GEOTECHNICAL INVESTIGATION

ROADWAY AND POND CONSTRUCTION
PACKSADDLE RANCH
7000 W 4000 N
TETON COUNTY, IDAHO

PREPARED FOR:
STRR LLC
ASPEN, COLORADO

PREPARED BY:
NELSON ENGINEERING
VICTOR, IDAHO

JANUARY 2024
Project No. 23-412-01

TABLE OF CONTENTS

GENERAL AND PROJECT DESCRIPTION

This is the report of a geotechnical investigation for roads and ponds within the proposed Packsaddle Ranch residential subdivision at 7000 W 4000 N in Teton County, Idaho. The project location is rolling uplands west of the Teton River about 4 miles west/southwest of Tetonia, Idaho. Subdivision plans are in the conceptual design phase. Conceptual design plans and descriptions of the desired subdivision by the owner are the basis for this report. The plans show the subdivision/replat of 645.81-acres into six 35- to 40-acre parcels and one 424.5-acre parcel. The plans also include roadways and ponds, but their exact layout will be determined as the designs advance. The geotechnical work for this report provides recommendations for gravel roadway sections and construction methods and pond construction and the possibility of using ponds as gravel sources for the roadways.

Scope of Services

The scope of services for this investigation was to provide geotechnical recommendations based on a subsurface investigation and soils laboratory testing. The purpose of the subsurface investigation was to determine soil and groundwater characteristics. The results of the subsurface investigation and subsequent laboratory testing were utilized in engineering analysis for recommendations for roadway and pond construction and general earthwork. It is our engineering judgment that the existing and proposed slope geometry and composition indicate stability therefore slope stability analyses were not conducted. Specific recommendations for drainage and surface water conveyance are not within the scope of work.

SITE CONDITIONS

Description

The 645.81-acre site is located in northwestern Teton Valley between the eastern base of the Big Hole Mountain Range and the Teton River. The southern portion of the site contains cultivated farmland while the northern portion of the site is grass and sagebrush rangeland. Access routes will be routed from W 4000 N and Eddyline Drive. Large tracts of agricultural land and residential parcels adjoin. Area topography consists of a broad alluvial fan sloping down from the Big Holes to the Teton River. Valleys are ridges within the fan orient from southwest to northeast. There are two valleys separated by flat upland ridges. The southern valley contains the active channel of Packsaddle Creek which flows seasonally during the spring and early summer during snowmelt. A broader valley with no stream channel is located on the northern portion of the parcels. Valley bottoms are relatively flat with moderately steep slopes on the valley edges. Two broad ridges orienting southwest to northeast are within the project, one central within the project and the other at the northern boundary of the project.

Uplands on the parcel are currently unirrigated upland agricultural fields, bottom lands in the valleys are unimproved grass and sagebrush fields. Eddyline Road runs north and south within an easement to properties north and east of the parcel. Historic aerial photography shows Eddlyline Road was historically an agricultural two track that was improved in the early 2000. Currently, the road is surfaced with pit-run with a potholed rough surface. A two track agricultural road traverses the northern valley from east to west.

Geologic and Soil Mapping

Surface geology is mapped on the Idaho Geologic Survey "Geologic Map of the Tetonia Quadrangle, Teton County, Idaho," Phillips, W.M., Garwood, D.L., and Embree, G.F., 2013. Mapped deposits within the two valleys are "$Qafw_1$ – Alluvial Fan 1 of West Teton Basin – Low relief surfaces lying in broad valleys and fans that cut older alluvial fans; deposits rarely exposed; consists of thickly bedded gravel and sand overlain by loess-derived soils." Mapped deposits within the two broad ridges are "$Qafw_2$ – Alluvial Fan 2 of West Teton Basin – Loess-covered, incised alluvial fans and fan remnants." Mapped deposits within the Packsaddle Creek channel and the historic channel of the northern valley are "Qas – Alluvium of tributary streams – Thin <10 ft of gravely and sand contained in narrow channels incised into alluvial fans."

The Soil Conservation Service Soil Survey has mapped the Alpine-Kucera complex and Alpine-St. Anthony complex within the valleys of the project. Alpine-Kucera complex soils are deep, well-drained loess and mixed alluvial deposits on 0 to 4 percent slopes and composed of silt loam, gravelly loam, very gravelly loam, extremely gravelly loam/sandy loam/loamy sand, and gravel. Alpine-St. Antony complex soils are deep, well drained mixed alluvial deposits on 0 to 2 percent slops that are composed of gravelly loam, very gravelly loam/sandy loam, extremely gravelly coarse sandy loam, extremely gravelly loam/sandy loam/loamy sand, and gravel. Mapped soils in the ridges and ridge slopes are the Kucera-Lostine complex and Iphil-Ririe complex. Kucera-Lostine complex soils are deep, well drained loess deposits on 0 to 4 percent slopes that are composed of silt loam. Iphile-Ririe complex soils are deep, well drained loess deposits on 4 to 20 percent slopes that are composed of silt loam and silt. Mapped soils within the Packsaddle Creek drainage are the Badgerton-Arimo complex. These soils are deep, well drained mixed alluvial deposits with loess influence on 0 to 2 percent slopes that are composed of loam, very gravelly loam/sandy loam, and extremely gravelly sand/loamy sand/loamy coarse sand.

Seismic Hazard

Teton Valley is located within the Intermountain Seismic Belt, a zone extending from southern Utah through eastern Idaho and western Montana, and encompassing western Wyoming and the Teton Range as referenced by Robert B. Smith and Walter J. Arabasz in "Seismicity of the Intermountain Seismic Belt, Neotectonics of North America," 1991. The USGS Earthquake Hazards Program has mapped Quaternary faults and folds in the United States as displayed on Google Earth with the following active faults near the project site: the Teton Fault, Grand Valley Fault, Rexburg Fault, and Heise Fault. In particular, the Teton Fault is thought to be capable of producing major earthquakes of a magnitude of six or greater. The USGS Earthquake Hazards Program shows the Teton Fault running along the base of the east side of the range about 23 miles east/southeast of the project site. Multiple minor earthquakes with epicenters near the site have occurred in recent years (USGS Earthquake Database).

SITE INVESTIGATIONS

Field Investigations

On December 7, 2023, eighteen test pits, TP-1 through TP-18, were excavated in the area of proposed improvements as shown on the **Test Pit Location Map** drawing in the Appendix. Test pits were located approximately using a Leica Zeno FLX100 handheld GPS unit. Test pit locations and depths were selected to determine subsurface conditions underlying the proposed development. All test pits were backfilled with excavated material after logging was completed.

Big Iron Excavation of Victor, Idaho, excavated the test pits with a Case 580 N backhoe. Andy Pruett, a Professional Geologist at Nelson Engineering, logged the test pits and directed the sampling. Soils were classified in the field and logged by the geologist. The soil classifications, moisture conditions, and presence of organic or other notable features were recorded in the field logs. Bulk samples were sealed in plastic bags and transported to our laboratory for testing and further classification. Relatively undisturbed samples of loess were obtained in cylindrical stainless-steel liners for consolidation testing. Groundwater observations were made at the time of the excavation based on field observations of soil moisture conditions. Field observations and laboratory testing results are presented both on the test pit logs and in the test result presentation sheets in the Appendix.

The stratification lines shown on the test pit logs represent the approximate boundary between soil types. The actual in-situ transition may be either gradual or abrupt. Due to the nature and depositional characteristics of natural soils and fills, care should be taken in interpolating subsurface conditions beyond the location of the test pits. Soil conditions can change rapidly in both the lateral and vertical directions. Groundwater conditions shown on the logs are only for the dates indicated.

The subsurface conditions were interpreted from the described test pits at the site. The soil properties inferred from the field and laboratory analyses supported by our experience formed the basis for developing our conclusions and recommendations.

Laboratory Investigations

Samples obtained during the field investigation were taken to the laboratory where they were visually classified in accordance with ASTM Test Method D-2487-93, which is based on the Unified Soils Classification System. Representative samples were selected for testing to determine the physical properties of the in-place soils and to estimate engineering properties. Engineering properties of concern at this location included bearing capacity, seismic response, drainage characteristics, and site-specific construction recommendations that are influenced by soil type and condition.

Laboratory testing was conducted to provide additional information to determine the suitability of the soils for use as foundation and subgrade materials and to verify field observations and classification estimates. The finalized laboratory observations were used to estimate soil strength and compressibility characteristics roadway section design and pond construction. Specific tests included Atterberg Limits Tests - ASTM Designation D4318, Grain Size Analysis - ASTM Designation C117 & C136, Soil Moisture Content Determinations - ASTM Designation D2226, and Soil Classification - ASTM Designation D2487. A potential source of pit run was tested for aggregate size. The soil samples stored in our laboratory will be discarded after 30 days from the date this report is submitted unless we receive a specific request to retain them.

SUBSURFACE CONDITIONS

Soil Profiles

Packsaddle Creek Test Pits

TP-1 and TP-15 were excavated where proposed roads cross Packsaddle Creek. Surficial soils were 1 to 2 feet depth of moist, brown/dark brown silt topsoil with blocky structure and very stiff to hard consistency with pocket penetrometer readings greater than 3.5 tons per square foot (TSF). In TP-1 from 1 to 3.5 feet, soils were moist, mottled brown/gray and light brown silt loess. Loess contained minor pinhole voids and had a very stiff consistency with pocket penetrometer readings between 2 to 3 TSF. From 3.5 to 5.25, soils were moist, homogenous light brown/gray silt loess with minor pinhole voids and very stiff consistency with pocket penetrometer readings between 2 to 3 TSF. Below topsoil in TP-15 from 2 to 3.5 feet soils were lensed alluvial deposits composed of dry, brown poorly-graded fine gravel and poorly-graded fine sand. Alluvial gravel deposits were encountered in TP-1 from 5.25 feet to test pit bottom at 9 feet and in TP-15 from 3.5 feet to 7.5 feet and were composed of dry, brown/light brown well-graded gravel with trace silt, sand, and cobbles up to 8-inches maximum dimension. The dense to very dense alluvial deposits contained approximately 75 percent round to sub-angular gravels and cobbles and 25 percent sand with silt. Underlying alluvial gravel deposits in TP-15 from 7.5 feet to test pit bottom at 14 feet was moist, light brown silt with sand and occasional gravels. The silt was homogenous, had no pinhole voids and a stiff consistency with pocket penetrometer readings between 1 to 2 TSF. Excavation throughout both test pits was characterized as easy using a backhoe.

Proposed Roadway Test Pits

TP-2 through TP-5, TP-8 through TP-10, and TP-14 were excavated in valleys and on slopes and ridges near proposed subdivision roadways. Surficial soils in all test pits were a half foot of moist, brown/dark brown silt topsoil with blocky structure and minor to abundant roots. Loess deposits were observed underlying topsoil in all test pits. Near surface loess to test pit bottom at 3 feet in TP-2 and to depths of about 2 feet in all other test pits except for TP-5 was moist, light brown/brown homogenous silt with minor pinhole voids that had very stiff consistency with pocket penetrometer readings between 2 to 3 TSF. In TP-3, TP-4, TP-8 and TP-14 from about 2 feet to test pit bottoms of 4 feet, a calcified hard pan stratum of loess was encountered and composed of dry, light brown homogenous silt with blocky structure and hard consistency. In the north valley below loess in TP-9 and TP-10 from 2 feet to test pit bottoms of 4 feet were alluvial gravels as described in the Packsaddle Creek test pits above. TP-5 was excavated in a 15- to 20 percent-northeast slope and below topsoil from 0.5 to 6.25 feet was dry, brown/dark brown homogenous silt loess with topsoil influence. Loess contained minor to moderate pinhole voids and had a hard consistency with pocket penetrometer readings greater than 4 TSF. At depth in TP-5 from 6.25 to test pit bottom at 9 feet was slightly moist, brown homogenous silt loess with minor pinhole voids and hard consistency with pocket penetrometer readings greater than 4 TSF. Excavation was characterized by easy digging through surficial topsoil and loess to 2 feet depth and moderate through hard pan loess and alluvial gravels.

Eddyline Drive Test Pits

Eddyline Drive provides access from 7000 N to the project parcels and to the parcel to the west and north of it. Roadway condition is fair to poor with a moderate to high concentration of potholes. The surface is gravel and cobble pit run; the road does not grade to drain. A surfacing course of crushed aggregate surface was not placed, the result is poor drainage and potholing. The home under construction to the west of Eddyline Drive appears to have improved the roadway with additional pit run section up to the point of the driveway. North of that point, the road is in worse condition with more potholes. In TP-17 roadway section was 1.5 feet of imported gravel and cobble aggregate. In TP-16 the roadway section was only 0.8 feet of gravel and cobble aggregate. In both test pits, pit run fill compositions were similar; moist, brown gravel with sand and cobbles up to 6-inches maximum dimension with approximately 75 percent round to sub-round gravels and cobbles and 25 percent sand. In TP-17 below fill from 1.5 feet to test pit bottom at 2.5 feet was moist, dark brown silt topsoil that contained no roots and had a very stiff consistency with pocket penetrometer readings between 2 to 3 TSF.

In TP-16 underlying native subgrade was to 2 feet was loess classified as moist, brown homogenous silt with minor pinhole voids and very stiff consistency with pocket penetrometer readings between 2.5 to 3.5 TSF. From 2 to 2.5 feet loess was dry, light brown homogenous silt with minor pinhole voids and very stiff to hard consistency with pocket penetrometer readings greater than 3.5 TSF. T

Pond Test Pits

TP-6 and TP-7 were located in northwest pond, TP-12 and TP-13 were excavated at the proposed northeast pond, TP-18 was excavated at the proposed southeast pond and TP-11 was excavated at an alternative site north of the proposed northwest pond. Similar soils were observed in the proposed northwest and northeast pond sites. Surficial soils were 0.5 to 1.5 feet of topsoil as described above. Underlying loess deposits as described above were observed to depths of 6.25 feet in TP-6, 4 feet in TP-7, and 2.5 feet in TP-12. Below topsoil in TP-13 from 1.5 to 3 feet was dry, brown gravelly silt with sand. The silt contained approximately 30 percent round to sub-angular fine gravel and had a hard consistency with pocket penetrometer readings greater than 4 TSF. Underlying silt deposits were alluvial deposits composed of dry, brown, well-graded gravel with trace silt, sand, and cobbles up to 8-inches maximum dimension. Dense to very dense alluvial deposits contained approximately 60 to 80 percent round to sub-angular gravels and cobbles and 20 to 40 percent sand/sand with silt. These soils were observed to 9 feet depth in TP-6, 10 feet in TP-7, 10.5 feet in TP-12, and 8 feet in TP-13. A poorly graded fine sand channel fill deposit was observed on the south wall only of TP-12 from 5 to 7 feet. Below alluvial deposits in TP-6 from 9 to 11.5 feet was moist, brown silty gravel with sand and cobbles up to 8-inches maximum dimension. The dense silty gravel contained approximately 60 percent round to sub-angular gravels and cobbles and 40 percent silt with sand. At depth in all test pits were silt deposits composed of moist, light brown homogenous silt with occasional gravels, no pinhole voids and very stiff consistency with pocket penetrometer readings between 2 to 3 TSF. Silt deposits were observed to test pit bottoms of 15 feet in TP-6 and TP-7, 14 feet in TP-12, and 13 feet in TP-13. TP-11 contained a half foot of topsoil and loess to 1.5 feet. Below loess to 8 feet were alluvial deposits as described above and from 8 feet to test pit bottom at 15 feet, soils were alluvial deposits composed of moist, brown poorly-graded gravel with sand and minor cobbles up to 6-inches maximum dimension. The dense alluvial gravel contained approximately 60 percent round to sub-angular fine to medium gravels and cobbles and 40 percent sand. TP-18 contained a half foot of topsoil with loess deposits as described above to 8 feet. Below 8 feet to test pit bottom at 15 feet were alluvial gravel deposits as described above. A poorly graded fine sand channel fill deposit was observed on the east and south wall of TP-18 from 10.5 to 12 feet. Excavation was characterized by easy digging through topsoil, loess, and deep silt deposits and easy to moderate through alluvial gravel deposits.

Groundwater

Groundwater was not encountered during the investigation. Orange oxidation was observed up to 4 feet depth in TP-6 and up to 8 feet in silt deposits in TP-15. Groundwater in the Packsaddle Creek valley is likely to be closely linked to creek water levels during spring runoff when the creek flows. Well logs for properties adjoining the site show variable local groundwater depths between 20 and 124 feet.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

General

Conceptual plans for a subdivision with roads, ponds and homesites have been provided. Approximately 3.2 miles of road are shown. Conceptual pond sites for several large and small ponds are shown. Test pits were excavated in select locations along the schematic road network and within schematic pond locations. Preliminary roadway section design was conducted, and pond sites evaluated for gravel sourcing and pond lining designs. Soils in the roadway areas will be assessed for use as pond lining. Pond locations as shown on the schematic design will be rough basis for pond investigations.

Roadway Design and Construction

Roadway section was designed utilizing our local experience and AASHTO design guidelines. Topsoil with concentrated roots and organics was consistently found throughout the site, topsoil depth ranged from about 6 to 4 inches. All topsoil and organics shall be removed within roadway and fill footprints. Loess and loess influenced soils were found to depths of 2 feet or greater throughout all the test pits. A zone where gravels were found at shallower depth was found in the northern valley in TP-11 and TP-9 and TP-10. Recommended section for roadways anticipates a minimum of 2 feet of loess/silty soils in most locations. The structural fill thickness and geotextile may be reduced or omitted where shallow gravels occur.

It is critical to minimize moisture from infiltrating silt and clay containing roadway subgrades. Most subgrades will be moisture sensitive. Measures to reduce moisture infiltration:

1. **Surface Drainage**: Stormwater and snowmelt shall be directed away from subgrades during construction. Ponding shall be prevented during construction. Completed roadways shall be constructed to shed storm drainage and to prevent ponding. Roadway surfaces shall be maintained and reshaped regularly to maintain proper grading for drainage.

2. **Subgrade Compaction:** Native subgrades shall be compacted to a depth of 8 inches to greater than 95% of maximum density per Standard Proctor (ASTM-D698). Where the moisture content does not allow compaction to 95% density, the engineer shall provide direction.

3.

ROADWAY SECTION	Paved	Gravel Surfaced
Asphaltic Concrete	2.0 inches	
¾ inch Minus Crushed Aggregate WYDOT GR	6.0 inches	6.0 inches
Structural Fill	16 inches	16 inches
Winfab 300HTM Geotextile or equiv. placed on subgrade		
Compacted Subgrade	Upper 8 inches of underlying soils compacted to 95% of max. as determined by ASTM D698.	

Roadway Quantities

Roadway quantities are estimated utilizing the following assumptions:

Roadway total length: 3.2 miles
Roadway width: 22 feet
Gravel thickness 16 inches
Geotextile width 16 feet

Preliminary calculation of the roadway quantities resulting are:

Structural Fill: 20,500 Cubic Yards
Geotextile: 41,000 Square Yards
Roadway Overburden Removal (topsoil and loess removal to 16 inches) : 21,000-24,000 Cubic Yards

Pond Evaluation

Ponds are labeled on the test pit location and site map.

Pond 1

Test pits 6 and 6 show 4 to 6 feet of silt/loess soils overlying a gravel layer. Below the gravels at depths of 10' to 11' feet seam is a layer of silt to the full depth of the test pits. Gravels within the thickness of the seams found in both test pits contained siltier zones that will be less than optimal for use as structural fill.

Pond 2

Test pits 12 and 13 were dug within Pond 2. Overburden of 2 to 3 feet was found, gravels were found from about 2 to 10 feet depth, below the gravels were silt. Both well graded and poorly graded gravels found in the two test pits are suitable for use in roadway construction. Processing to remove larger cobbles may be required.

Test Pit 9,10, 11 Area

Overburden of loess and topsoil is less than 3 feet in these test pits. Test pits 9 and 10 were shallow, Test Pit 11 was dug to 15 feet, well graded and poorly graded gravels were found to the full depth of the pit. The gravels found in these test pits are suitable for roadway fills.

Pond excavation to obtain gravels for roadway construction is feasible in any of the locations. Pond 2 and the test pit 9,10, 11, area show the best potential as a gravel source. A pond lining is likely to be needed to prevent undo water loss in any of the pond sites.

Underlying silt layers in several of the sites may offer the opportunity for utilizing amended site soils as an economical liner.

A gravel thickness of 8 feet thick would have to be excavated to an area of 1.8 acres to provide **20,500 cubic yards** of structural fill assuming 15% shrink due to oversize and unsuitable materials.

Construction Observation and Testing
Before commencement of grading Nelson Engineering will require a separate contract for quality control observation and testing. A minimum of 48 hours' notice is required to mobilize onsite for field observation and testing.

CONSTRUCTION CONSIDERATIONS

Earthwork and Site Grading

Excavation work and heavy equipment access will be difficult due to soft rutting soils when wet conditions exist. **Additional ground stabilization measures including geotextile and structural fill placement may be required during wet periods to stabilize driveway and construction access routes.** General recommendations for earthwork suitability, placement, and compaction procedures are provided below:

- Within the roadway footprints, all organic material, deleterious undocumented fill, and debris should be stripped and removed. Loose and disturbed native soils should be scarified, moisture-conditioned, and compacted. Finish surfaces shall be sloped away from foundations.

- Loess and silt containing soils will be moisture sensitive. Efforts should be made to ensure moisture from rainfall and groundwater does not infiltrate roadway subgrade soils during construction. Measures including tarping, cessation of work, and grading to drain storm water from exposed excavations during precipitation and snowmelt events should be taken.

- Fill materials shall not be placed, spread, or compacted while the ground is frozen or during unfavorable weather conditions. Fill materials should be at the proper moisture content prior to compaction and should contain no frozen soil.

- **Structural Fill: Approved structural fills are** Gravels (USCS classification GW or GP) Clean Rock, and Crushed Concrete. Clean Rock and Crushed Concrete may be utilized at and below the water table if approved and inspected by NE.

  Gravels shall have the following characteristics: 6-inch maximum particle size with no more than 40% greater than 2" and no more than 5% fines passing the #200 sieve. Structural fill shall be placed in layers of not more than 8 inches in thickness. Where placed on slopes, fill shall be keyed into the slope in near vertical steps of 16-inch maximum height. Each layer of structural fill should be moisture conditioned to within 2% of optimum moisture content and compacted to a minimum density of 95% of the maximum dry density as determined by ASTM Designation D 698. The maximum density of material containing more than 30% oversize (greater than ¾" diameter) cannot be determined by use of the ASTM Designation D 698. In this case, a field maximum density may be determined by a test strip method. The material shall be compacted at or near optimum moisture content and a field density test shall be taken after each pass of the compaction equipment. This sequence shall continue until the maximum field density is achieved. This maximum field density shall be used for subsequent field compaction tests. Enough density tests should be taken to monitor proper compaction. Where a proctor cannot be performed on structural fill, lift compaction shall be verified via proof rolling with loaded rubber-tired equipment observed and approved of by NE.

Crushed Concrete shall meet the gradation requirements of gravels and shall be free of all debris and rebar. Gradation and rock source and compaction methods shall be submitted to Nelson Engineering for approval prior to use.

Clean Rock consisting of hard durable crushed or screened rock of 3/4”-4” may be used as Structural Fill with prior notice and approval of gradation and source by this office. Clean Rock may be used beneath the water table with approval from NE.

Crushed Concrete and Clean Rock fill compaction testing shall consist of proof rolling with loaded rubber-tired equipment observed and approved of NE.

- Safety of construction personnel including safe trenches and excavations are the responsibility of the contractor. Excavations for retaining walls and foundations shall conform to the applicable OSHA and Wyoming safety standards. Excavations and utility trenches shall be laid back to safe slopes or properly shored. Excavations and shoring operations shall be conducted in accordance with the most recent versions of the OSHA Construction Standards for Excavations, Part 1926, Subpart P and applicable State of Wyoming regulations. Excavations for utilities shall be shored if the proper slope cannot be maintained.

GENERAL COMMENTS

Monitoring and testing should be performed to verify that suitable materials are used for fills and roadway sections.

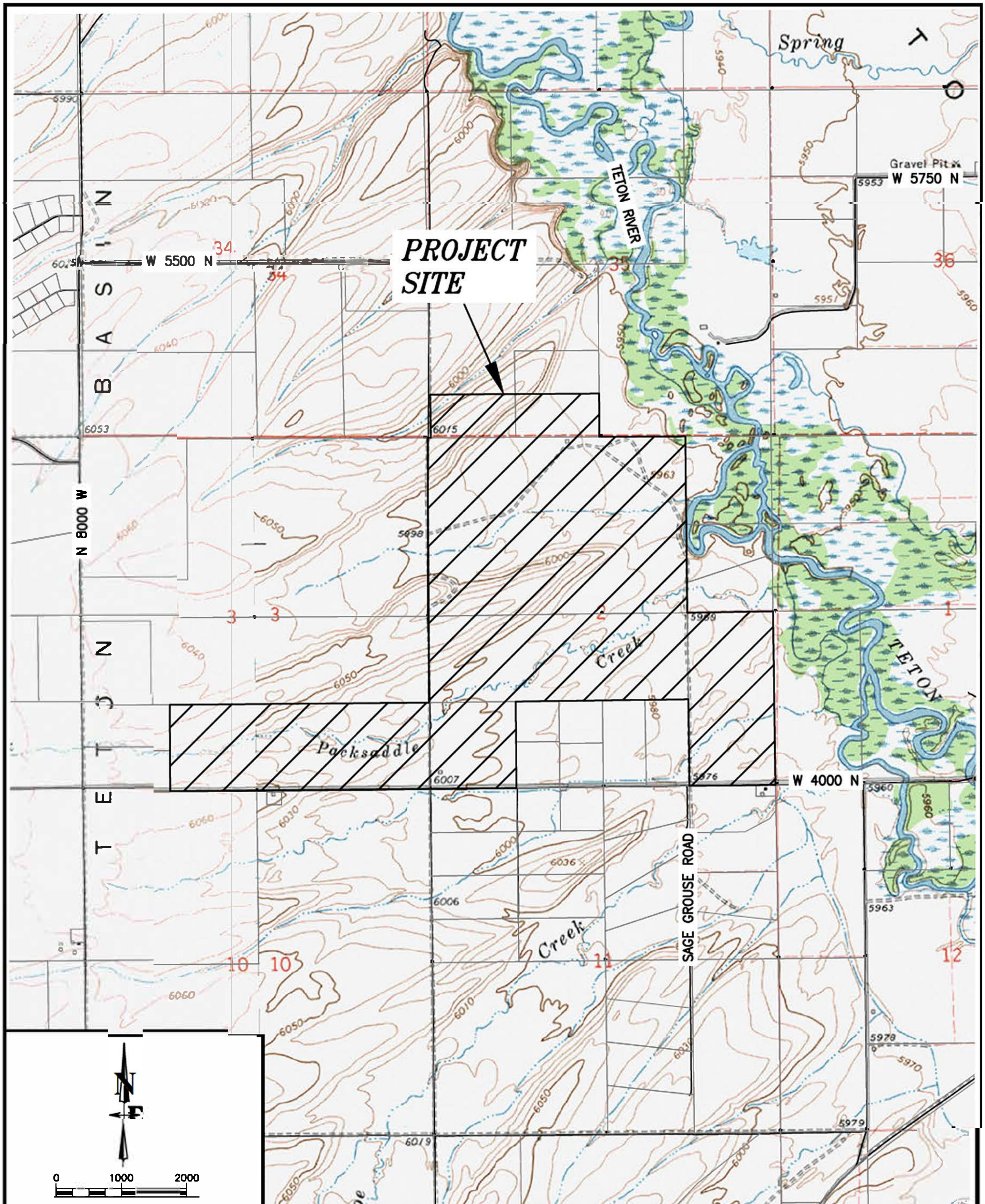
WARRANTY AND LIMITING CONDITIONS

This report was prepared for use by STRR LLC (“Client”). The scope of work was specifically prepared for and limited to the specific purpose of providing geotechnical recommendations for project described. The report is for the sole use of the named client and the design and construction team for this project. This report is non-transferable to future property owners without the written consent of Nelson Engineering. This report has been prepared based on a limited amount of data. Actual site conditions may vary. These services have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty is made or implied. This report is site-specific. The report is limited to the information available at the time it was prepared. In the event additional information is provided to Nelson Engineering following this report, it will be forwarded to the client in the form received for evaluation by the client. Use or misuse of this report, or reliance upon the findings hereof by any parties other than the Client, is at their own risk. Neither the Client nor Nelson Engineering may make any representation of warranty to such other parties as to the accuracy or completeness of this report or the suitability of its use by other parties for any purpose whatsoever, known, or unknown, to the Client or Consultant. Neither Client nor Nelson Engineering shall have any liability to or indemnify or hold harmless third parties for any losses incurred by the actual or purported use or misuse of this report.

Philip Gyr, PE
Geotechnical Engineer

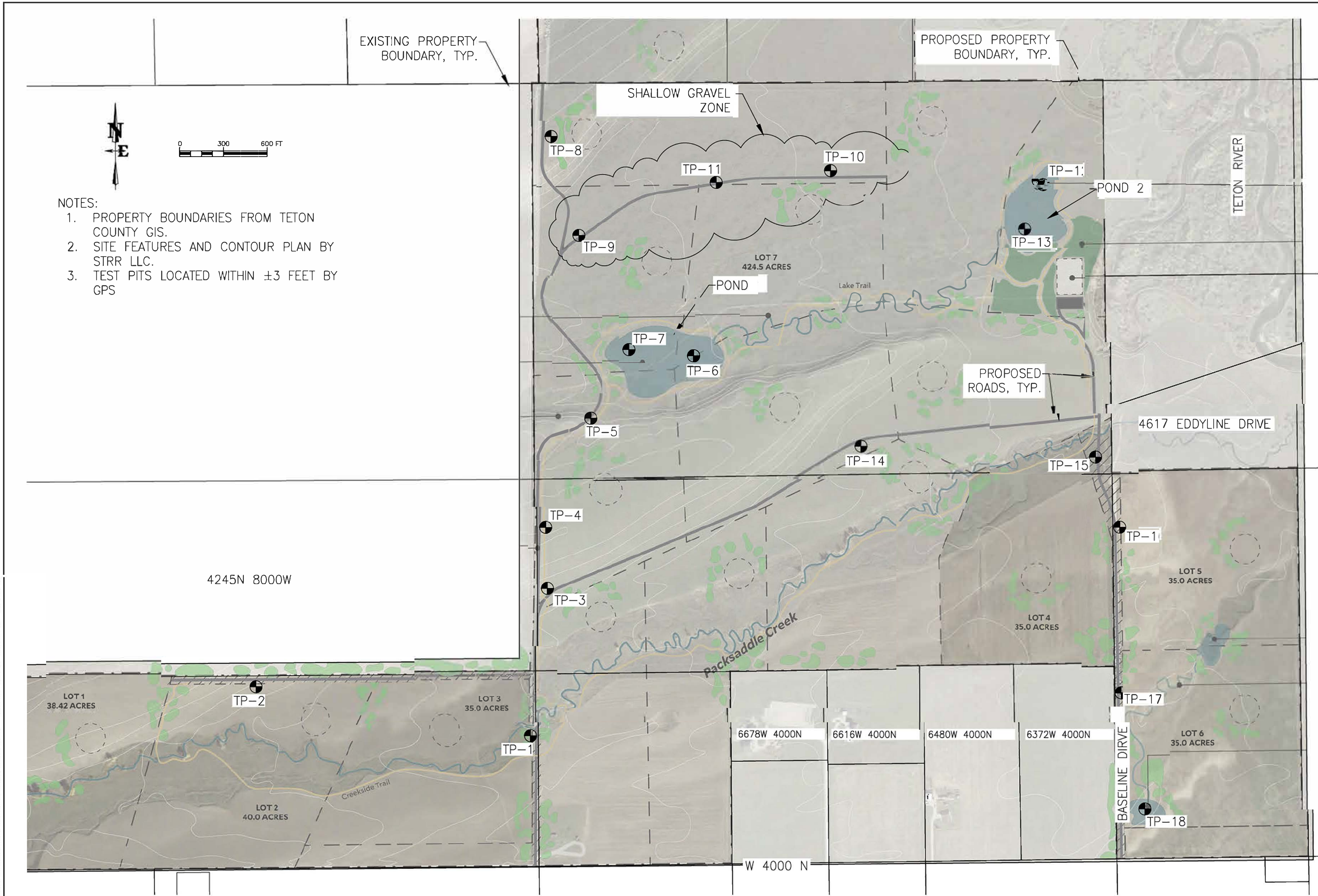
APPENDIX

DRAWINGS



SITE VICINITY MAP

DRAWING NO 1	TITLE PACKSADDE RANCH ROADS & PONDS 7000W 4000N GEOTECHNICAL INVESTIGATION	NELSON ENGINEERING P.O. BOX 1599, JACKSON WYOMING (307) 733-2087	DATE 12/27/2023 SURVEYED – DRAWN AP CHECKED PG APPROVED PG REV.
JOB NO 23-412-01			



DATE	12/27/2023
SURVEYED	
ENGINEERED	AP
DRAWN	AP
CHECKED	PG

REV.

NELSON ENGINEERING
P.O. BOX 1599 JACKSON, WYOMING (307) 733-2087

DRAWING TITLE
TEST PIT LOCATION MAP

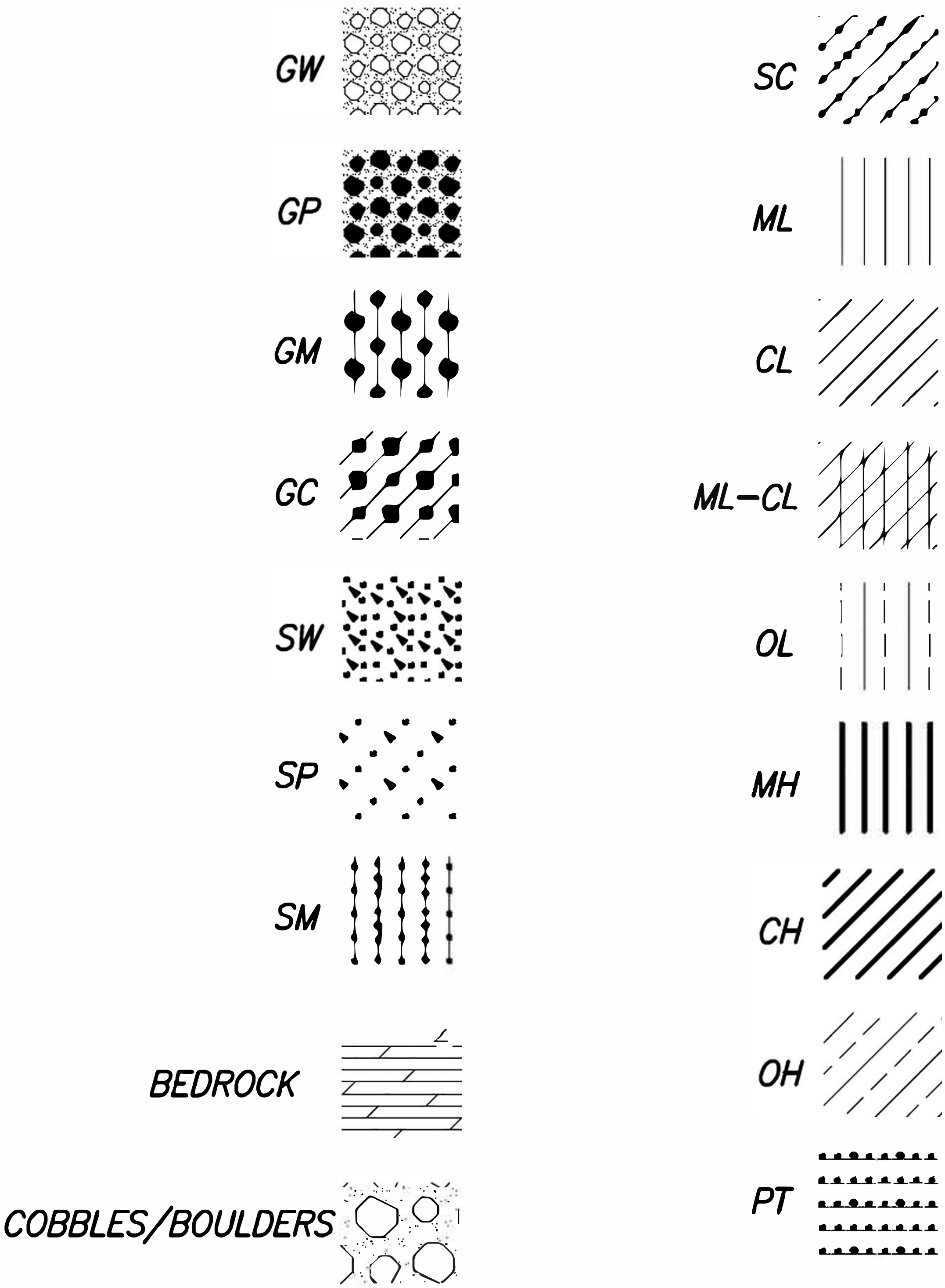
JOB TITLE
PACKSADDLE RANCH SUBDIVISION
7000 W 4000 N, TETON COUNTY, ID
GEOTECHNICAL INVESTIGATION

DRAWING NO 2

JOB NO 23-412-01

TEST PIT LOGS

SOIL GRAPHICS



NOTE: ANGLED DEMARCATIONS ON THE LOGS INDICATE APPROXIMATE OR POORLY DEFINED BOUNDARIES BETWEEN SOIL TYPES.

NELSON ENGINEERING
P.O. BOX 1599, JACKSON WYOMING (307) 733-2087

GEOTECHNICAL GENERAL NOTES

CORRECTED SPT: Standard Penetration Test values corrected to $N1_{60}$ correcting for theoretical free-fall hammer energy and overburden pressure per 7th edition of the AASHTO Bridge Design Specifications.

DRILLING, SAMPLING, AND SOIL PROPERTIES ABBREVIATIONS AND SYMBOLS

N: Standard Penetration Test
U_c: Unconfined compressive strength, Pounds/ft^2 (PSF)
Pp: Pocket Penetrometer values, Ton/ft^2 (TSF)
FILGC: Fragments indicate gravels and cobbles larger than split spoon diameter.
w: Water content, %
LL: Liquid limit, %
PI: Plasticity index, %
gd: In-situ dry density, lbs/ft^3 (PCF)
**:** Ground water level
SS: Split-Spoon Sample
ST: Shelby Tube Sampler
CS: Cylindrical Brass Lined Sample


Monitoring Well, diagonal hatching indicates screen and sand packed interval

SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Non-Cohesive Soils	SPT	Cohesive Soils	Pp-(tons/ft^2)
Very Loose	0 - 4	Very Soft	0 - 0.25
Loose	4 - 10	Soft	0.25 - 0.50
Slightly Compact	8 - 15	Medium Stiff	0.50 - 1.00
Medium Dense	10 - 30	Stiff	1.00 - 2.00
Dense	30 - 50	Very Stiff	2.00 - 4.00
Very Dense	50+	Hard	4.00+

PARTICLE SIZE

Boulders:	12 in.+	**Coarse Sand:**	5 mm(#4)-2 mm(#10)	**Silts and Clays:** <#200
Cobbles:	12 in.-3in.	**Medium Sand:**	2 mm(#10)-0.4mm(#40)	
Gravel:	3in.-5mm(#4)	**Fine Sand:**	0.4mm(#40)-0.075mm(#200)	

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Non-Cohesive Soils	SPT	Cohesive Soils	Pp-(tons/ft^2)
Very Loose	0 - 4	Very Soft	0 - 0.25
Loose	4 - 10	Soft	0.25 - 0.50
Slightly Compact	8 - 15	Medium Stiff	0.50 - 1.00
Medium Dense	10 - 30	Stiff	1.00 - 2.00
Dense	30 - 50	Very Stiff	2.00 - 4.00
Very Dense	50+	Hard	4.00+

PARTICLE SIZE

Boulders:	12 in.+	**Coarse Sand:**	5 mm(#4)-2 mm(#10)	**Silts and Clays:** <#200
Cobbles:	12 in.-3in.	**Medium Sand:**	2 mm(#10)-0.4mm(#40)	
Gravel:	3in.-5mm(#4)	**Fine Sand:**	0.4mm(#40)-0.075mm(#200)	

LABORATORY RESULTS

USCS CLASSIFICATION

Sample ID: TP1-1 Depth (ft): 4' - 5'

Unified Soils Classification

CL-ML (Silty Clay)

Gravel	1%
Sand	7%
Fines	92%

Liquid Limit:	26
Plastic Limit:	21
Plasticity Index:	5

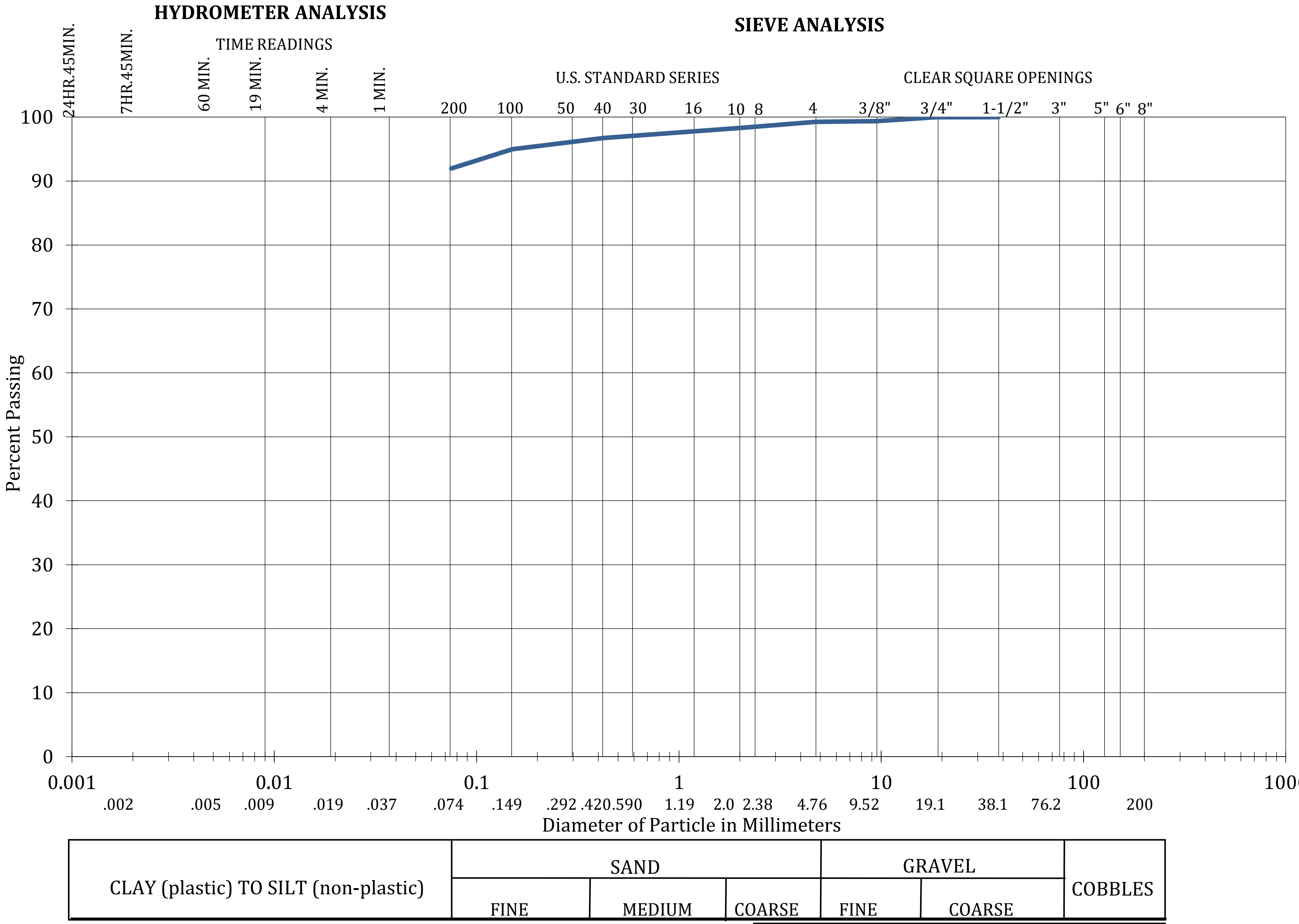
In-Situ Moisture Content	17.0%

Standard Sieve No.	Particle Size (mm)	Tare Weight (g)	Sample + Tare (g)	Sample Weight (g)	Cumulative % Retained	Percent Passing
1.5"	38	169.0	169.0	0.0	0%	100%
1"	25	169.0	169.0	0.0	0%	100%
3/4"	18.75	169.0	169.0	0.0	0%	100%
3/8"	9.5	169.0	171.9	3.0	1%	99%
#4	4.75	169.0	169.4	0.4	1%	99%
#10	2.00	169.0	173.5	4.5	2%	98%
#40	0.425	169.0	176.7	7.7	3%	97%
#100	0.15	169.0	177.3	8.3	5%	95%
#200	0.075	169.0	183.4	14.5	8%	92%
Pan	0	169.0	609.9	441.0	100%	0%
		Total Weight of Sample (g)		479.5		

Moisture Content	
Wet Wt + Tare (g)	731.1
Dry Wt. + Tare (g)	649.3
Wt of Water (g)	81.7
Tare Wt. (g)	169.8
Dry Wt. (g)	479.5
Moisture Content	17.0%
Wash	
Wet Wt. + Tare (g)	731.1
Pre Wash Dry (g)	479.5
Post Wash Dry (g)	38.5
Tare Wt. (g)	169.8
Wt.Of Minus #200 =	441.0

Project:	Packsaddle Ranch Roads and Ponds	Sampled By:	AP
Job Number	23-412-01	Date:	12/7/2023
Visual ID:	Brown Silt Loess	Tested By:	JH
		Date:	12/27/2023

USCS CLASSIFICATION SIEVE CHART



TP1-1

Packsaddle Ranch
Roads and Ponds

SPLIT GRADATION USCS SOILS CLASSIFICATION

Sample ID: TP11-1

Depth: 6' - 7'

Project: Packsaddle Ranch Roads and Ponds
Job Number: 23-412-01
Visual ID: Brown Gravel with Sand and Cobbles

Sampled By: AP
Date: 12/7/2023
Tested By: JH
Date: 1/2/2024

Gravel	61%
Sand	34%
Fines	5%

In-Situ Moisture Content	4.7%

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP

Unified Soils Classification

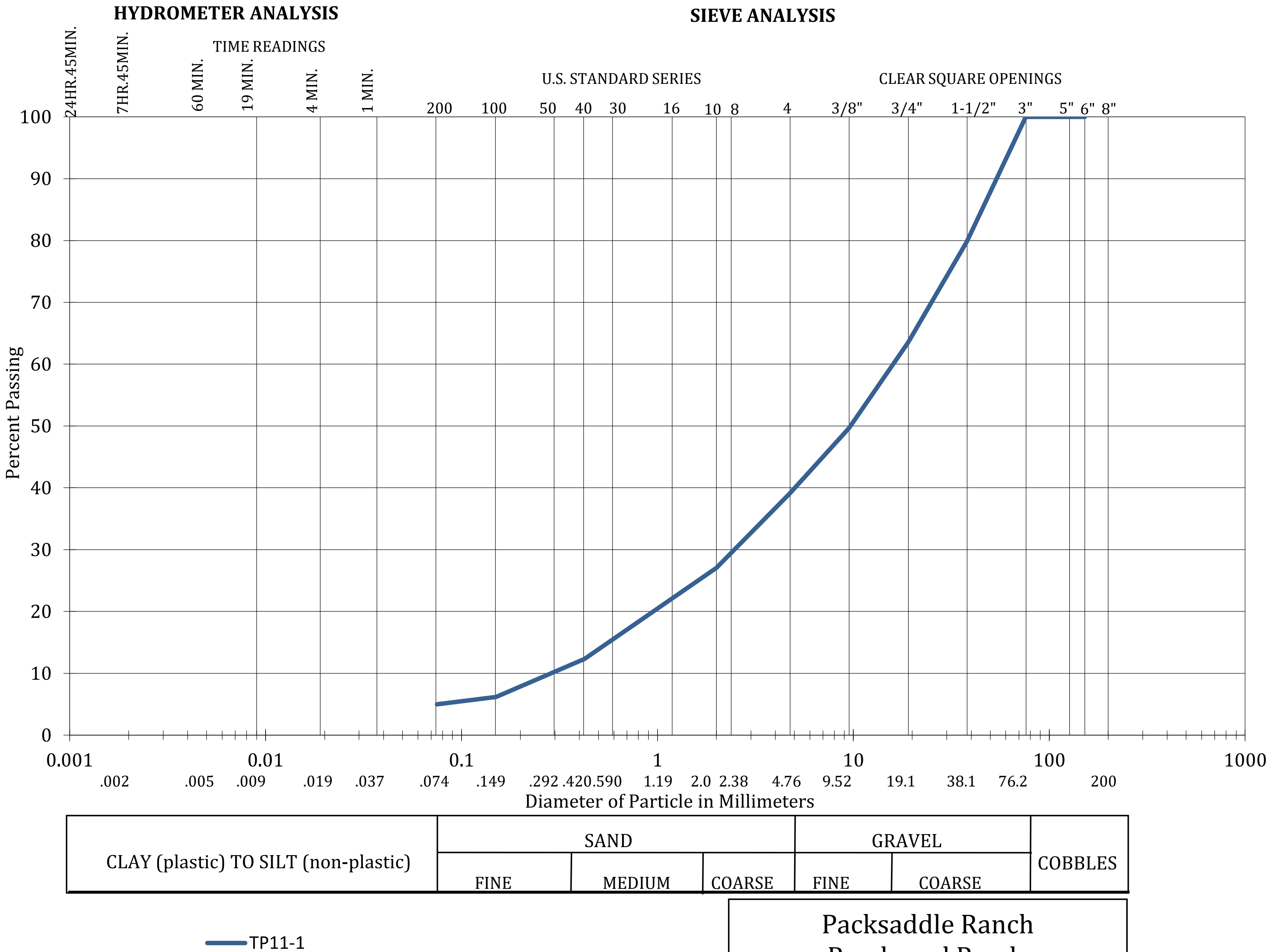
GW-GM (Well-Graded Gravel with Silt and Sand)

Particle Size	
D60=	16
D30=	2.4
D10=	0.3
Cu=	53
Cc=	1

Moisture Content	
Wet Wt + Tare (g)	5412.2
Dry Wt. + Tare (g)	5185.3
Wt of Water (g)	226.9
Tare Wt. (g)	340.3
Dry Wt. (g)	4845.0
Wash for <3/4"	
Dry Wt. + Tare (g)	5185.31
Dry Wt. (g)	4845.0
Post Wash Dry (g)	4464.4
Tare Wt. (g)	340.3
Wt.Of Minus #200 =	380.6

					For Split Sample		For Total Sample	
Standard Sieve No.	Particle Size (mm)	Tare Weight (g)	Sample + Tare (g)	Sample Weight (g)	Cumulative % Retained	Percent Passing	Cumulative % Retained	Percent Passing
6"	152.0	821.0	821.0	0.0	0%	100%	**0%**	**100%**
3"	76.0	821.0	821.0	0.0	0%	100%	**0%**	**100%**
1.5"	38.0	821.0	10786.4	9965.4	20%	80%	**20%**	**80%**
3/4"	19.0	821.0	8917.6	8096.6	37%	63%	**37%**	**63%**
	Total Weight of Sample (g)			**49414.4**				
3/8"	9.5	170.8	1224.8	1054.0	22%	78%	**50%**	**50%**
#4	4.75	170.8	974.2	803.4	38%	62%	**61%**	**39%**
#10	2.0	170.8	1091.9	921.1	57%	43%	**73%**	**27%**
#40	0.425	170.8	1294.8	1124.0	81%	19%	**88%**	**12%**
#100	0.150	170.8	641.3	470.5	90%	10%	**94%**	**6%**
#200	0.075	170.8	262.2	91.4	92%	8%	**95%**	**5%**
Pan	0	170.8		380.6	100%	0%	**100%**	**0%**
	Total Weight of Sample (g) <3/4"			**4845.0**				

USCS CLASSIFICATION SIEVE CHART



<table>
<tr><td rowspan="2">CLAY (plastic) TO SILT (non-plastic)</td><td colspan="3">SAND</td><td colspan="2">GRAVEL</td><td rowspan="2">COBBLES</td></tr>
<tr><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>COARSE</td></tr>
</table>

Packsaddle Ranch
Roads and Ponds

NELSON ENGINEERING SINCE 1964
Professional Engineers & Land Surveyors
JACKSON, WY | BUFFALO, WY | VICTOR, ID
NELSONENGINEERING.NET

USCS CLASSIFICATION

Sample ID: TP15-1 Depth (ft): 9' - 10'

Unified Soils Classification
ML (Silt)

Gravel	0%
Sand	4%
Fines	96%

Liquid Limit:	29
Plastic Limit:	24
Plasticity Index:	5

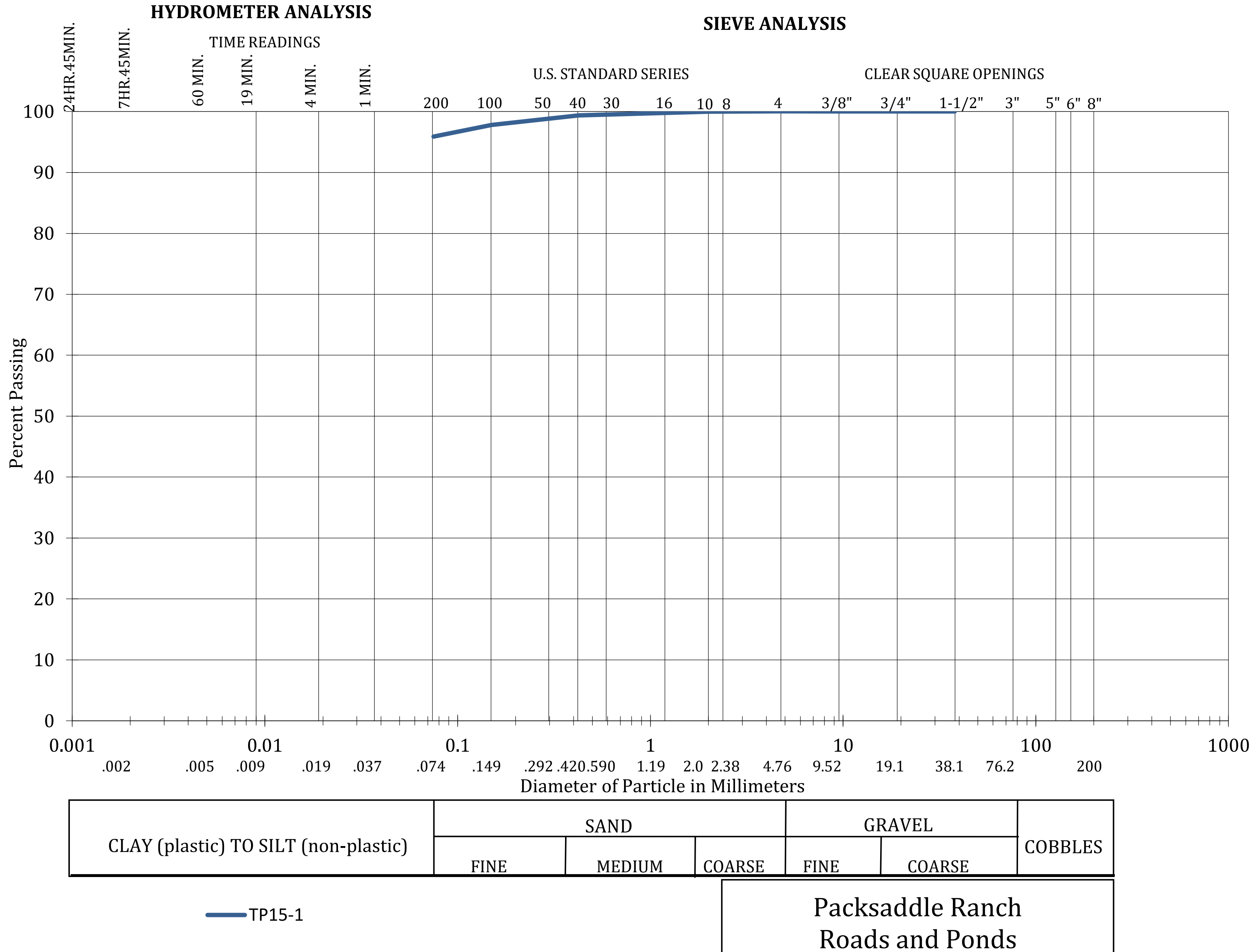
In-Situ Moisture Content	34.6%

Standard Sieve No.	Particle Size (mm)	Tare Weight (g)	Sample + Tare (g)	Sample Weight (g)	Cumulative % Retained	Percent Passing
1.5"	38	168.9	168.9	0.0	0%	100%
1"	25	168.9	168.9	0.0	0%	100%
3/4"	18.75	168.9	168.9	0.0	0%	100%
3/8"	9.5	168.9	168.9	0.0	0%	100%
#4	4.75	168.9	168.9	0.0	0%	100%
#10	2.00	168.9	169.0	0.1	0%	100%
#40	0.425	168.9	169.6	0.7	1%	99%
#100	0.15	168.9	170.8	1.8	2%	98%
#200	0.075	168.9	171.1	2.2	4%	96%
Pan	0	168.9	280.5	111.6	100%	0%
		Total Weight of Sample (g)		116.3		

Moisture Content	
Wet Wt + Tare (g)	325.6
Dry Wt. + Tare (g)	285.3
Wt of Water (g)	40.3
Tare Wt. (g)	169.0
Dry Wt. (g)	116.3
Moisture Content	34.6%
Wash	
Wet Wt. + Tare (g)	325.6
Pre Wash Dry (g)	116.3
Post Wash Dry (g)	4.8
Tare Wt. (g)	169.0
Wt.Of Minus #200 =	111.6

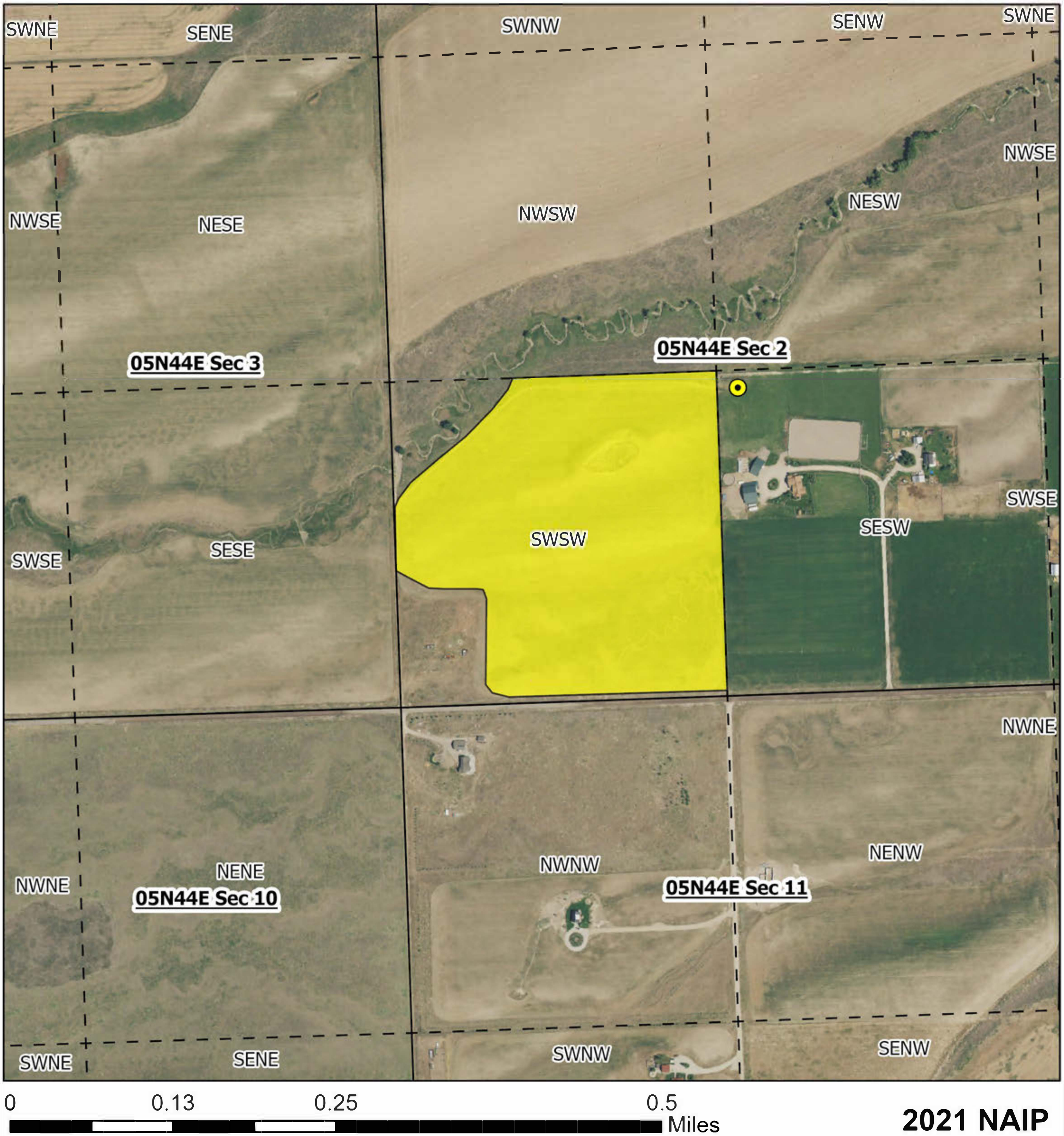
Project:	Packsaddle Ranch Roads and Ponds	Sampled By:	AP
Job Number	23-412-01	Date:	12/7/2023
Visual ID:	Brown silt	Tested By:	JH
		Date:	12/27/2023

USCS CLASSIFICATION SIEVE CHART



Packsaddle Ranch
Roads and Ponds

Attachment #7b



2021 NAIP

WR POU

POD

Section

QQ

Existing Water Right

Brandon Darnton

Project #: 23-0029

Drawn by: TK

Date: 6/14/2024

Rocky Mountain ENVIRONMENTAL ASSOCIATES, INC.