complete, and if significant changes are made in the character or location of the proposed structure, consultation with MTI must be arranged as supplementary recommendations may be required. Suitability of subgrade soils and compaction of structural fill materials must be verified by MTI 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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APPENDICES

ACRONYM LIST

AASHTO:	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ASCE	American Society of Civil Engineers
ASTM:	American Society for Testing and Materials
bgs:	below ground surface
CBR:	California Bearing Ratio
D:	natural dry unit weight, pcf
ESAL	Equivalent Single Axle Load
GS:	grab sample
IBC:	International Building Code
IDEQ	Idaho Department of Environmental Quality
ISPWC:	Idaho Standards for Public Works Construction
ITD:	Idaho Transportation Department
LL:	Liquid Limit
M:	water content
MSL:	mean sea level
N:	Standard "N" penetration: blows per foot, Standard Penetration Test
NP:	nonplastic
OSHA	Occupational Safety and Health Administration
PCCP:	Portland Cement Concrete Pavement
PERM:	vapor permeability
PI:	Plasticity Index
PID:	photoionization detector
PVC:	polyvinyl chloride
Qc:	cone penetrometer value, unconfined compressive strength, psi
Qp:	Penetrometer value, unconfined compressive strength, tsf
Qu:	Unconfined compressive strength, tsf
RMR	Rock Mass Rating
RQD	Rock Quality Designation
R-Value	Resistance Value
SPT:	Standard Penetration Test (140:pound hammer falling 30 in. on a 2:in. split spoon)
USCS:	Unified Soil Classification System
USDA:	United States Department of Agriculture
UST:	underground storage tank
V:	vane value, ultimate shearing strength, tsf

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GEOTECHNICAL GENERAL NOTES

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION			
Coarse-Grained Soils	**SPT Blow Counts (N)**	**Fine-Grained Soils**	**SPT Blow Counts (N)**
Very Loose:	< 4	Very Soft:	< 2
Loose:	4-10	Soft:	2-4
Medium Dense:	10-30	Medium Stiff:	4-8
Dense:	30-50	Stiff:	8-15
Very Dense:	>50	Very Stiff:	15-30
		Hard:	>30

Moisture Content	
Description	**Field Test**
Dry	Absence of moisture, dusty, dry to touch
Moist	Damp but not visible moisture
Wet	Visible free water, usually soil is below water table

Cementation	
Description	**Field Test**
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or beaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

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

UNIFIED SOIL CLASSIFICATION SYSTEM			
Major Divisions		**Symbol**	**Soil Descriptions**
Coarse-Grained Soils <50% passes No.200 sieve	Gravel & Gravelly Soils <50% coarse fraction passes No.4 sieve	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 passes No.4 sieve	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

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ROCK CLASSIFICATION SYSTEM

WEATHERING	
WEATHERING	**FIELD TEST**
Fresh	No sign of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	Slight discoloration inwards from open fractures, otherwise similar to Fresh.
Moderately Weathered	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped with a knife. Texture preserved.
Highly Weathered	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	Minerals decomposed to soil but fabric and structure preserved. Specimens easily crumbled or penetrated.

FRACTURING	
SPACING	**DISCRIPTION**
6 ft.	Very widely
2 – 6 ft.	Widely
8 – 24 in.	Moderately
2 ½ - 8 in.	Closely
¾ - 2 ½ in.	Very Closely

ROCK QUALITY DESIGNATION (RQD)	
RQD (%)	**ROCK QUALITY**
90 – 100	Excellent
75 – 90	Good
50 – 75	Fair
25 – 50	Poor
0 - 25	Very Poor

COMPETENCY			
STRENGTH	**CLASS**	**FIELD TEST**	**APPROXIMATE RANGE OF UNCONFINED COMPRESSIVE STRENGTH (tsf)**
Extremely Strong	I	Many blows with geologic hammer required to break intact specimen.	>2000
Very Strong	II	Hand-held specimen breaks with pick end of hammer under more than one blow.	2000 - 1000
Strong	III	Cannot be scraped or peeled with knife, hand-held specimen can be broken with single moderate blow with pick end of hammer.	1000 - 500
Moderately Strong	IV	Can just be scraped or peeled with knife. Indentations 1 mm to 3 mm show in specimen with moderate blow with pick end of hammer.	500 - 250
Weak	V	Material crumbles under moderate blow with pick end of hammer and can be peeled with a knife, but is hard to hand-trim for tri-axial test specimen.	250 - 10
Friable	VI	Material crumbles in hand.	N/A

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GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-1 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio
Excavated by: TMC Contractors **Location:** See Site Map Plates
Latitude: 43.50364 **Longitude:** -112.02857
Depth to Water Table: Not Encountered **Total Depth:** 10.0 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.3	Concrete: 3.6 inches				
0.3-1.2	Silty Gravel Fill (GM-FILL): *Dark brown to brown, slightly moist, medium dense, with 1.5-inch-minus gravel.*				
1.2-3.0	Silty Sand (SM): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand.*				
3.0-10.0	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, dense, with fine to coarse-grained sand and fine to coarse gravel.*				

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GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-2 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio

Excavated by: TMC Contractors **Location:** See Site Map Plates

Latitude: 43.50361 **Longitude:** -112.02765

Depth to Water Table: Not Encountered **Total Depth:** 9.0 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.2	Concrete: 2.4 inches				
0.2-0.7	Poorly Graded Gravel with Sand (GP-FILL): *Brown, slightly moist, medium dense, with medium to coarse-grained sand and 2-inch-minus gravel.*				
0.7-2.6	Poorly Graded Sand (SP): *Brown, slightly moist, dense, with fine to medium-grained sand.*				
2.6-6.8	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, dense, with fine to medium-grained sand and fine to coarse gravel.* *--Weak calcium carbonate cementation throughout.*				
6.8-9.0	Poorly Graded Sand (SP): *Gray, slightly moist, loose to medium dense, with fine to medium-grained sand.*				

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Geotechnical Investigation Test Pit Log

Test Pit Log #: TP-3 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio

Excavated by: TMC Contractors **Location:** See Site Map Plates

Latitude: 43.50310 **Longitude:** -112.02857

Depth to Water Table: Not Encountered **Total Depth:** 9.3 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.35	Concrete: 4.2 inches				
0.35-0.9	Silty Gravel Fill (GM-FILL): *Dark brown to brown, slightly moist, medium dense, with 1.5-inch-minus gravel.*				
0.9-1.4	Silty Sand (SM): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand.*				
1.4-9.3	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand and 2-inch-minus gravel.*				

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GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-4 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio
Excavated by: TMC Contractors **Location:** See Site Map Plates
Latitude: 43.50324 **Longitude:** -112.02727
Depth to Water Table: Not Encountered **Total Depth:** 10.2 Feet bgs
Notes: Piezometer installed to 10.2 feet bgs.

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.3	Concrete: 3.6 inches				
0.3-2.0	Silty Sand Fill (SM-FILL): *Dark brown to brown, slightly moist, dense.* *--Minor wood debris throughout.*				
2.0-10.2	Silty Sand (SM): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand.* *--12-inch basalt boulder noted at 5.0 feet bgs.* *--Fine to coarse gravel lens noted from 7.0-8.0 feet bgs.*				

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GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-5 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio
Excavated by: TMC Contractors **Location:** See Site Map Plates
Latitude: 43.50247 **Longitude:** -112.02879
Depth to Water Table: Not Encountered **Total Depth:** 12.5 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.5	Silty Gravel with Sand Fill (GM-FILL): *Dark brown to brown, slightly moist, dense, with 1.5-inch-minus gravel.*				
0.5-2.6	Poorly Graded Sand Fill (SP-FILL): *Light brown to brown, slightly moist, medium dense, with fine to medium-grained sand.* *--Piece of wire at 1.5 feet bgs.*				
2.6-4.4	Silty Sand (SM): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand.*				
4.4-12.5	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, medium dense to dense, with fine to coarse-grained sand, fine to coarse gravel, and 5-inch-minus cobbles.*				

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GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-6 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio
Excavated by: TMC Contractors **Location:** See Site Map Plates
Latitude: 43.50281 **Longitude:** -112.02797
Depth to Water Table: Not Encountered **Total Depth:** 8.0 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.9	Silt with Gravel Fill (ML-FILL): *Brown to dark brown, slightly moist, hard, with 2-inch-minus gravel.* *--Wood chips noted throughout.*			4.5+	
0.9-4.5	Silty Sand (SM): *Brown, slightly moist, medium dense to dense, with fine to medium-grained sand.*	GS	2.1-2.8		7334
4.5-5.6	Poorly Graded Sand with Gravel (SP): *Brown, slightly moist, medium dense to dense, with fine to coarse-grained sand, fine to coarse gravel, and 8-inch-minus cobbles.*				
5.6-8.0	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, dense to very dense, with fine to coarse-grained sand, fine to coarse gravel, and 12-inch-minus basalt cobbles.*				
Below 8.0	Basalt: *Dark gray, slightly weathered, widely fractured, strong.*				

Lab Test ID	M	LL	PI	Sieve Analysis (% passing)				
-	%	-	-	#4	#10	#40	#100	#200
7334	7.9	NP	NP	98	97	91	71	42.8

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Geotechnical Investigation Test Pit Log

Test Pit Log #: TP-7 **Date Advanced:** 13 Sept 2019 **Logged by:** Troy Posio

Excavated by: TMC Contractors **Location:** See Site Map Plates

Latitude: 43.50236 **Longitude:** -112.02784

Depth to Water Table: Not Encountered **Total Depth:** 10.0 Feet bgs

Depth (Feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (Feet bgs)	Qp	Lab Test ID
0.0-0.2	Asphalt: 2.4 inches				
0.2-0.5	Poorly Graded Gravel with Sand Fill (GP-FILL): *Brown, slightly moist, medium dense to dense, with fine to coarse-grained sand and crushed 3/4-inch-minus gravel.*				
0.5-1.3	Poorly Graded Gravel with Sand Fill (GP-FILL): *Brown, slightly moist, medium dense to dense, with fine to coarse-grained sand and 2-inch-minus gravel.*				
1.3-3.7	Sandy Silt (ML): *Brown, slightly moist, stiff to very stiff, with fine-grained sand.*	GS	2.5-3.0	1.5-3.5	7333
3.7-8.1	Poorly Graded Gravel with Sand (GP): *Brown, slightly moist, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel.*				
8.1-10.0	Silty Sand (SM): *Brown, slightly moist, medium dense, with fine to medium-grained sand.*				

Lab Test ID	M	LL	PI	Sieve Analysis (% passing)				
-	%	-	-	#4	#10	#40	#100	#200
7333	18.2	NP	NP	100	100	97	86	65.0

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AASHTO PAVEMENT THICKNESS DESIGN PROCEDURES

Pavement Section Design Location: Proposed IFPD, Light Duty

Average Daily Traffic Count:	200	All Lanes & Both Directions		
Design Life:	20	Years		
Percent of Traffic in Design Lane:	50%			
Terminal Seviceability Index (Pt):	2.5			
Level of Reliability:	95			
Subgrade CBR Value:	5		**Subgrade Mr:**	7,500

Calculation of Design-18 kip ESALs

	Daily Traffic	Growth Rate	Load Factors	Design ESALs
Passenger Cars:	86	2.0%	0.0008	610
Buses:	0	2.0%	0.6806	0
Panel & Pickup Trucks:	10	2.0%	0.0122	1,082
2-Axle, 6-Tire Trucks:	3	2.0%	0.1890	5,028
Emergency Vehicles:	1	2.0%	4.4800	39,731
Dump Trucks:	0	2.0%	3.6300	0
Tractor Semi Trailer Trucks:	0	2.0%	2.3719	0
Double Trailer Trucks	0	2.0%	2.3187	0
Heavy Tractor Trailer Combo Trucks:	0	2.0%	2.9760	0
Average Daily Traffic in Design Lane:	100			

Total Design Life 18-kip ESALs:	46,452
Actual Log (ESALs):	4.667
Trial SN:	2.40
Trial Log (ESALs):	4.867
Pavement Section Design SN:	2.41

	Design Depth Inches	**Structural Coefficient**	**Drainage Coefficient**
Asphaltic Concrete:	2.50	0.42	n/a
Asphalt-Treated Base:	0.00	0.25	n/a
Cement-Treated Base:	0.00	0.17	n/a
Crushed Aggregate Base:	4.00	0.14	1.0
Subbase:	8.00	0.10	1.0
Special Aggregate Subgrade:	0.00	0.09	0.9

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AASHTO Pavement Thickness Design Procedures

Pavement Section Design Location: Proposed IFPD, Moderate Duty

Average Daily Traffic Count:	200	All Lanes & Both Directions
Design Life:	20	Years
Percent of Traffic in Design Lane:	50%	
Terminal Seviceability Index (Pt):	2.5	
Level of Reliability:	95	
Subgrade CBR Value:	5	**Subgrade Mr:** 7,500

Calculation of Design-18 kip ESALs

	Daily Traffic	Growth Rate	Load Factors	Design ESALs
Passenger Cars:	28	2.0%	0.0008	199
Buses:	0	2.0%	0.6806	0
Panel & Pickup Trucks:	30	2.0%	0.0122	3,246
2-Axle, 6-Tire Trucks:	40	2.0%	0.1890	67,046
Emergency Vehicles:	2	2.0%	4.4800	79,462
Dump Trucks:	0	2.0%	3.6300	0
Tractor Semi Trailer Trucks:	0	2.0%	2.3719	0
Double Trailer Trucks	0	2.0%	2.3187	0
Heavy Tractor Trailer Combo Trucks:	0	2.0%	2.9760	0
Average Daily Traffic in Design Lane:	100			

Total Design Life 18-kip ESALs:	149,953
Actual Log (ESALs):	5.176
Trial SN:	2.80
Trial Log (ESALs):	5.270
Pavement Section Design SN:	2.82

	Design Depth Inches	**Structural Coefficient**	**Drainage Coefficient**
Asphaltic Concrete:	3.00	0.42	n/a
Asphalt-Treated Base:	0.00	0.25	n/a
Cement-Treated Base:	0.00	0.17	n/a
Crushed Aggregate Base:	4.00	0.14	1.0
Subbase:	10.00	0.10	1.0
Special Aggregate Subgrade:	0.00	0.09	0.9

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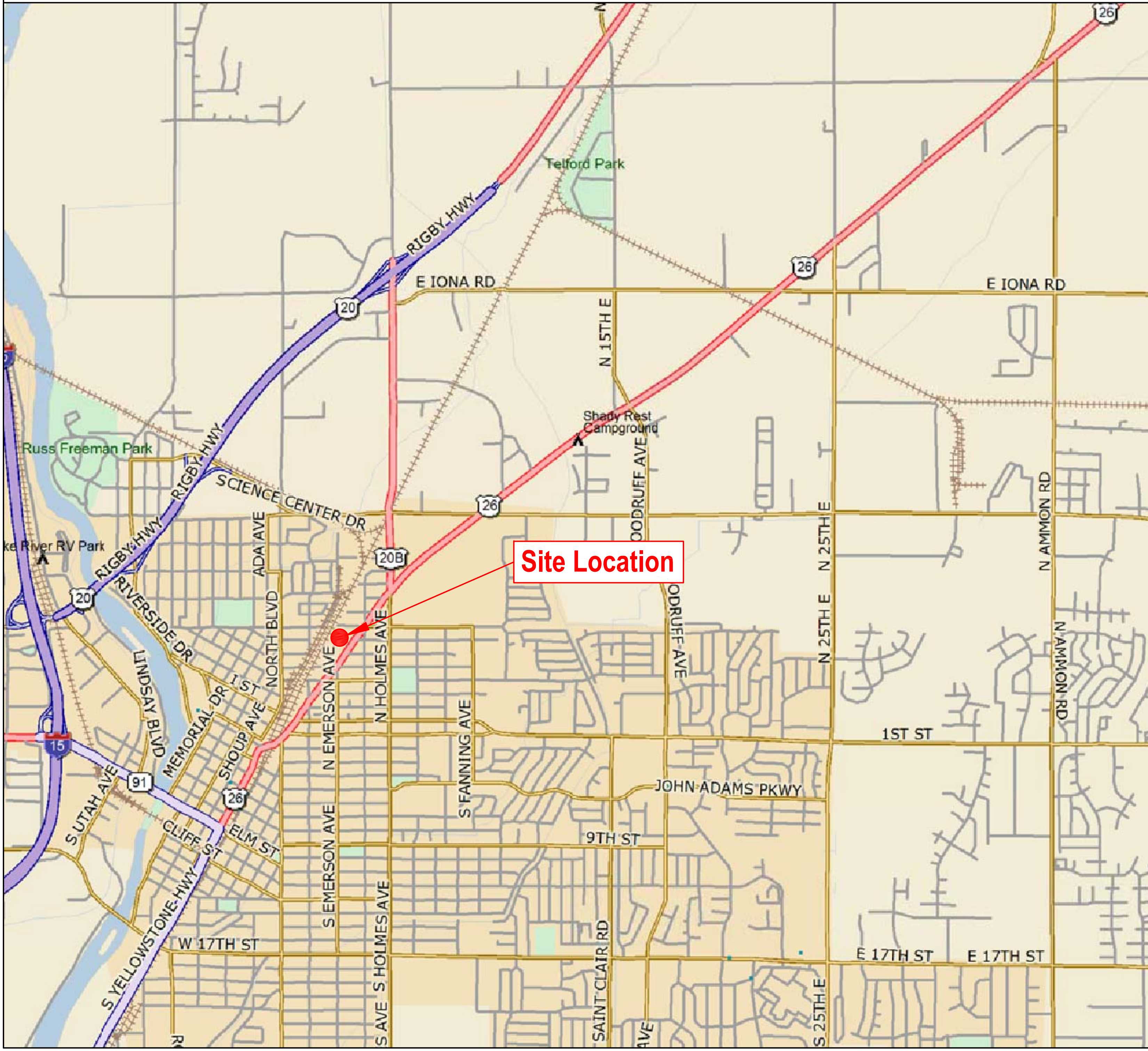
Vicinity Map

Plate 1



MAP NOTES:

- Delorme Street Atlas
- Not to Scale

LEGEND

Approximate Site Location

Law Enforcement Buildings
701 Northgate Mile
Idaho Falls, ID

Modified from DeLorme by: CCW
9 October 2019
Drawing: E190182g

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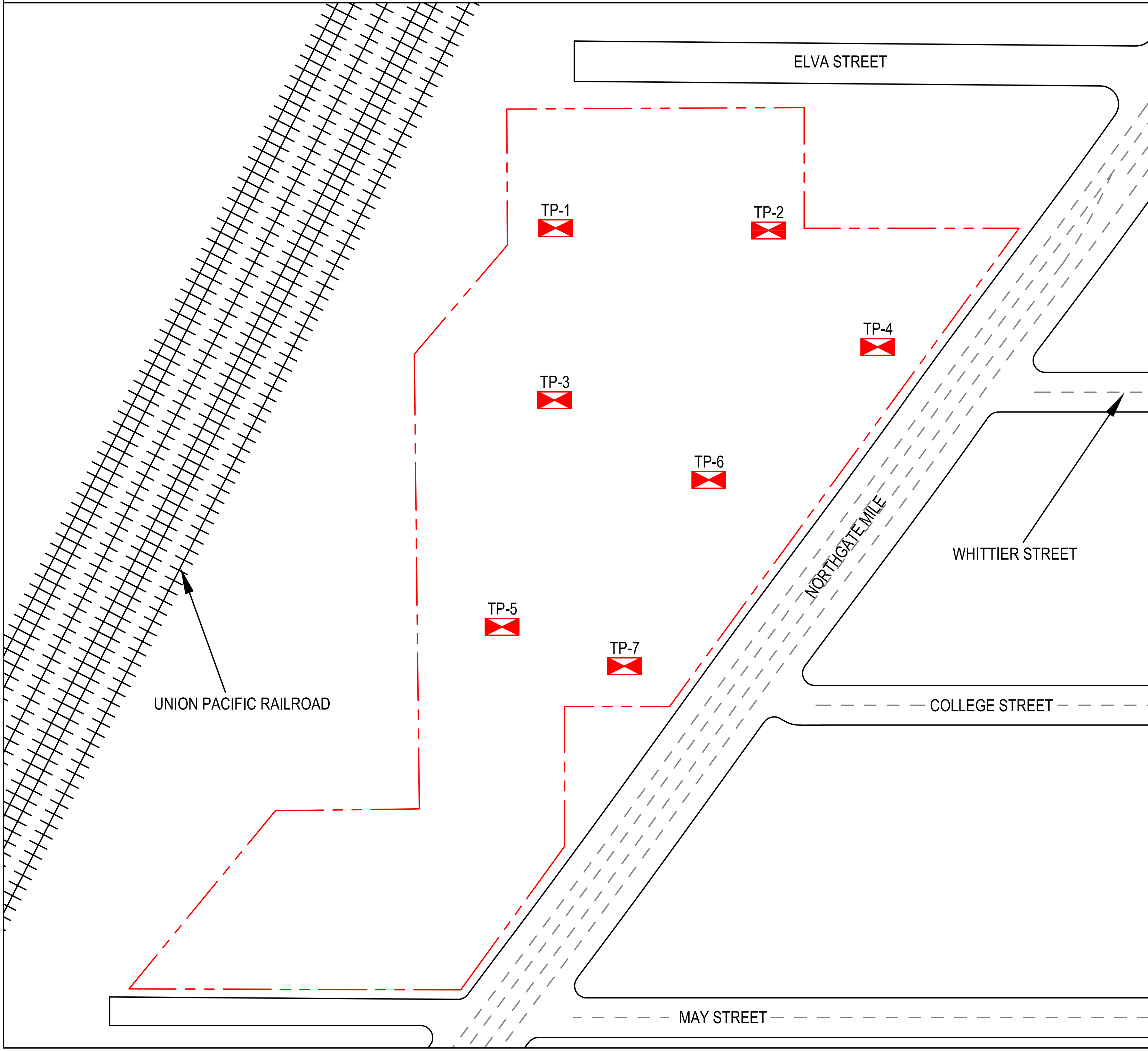
Site Map

Plate 2



NOTES:
- Not to Scale

LEGEND

Approximate Site Boundary

Approximate MTI Test Pit Location

Law Enforcement Buildings
701 Northgate Mile
Idaho Falls, ID

Drawn by: CCW
9 October 2019
Drawing: E190182g

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