Appendix B: Technical Reports

Contents

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Project TF24-5

Class III Cultural Resource Inventory

of

Federal Aviation Administration
Building near Five Springs Road

by

Terra Alta Archaeology
Cody, Wyoming

2024

UNDERTAKING/PROJECT DESCRIPTION: The project involves construction of a storage building for maintenance vehicles. An inventory was conducted of a 2 acre block on Bureau of Land Management lands. Centered on the proposed 60' by 60' by 16' high building, the entire inventoried block is considered the area of potential effect (APE) to allow for a concrete ramp to 3 garage doors, a 50' long gravel access road between the planned building and Kane to Dayton Road, an 80' by 80' gravel pad underneath the building, and construction activity. Also, it is speculated that the building will be removed within the next 30 years when it will no longer be needed, and the building site will be restored to a natural appearance. No visual, auditory, or atmospheric APE was defined for this study.

ENVIRONMENTAL SETTING: Located on the western face of the Bighorn Mountains approximately 20 miles east of Lovell, Wyoming, the project area principally overlies Quaternary rocks and unconsolidated landslide deposits. The study area lies on a minor bench about 120 meters north of Five Springs Creek and exhibits slopes of 1 to 10° with primarily southern aspects. The perennial creek runs westerly approximately 10 miles to join north-flowing Bighorn River.

Soils within the inventory area range from shallow to deep and consist of partially disturbed alluvial, colluvial, and residual gray silty clays. Sparse to abundant surficial limestone pebbles, cobbles, fragments, and boulders occur, but no bedrock outcrops were noted. Potential for significant buried cultural deposits is deemed low, due to limited amounts of alluvial soil deposition, along with previous road construction, ditch maintenance, and powerline ground disturbances. Vegetational ground coverage ranges from 0 to 100%, averages 70%, and includes wheatgrass, cheatgrass, low sagebrush, rabbitbrush, prickly pear cactus, gumweed, Indian paintbrush, alfalfa, sego lily, pepperweed, clover, wild rose, morning glory, juniper, and various forbs.

Elevation of the inventory area is 5,700 feet above mean sea level. Previous surface disturbances noted within the project area include paved roads, a two-track trail, a powerline, a culvert, a small ditch, dispersed modern trash, grazing, and erosion. The above activities and roads have disturbed nearly 30% of the project area ground surface. Otherwise, no particular consequential cultural resource discovery constraints were noted at the time of survey.

PRESENT BUILT ENVIRONMENTAL SETTING: Visible manmade features viewed from the project area include paved highways, two-track trails, ditches, powerlines, and road signs and signals (see attached project overview photographs).

BACKGROUND RESEARCH: A file search (#5893) was requested on May 30, 2024, and an add-on file search (#5985) was obtained on June 28, 2024, from the Wyoming State Historic Preservation Office for the sections within which the project is located. The file search indicates 10 prior projects and 3 previously recorded archaeological sites within the sections. Two apparent file search errors occur in T56N, R92W, Section 30: project DBI_WY_2021_435 is actually located in Carbon County, and project DBI_2021_704 is in fact located in Sublette County. The remaining 8 prior projects, reportedly conducted between 1999 and 2023, involve an Earthscope experiment, a US Highway 14A warning system, a Medicine Mountain archaeological assessment, roads, fuels treatment, and an unreported purpose project. Just one of the prior projects (succinctly described below) contacts the current project, as determined by file search and WYCRO map information.

A 2022 linear Class III US Highway 14A warning system project appears to briefly overlap the northern edge of the current project area. The brief contact is insufficient to warrant an inventory exclusion.

Of the 3 previously recorded sites (48BH1390, 48BH4809, and 48BH4820), only one, 48BH1390 (Kane to Dayton Road), occurs inside the current project boundaries and is discussed in Inventory Results below. One historic road (48BH1390) is considered eligible for nomination to the National Register of Historic Places (NRHP), while one historic cairn site (48BH4809) and one multicomponent site (48BH4820) are regarded as not eligible. These prior findings suggest a high probability of finding significant cultural properties within the project area.

A 1935 General Land Office (GLO) map shows US Highway 14 in T56N, R93W, Section 25, and a 1940 GLO map delineates Kane to Dayton Road in T56N, R92W, Section 30. The National Register does not list any sites in the pertinent sections. No additional historic research is deemed necessary.

SURVEY METHODOLOGY: In absence of an archaeologist at the BLM's Cody Field Office, the BLM's Jon Davidson gave verbal field work authorization to Terra Alta Archaeology for June 5, 2024. On that day, an on-site meeting included Federal Aviation Administration representatives Scott Babos and Tony Paugels, along with Allan Burns and Karen Jones of Terra Alta Archaeology. At that time, spring run-off was flooding the project area and, as a result, field work was rescheduled for June 26 to allow time for drying the ground surface.

Standard Class III methods were utilized during survey, except 15 meter transects were utilized instead of the usual 30 meter transects. Ground visibility ranged from nil (because of dense grass adjacent to a ditch) to ample. At any rate, about 30% of the ground surface is disturbed by construction of two paved roads, a powerline, a two-track trail, and a ditch, including their maintenance. The weather was cloudy and warm. No snow covered the ground. Otherwise, field conditions did not alter methods or results.

A Trimble Juno 5B Enhanced WEHH GPS was utilized to plot the proposed project area, building, and other features, including a delineation of Site 48BH1390. Pathfinder software was used to process GPS data. Photographs were taken with an Apple iPhone 8 camera. Field notes and photographs are retained at the Terra Alta Archaeology office.

An updated site form is provided for previously recorded Site 48BH1390 to document new information added by the current study. No artifacts were collected and no subsurface testing was conducted. Because the part of 48BH1390_12 in and adjacent to the planned project is recommended as noncontributing to NRHP eligibility, no visual, auditory, or atmospheric assessment is deemed necessary.

INVENTORY RESULTS: For the purposes of this project, a prehistoric site is defined as 15 or more spatially associated prehistoric artifacts within a 30 meter diameter, while a historic site is defined as 50 or more associated historic (greater than 50 years of age) artifacts within a 30 meter diameter. Also, one or more clearly definable features or structures (greater than 50 years of age) are regarded as a site. One previously recorded historic site was identified by this inventory of the project area.

Site 48BH1390 – The historic Kane to Dayton Road, formally documented first by the Forest Service in 1989 and subsequently recorded in segments by various consultants, is considered eligible for nomination to the National Register of Historic Places under Criterion A (SHPO concurrence). The current study concurs with the prior overall NRHP

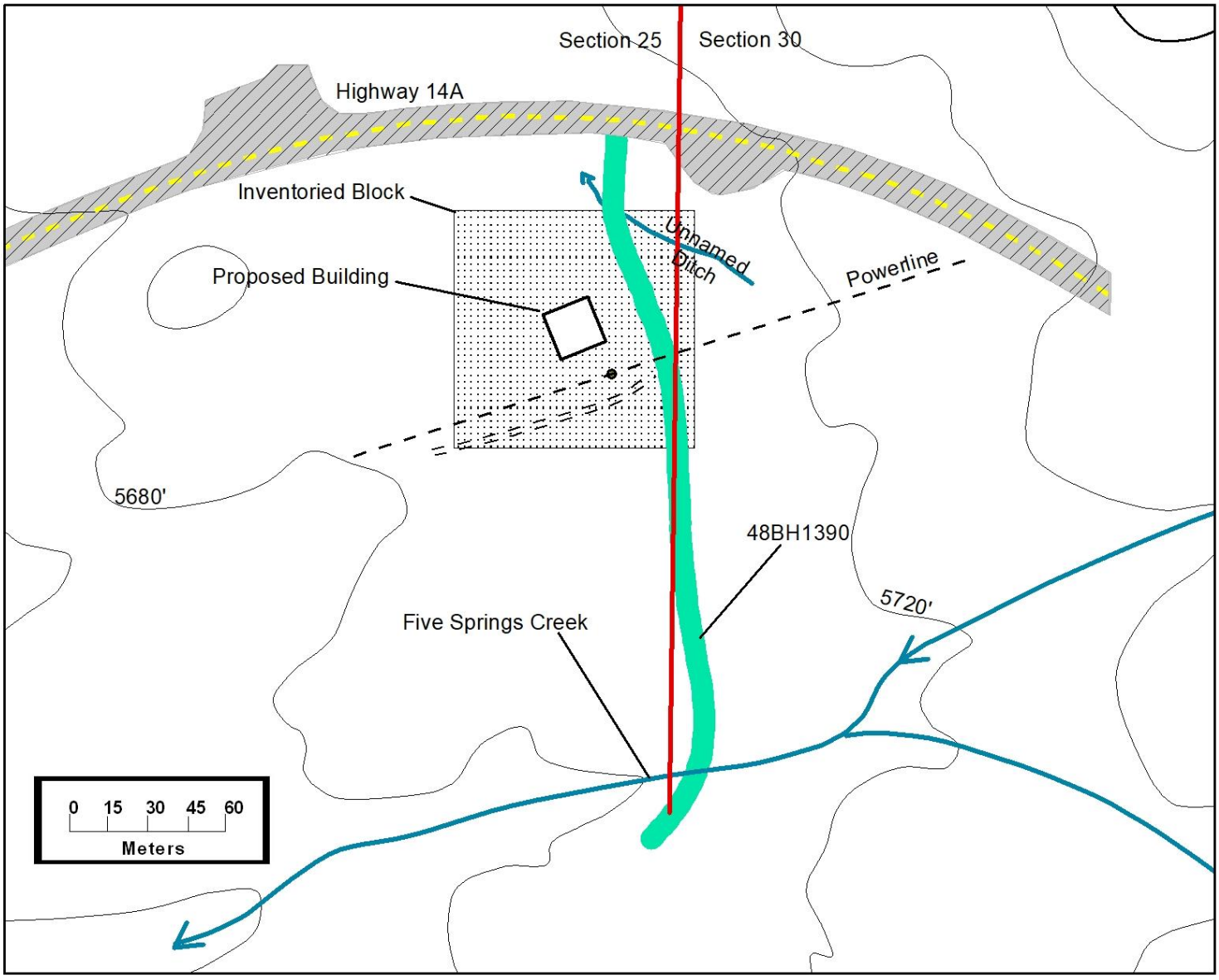
N

48BH1390
TF24-5
Scale: 1″ = 60 meters

Legend

= Highway 14A
= Site 48BH1390
= Power Pole location
=== = Two-track Trail

“For Official Use Only: Disclosure of site locations prohibited (43 CFR 7.18)”



evaluation and identifies part of one segment (48BH1390_12) of the historic road. Sufficient historic documentation is contained in previous 48BH1390 studies and is not repeated herein.

Recorded by Cultural Resource Analysts, Inc., in 2023, 48BH1390_12 was evaluated as contributing to the site's NRHP eligibility. This segment bisects the current study area and passes 50' east of the proposed building. The 24' wide asphalt road segment runs south from modern US Highway 14A on a 1-3° downhill slope to cross Five Springs Creek and then continues southwest. Soils appear deep and consist of disturbed alluvial, colluvial, and residual gray silty clays. Sparse to abundant surficial limestone pebbles, cobbles, fragments, and boulders occur in proximity, but bedrock outcrops were not noted. Vegetational ground coverage ranges from 0 to 100%, averages 70%, and includes wheatgrass, cheatgrass, Indian ricegrass, low sagebrush, greasewood, rabbitbrush, prickly pear cactus, halogeton, kochia, gumweed, Russian olive, and various forbs.

The Kane to Dayton Road is considered eligible for nomination to the National Register of Historic Places. The site is "…associated with events (transportation) that have made a significant contribution to the broad patterns of our history (Criterion A)". However, the site is not associated with any important person (Criterion B), does not embody distinctive characteristics of a type, period, or method of construction (Criterion C), and is not likely to contribute important information that addresses important research questions (Criterion D).

The current study involves a short segment (48BH1390_12) of Kane to Dayton Road. The road segment is still in use to access informal camping areas, is not maintained, and retains no remarkable historic structural features. While integrity of location, design, and materials are reasonably intact, the aspects of setting, feeling, and association are changed by adjacent US Highway 14A and other modern developments to the point that historic significance is compromised. Workmanship is a minor factor as the segment is essentially a common asphalt road.

The observed deteriorating Kane to Dayton Road 48BH1390_12 segment is developing cracks and potholes aided by encroaching vegetation. Besides the road itself, surface disturbances include modern paved US Highway 14A and associated construction within the Highway right-of-way (including a turnout), a two-track trail, a powerline, culverts, a small ditch and ditch maintenance, dispersed modern trash, grazing, and erosion. Additionally, road signs and signals are visible along the modern highway. A better and much longer example of 48BH1390 is found north of US Highway 14A, where segment 48BH1390_14 is used to access Five Springs Campgrounds. Consequently, the currently inventoried 240m long road portion extending from US Highway 14A to Five Springs Creek is recommended as noncontributing to NRHP eligibility.

In summary, building construction is proposed 50' west of 48BH1390. A short gravel driveway will connect the building with the historic road and, hence, will cause impact to a small part of segment 48BH1390_12, which is considered eligible for nomination to the National Register of Historic Places. However, this segment of Kane to Dayton Road is deemed noncontributing toward NRHP eligibility. Therefore, a determination of no adverse effect is recommended.

CONCLUSIONS/SUMMARY: One historic NRHP-eligible site, 48BH1390_12, was identified by this inventory. Recommendations are as follows.

Site 48BH1390 – Building construction is proposed 50' west of 48BH1390. A short gravel driveway will connect the building with the historic road and, hence, will cause impact to a small part of segment 48BH1390_12, which is considered eligible for nomination to the National Register of Historic Places. However, this segment of Kane to Dayton Road is deemed noncontributing toward NRHP eligibility. Therefore, a determination of no adverse effect is recommended.

The results of the current survey are consistent with the results of previous inventories in that historic road remains were identified. There is a high degree of confidence that the objectives of the inventory have been met. The probability of unlocated significant buried cultural deposits existing within the project area is considered minimal to nonexistent. No additional archaeological or historical work is believed necessary, and cultural resource clearance is recommended for the project.

REFERENCES CITED:

Bureau of Land Management

n.d. Master Title Plats, Tract Books, Historical Indices, and General Land Office Plats, BLM Land Office, Cheyenne, Wyoming.

Love, J.D., and Ann Coe Christiansen

1985 Geologic Map of Wyoming. On file, Geological Survey of Wyoming, Laramie, Wyoming.

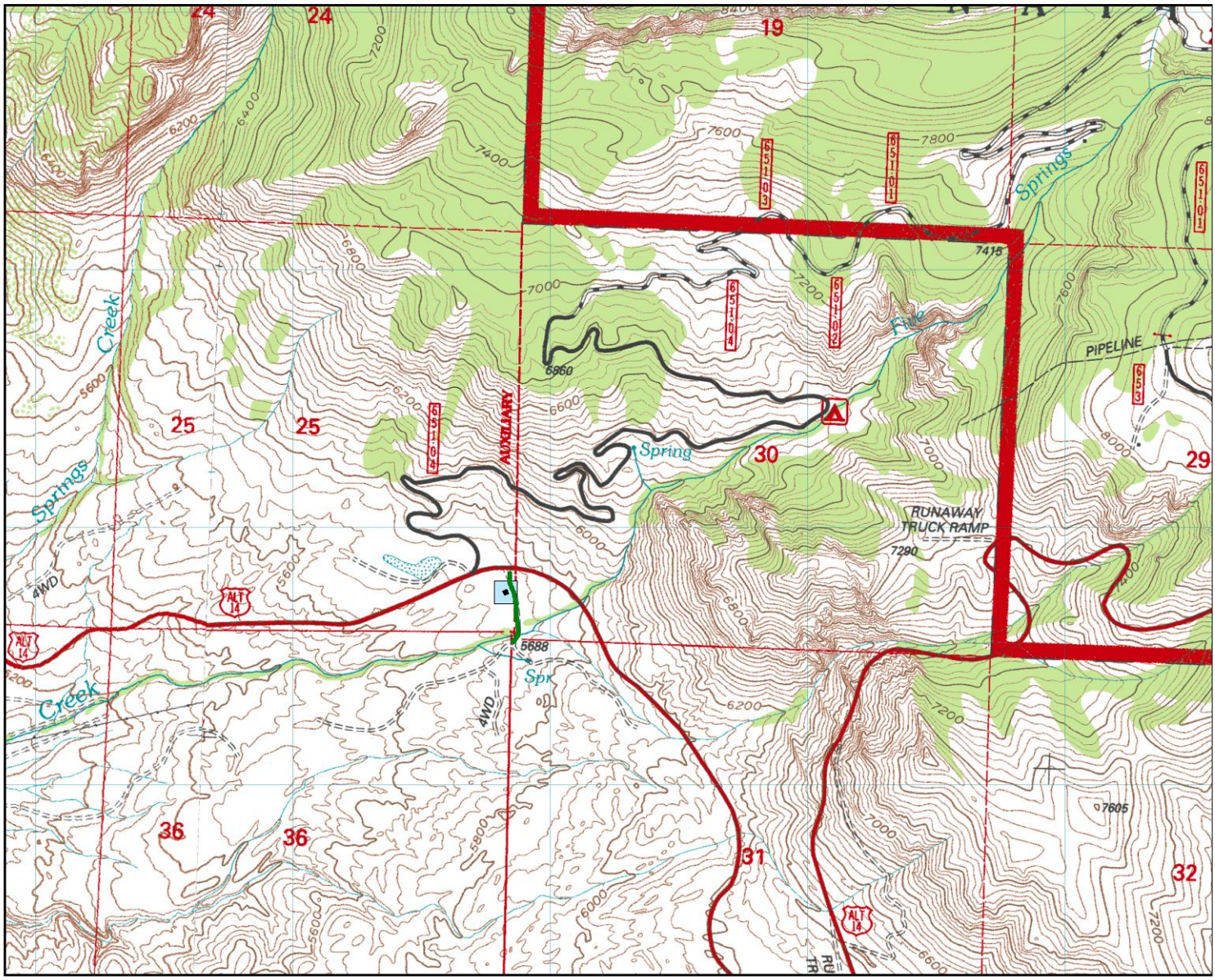
Stubbs, Donna

2022 A Class III Cultural Resource Survey of US Highway 14A Warning System, Lovell-Burgess Section, in Big Horn County, Wyoming. On file, Wyoming State Historic Preservation Office, Laramie, Wyoming.

Thurman, Morgan and Colin R. Ferriman

2023 West Slope Mechanical Class III Cultural Resources Inventory for Fuels Treatment Project, Big Horn County, Wyoming. On file, Wyoming State Historic Preservation Office, Laramie, Wyoming.

TF24-5
Federal Aviation Administration
Building Near Five Springs Road
Big Horn County, Wyoming
Section 30, T56N R92W;
Section 25, T56N, R93W
USGS 7.5 Medicine Wheel, Wyoming Quadrangle (1960/1978)



"For Official Use Only: Disclosure of site locations prohibited (43 CFR 7.18)"

Project Overviews - Top: Looking southeast from northwest corner of inventory area. The proposed building site is to the right of the truck on historic 48BH1390_12. **Bottom:** Looking east toward present-built US Highway 14A, from northwest corner of inventory area. Site 48BH1390_12 connects to Highway at truck. A ditch flows right to left across the photo and runs through a culvert under 48BH1390. Unedited photos taken by Allan Burns 06/26/2024.

Project Overviews - Top: Present-built US Highway 14A from northwest corner of inventory area, looking northwest. Note Segment 48BH1390_14 is in the background (across the highway from the project area). **Bottom:** Overview looking southwest from northeast corner of inventory area. The truck is sitting on 48BH1390_12 to the left of the proposed building site. Note power poles and powerline, along with with the ditch that flows left to right and through a culvert under 48BH1390_12. Unedited photos taken by Allan Burns 06/26/2024.

Project Overviews - Top: Present-built US Highway 14A from northeast corner of inventory area, looking northwest. Note turnout at right side of photo. **Bottom:** Present-built US Highway 14A from northeast corner of inventory area, looking northeast. Note turnout, along with traffic signals at right of photo. Unedited photos taken by Allan Burns, 06/26/2024.

Project Overview – Looking northwest from southeast corner of inventory area. The near truck sits on 48BH1390_12 and the two yellow vehicles are on US Highway 14A. The proposed building site is 50’ left of the near truck. The ditches passes under 48BH1390_12 between the near truck and the two yellow vehicles. Note powerlines across top of photo. Unedited photo taken by Allan Burns, 06/26/2024.

Site 48BH1390_12 – Top: Historic Kane to Dayton Road from south inventory boundary, looking north. Note proximity to US Highway 14A and powerline at top of photo. Proposed building is 50’ left of near truck. **Bottom:** Historic Road from north inventory boundary, looking south from north project boundary (proposed building in line with powerpole). Note ditch passing through culvert under 48BH1390_12. Unedited photos taken by Allan Burns, 06/26/2024.

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JB ENGINEERS

GEOTECHNICAL ENGINEERING REPORT

New Storage Garage
Near 5 Springs Campground
Big Horn County, Wyoming

August 19, 2024

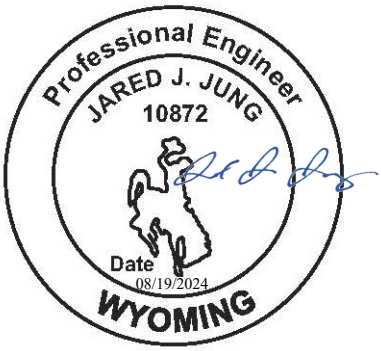
Prepared For:

FAA/ NDP- WSA Liaison
Attn: Scott Babos
Des Moines, Washington

Prepared by:

JB Engineers
341 East E Street, Suite 115
Casper, Wyoming 82601

August 19, 2024



Attn: Scott Babos
FAA/NDP- WSA Liaison
Des Moines, WA
C. 907.230.0486
E. Scott.Babos@faa.gov

RE: Geotechnical Engineering Report (01-24079)
New Storage Garage
Near 5 Springs Campground
Big Horn County, Wyoming

Dear Mr. Babos:

This report presents the results of the geotechnical engineering study for the proposed new storage garage near 5 Springs Campground in Big Horn County, Wyoming. The geotechnical engineering report was prepared to evaluate the subsurface condition at the site and to provide geotechnical opinions and recommendations to support the proposed planning, design and construction of the project. We completed our services referencing our revised proposal dated May 24, 2024.

The report has been prepared to summarize the data obtained during this study, and to present conclusions and recommendations based on the proposed construction and subsurface conditions encountered. A discussion of geotechnical engineering considerations, opinions and recommendations related to construction is included in this report.

JB Engineers,

Jared J. Jung, PE
Principal Engineer
341 East E Street, Suite 115
Casper, Wyoming 82601
P. 307.333.4374
E. jared.jung@jb-engineers.com

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PURPOSE AND SCOPE OF STUDY

This report presents the results of the geotechnical engineering study for the proposed new storage garage near 5 Springs Campground in Big Horn County, Wyoming. The geotechnical engineering report was prepared to evaluate the subsurface condition at the site and to provide geotechnical opinions and recommendations to support the proposed planning, design and construction of the project. We completed our services referencing our revised proposal dated May 24, 2024.

The field exploration program consisted of drilling one (1) exploratory boring to obtain information on the subsurface conditions at the site. The boring was generally located as shown on the Boring Location Diagram in **Appendix A**. Samples of the soil obtained during the field exploration were tested in our laboratory to determine physical and engineering characteristics and analyzed to develop design opinions and recommendations. The results of the field and laboratory testing are presented herein.

The report has been prepared to summarize the data obtained during this study, and to present conclusions and recommendations based on the proposed construction and subsurface conditions encountered. A discussion of geotechnical engineering considerations, opinions and recommendations related to construction is included in this report.

PROJECT INFORMATION

EXISTING SITE CONDITIONS

The site is located south of 5 Springs Campground located N of road Alt US-14A near GPS coordinates 44°47’51.01” North Latitude and 107°59’9.34” West Longitude. The site slopes down to the south to southwest and is vegetated with prairie grass, weeds, and sagebrush. Rock outcrops were noted on the southwest corner of the site. The site is bordered to the north by Alt US-14A and undeveloped on the east, west, and south sides. A gravel road was noted along the eastern side of the site and will provide access to the site off of Alt US-14A.

Photograph 1. View of Site 1

PROPOSED CONSTRUCTION

This project will include the design and construction of a new storage garage building. The storage building will be 60 feet by 60 feet (3600 SF). We expect the building will be a single-story, slab on-grade, metal-framed building utilizing shallow foundations. We expect the building to have maximum wall and columns loads of 3.5 klf and 150 kips, respectively. We expect fills of up to five (5) feet to balance the site and bring the building pad to design elevations.

FIELD EXPLORATION

JB Engineers conducted the field exploration on July 30, 2024. One (1) boring was drilled at the site to an approximate depth of 21.5 feet. The boring location is shown on the Boring Location Diagram in **Appendix A**.

The bore hole was advanced through the on-site soils with a Simpco truck-mounted drill rig using 4-inch diameter solid-stem auger. A JB Engineers personnel logged the boring. Samples of the subsurface soils were obtained using a 1-3/8 inch inside diameter split barrel samplers. The samplers were driven into the various strata using a 140 lb. hammer falling 30 inches. The total number of blows required to advance the samplers each of three concessive 6-inch increments was recorded and the sum of the second and third 6-inch increments was recorded as the penetration resistance value or SPT-N value. The testing was performed in accordance with ASTM D1586, Split Barrel Sampling. Penetration resistance values provide an indication of the relative density of granular soils or consistency of fine-grained soils. Depths at which the samples were obtained, and the penetration resistance values are shown on the boring log.

Groundwater was checked during drilling. The boring was backfilled with auger cuttings upon completion of subsequent groundwater readings.

LABORATORY TESTING

Samples of soil obtained during the field exploration were observed and visually classified in accordance with ASTM D2487, which is based on the Unified Soil Classification System. Samples were selected for testing to determine the engineering and physical properties in general accordance with ASTM or other generally recognized procedures. The following table summarizes the tests performed for this project:

Test	ASTM Designation
Natural Water Content	D2216
Particle Size Analysis	D1140
Atterberg Limits	D4318
Water Soluble Sulfate	

Results of all laboratory tests are summarized on the Laboratory Test Summary in **Appendix B**, presented on the figures provided in **Appendix B**, and shown on the boring log in **Appendix A**. The laboratory data, along with the visual field logging information, were used to prepare the final exploratory boring logs.

SUBSURFACE CONDITIONS

Topsoil/sage brush was encountered at the surface at the site. In addition, large boulders/rock outcrops were noted on the site. Topsoil was noted at a depth of 6 inches at the bore location. Contractors shall verify topsoil stripping depths as it may vary across the site and deeper stripping depths where heavy sage brush/greasewood brush is encountered. In general, the soil extending below the topsoil varies from clayey gravel to clayey sand. Descriptions of each soil type are provided below:

CLAYEY GRAVEL TO CLAYEY SAND (GC TO SC)

The soils extending below topsoil consisted of clayey gravel to clayey sand with gravel. The gravel content decreased with depth. The soils were brown to olive green in color and had a moist to wet in-situ moisture content. The relative density of the material varied from loose to very dense as indicated by SPT-N blow counts ranging from 9 to 50. A swell/consolidation test was attempted but due to the granular nature of the material was not able to be performed. Laboratory tests are presented in **Appendix B**.

GROUNDWATER

Groundwater encountered at a depth of 19 feet during drilling. Numerous factors contribute to fluctuations of groundwater levels, and evaluation of such factors is beyond the scope of this study. We do not expect that groundwater to be encountered during mass grading of the site or utility installations.

GEOTECHNICAL ENGINEERING OPINIONS AND RECOMMENDATIONS

The recommended design and construction criteria presented below must be observed for the geotechnical engineering aspects of the project. The following construction details should be considered when preparing the project documents.

EARTHWORK

Site Grading

Rough elevations at the site vary up to 10 feet. We expect that site grading will require fills of up to 6 feet to balance the site and bring the building pad to design grades. On-site soils or import soils can be used as fill to establish grades at the site. Import material shall consist of WYDOT grading "W" crushed base course. All site grading shall be constructed as specified in the **Compaction Requirements** section of this report. Some larger cobbles/boulders/rock out cropping should be anticipated near the surface and cannot be used as fill material.

Site Preparation

Prepare the site by following the general recommendations provided below:

- Strip and remove topsoil and sage brush and any deleterious material from structural areas or any area to receive cuts and/or fills. Topsoil depths are noted at 6 inches on the boring log in **Appendix A**. Contractors shall verify topsoil stripping depths when bidding on the project.
- Proof roll any areas to receive fill with a loaded dump truck (or engineer approved equivalent) to check for loose or soft areas prior to placing new fill or structures.
- All fill and backfill must be approved by the geotechnical engineer. On-site soils can be used as fill material. All material must be processed into pieces smaller than 3 inches prior to being used as fill. Some larger cobbles/boulders/rock out cropping should be anticipated near the surface and cannot be used as fill material.

Excavation/Trench Construction

Excavations required for mass grading, foundations, and utility trenches will extend into the clayey sand with gravel and some large boulders/outcropping. Conventional heavy-duty earth moving equipment will be sufficient for the proposed excavations at the site. It should be noted that gravel and surface boulders / bedrock outcrops were encountered at the site. Rock hammers or other means may be necessary to advance through bedrock and gravel lenses encountered at the site and shall be anticipated by contractors. While it is the responsibility of the contractor to provide safe working conditions and to comply with OSHA standards in connection with underground excavations, the following guidelines are provided for

planning purposes. The subgrade soil and trench conditions must be evaluated during construction by the contractor's competent person.

Plan excavations with water collection points and utilize conventional sumps and pumps to remove nuisance water runoff or precipitation. If site soil excavations are not immediately backfilled, they may degrade when exposed to runoff and require over-excavation and replacement with structural fill. We recommend construction activities and excavation backfilling be performed as rapidly as possible following excavation to reduce the potential for subgrades to degrade under construction traffic.

Groundwater was encountered at 19 feet during our site reconnaissance. Dewatering prior to foundation excavation is not anticipated during construction. Dewatering may be required during utility excavations depending on final design depths. If encountered, dewatering must lower the groundwater level a minimum depth of 18 inches below excavation floors to reduce the potential of groundwater affecting the stability of the soils in the excavation bottoms.

Compaction Requirements

Place fill in thin (8-inch maximum), uniform lifts and compacted to the following minimum percentages of the maximum dry unit weight as determined by ASTM D698 (Standard Proctor):

Area	Compaction (% of ASTM D698)
Structural Fill < 8 feet	95
Structural Fill > 8 feet	98
Foundation Backfill	95
Utility Trenches	95
Overlot Fill (non-structural areas)	90

Place all fill material within minus 2 percent to plus 2 percent of the optimum moisture as determined by ASTM D698. The following shall be implemented during construction:

- **Open Hole Observation:** An open hole must be observed by JB Engineers to document and ensure the soils encountered during construction are similar to those observed during this study.
- **Foundation Backfill**: One compaction test every 50 linear feet (lf) or two tests total, whichever results in greater number of tests, per each foot lift of backfill.
- **Structural Fill / Building Pad Preparation:** One test every 2,500 square feet (sf) of each 12-inch lift of backfill.
- **Utility Trench Backfill**: One compaction test every 100 linear feet (lf) of trench per each 16-inch lift of backfill.

The contractor must understand and plan for the time required to process soil to meet the report requirements. Difficulty achieving required compaction may impact construction costs, schedules, and other project aspects. Allowing time and space (i.e., lay-down area) to process excavated site soil and facilitate proper moisture conditioning during dry weather is critical if the contractor plans to re-use the site soil as fill. Proper moisture conditioning or drying can help reduce compaction efforts and the need to import dry soil or aggregate.

BUILDING FOUNDATIONS

Based on the results of our field investigation the proposed site is suitable for support of the building using spread footings. If rock outcropping is encountered in excavations the area shall be over-excavated a minimum depth of 18 inches and fill be used to establish footing grades to provide a uniform bearing surface for the building. Over-excavation (if required) shall be excavated laterally 2 feet on all sides. The overburden soils can be used to re-establish grades or WYDOT grading "W" aggregate base course and shall be moisture conditioned and compacted as specified in the **Compaction Requirements** section of this report.

The design and construction criteria presented below must be observed for the spread footing foundation system design and construction:

- The footing depth and bearing pressure for the design of footings was determined to provide against bearing failure and excessive settlement. Based upon our experience and analysis using one-dimensional settlement theory, we recommend that footings be designed using a maximum allowable bearing pressure of 3,000 psf bearing on native soils or structural fill. For footings designed using the supplied bearing pressure, we estimate the total settlement for the footings will be 1 inch or less. We estimate the total settlement will be less than half the total settlement.
- Friction acting along the base of the footings founded on recompacted native materials can be computed by using a coefficient of friction of 0.32 with the normal dead load.
- If loose or soft areas are encountered during footing excavations, the footings should extend to adequate bearing soil. As an alternative, the loose or soft areas can be over-excavated and replaced with on-site soils. Structural fill placed in over-excavations should be compacted to the specifications outlined above in the **Compaction Requirements** section of this report.
- Design exterior footings below unheated areas should be placed at least 48 inches below final exterior grade for frost protection.
- Design minimum footing widths of 16 inches for continuous footings and 22 inches for isolated pads.
- Reinforce continuous footings and foundation walls to span an unsupported length of 12 feet. This will allow the foundation to span any potential soft or loose areas that are not detected during excavation.
- Based on our field exploration and our general knowledge of the local geology, we recommend a Site Class D be utilized as a basis for structural seismic design.

FLOOR SLABS

Slab on-grade floors can be utilized for the building flooring supported on native soils or WYDOT Grading "W" base course. The following recommendations must be followed:

- Separate all bearing walls from columns with expansion joints, which allow for unrestrained vertical movement and reduction in differential movement.
- Floor slab control joints should be used to reduce damage due to shrinkage cracking. Provide joints in accordance with appropriate ACI criteria.
- Use a modulus of subgrade reaction (K) of 125 pci for the prepared on-site soils.
- The requirements for slab reinforcement and thickness should be established by the designer based on experience and the intended use of the slab.
- Floor slabs should not be placed on frozen subgrades.

- Exterior slabs are susceptible to frost action, which can generate substantial frost heave at certain times of the year. The potential for frost heave may not be acceptable at doorways or other critical areas adjacent to the building that will be exposed to weather. One approach is to provide partial frost protection would be to place and compact a minimum of 24 inches of aggregate base course beneath the slab. Alternatively, if partial frost protection is acceptable, over-excavation and aggregate base course replacement must be accomplished to the full frost depth of 36 inches.

SITE DRAINAGE

The following drainage precautions must be observed during construction and maintained at all times after the building has been completed. Detrimental foundation movement may occur if site grading and surface drainage recommendations are not followed since the near-surface soils are active and prone to significant volume change with variations in moisture. Landscaping that may be completed after the building is completed must not alter positive drainage away from the building.

- The ground surface adjacent to exterior foundations should be sloped to drain away from the foundations in all directions. We recommend a minimum slope of 6 inches in the first 10 feet (5%).
- Roof downspouts and drains should discharge well beyond the limits of the foundation wall backfill and should be well maintained over the life of the facility.
- Landscaping that requires irrigation should remain at least 8 feet from the structure.
- Cracks between buildings and exterior concrete flatwork and cracks that develop within exterior flatwork should be sealed and maintained to prevent surface water from infiltrating the subsurface soils.
- Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possible of moisture infiltration.
- Do not install landscape curbs, flatwork, or other landscaping that impairs drainage away from the structure.

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SITE CONCRETE/CORROSION

The concentration of water-soluble sulfates measured in a sample of the on-site clayey sand soil obtained at a depth of one foot was 0.07%. This concentration of water-soluble sulfates represents a mild degree of attack on concrete exposed to these materials. This degree of attack is based on the scale presented in ACI Manual of Concrete Practice, Section 225R, Table 6.5 of mild, moderate, severe, and very severe. We recommend using Type I or II cement, and a minimum compressive strength of 4,000 psi.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the design data submitted to JB Engineers, data obtained from the exploratory boring drilled at the location indicated on the Boring Location Diagram, and the proposed construction discussed in this report. The nature and extent of subsurface variations across the site may not become evident until construction. During construction, if fill, soil, bedrock or water conditions appear to be different from those described herein, this office should be advised at once so that we may re-evaluate the recommendations made.

This report has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information which has not been described or documented in this report. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Significant design changes may require additional analysis or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata and testing of all fill by a representative of the geotechnical engineer.

Appendix A – Boring Location Diagram
Key to Symbols
Boring Log (BH-1)

JB ENGINEERS

BORING LOCATION DIAGRAM
FAA Storage Garage
Near 5 Springs Campground
Big Horn County, Wyoming

Legend

BORING LOCATION

Project No. 01-24079

N

NOT TO SCALE

KEY TO SYMBOLS

JB ENGINEERS

CLIENT FAA/NDP - WSA Liaison

PROJECT NAME New Storage Garage, Near 5 Springs Campground

PROJECT NUMBER 01-24079

PROJECT LOCATION Big Horn County, WY

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)


GC: USCS Clayey Gravel


SC: USCS Clayey Sand


TOPSOIL: Topsoil

SAMPLER SYMBOLS


California Sampler


Split Spoon

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

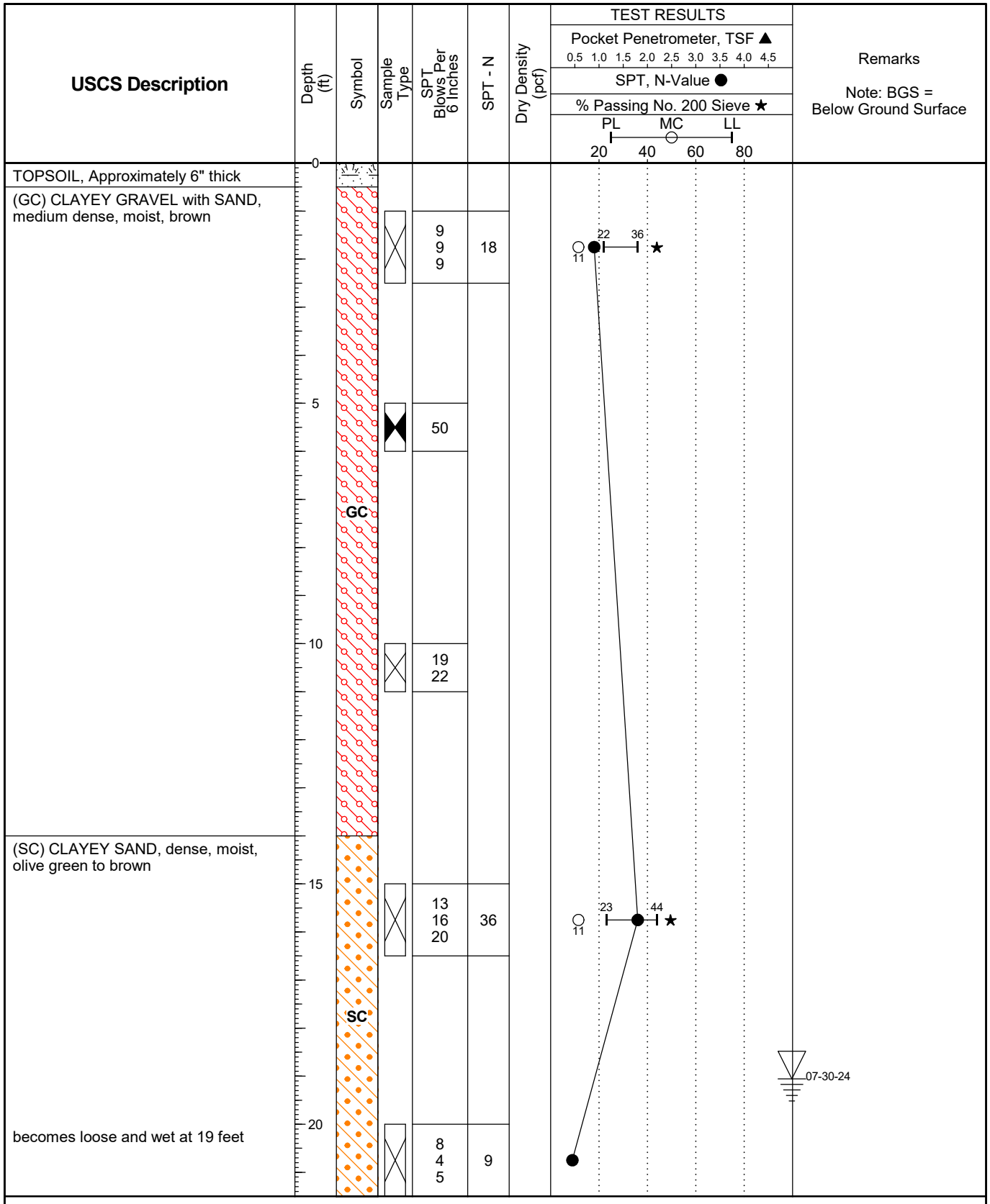
LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION


Water Level at Time Drilling, or as Shown


Water Level at End of Drilling, or as Shown


Water Level After 24 Hours, or as Shown


USCS Description
Depth (ft)
Symbol
Sample Type
SPT Blows Per 6 Inches
SPT - N
Dry Density (pcf)
TEST RESULTS
Pocket Penetrometer, TSF ▲
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
SPT, N-Value ●
% Passing No. 200 Sieve ★
PL MC LL
20 40 60 80
Remarks
Note: BGS = Below Ground Surface
TOPSOIL, Approximately 6" thick
(GC) CLAYEY GRAVEL with SAND, medium dense, moist, brown
9 9 9
18
50
GC
19 22
(SC) CLAYEY SAND, dense, moist, olive green to brown
13 16 20
36
SC
becomes loose and wet at 19 feet
8 4 5
9
0
5
10
15
20
22 36
11
23 44
11
07-30-24
Borehole Terminated at 21.5 Feet.
Project Name: New Storage Garage, Near 5 Springs Campground, Big Horn Co., WY
Project Number: 01-24079
Client: FAA/NDP - WSA Liaison
Date Drilled: 7/30/2024
Drill Rig: Simpco
Borehole Dia.: 4"
Groundwater Depth: 19'
Drilled By: Quality Drilling
Logged By: K. Dutton
JB ENGINEERS
BORING LOG
BH-1
Sheet 1 Of 1

Appendix B – Laboratory Test Results

SUMMARY OF LABORATORY RESULTS

JB ENGINEERS

CLIENT FAA/NDP - WSA Liaison **PROJECT NAME** New Storage Garage, Near 5 Springs Campground

PROJECT NUMBER 01-24079 **PROJECT LOCATION** Big Horn County, WY

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
BH-1	1.0	36	22	14	25	44	GC	11.5			
BH-1	15.0	44	23	21	25	50	SC	11.5			

GRAIN SIZE DISTRIBUTION

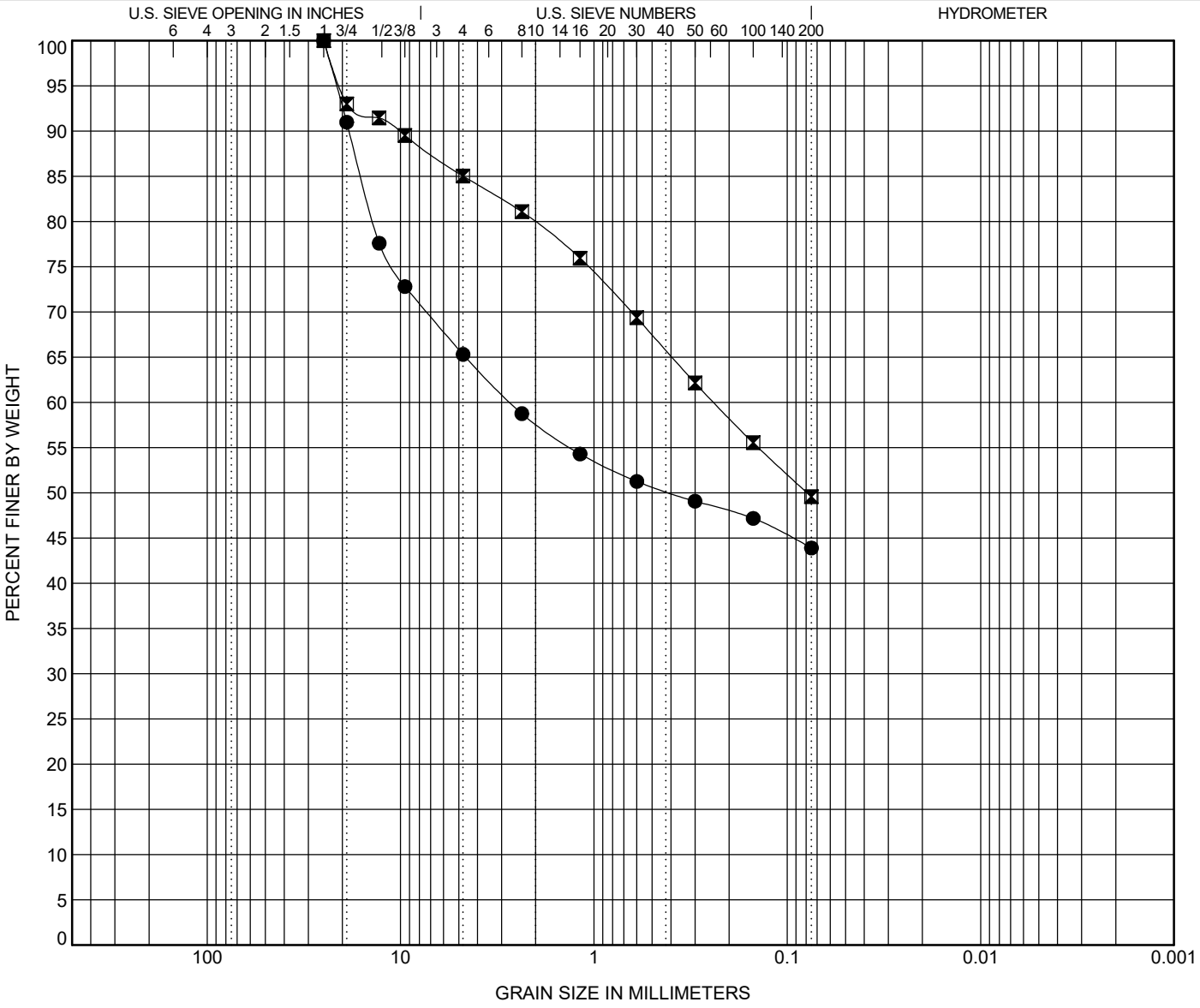
JB ENGINEERS

CLIENT FAA/NDP - WSA Liaison

PROJECT NAME New Storage Garage, Near 5 Springs Campground

PROJECT NUMBER 01-24079

PROJECT LOCATION Big Horn County, WY



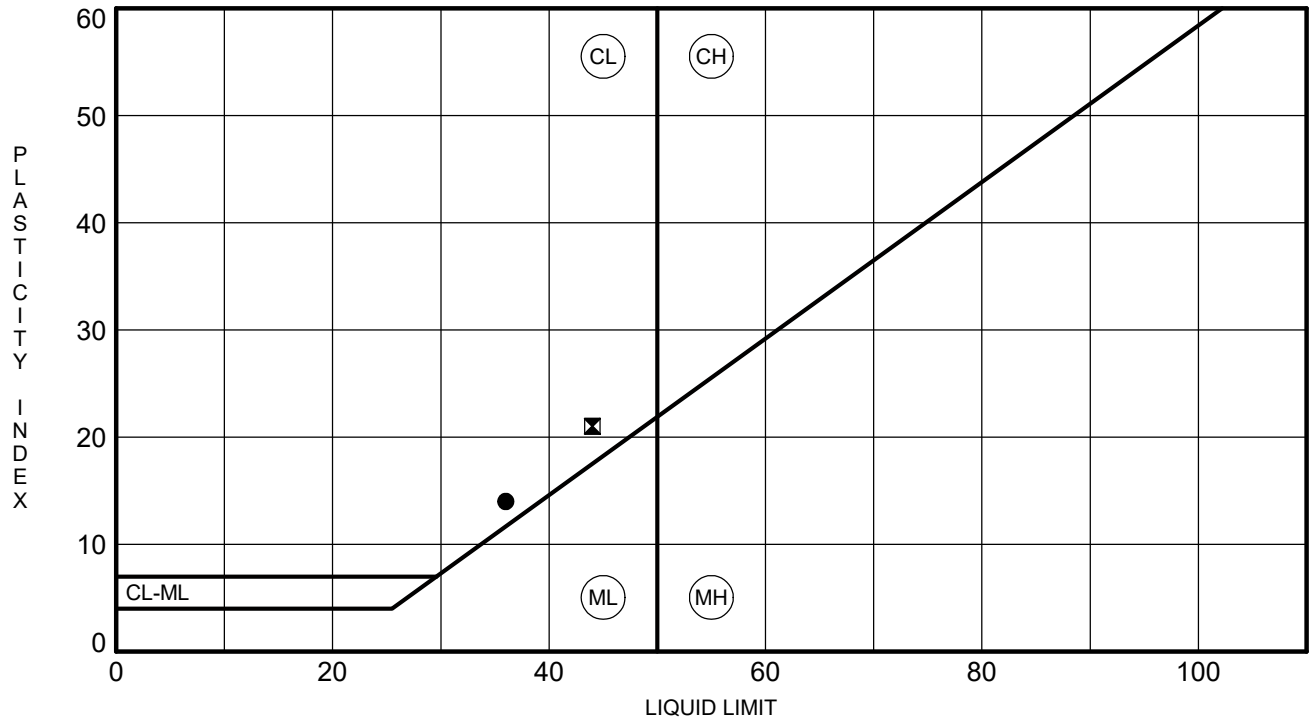
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-1**	**1.0**	**CLAYEY GRAVEL with SAND(GC)**	**36**	**22**	**14**		
⊠	**BH-1**	**15.0**	**CLAYEY SAND(SC)**	**44**	**23**	**21**		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-1**	**1.0**	**25**	**2.695**			**34.7**	**21.4**	**43.9**	
⊠	**BH-1**	**15.0**	**25**	**0.239**			**15.0**	**35.5**	**49.6**	

ATTERBERG LIMITS' RESULTS

CLIENT FAA/NDP - WSA Liaison
PROJECT NAME New Storage Garage, Near 5 Springs Campground
PROJECT NUMBER 01-24079
PROJECT LOCATION Big Horn County, WY



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BH-1**	**1.0**	**36**	**22**	**14**	**44**	**CLAYEY GRAVEL with SAND(GC)**
⧓	**BH-1**	**15.0**	**44**	**23**	**21**	**50**	**CLAYEY SAND(SC)**