# TOWN OF JACKSON
# PLANNING & BUILDING DEPARTMENT

## TRANSMITTAL MEMO

**Town of Jackson**
- ☒ Public Works/Engineering
- ☐ Building
- ☐ Title Company
- ☒ Town Attorney
- ☐ Police

**Joint Town/County**
- ☐ Parks and Recreation
- ☐ Pathways
- ☐ Housing Department

**Teton County**
- ☐ Planning Division
- ☐ Engineer
- ☐ Surveyor- *Nelson*
- ☐ Assessor
- ☐ Clerk and Recorder
- ☐ Road and Levee

**State of Wyoming**
- ☐ Teton Conservation
- ☒ WYDOT
- ☐ TC School District #1
- ☐ Game and Fish
- ☐ DEQ

**Federal Agencies**
- ☐ Army Corp of Engineers

**Utility Providers**
- ☐ Qwest
- ☐ Lower Valley Energy
- ☐ Bresnan Communications

**Special Districts**
- ☐ START
- ☐ Jackson Hole Fire/EMS
- ☐ Irrigation Company

Date: August 1, 2019

Item #: P19-188

Planner: Tyler Valentine

Phone: 733-0440 ext. 1305

Fax: 734-3563

Email: tvalentine@jacksonwy.gov

**Owner:**
Trident Holdings
323 Park Ave S, #4A
New York, NY 10010

**Applicant:**
Northworks Architects
PO Box 1613
Jackson, WY 83001

**REQUESTS:**

The applicant is submitting a request for an Encroachment Agreement for a driveway at 723 Rodeo Drive legally known as LOT 18, KARNS HILLSIDE ADDITION.

For questions, please call Tyler Valentine at 733-0440, x1305 or email to the address shown below. Thank you.

**Please respond by:**
**August 22, 2019 (with Comments)**

**RESPONSE:** For Departments not using Trak-it, please send responses via email to:
tstolte@jacksonwy.gov

# ENCROACHMENT AGREEMENT APPLICATION

**Planning & Building Department**
**Planning Division**

150 E Pearl Ave. | ph: (307) 733-0440
P.O. Box 1687 | fax: (307) 734-3563
Jackson, WY 83001 | www.townofjackson.com

**OWNER OF PROPERTY:**

Name: TRIDENT HOLDINGS | WY LLC Phone: _____

Mailing Address: 323 PARK AVE. S, #4A NEW YORK, NY ZIP: 10010

E-mail: _____

**APPLICANT/AGENT:**

Name: NORTHWORKS ARCHITECTS Phone: 307-201-5324

Mailing Address: 185 E HANSEN AVE. JACKSON, WY PO BOX 1613 ZIP: 83001

E-mail: MAUST@NWKS.COM; BFRYZEL@NWKS.COM

**DESIGNATED PRIMARY CONTACT:**

Owner _____ Applicant/Agent x

**PROPERTY:**

Physical Address of Property: 723 Rodeo Drive, Jackson, WY 83001

Lot, Subdivision: Lot 18, Karns Hillside Addition

PIDN: 22-41-16-33-3-07-018

Description of Public Right-of Way: South side of Rodeo Drive

**SUBMITTAL REQUIREMENTS.** Three (3) hard copies and one (1) digital copy of the application package (this form, plus all applicable attachments) should be submitted to the Planning Department. Please ensure all submittal requirements are included. The Planning Department will not hold or process incomplete applications. Partial or incomplete applications will be returned to the applicant.

Have you attached the following?

N/A **Application Fee.** Fees are cumulative. Applications for multiple types of permits, or for multiple permits of the same type, require multiple fees. See the currently adopted Fee Schedule in the Administrative Manual for more information.

__x__ **Notarized Letter of Authorization**. A notarized letter of consent from the landowner is required if the applicant is not the owner, or if an agent is applying on behalf of the landowner. If the owner is a partnership or corporation, proof that the owner can sign on behalf of the partnership or corporation is also required. Please see the Letter of Authorization template in the Administrative Manual for a sample.

__x__ **Narrative Description of the Request.** Provide a detailed narrative description explaining the use of the noted public right-of-way. Construct driveway and retaining walls, and site grading.

__x__ **Exhibit.** Provide an exhibit (picture, drawings, maps, plans) of the use of the noted public right-of-way including dimensions of requested encroachment. See sheet C1.2 in GEC plan set

**FORMAT:**

The main component of any application is demonstration of compliance with all applicable Land Development Regulations (LDRs) and Resolutions.

Note: Information provided by the applicant or other review agencies during the planning process may identify other requirements that were not evident at the time of application submittal. Staff may request additional materials during review as needed to determine compliance with the LDRs.

Under penalty of perjury, I hereby certify that I have read this application and state that, to the best of my knowledge, all information submitted in this request is true and correct. I agree to comply with all county and state laws relating to the subject matter of this application, and hereby authorize representatives of the Town of Jackson to enter upon the abovementioned property during normal business hours, after making a reasonable effort to contact the owner/applicant prior to entering.

Signature of Owner or Authorized Applicant/Agent

7-29-19
Date

ADAM JANAK FOR NORTHWORKS ARCHITECTS
Name Printed

PRINCIPAL
Title

# LETTER OF AUTHORIZATION

TRIDENT HOLDINGS I WY, LLC ,"Owner" whose address is:

323 PARK AVE S, #4A, NEW YORK, NY 10010

(NAME OF ALL INDIVIDUALS OR ENTITY OWNING THE PROPERTY)

, as the owner of property more specifically legally described as:

LOT 18, KARNS HILLSIDE ADDITION, 723 RODEO DRIVE, JACKSON, WY 83001

(If too lengthy, attach description)

**HEREBY AUTHORIZES** NORTHWORKS ARCHITECTS + PLANNERS **as agent to represent and act for Owner in making application for and receiving and accepting on Owners behalf, any permits or other action by the Town of Jackson, or the Town of Jackson Planning, Building, Engineering and/or Environmental Health Departments relating to the modification, development, planning or replatting, improvement, use or occupancy of land in the Town of Jackson. Owner agrees that Owner is or shall be deemed conclusively to be fully aware of and to have authorized and/or made any and all representations or promises contained in said application or any Owner information in support thereof, and shall be deemed to be aware of and to have authorized any subsequent revisions, corrections or modifications to such materials. Owner acknowledges and agrees that Owner shall be bound and shall abide by the written terms or conditions of issuance of any such named representative, whether actually delivered to Owner or not. Owner agrees that no modification, development, platting or replatting, improvement, occupancy or use of any structure or land involved in the application shall take place until approved by the appropriate official of the Town of Jackson, in accordance with applicable codes and regulations. Owner agrees to pay any fines and be liable for any other penalties arising out of the failure to comply with the terms of any permit or arising out of any violation of the applicable laws, codes or regulations applicable to the action sought to be permitted by the application authorized herein.**

**Under penalty of perjury, the undersigned swears that the foregoing is true and, if signing on behalf of a corporation, partnership, limited liability company or other entity, the undersigned swears that this authorization is given with the appropriate approval of such entity, if required.**

**OWNER:**

(SIGNATURE) (SIGNATURE OF CO-OWNER)

***Title*:** TRIDENT HOLDINGS I. WY, LLC MEMBER

**(if signed by officer, partner or member of corporation, LLC (secretary or corporate owner) partnership or other non-individual Owner)**

~~STATE~~ Parish OF Pembroke )

~~COUNTY~~ Country OF Bermuda ) )SS.

The foregoing instrument was acknowledged before me by this 31 day of July, 2019.

**WITNESS my hand and official seal.**

**(Notary Public)**

**My commission expires:**

Phelecia Barnett
Notary Public
RenaissanceRe Services Ltd
12 Crow Lane
Pembroke HM 19,
Bermuda
My Commission Does Not Expire

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y2consultants.com
307 733 2999

ENGINEERING, SURVEYING & PLANNING
LANDSCAPE ARCHITECTURE, GIS
NATURAL RESOURCE SERVICES

Town of Jackson Public Works
PO Box 1687
450 West Snow King Ave.
Jackson, WY 83001
(307) 733-3079

July 31, 2019

**Re: TOJ Encroachment Agreement Application Narrative**
**723 Rodeo Drive**

To whom this may concern,

This Narrative is submitted as part of the Encroachment Agreement Application to accompany the Building and Grading and Erosion Control Permits submitted for 723 Rodeo Drive.

The proposed encroachment into the TOJ Right of Way is necessary to allow driveway access from Rodeo Drive to the residence. Due to the conditions of existing grade in the ROW the driveway design requires retaining walls on both sides. The encroachment therefore includes a portion of the driveway and two lengths of retaining walls that approximately form a rectangle about 86' long and 11' wide spanning from the street gutter to the property boundary. The walls are anticipated to be between 4 and 6 feet in height from final grade. Some minor grading may be required to feather the retaining walls into existing grade, and is proposed as part of this work.

Please contact our office with any questions or requests for additional information

Sincerely,

Zia Yasrobi, PE
Owner
zia@y2consultants.com

Vince Roux
Civil Engineering Dept. Co-Manager
vince@y2consultants.com

# GRADING AND EROSION CONTROL NOTES (PLAN LEVEL)

| DISTURBANCE (SF) | SLOPES (%) |
|---|---|
| 25 | 0–5 |
| 1,165 | 5–15 |
| 14,010 | >15 |
| 15,195 | TOTAL |

>3,000 SF OF DISTURBANCE
THEREFORE A GEC PLAN IS REQUIRED.
EXISTING IMPERVIOUS SURFACES: 0%
PROPOSED IMPERVIOUS SURFACES: 30%

DEVELOPMENT SCHEDULE:
- LAND DISTURBING ACTIVITIES WILL BEGIN FALL 2019 (PENDING PERMIT APPROVALS) AND COMPLETED FALL 2020.
- REVEGETATION WILL OCCUR AS SOON AS CONDITIONS ALLOW PER THE DETAILS BELOW.

INVASIVE SPECIES MANAGEMENT
- 30 DAYS PRIOR TO COMMENCING LAND DISTURBING ACTIVITIES THE CONTRACTOR SHALL CONTACT TETON COUNTY WEED AND PEST TO INVENTORY EXISTING WEEDS DEVELOP AN INVASIVE SPECIES MANAGEMENT PLAN. CONTRACTOR WILL ALSO COMPLY WITH THE FOLLOWING NOTES:
- ALL CONSTRUCTION EQUIPMENT WILL BE CLEANED PRIOR TO ENTERING THE SITE.
- SOIL STOCKPILES WILL BE ROUTINELY CHECKED AND TREATED FOR INVASIVE SPECIES.
- DISTURBANCE OUTSIDE OF THE CONSTRUCTION ZONE AND IN AREAS WHERE INVASIVE SPECIES ARE PRESENT WILL BE MINIMIZED.
- ALL AREAS OUTSIDE OF THE CONSTRUCTION ZONE WILL BE KEPT ON ACTIVE MANAGEMENT USING THE METHODS LISTED IN THE INVASIVE SPECIES MANAGEMENT PLAN. THIS AREA WILL BE MONITORED AND TREATED AT LEAST TWICE EACH GROWING SEASON.

PROPOSED GRADING PLAN:
- GRADE ALL AREAS AS SHOWN ON THE PLANS WHILE PROVIDING FOR SMOOTH TRANSITIONS TO EXISTING GRADE.
- MATERIAL STOCKPILE LOCATIONS PER PLANS.
- TOPSOIL WILL BE STRIPPED FROM AREAS TO BE DISTURBED BY EXCAVATION, FILLING, OR COMPACTION BY EQUIPMENT.
- STOCKPILE TOPSOIL ONSITE, PREVENT MIXING WITH SUBSOIL OR OTHER MATERIALS, AND PROTECT FROM EROSION.
- SOIL IN AREAS COMPACTED BY HEAVY EQUIPMENT TRAVEL WILL BE PREPARED FOR RESEEDING BY SCARIFICATION.
- STOCKPILED AND / OR IMPORTED TOPSOIL WILL BE DISTRIBUTED OVER AREAS TO BE REVEGETATED AT A DEPTH OF 3–6 INCHES.
- IMMEDIATELY PRIOR TO SPREADING TOPSOIL, LOOSEN THE SUBGRADE BY DISKING OR SCARIFY TO A DEPTH OF 4" TO ENSURE BONDING OF THE TOPSOIL AND SUBSOIL. REMOVE ROCKS AND OTHER MATERIAL GREATER THAN 3" IN DIAMETER.

REVEGETATION DETAILS:
- DISTURBED AREAS WILL BE REVEGETATED WITH NATIVE GRASSES PERENNIALS AND OTHER PLANTS AS SHOWN, AND AS DESCRIBED IN THE PURE LIVE SEED (PLS) SEED MIX BELOW UNLESS OTHERWISE NOTED.
- SEED WILL BE BROADCAST WITH TWO PERPENDICULAR PASSES.
- REVEGETATION WILL OCCUR BEFORE MAY 15 OR AFTER SEPTEMBER 15 OF ANY CALENDAR YEAR (FALL AND SPRING).
- THIS SEED MIX MAY BE SUPPLEMENTED WITH DROUGHT TOLERANT NATIVE WILDFLOWERS, AS DESIRED.
- PLS SEEDING RATIOS ARE:

| SCIENTIFIC NAME | COMMON NAME | POUNDS / ACRE |
|---|---|---|
| GRASSES: | | |
| FESTUCA IDAHOENIS | IDAHO FESCUE | 5.0 |
| POA SECUNDA SANDBERGII | SANDBERG BLUEGRASS | 5.0 |
| TOTAL POUNDS PURE LIVE SEED/ACRE | | 10.0 |

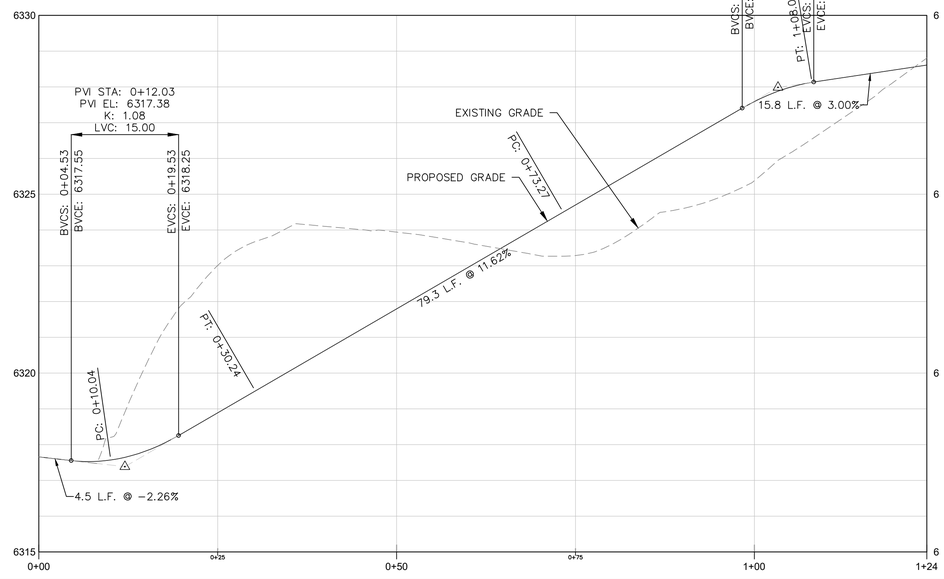
[GRADING AND EROSION CONTROL NOTES CONTINUED]
- SEED SHALL BE UNIFORMLY DISTRIBUTED OVER THE SURFACE BY APPROVED MECHANICAL BROADCASTING DEVICE.
- IF DRILL SEEDED, SEEDING RATE CAN BE REDUCED BY 30%.
- SEED SHALL NOT BE APPLIED DURING HIGH WINDS.
- AFTER SEEDING (VIA BROADCAST), THE SURFACE OF THE SOIL WILL BE THOROUGHLY RAKED WITH A FINE–TOOTHED RAKE TO INCORPORATE SEED INTO THE TOPSOIL.
- SEED SHALL COMPLY WITH WYOMING SEED LAW AND SHALL BE PURCHASED FROM A DEALER LICENSED WITH THE WYOMING DEPARTMENT OF AGRICULTURE.

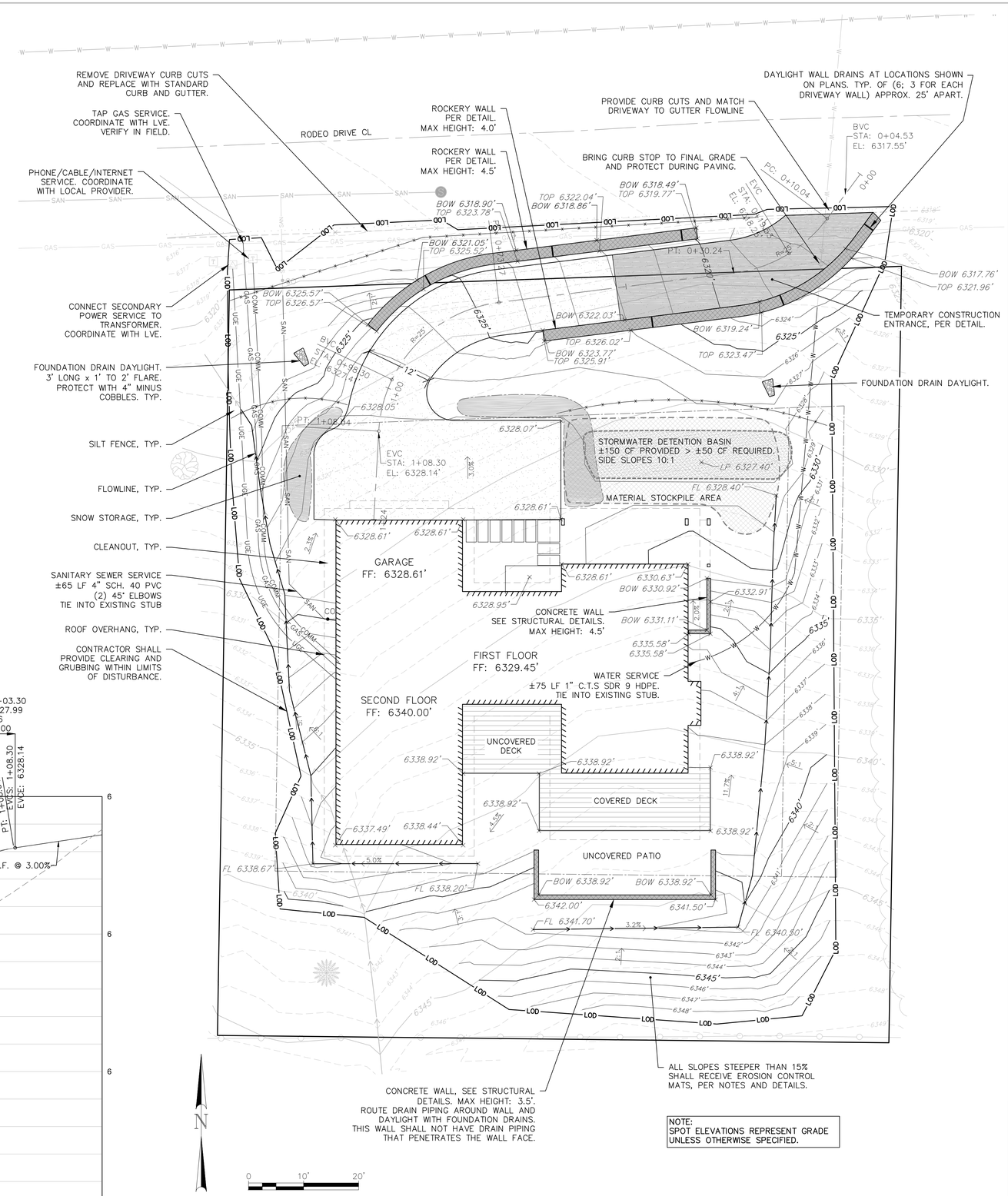
EROSION CONTROL PLAN:
- EROSION CONTROL MEASURES SHALL BE INSPECTED WEEKLY BY THE GENERAL CONTRACTOR/CONSTRUCTION SITE MANAGER AND REPAIRED AS REQUIRED.
- THE GENERAL CONTRACTOR/CONSTRUCTION SITE MANAGER SHALL COMPLY WITH WYDEQ WYPDES SMALL CONSTRUCTION GENERAL PERMITS AND LARGE CONSTRUCTION GENERAL PERMITS FOR SITES LESS THAN 5 ACRES AND LARGER THAN 5 ACRES, RESPECTIVELY.
- SILT FENCES WILL BE INSTALLED ALONG THE TOE OF THE DOWN–SLOPE SIDE OF MATERIAL STOCKPILES AND CUT AND FILL SLOPES, AND WHERE INDICATED ON PLANS.
- THE SILT FENCES WILL REMAIN IN PLACE UNTIL THE STOCKPILED MATERIAL IS REMOVED, AND ELSEWHERE UNTIL AREAS ARE REVEGETATED.
- SLOPE STABILIZATION BLANKETS SHALL BE INSTALLED ON ALL CUT AND FILL SLOPES STEEPER THAN 15% BEING REVEGETATED. USE AMERICAN EXCELSIOR INC. CURLEX II CL BLANKET OR EQUAL, PER DETAILS.

## LEGEND
(E) - EXISTING (P) - PROPOSED

- (E) MAJOR CONTOUR
- (E) MINOR CONTOUR
- (P) MAJOR CONTOUR
- (P) MINOR CONTOUR
- (P) SWALE/ DITCH CL
- (P) BUILDING
- PROPERTY BOUNDARY
- BUILDING ENVELOPE
- LIMITS OF DISTURBANCE
- (E) WATER SERVICE
- (P) WATER SERVICE
- (P) SEWER SERVICE
- (E) UNDERGROUND ELECTRICAL
- (P) UNDERGROUND ELECTRICAL
- (E) TELEPHONE PEDESTAL
- (E) ELECTRICAL TRANSFORMER
- (E) SANITARY MANHOLE
- (E) SIGN POST
- (E) CURB STOP
- (P) CLEANOUT
- SPOT ELEVATIONS

## DRIVEWAY-CL PROFILE
24x36 SHEET SCALE: HORIZ. 1" = 10' VERT. 1" = 2'
START STA: 0+00.00, END STA: 1+24.10




DRAWING SET TITLE: GEC DRAFT
DATE: 07/25/2019
DRAWN BY: JG
CHECKED BY: VR
JOB #: 19179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LANDSCAPE ARCHITECTURE, GIS
NATURAL RESOURCE SERVICES
y2consultants.com
307.733.2999


Professional Engineer (Civil) BE/ED Zia A. YASROBI 8902 WYOMING 07/25/2019

723 RODEO DRIVE GEC
TRIDENT HOLDINGS I WY, LLC.
723 RODEO DRIVE
JACKSON, WY 83001

GRADING PLAN

C2.1


LAST SAVED: 7/25/2019 3:00 PM BY: JACOBG PLOT BY: JACOB GARDNER
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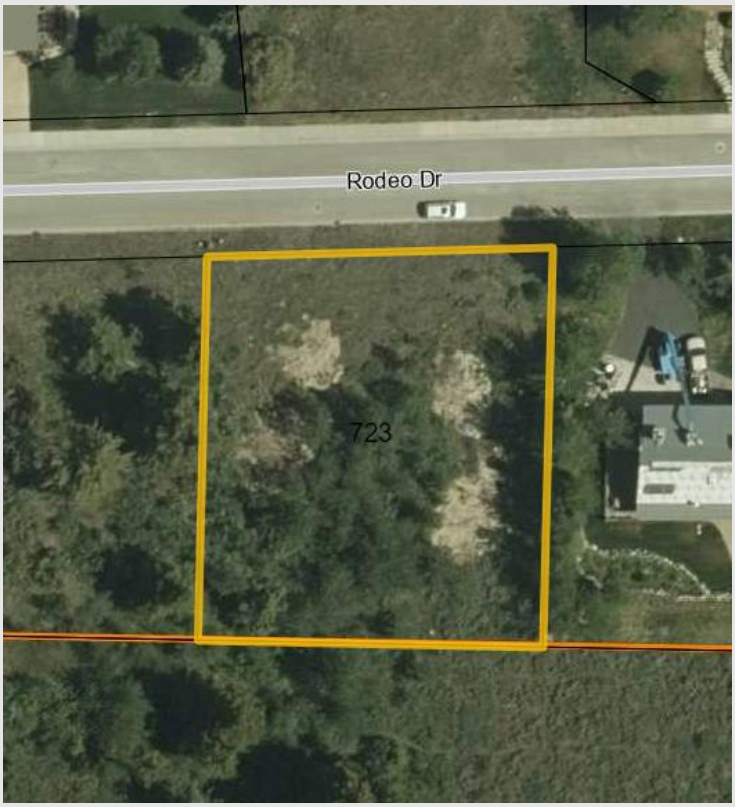


# SLOPE STABILITY REPORT

## 723 RODEO DRIVE, JACKSON, WYOMNG

**Prepared by:**
Y2 Consultants, LLC
Zia Yasrobi, PE
Vince Roux

**Prepared for:**
Marcia Taylor
PO Box 11062
Jackson, WY 83002

August 6, 2019

Y2 CONSULTANTS

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307 733 2999

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# Contents

# 1. INTRODUCTION

This report presents the results of the slope stability analysis based on information provided, including the geotechnical investigation, proposed grading drawings, and site photos. This report and the enclosed analyses were conducted by Y2 Consultants and its subcontractors.

# 2. SITE AND PROJECT DESCRIPTION

The site is located at Lot 18 of the Karns Hillside Addition (Plat 961) in Jackson, Wyoming. The site is on the south side of Rodeo Drive. The approximate location of the site is shown on Figure 1.

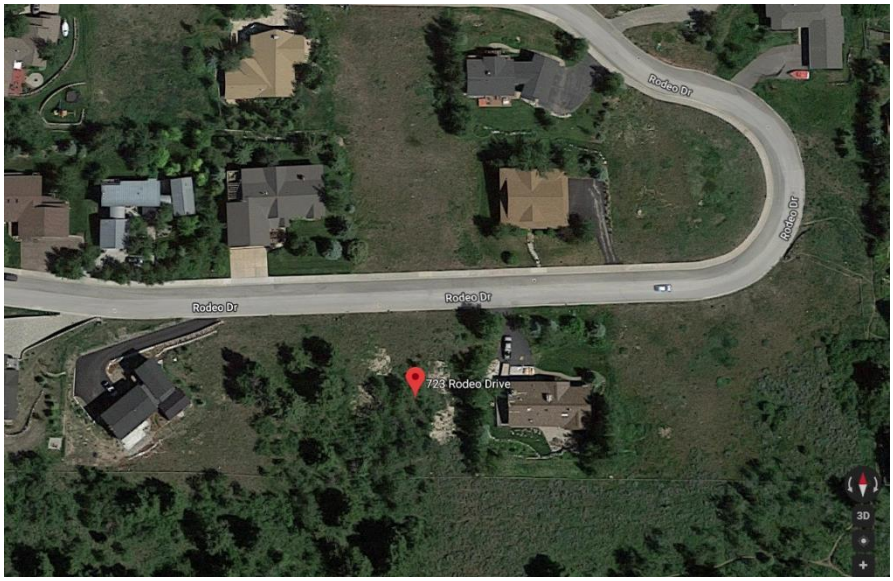


Figure 1. Site location.

The property is currently undeveloped and a multi-story building with attached garage, entrance drive, site retaining walls, and associated utilities are proposed. The property is located on the lower, north facing slope of Snow King Mountain on the southern edge of the Town of Jackson. The topography of the slopes is downward from south to north at about 15 to 25 percent. Rodeo Drive exists at the north boundary of the property, at the bottom of the slopes, and provides access to the lot.

A Geotechnical Investigation was completed for this site by Nelson Engineering (enclosed in Appendix A) determining the soils and the groundwater characteristics of the site.

The purpose of this report is to provide a slope stabilization analysis to assess the proposed development with respect to longterm geotechnical stability and compare with relevant safety factors

# 3. SUBSURFACE CONDITIONS

## 3.1 SUMMARY

As previously mentioned, a geotechnical investigation was carried out by Nelson Engineering including four test pits on the different places of the site. TP-1 is approximately located at the top of the slope and TP-4 is at the base of the slope. The test pits were advanced to depth of about 14 to 18 fts. below the grade.

The subsurface soil and ground water information was obtained from the geotechnical investigation report by Nelson Engineering. It should be noted that Y2 Consultants did not carry out any field work to identify/confirm this information and solely relies on the information provided by Nelson Engineering.

It should be noted that the soil and ground water condition reflect those found at the test pit locations only and may vary at other locations of the site.

## 3.2 SOIL STRATIGRAPHY

Based on the test pit logs and the geotechnical report provided by Nelson Engineering, soil profiles in all test pits were similar. The site is underlain by a layer of surficial material overlying the undisturbed native soil.

### 3.2.1 TOPSOIL MATERIAL

The surficial soils in all test pits consisted of 3 to 5.5 ft. of moist dark brown colluvium composed of a silt matrix with gravels and boulders up to 3 ft. maximum dimension. The surficial soils were medium dense with a stiff to very stiff matrix corresponding to the pocket penetrometer readings which were between 1 to 3 tons per square foot (TSF) and contained moderate roots throughout. The soils contained between 50 to 65 percent gravels, cobbles, boulders and 35 to 50 percent silt matrix.

### 3.2.2 BASE MATERIALS

Below the surficial soils and to the bottom of the test pits, soil was colluvium of dry, tan/light brown/brown clayey sand/sandy lean clay matrix with gravel, cobbles, and boulders up to 4 ft. maximum dimension. The dense to very dense colluvium deposits were composed of approximately 80 percent angular to sub-angular gravels cobbles and boulders and 20 percent matrix. Occasional 6-inch lenses of fine gravels and lean clay matrix were observed. In TP-1 from 11 feet to the bottom of the test pit at 18 feet, soils were colluvium deposits as observed above. However, the soils contained approximately 65 percent gravels, cobbles, and boulders and 35 percent matrix. The matrix soils contained a higher moisture content and classified as moist with a medium stiff to stiff consistency corresponding to pocket penetrometer readings of 0.5 to 1.5 TSF.

## 3.3 GROUND WATER

Groundwater wasn't encountered during the investigation. Soil moisture content in the test pits were field-classified as moist to dry.

The test pits logs provided by the Nelson Engineering are presented in Appendix A.

# 4. SLOPE STABILIZATION ANALYSIS

As previously noted, a multi-story residential dwelling is proposed at the site. Based on the results of the geotechnical report by Nelson Engineering and the proposed grading plan, three sections were selected for the slope stabilization analysis to identify the worst slope condition. All three sections were analyzed, and the related safety factors were calculated with Slope/W V7.12 software (professional-grade geotechnical software).

## 4.1 INTRODUCING METHOD

Since the 1930s, the limit equilibrium (LE) approach has been used to analyze the slopes. This approach is convenient for the use of differing analysis methods depending on the type of problem (circular vs non-circular) to be solved and the required accuracy of the result. Currently, most of the slope stability analyses involve LE analysis due to its simplicity and accuracy. These methods consist of cutting the slope into fine slices and applying the appropriate equilibrium equations (equilibrium of the forces and/or moments). According to the assumptions made on the efforts between the slices and the equilibrium equations considered, many alternatives were proposed, such as Bishop and Fellenius methods.

As discussed previously, the Equilibrium Model is the most common method for evaluation of the slope stability. In this analysis, the Slope/W V7.12 software is used for the slope stability analysis. This stability analysis software using several methods, including common methods, Bishop, Morgenstern, Janbu and Spencer.

## 4.2 GEOTECHNICAL DESIGN PARAMETERS

The analyses in this report are based on the geotechnical parameters for base soil strata provided by Nelson Engineering. According to the test pits logs provided by Nelson Engineering, the geotechnical parameters are presented in the following table.

Table 1. Geotechnical Parameters

| Layer | Unit Weight ($lb/ft^2$) | Cohesion (psf) | Angle of Internal Friction (degrees) |
|---|---|---|---|
| Base Material | 135 | 0 | 35 |

## 4.3 EXISTING SLOPE CONDITIONS

The elevation change is about 30 ft. across the study area with slopes varying from 15 to 25%

Three (3) slope cross sections (Sections 1 to 3) were derived from the proposed grading plan for slope stability analyses. The cross-section locations were selected based on the slope height and inclination to represent the critical slope conditions within the study area, and to obtain sufficient coverage of the subject slope. The sections extended through the development to the toe of the slopes. The locations of the slope cross sections are presented in Figure 2. Although the existing topography is shown in Figure 2, the analyses were carried out using the proposed grading plan.

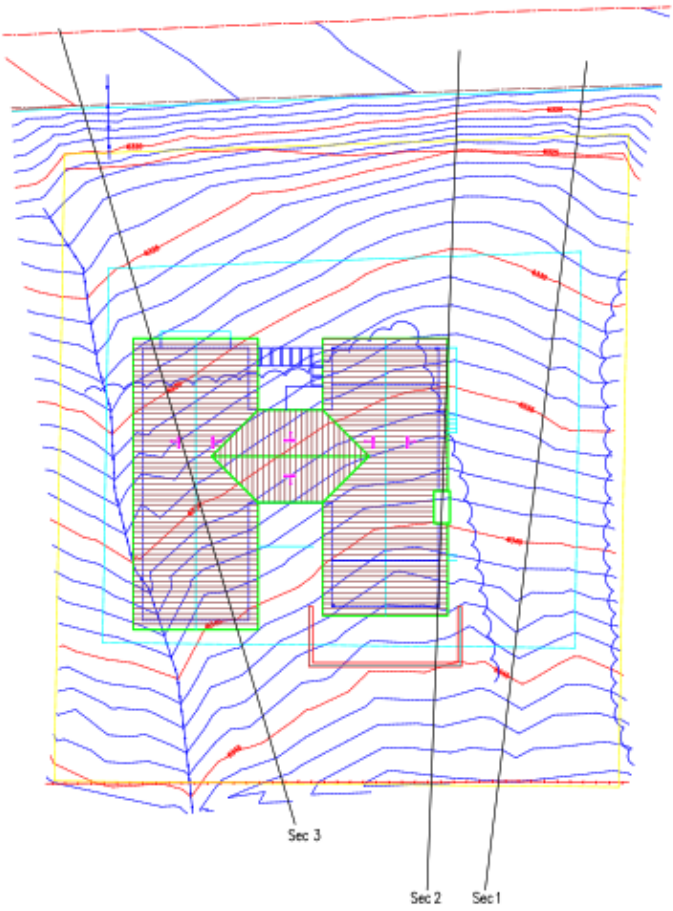



Figure 2. Cross section locations.

The slope stability analysis was carried out by Slope/W software, utilizing several standard methods of limit equilibrium analysis (Bishop's, Janbu, and Spencer). These methods of analysis allow the calculation of safety factors for the hypothetical or assumed failure surfaces through the slope.

The analysis was carried out by preparing a geometry model of the slope and subsurface conditions and analyzing various failure surfaces through the slope in order to find the minimum or critical safety factor for the specific slope conditions. The pertinent data obtained from the topographic survey, and the test pits information were entered for the slope stability analysis. Many calculations were carried out to examine the Factor of Safety for varying depths of the potential failure surfaces.

The geotechnical parameters presented in the previous section were used for the slope stability analysis.

The results of the slope stability analysis for proposed slope conditions are presented in Appendix B and summarized as follows:

Table 2. Summary of Slope Stability Analysis Results

| Section | Station | Factor of Safety | Factor of Safety in earthquake condition |
|---|---|---|---|
| 1 | 0+16.90 | 3.49 | 2.19 |
| 2 | 0+41.24 | 3.38 | 2.17 |
| 3 | 0+94.45 | 3.50 | 2.25 |

The minimum computed factors of safety for the overall stability of the analyzed sections are more than the minimum 1.5 required factor of safety. Therefore, the existing slope profiles are considered stable in the long-term slope stability analysis. The slope stability analysis results for all three sections are presented in Appendix B.

# 5. LIMITATIONS AND USE OF REPORT

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. A comprehensive sampling and testing program implemented in strict accordance with the most stringent level of care may fail to detect certain conditions. Y2 Consultants has assumed for the purposes of providing advice, that the conditions which exist between sampling points are the ones found at the samples' locations. The conditions that Y2 Consultants has interpreted may vary between sampling points from those that actually exist. It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions.

The discussion and recommendations provided here are based on the factual data obtained from the investigation and are intended to use by the owner and its retained designers in the design phase of the project. Since the project is still in the design stage, all aspects of the project relative to the subsurface conditions cannot be anticipated. Y2 Consultants should review the design drawings and specifications prior to the construction of this work. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant to the revised project scope. Y2 Consultants should be retained to review the implications of these changes with respect to the contents of this report.

Contractors bidding on or undertaking work on this project should therefore, in this light, be directed to decide on their own investigations, as well as their own interpretations of the factual investigation results. They should be cognizant of the risks implicit in subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was prepared for the express use of TRIDENT HOLDINGS I WY, LLC and its retained design consultants. It is not for use by others. This report is copyright of Y2 Consultants, and no part of this report may be reproduced by any means, in any form, without the prior written permission of Y2 Consultants who are the authorized users.

It is recognized that the regulatory agencies in their capacities as the planning and building authorities under State statutes, will make use of and rely upon this report, cognizant of the limitations thereof, both expressed and implied.

# 6. CLOSURE

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.


Zia Yasrobi, PE
Owner
zia@y2consultants.com

Vince Roux, MS
Civil Engineering Dept. Co-Manager
vince@y2consultants.com

# APPENDIX A

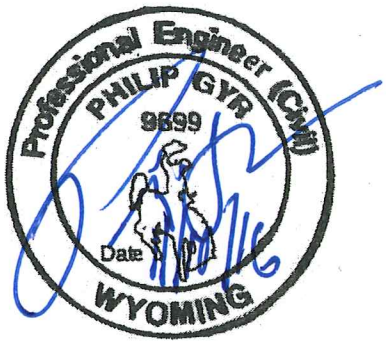
## NELSON ENGINEERING GEOTECHNICAL INVESTIGATION REPORT

# GEOTECHNICAL INVESTIGATION

## 723 RODEO DRIVE
## LOT 18 KARNS HILLSIDE ADDITION
### JACKSON, WYOMING

PREPARED
FOR
**DON LEBOWITZ**
JACKSON, WYOMING

PREPARED
BY
**NELSON ENGINEERING**
JACKSON, WYOMING




NOVEMBER 2016
Project No. 16-252-02

# TABLE OF CONTENTS

## GENERAL AND PROJECT DESCRIPTION

This is the report of a geotechnical investigation for a proposed residence at Lot 18 of the Karns Hillside Addition subdivision in Jackson, Wyoming. The site is located on the lower, north facing slopes of Snow King Mountain on the southern edge of the Town of Jackson, Wyoming. Project plans are in final development at the time of this report. Proposed development includes a multi-story residence with basement, attached garage, entrance drive, site retaining walls and associated utilities. Geotechnical recommendations in this report are based on a site plan developed by Nelson Engineering and preliminary project information provided to Nelson Engineering by Don Lebowitz.

### Scope of Services

The scope of services for this investigation was to provide geotechnical recommendations based on a subsurface investigation and soils laboratory testing for the proposed project. The purpose of the subsurface investigation was to determine soils and groundwater characteristics. The results of the subsurface investigation and subsequent laboratory testing were utilized in an engineering analysis for foundation, retaining wall, and pavement section recommendations. Slope stability analyses were not conducted, as it is our engineering judgment that the existing and proposed slope geometry and soil composition indicate stability. Specific recommendations for drainage and surface water conveyance were not within the scope of work for this report.

The foundation analysis and resulting recommendations contained herein are based on typical loads for the type of structures envisioned in the conceptual design. In the final design phase of the project, it will be critical that structural loads be properly communicated to the geotechnical engineer to verify that the imposed loading conditions on the proposed foundation configuration do not cause excessive settlement, exceed the bearing capacity of the site soils, or exceed the seismic loading capacity of the foundation elements. Lateral earth pressure recommendations contained within this report are general in nature; it is critical that final retaining wall designs are reviewed by the geotechnical engineer for review and approval. For this report, it is assumed that foundation elements would not be subjected to unusual loading conditions such as eccentric loads or vibratory equipment. Unusual load conditions can induce settlement or reduce the bearing capacity of foundation elements.

## SITE CONDITIONS

### Description

The site is a 0.39-acre lot located in Jackson, Wyoming. The lot is located on the lower north facing slopes of Snow King Mountain. An undeveloped residential lot borders the property to the west, a developed residential lot borders the property to the east, and Bridger Teton National Forest land borders the property to the south. Rodeo Drive forms the northern lot boundary and provides access to the lot. Topography within the lot slopes downward from south to north at about 15 to 25 percent. The road cut of Rodeo Drive creates a steep slope of greater than 30 percent along the northern portion of the lot. Currently the lot is occupied by abundant grass, sagebrush, an aspen grove on the southwest portion of the lot, and a small drainage ditch on the western portion of the lot.

**Geologic and Soil Mapping**
The area's surface geology is mapped on the USGS "Geologic Map of the Jackson Quadrangle, Teton County, Wyoming," Love, J.D. and Albee, H.F., 2004. Mapped deposits on the site are "Qc – Colluvium – Mostly slope wash of silt- to boulder-sized fragments derived from underlying and adjacent formations."

The Soil Conservation Service's Soil Survey has mapped the north half of the property. Soil deposits on the mapped portion of the property are the Greyback-Thayne complex on 10 to 20 percent slopes. These deposits are deep, somewhat excessively drained alluvial, glaciofluvial, and/or loess soils. The soils are composed of gravelly loam, very gravelly sandy loam, very gravelly loamy sand, and silt loam.

**Seismic Hazard**
Jackson Hole and the project site are 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 (Smith and Arabasz, 1991). The "Map of Quaternary Faults and Folds in Wyoming" (Machette et al, 2001) shows the following active faults near the project site: the Teton Fault, Philips Canyon Faults, and secondary faults in the Jackson Hole Valley. In particular, the Teton Fault is thought to be capable of producing major earthquakes of a magnitude of six or greater. The portion of the Teton Fault mapped as active in the Quaternary is approximately 7.0 miles northwest of the site. According to the "Geologic Map of the Jackson Quadrangle" Love, J.D. and Albee, H.F., 2004, the concealed postulated trace of the Jackson Thrust Fault is approximately 200 feet north/northeast of the project site. The Jackson Thrust Fault is not classified by the USGS as an active fault. Multiple minor earthquakes with epicenters near the site have occurred in recent years (USGS Earthquake Database).

**SITE INVESTIGATIONS**

**Field Investigations**
On October 26, 2016, four test pits, TP-1 through TP-4, were excavated within the property as shown on the Test Pit Location Drawing in the Appendix. Test pits were located approximately using a Trimble GeoXT GPS unit. Test pit locations and depths were selected to determine subsurface conditions throughout the building envelope. All test pits were backfilled with excavated material after logging was completed.

Fish Creek Excavation of Jackson, Wyoming, excavated the test pits with a Volvo EC160EL track hoe. 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. 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.

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.

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

Soil profiles in all test pits were similar. Surficial soils in all test pits consisted of 3 to 5.5 feet of moist dark brown colluvium composed of a silt matrix with gravels, cobbles, and boulders up to 3 feet maximum dimension. The surficial soils were medium dense with a stiff to very stiff matrix corresponding to pocket penetrometer readings between 1 to 3 tons per square foot (TSF) and contained moderate roots throughout. The soils contained between 50 to 65 percent gravels, cobbles, and boulders and 35 to 50 percent silt matrix. Below the surficial soils and to the bottom of all test pits to depths of 14 to 16 feet except for TP-1, soils were colluvium composed of dry, tan/light brown/brown clayey sand/sandy lean clay matrix with gravels, cobbles, and boulders up to 4 feet maximum dimension. The dense to very dense colluvium deposits were composed approximately 80 percent angular to sub-angular gravels cobbles and boulders and 20 percent matrix. Occasional 6-inch lenses of fine gravels and lean clay matrix were observed. In TP-1 from 11 feet to the bottom of the test pit at 18 feet, soils were colluvium deposits as observed above, however, the soils contained approximately 65 percent gravels, cobbles, and boulders and 35 percent matrix. The matrix soils contained a higher moisture content and classified as moist with a medium stiff to stiff consistency corresponding to pocket penetrometer readings of 0.5 to 1.5 TSF.

### Groundwater

Groundwater was not encountered during the investigation. Soil moisture contents in the test pits were field-classified as moist or dry. Indications of seasonal high groundwater were not observed in the test pits. Groundwater is not expected to occur within 20 feet of ground surface at the site of the proposed residence.

## ENGINEERING ANALYSIS AND RECOMMENDATIONS

### General

Based upon the current site plan, the structure will incorporate a full walkout basement with garage and an upper main level. The proposed elevation of the basement finished floor is 6325-ft and the main finished floor elevation is 6336-ft. Based on these elevations

excavation depths for the basement will range from 6-ft to 14-ft below existing ground. The deepest excavations will be adjacent to the southern perimeter of the structure. Items presented in this section emphasize concerns at depths at and below the anticipated bottom footing depth in soils influenced by foundation loading. Bearing soils will consist of native colluvium soils comprised of gravels, cobbles and boulders.

**Seismic Design Parameters**

The 2012 International Building Code (IBC) designates site class per ASCE 7 Chapter 20. Data obtained in this investigation is not sufficient to determine soil parameters as required by ASCE 7; therefore the IBC directs that seismic coefficients and design spectra shall be determined using Site Class D and Latitude of 43.469° and Longitude of -110.774°.

**Boulders**

Several large boulders were encountered in the test pits. Surficial cobbles and boulders are evident throughout the lot. Numerous boulders have been unearthed in adjacent lots and throughout the subdivision. Large boulders may be encountered and require special techniques to remove them. Boulders occurring at footing grade will require evaluation on an individual basis; boulder removal and backfill with structural fill to achieve footing grades may be required.

**Conventional Spread Footings**

The proposed structure can be supported on conventional spread footings bearing on native colluvium or structural fill. A typical foundation and backfill configuration is shown in the drawing entitled **FOUNDATION BACKFILL DETAIL** in the Appendix**.** Site grading plans should be carefully reviewed to ensure surface waters, snowmelt, and irrigation systems drain away from foundation elements. A minimum burial depth for foundation elements of **42 inches** for frost protection is recommended.

A net allowable bearing capacity of **4000 PSF** can be accepted for conventional spread footings bearing on dense gravel, cobble, and boulder soils with clayey sand/sandy lean clay matrix. Footings shall be placed on native subgrade compacted to a depth of 8 inches using vibratory compaction equipment to 95% of maximum density per ASTM D 698 (Standard Proctor).

Structural fill shall be placed to achieve the required subgrade elevation beneath footings where required. In areas where structural fill placement is necessary to achieve grade, a minimum of 2 feet of surficial soils shall be excavated and removed prior to placing structural fill. Structural fill shall extend horizontally beyond the perimeter of all footers a minimum of 2 feet or a distance equal to the total depth of structural fill, whichever is less. Structural fill placed above the existing ground surface to achieve footing grade, beyond the 2-foot minimum level from the footings, shall have a maximum slope of 1.5(H):1(V).

Lateral loads may be resisted by friction between the footing base and supporting soil and lateral bearing pressure against the sides of the footings. For design purposes, a **coefficient of friction of 0.35** at the footing base is appropriate. A lateral passive bearing pressure of **300 PSF** per foot of depth is appropriate.

The above analysis assumes **a maximum width of 2.0 feet** for continuous footings and a maximum dimension of **8 feet for isolated footings**. Construction of large footing sizes can

lead to increased settlement as the bearing pressure bulb can extend deeper into the soil profile resulting in settlement of greater than that specified. The net allowable soil pressure includes dead load plus maximum live load. These calculations assume a minimum depth of burial of the footing of 42 inches and that a maximum total settlement of **0.5 inches** can be tolerated on any one footing and the maximum differential settlement between footings that can be tolerated is **0.5 inches**. Bearing capacity values and settlement should be checked for each combination of load to determine whether settlement or bearing capacity will control the response of the footing. This office shall be consulted to verify specific footing loads and sizes. **Isolated footings with bearing areas larger than 64 square feet or those foundation elements supporting large concentrated loads such as stone fireplaces shall be analyzed on an individual basis to determine settlement and bearing characteristics.** Other foundation parameters are as noted below:

1. A one-third increase in allowable bearing capacity may be used for short duration loads such as wind or seismic.
2. Backfill against shallow foundations and stem walls shall conform to the **FOUNDATION BACKFILL DETAIL** drawing in the Appendix. In no case shall material greater than 6 inches in diameter bear directly on or against foundation elements. Placing oversized material against rigid surfaces can damage the structure and interferes with proper compaction.
3. For stem walls and retaining walls that retain soils greater than 4 feet in height, follow the recommendations contained in the Retaining Walls section below.

Any soil type encountered at the bottom of footing excavations other than the ones described above shall be analyzed by Nelson Engineering. Isolated boulders at footing grade shall be excavated and removed unless approved by Nelson Engineering. Any excessively loose material or soft spots encountered in the footing subgrade will require over-excavation and backfilling with structural fill. All footings shall be suitably reinforced to make them as rigid as possible.

**Retaining Walls**

For this analysis, it is assumed that all retaining walls will be backfilled with compacted fill per the **FOUNDATION BACKFILL DETAIL** drawing in the Appendix.

For foundation or stem walls restrained from movement such that active earth pressures will not be allowed to develop, an at-rest equivalent fluid pressure of **60 PCF** is appropriate.

The Mononobe-Okabe (M-O) equations are often used to estimate dynamic forces against retaining walls. The M-O analysis is theoretically derived using active earth pressure conditions. Although there is debate about the theoretical applicability of this methodology to restrained or rigid walls, the method has been used for many years for the seismic design of such walls. The performance record of underground walls during earthquakes has generally been good. Appropriate parameters for the M-O analysis are: 1) soil unit weight 135 pounds per cubic foot, and 2) Internal Friction Angle= 35˚. The more limiting case, at-rest or active seismic pressure, shall be utilized in the structural design of restrained or rigid retaining walls.

For foundation or stem walls with active earth pressure loading, an equivalent fluid pressure of **45 PCF** is appropriate.

Excavations for retaining walls and foundations shall conform to the applicable OSHA and Wyoming safety standards.

**Interior Slabs-On-Grade**

In interior slab areas, a minimum of 1.0 feet thickness of the surface soils shall be excavated and removed. Interior slabs shall be founded upon the following section from top to bottom: 1) a leveling course mat 6 inches in thickness composed of a ¾-inch minus free draining material (WYDOT Grade W or equivalent) compacted to a minimum of 95% of maximum density as determined by ASTM D 1557, 2) the upper 8 inches of native subgrade soils compacted to a minimum of 95% density as determined by ASTM D 698. Any excessively loose material or soft spots encountered in slab subgrade will require over-excavation and backfilling with structural fill.

All slabs should be a minimum of 4 inches thick. A moisture retardant barrier can be placed beneath all floor slabs to minimize potential ground moisture effects on floor coverings and to minimize the potential for radon infiltration. Testing for the presence of radon has not been conducted at this location. If desired, placing ASTM C33 size 5 aggregate for the granular mat beneath slabs can enhance radon remediation.

Concrete slab-on-grade control joints should be saw-cut as early as possible. Nelson Engineering recommends the use of a soft cut system, which allows saw cutting as soon as the concrete can support foot traffic. Successful crack control is dependent upon proper joint spacing. Control joints should be placed in accordance with current Portland Cement Concrete Paving Association guidelines.

**Sidewalks and Exterior Slabs**

Sidewalks and exterior concrete slabs for foot traffic shall be placed upon a minimum of 6 inches of ¾-inch minus crushed gravel placed upon compacted native subgrade. Native subgrade shall be compacted to a minimum of 95% of maximum dry density per ASTM D698 and inspected to 8 inch depth. Any fill required to increase the elevation of the slab should meet the requirements for granular structural fill. (Refer to the section on structural fill for requirements). All fill material within 2 feet of the slabs must be compacted to a minimum 95% of the maximum density as determined by ASTM D698. Any excessively loose material, soft spots or isolated boulders encountered in the footing subgrade will require over-excavation and backfilling with structural fill.

**Driveway and Parking Lot Recommendations**

Recommended road and parking lot sections are given in the table below. Proper drainage is essential for satisfactory road and parking area performance. Where Nelson Engineering determines suitably dense native soils form the subgrade, the requirement of 10 inches of structural fill may waived.

| PAVEMENT SECTION COMPONENTS | Paved | Gravel Surfaced |
|---|---|---|
| Asphaltic Concrete | 2.0 inches | |
| ¾ inches Minus Crushed Aggregate | 4.0 inches | 6.0 inches |
| Structural Fill | 10 inches | 10 inches |
| Compacted Subgrade | Upper 8 inches of native in-place material compacted to 95% of the maximum density determined by ASTM D698. | |

**CONSTRUCTION CONSIDERATIONS**

**Earthwork and Site Grading**

Excavation work and heavy equipment access will be difficult when wet conditions exist. A protracted period of wet conditions can be expected during and after seasonal snowmelt. Placement of gravel surfacing and/or free-draining native material supported by geotextiles may be required to provide construction access. General recommendations for earthwork suitability, placement, and compaction procedures are provided below:

- Within structure footprints, hardscape, and areas to be paved, all organic material, undocumented fill, and debris should be stripped and removed. Loose and disturbed native soils should be scarified, moisture-conditioned, and compacted. Finish surfaces should be sloped away from the foundations at a minimum of five percent.

- 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. When site grading is interrupted by precipitation, filling operations should not resume until Nelson Engineering approves the moisture and density conditions of the previously placed fill.

- Silt, clayey sand and sandy lean clay matrix soils are present that will exhibit undesirable engineering properties when wetted. Every effort should be made to ensure that moisture from precipitation or other sources infiltrate foundation bearing, slab, and roadway subgrade during construction. Grading during construction shall be provided to drain storm water from the exposed excavations during precipitation and snowmelt events. In case of rain or snow, excavation work shall stop and exposed soils shall be covered to prevent moisture infiltration. If moisture has been allowed to infiltrate the subgrade and bearing soils in any fashion, filling and excavation operations shall not resume until Nelson Engineering approves the moisture and density conditions of the subgrade soils.

- **Structural Fill:** Pit run or gravel backfill as described herein may be utilized. **Pit run fill** shall consist of imported rock fragments from a local gravel pit with the following characteristics: 3/4 to 6-inch particle size with no more than 5% passing the #4 sieve and no more than 2% fines. Rock shall be placed in lifts of less than 10-inch thickness and compacted with a vibratory compactor approved by Nelson Engineering. **Gravel**

**fill** shall consist of imported or site derived coarse grained soils, (USCS classification GW, GP) with the following characteristics: 4-inch maximum particle size, no more than 30% oversize (greater than ¾ inch), a minimum of 30% greater than the #40 sieve, and less than 5% fines passing the #200 sieve with a Plasticity Index of less than 3. Gravel fill shall be placed in layers of not more than 8 inches in thickness. Each layer of gravel 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.

- Over-excavations and utility trenches should be laid back to safe slopes or properly shored. Excavations and shoring operations should be conducted in accordance with the most recent versions of the OSHA Construction Standards for Excavations, Part 1926, Subpart P and Wyoming Public Works Standard Specifications. Safety of construction personnel is the responsibility of the contractor. Excavations for utilities shall be shored if the proper slope cannot be maintained.

- During earthwork phases of the project, a representative of Nelson Engineering should be present to observe exposed native soils and fill materials for suitability and consistency. A documented testing program should be conducted to determine that soil compaction is in accordance with requirements.

- Backfill placed against structures (i.e., pipes and walls) shall be of a character and in a manner that will not damage that structure. In no case shall material greater than 6 inches in diameter bear directly on or against these structures. Placing oversized material against rigid surfaces can damage the structure and interferes with proper compaction.

**GENERAL COMMENTS**

It is critical that the structural engineer, civil engineer and other project designers review this report. When project plans and specifications are complete, a consultation with this office should be arranged to ensure compliance with this report. Additional or supplementary recommendations concerning foundations and earthwork may be required at this time. Monitoring and testing should also be performed to verify that suitable materials are used for structural fills and backfills and that fills are properly placed and compacted. Concrete testing and special inspections should be performed prior to and during placement of all concrete to ensure concrete and reinforcing steel bar comply with project plans and specifications.

## WARRANTY AND LIMITING CONDITIONS

The field observations and research reported herein are considered sufficient in detail and scope to form a reasonable basis for the purposes cited above. Nelson Engineering warrants that the findings and conclusions contained herein have been promulgated in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology, only for the site described in this report. No other warranties are implied or expressed.

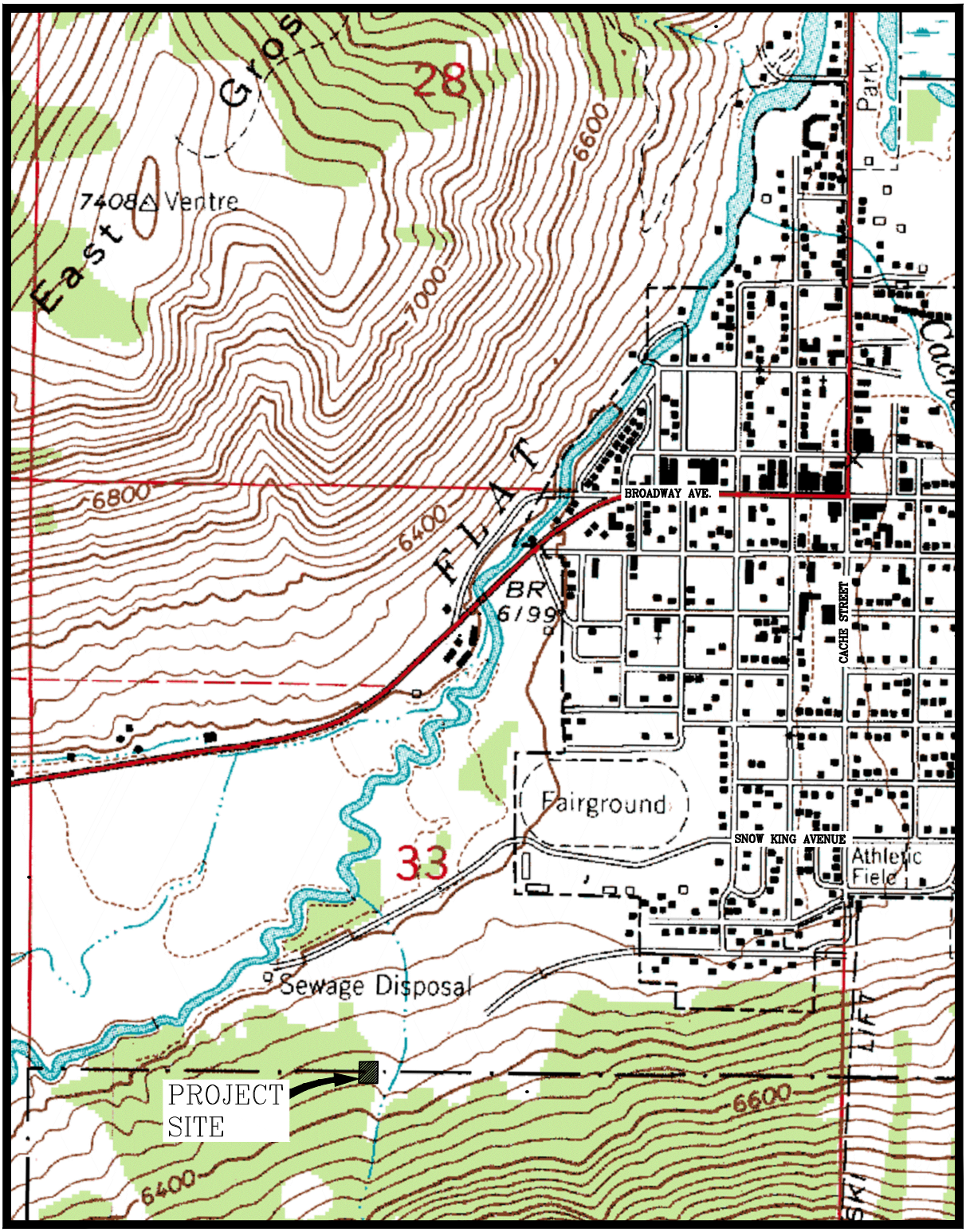
These engineering methods have been developed to provide the client with information regarding apparent or potential engineering conditions relating to the subject property within the scope cited above and are limited to the conditions observed at the time of the site visit and research. There is a distinct possibility that conditions may exist which could not be identified within the scope of the investigation or which were not apparent during the site investigation. The report is also 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. This report was prepared for use by Don Lebowitz in Jackson, Wyoming ("Client") and the conclusions and recommendations presented in this report are based on the agreed-upon scope of work outlined in the report and the contract for professional services between Client and Nelson Engineering ("Consultant"). 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 Consultant 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 such other parties for any purpose whatsoever, known or unknown, to the Client or Consultant. Neither Don Lebowitz nor Nelson Engineering shall have any liability to, or indemnifies or holds harmless third parties for any losses incurred, by the actual or purported use or misuse of this report. No other warranties are implied or expressed.

Blair Rushing, PE
Geotechnical Engineer

Philip Gyr, PE
Geotechnical Engineer

# APPENDIX

# DRAWINGS

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## VICINITY MAP

SCALE: 1"=1000'

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|---|---|---|---|---|---|
| DRAWING NO 1 | TITLE SITE VICINITY MAP<br>LOT 18 KARNS HILLSIDE<br>GEOTECHNICAL INVESTIGATION | NELSON ENGINEERING<br>P.O. BOX 1599, JACKSON WYOMING (307) 733-2087 | DATE | 11/8/16 | REV. |
| JOB NO 16-252-02 | | | SURVEYED | N/A | |
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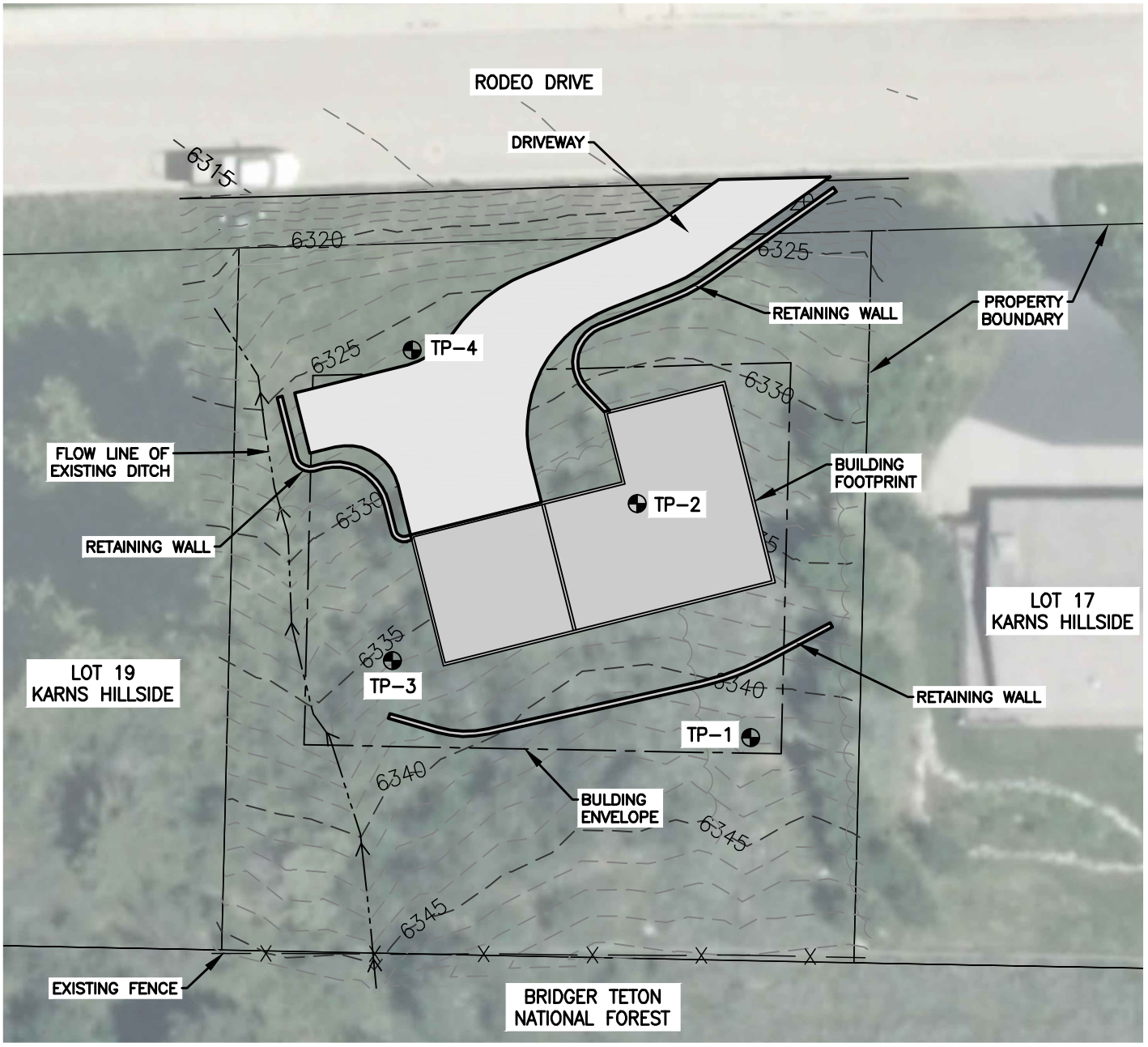
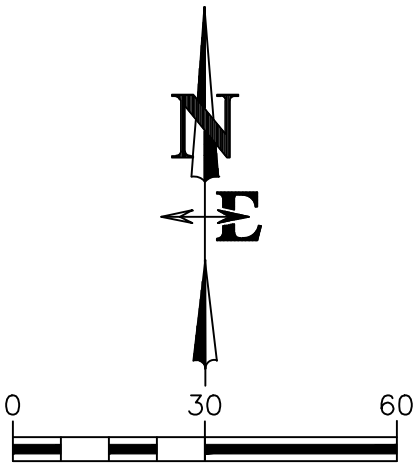
| | | | CHECKED | BR | |
| | | | APPROVED | PG | |

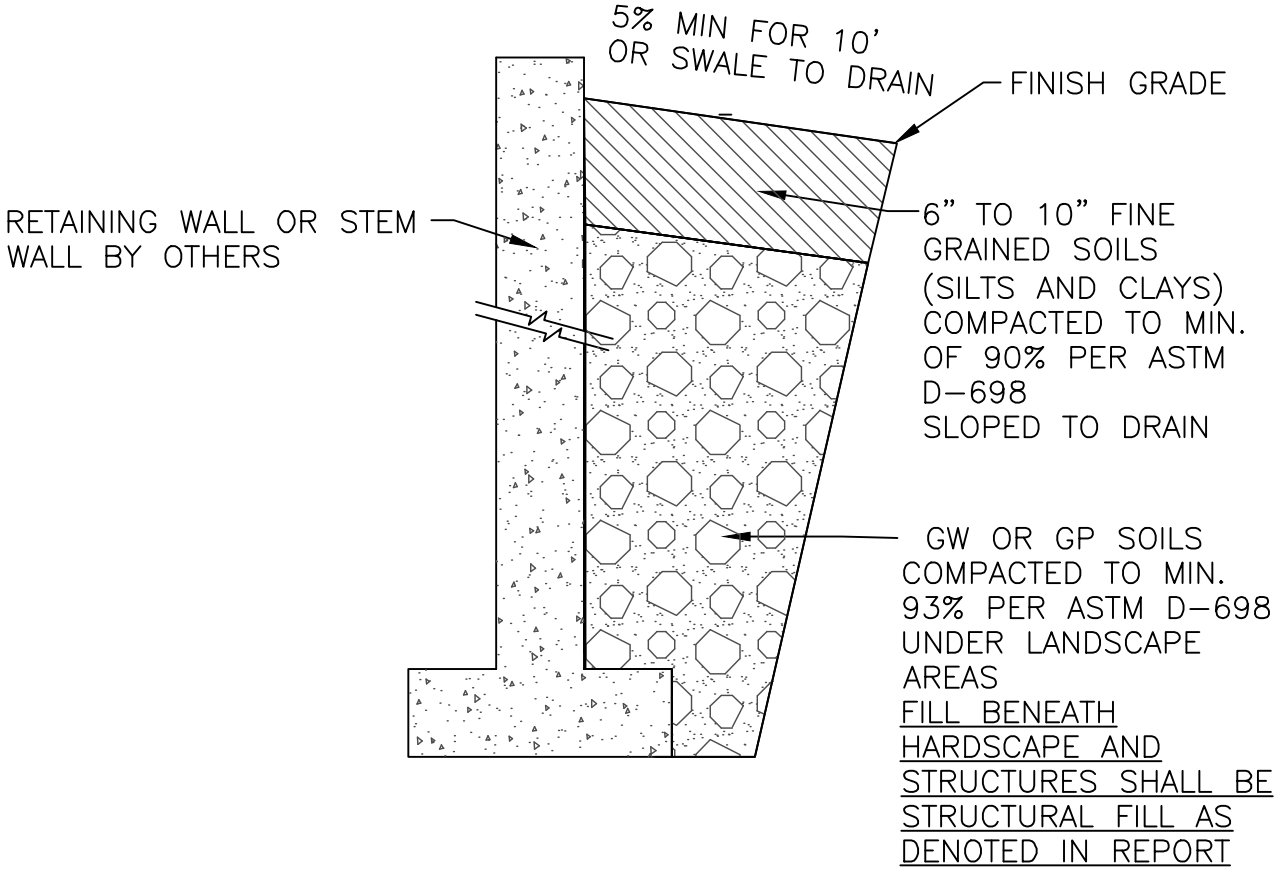



PROPERTY BOUNDARIES AND AERIAL PHOTOGRAPHY FROM 2015 PROVIDED BY TETON COUNTY GIS. SITE SURVEY PERFORMED BY NELSON ENGINEERING. TEST PITS LOCATED WITH TRIMBLE GPS UNIT WITH ±5 FEET ACCURACY.




| | | | | | |
|---|---|---|---|---|---|
| DRAWING NO 2 | TITLE TEST PIT LOCATION MAP LOT 18 KARNS HILLSIDE GEOTECHNICAL INVESTIGATION | NELSON ENGINEERING P.O. BOX 1599, JACKSON WYOMING (307) 733-2087 | DATE | 11/8/2016 | REV. |
| JOB NO 16-252-02 | | | SURVEYED | – | |
| | | | DRAWN | AP | |
| | | | CHECKED | BR | |
| | | | APPROVED | PG | |

S:\Proj2016\252-02 Lot 18 Karns Hillside Geotechnical\Lot 18 Karns Hillside TPLOCMAP.dwg <8x11> - Nov 08 2016 05:04:56 pm PLOTTED BY: rushing




FOUNDATION BACKFILL (TYPICAL)

NOT TO SCALE



| | | | | | |
|---|---|---|---|---|---|
| DRAWING NO 3 | TITLE: LOT 18 KARNS HILLSIDE<br>723 RODEO DRIVE<br>FOUNDATION BACKFILL TYPICAL | NELSON ENGINEERING<br>P.O. BOX 1599, JACKSON WYOMING (307) 733-2087 | DATE | 11 08 16 | REV. |
| JOB NO 16-252-02 | | | SURVEYED | | |
| | | | DRAWN | BR | |
| | | | CHECKED | BR | |
| | | | APPROVED | PG | |

# TEST PIT LOGS

## GEOTECHNICAL GENERAL NOTES

**CORRECTED SPT**: Standard Penetration Test values corrected to 60% of the theoretical free-fall hammer energy and for corrected for overburden pressure per AASHTO LRFD 6th ED Article 10.4.6.2.4.

**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

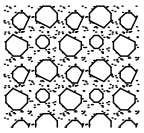
### SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

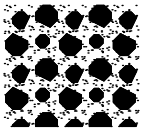
| Non-Cohesive Soils | Standard Penetration Resistance | Cohesive Soils | Pp-(tons/ft$^2$) |
|---|---|---|---|
| Very Loose | 0 - 4 | Very Soft | 0 - 0.25 |
| Loose | 4 - 10 | Soft | 0.25 - 0.50 |
| Slightly Compact | 8 - 15 | Firm (Medium) | 0.50 - 1.00 |
| Medium Dense | 10 - 30 | Stiff | 1.00 - 2.00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

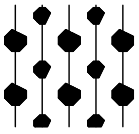
### PARTICLE SIZE

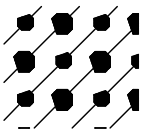
| | | | | |
|---|---|---|---|---|
| **Boulders:** | 12 in.+ | **Coarse Sand:** | 5 mm(#4)-2 mm(#10) | **Silts and Clays: <#200** |
| **Cobbles:** | 12 in.-3in. | **Medium Sand:** | 2 mm(#10)-0.4mm(#40) | |
| **Gravel:** | 3in.-5mm(#4) | **Fine Sand:** | 0.4mm(#40)-0.075mm(#200) | |

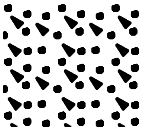
# SOIL GRAPHICS

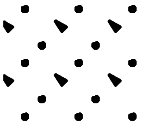
GW 

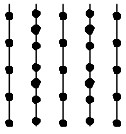
GP 

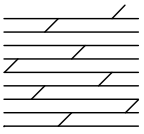
GM 

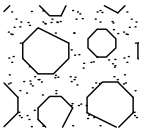
GC 

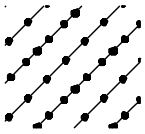
SW 

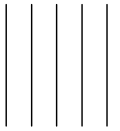
SP 

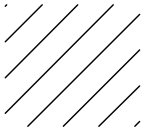
SM 

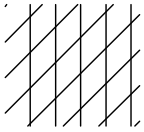
BEDROCK 

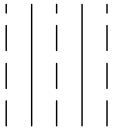
COBBLES/BOULDERS 

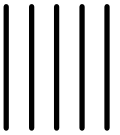
SC 

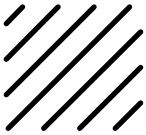
ML 

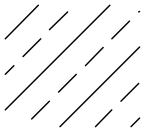
CL 

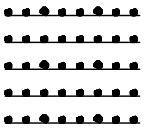
ML–CL 

OL 

MH 

CH 

OH 

PT 

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

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| | | | |
|---|---|---|---|
| PROJECT NAME: **LOT 18 KARNS HILLSIDE** | **TEST PIT No. 1** | PAGE: | 1 |
| DATE STARTED / FINISHED: **10/26/2016** | OPERATOR: **FISH CREEK EXCAVATION** | | |
| LOGGED BY: **PRUETT** | EXCAVATOR TYPE: **VOLVO EC160EL TRACK HOE** | | |
| BOREHOLE LOCATION/ELEVATION: **SEE TEST PIT LOCATION MAP** | | | |

| WELL LOG | GRAPHICS LOG | DEPTH (FT) | SAMPLES: UNDISTURBED | SAMPLES: BULK | SAMPLE ID | MATERIAL DESCRIPTION | LIQUID LIMIT | PLASTIC LIMIT | DRY DENSITY (PCF) | MOISTURE (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | This log is part of a report prepared by Nelson Engineering for this project and should be read with the report. This summary applies only at the location of the test pit and at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with passage of time. The data presented is a simplification of actual conditions encountered. | | | | | |
| | | | | | | *0'–3.0' MOIST DK BROWN SILT MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 18" MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLASTS, MODERATE ROOTS THROUGHOUT, MEDIUM DENSE, MATRIX PP=2–3 TSF, VERY STIFF, ~65% GRAVELS, COBBLES, AND BOULDERS, ~35% MATRIX* | | | | | *GRASS AND SAGEBRUSH N/NE–FACING SLOPE WITH COBBLES AND BOULDERS ON G.S.* |
| | | 2 | | | | | | | | | *HARD DIGGING THROUGHOUT* |
| | | 3 | | | | *3.0'–11.0' DRY TAN/LT BROWN CLAYEY SAND/SANDY LEAN CLAY MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 3' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLATS, DENSE TO VERY DENSE, ~80% GRAVELS, COBBLES, AND BOULDERS, ~20% MATRIX* | | | | | |
| | | 4 | | | | | | | | | |
| | | 5 | | | | *VARIABLE 6" LENSES OF FINE GRAVELS AND LEAN CLAY MATRIX THROUGHOUT* | | | | | |
| | | 6 | | | | | | | | | |
| | | 7 | | | | | | | | | |
| | | 8 | | | | | | | | | *MINOR RAVELING/CAVING OF TEST PIT WALLS* |
| | | 9 | | | | | | | | | |
| | | 10 | | | | | | | | | |
| | | 11 | | | | *11.0'–BOP MOIST BROWN/REDDISH BROWN CLAYEY SAND/SANDY LEAN CLAY MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 2' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLASTS, MATRIX PP=0.5–1.5 TSF, MEDIUM STIFF TO STIFF, DENSE, ~65% GRAVELS, COBBLES, AND BOULDERS, ~35% MATRIX* | | | | | |
| | | 12 | | X | *TP1–1 12'–13'* | | | | | | |
| | | 13 | | | | | | | | | |
| | | 14 | | | | | | | | | |
| | | 18 | | | | *BOP=18.0'  NO GROUNDWATER ENCOUNTERED* | | | | | |


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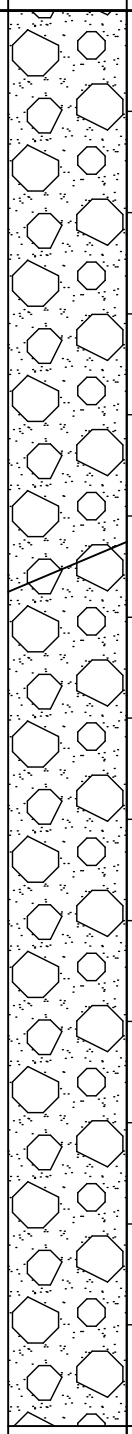
CLIENT: **DON LEBOWITZ**
**JACKSON, WYOMING**

JOB NO. 16–252–02

| | | | |
|---|---|---|---|
| PROJECT NAME: **LOT 18 KARNS HILLSIDE** | **TEST PIT No. 2** | PAGE: | **1** |
| DATE STARTED / FINISHED: **10/26/2016** | OPERATOR: **FISH CREEK EXCAVATION** | | |
| LOGGED BY: **PRUETT** | EXCAVATOR TYPE: **VOLVO EC160EL TRACK HOE** | | |
| BOREHOLE LOCATION/ELEVATION: **SEE TEST PIT LOCATION MAP** | | | |



| DEPTH (FT) | SAMPLES: UNDISTURBED | SAMPLES: BULK | SAMPLE ID | MATERIAL DESCRIPTION | LIQUID LIMIT | PLASTIC LIMIT | DRY DENSITY (PCF) | MOISTURE (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | *0'–5.5' MOIST TO DRY DK BROWN SILT MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 24" MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLASTS, MODERATE ROOTS THROUGHOUT, MEDIUM DENSE, MATRIX PP=2–3 TSF, VERY STIFF, ~60% GRAVELS, COBBLES, AND BOULDERS, ~40% MATRIX* | | | | | *GRASS AND SAGEBRUSH N/NE–FACING SLOPE ON FRINGE OF ASPEN GROVE WITH COBBLES ON G.S.* |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | *HARD DIGGING THROUGHOUT* |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | *5.5'–BOP DRY LT BROWN CLAYEY SAND/SANDY LEAN CLAY MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 4' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLATS, DENSE TO VERY DENSE, ~80% GRAVELS, COBBLES, AND BOULDERS, ~20% MATRIX* | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | *MINOR RAVELING/CAVING OF TEST PIT WALLS* |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | *REFUSAL AT 14' DUE TO LARGE BOULDER BOP=14.0'* | | | | | |
| 15 | | | | *NO GROUNDWATER ENCOUNTERED* | | | | | |

This log is part of a report prepared by Nelson Engineering for this project and should be read with the report. This summary applies only at the location of the test pit and at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with passage of time. The data presented is a simplification of actual conditions encountered.

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P.O. BOX 1599, JACKSON WYOMING (307) 733–2087

CLIENT: **DON LEBOWITZ**
**JACKSON, WYOMING**

JOB NO. 16–252–02

| | | | |
|---|---|---|---|
| PROJECT NAME: **LOT 18 KARNS HILLSIDE** | **TEST PIT No. 3** | PAGE: | **1** |
| DATE STARTED / FINISHED: **10/26/2016** | OPERATOR: **FISH CREEK EXCAVATION** | | |
| LOGGED BY: **PRUETT** | EXCAVATOR TYPE: **VOLVO EC160EL TRACK HOE** | | |
| BOREHOLE LOCATION/ELEVATION: **SEE TEST PIT LOCATION MAP** | | | |

This log is part of a report prepared by Nelson Engineering for this project and should be read with the report. This summary applies only at the location of the test pit and at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with passage of time. The data presented is a simplification of actual conditions encountered.

| WELL LOG | GRAPHICS LOG | DEPTH (FT) | SAMPLES: UNDISTURBED | SAMPLES: BULK | SAMPLE ID | MATERIAL DESCRIPTION | LIQUID LIMIT | PLASTIC LIMIT | DRY DENSITY (PCF) | MOISTURE (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | *0'–3.0' MOIST DK BROWN SILT MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 3' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLASTS, MODERATE ROOTS THROUGHOUT, MEDIUM DENSE, MATRIX PP=2–3 TSF, VERY STIFF, ~60% GRAVELS, COBBLES, AND BOULDERS, ~40% MATRIX* | | | | | *WITHIN ASPEN GROVE WITH GRASS AND SAGEBRUSH, E OF EXISTING DRAINAGE CHANNEL WITH COBBLES AND BOULDERS ON G.S.* |
| | | 2 | | | | | | | | | |
| | | 3 | | | | *3.0'–BOP DRY BROWN CLAYEY SAND/SANDY LEAN CLAY MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 4' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLATS, DENSE TO VERY DENSE, ~80% GRAVELS, COBBLES, AND BOULDERS, ~20% MATRIX* | | | | | *HARD DIGGING THROUGHOUT* |
| | | 4 | | | | | | | | | |
| | | 5 | | | | | | | | | |
| | | 6 | | | | | | | | | |
| | | 7 | | | | | | | | | |
| | | 8 | | | | | | | | | |
| | | 9 | | | | | | | | | |
| | | 10 | | | | | | | | | *4' BOULDER FROM 10'–11.5'* |
| | | 11 | | | | | | | | | |
| | | 12 | | | | | | | | | |
| | | 13 | | | | | | | | | |
| | | 14 | | | | | | | | | |
| | | 16 | | | | *BOP=16.0'  NO GROUNDWATER ENCOUNTERED  NO CAVING* | | | | | |

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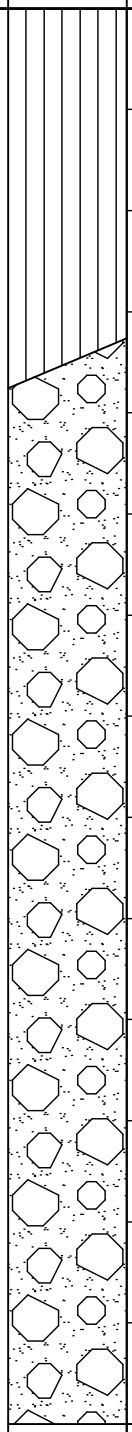
CLIENT: **DON LEBOWITZ**
**JACKSON, WYOMING**

JOB NO. 16–252–02

| | | | |
|---|---|---|---|
| PROJECT NAME: **LOT 18 KARNS HILLSIDE** | **TEST PIT No. 4** | PAGE: | **1** |
| DATE STARTED / FINISHED: **10/26/2016** | OPERATOR: **FISH CREEK EXCAVATION** | | |
| LOGGED BY: **PRUETT** | EXCAVATOR TYPE: **VOLVO EC160EL TRACK HOE** | | |
| BOREHOLE LOCATION/ELEVATION: **SEE TEST PIT LOCATION MAP** | | | |



| DEPTH (FT) | SAMPLES: UNDISTURBED | SAMPLES: BULK | SAMPLE ID | MATERIAL DESCRIPTION | LIQUID LIMIT | PLASTIC LIMIT | DRY DENSITY (PCF) | MOISTURE (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | *0'–3.5' MOIST DK BROWN SILT MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 12" MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLASTS, MODERATE ROOTS THROUGHOUT, MEDIUM DENSE, MATRIX PP=1–2 TSF, STIFF, ~50% GRAVELS, COBBLES, AND BOULDERS, ~50% MATRIX* | | | | | *GRASS AND SAGEBRUSH N–FACING SLOPE* |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | *3.5'–BOP DRY BROWN/LT BROWN CLAYEY SAND/SANDY LEAN CLAY MATRIX WITH GRAVELS, COBBLES, AND BOULDERS UP TO 3' MAXIMUM DIMENSION, COLLUVIUM, ANGULAR TO SUB–ANGULAR CLATS, DENSE TO VERY DENSE, ~80% GRAVELS, COBBLES, AND BOULDERS, ~20% MATRIX* | | | | | *HARD DIGGING THROUGHOUT* |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | *ABUNDANT GRAVELS AND SMALL COBBLES AND MINOR BOULDERS FROM 3.5'–BOP* |
| 8 | | | *TP4–1 8'–9'* | | | | | | |
| 9 | | | | | | | | | *MINOR RAVELING/CAVING OF TEST PIT WALLS* |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | *REFUSAL AT 14' DUE TO LARGE BOULDER BOP=14.0'* | | | | | |
| | | | | *NO GROUNDWATER ENCOUNTERED* | | | | | |
| 15 | | | | | | | | | |

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

CLIENT: **DON LEBOWITZ**
**JACKSON, WYOMING**

JOB NO. 16–252–02

# APPENDIX B

## SLOPE STABILITY ANALYSIS RESULTS

**Table. 1, Geotechnical parameters for layers**

| Layer | $\rho_m$ (lb/ft$^3$) | C (psf) | φ (°) |
|---|---|---|---|
| Base Material | 135 | - | 35 |

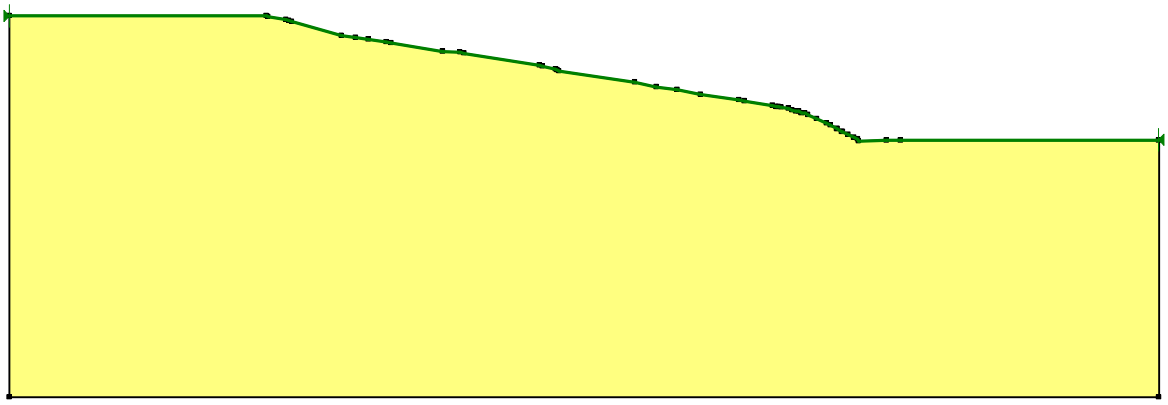

**Figure 1- STATION 0+16.90- Equilibrium Model**

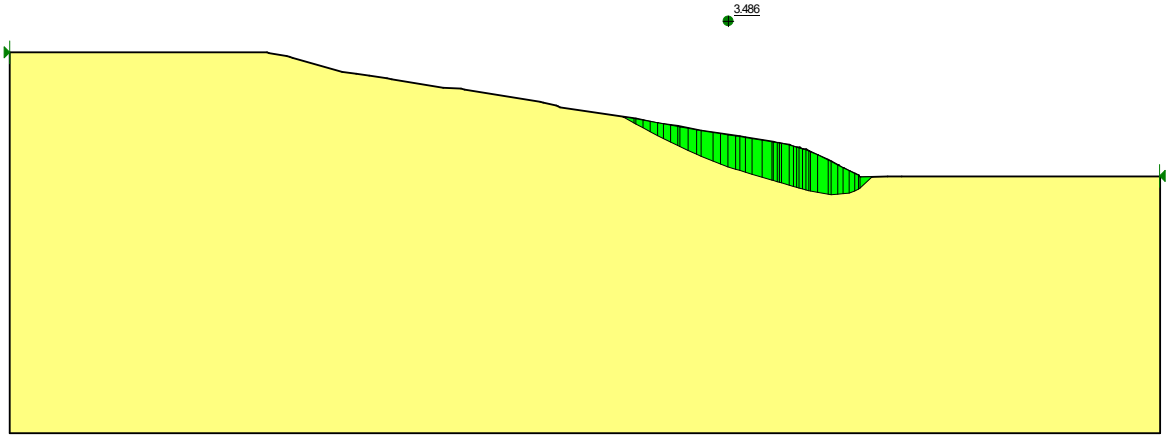


**Figure 2- STATION 0+16.90- Failure Surface**

**FS=3.49**

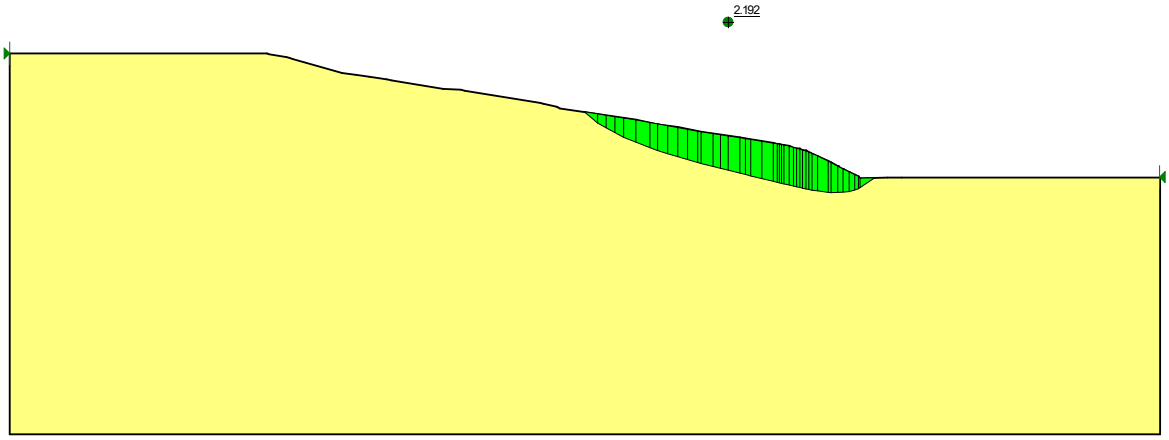


**Figure 3- STATION 0+16.90- Failure surface in earthquake condition**

**FS=2.19**

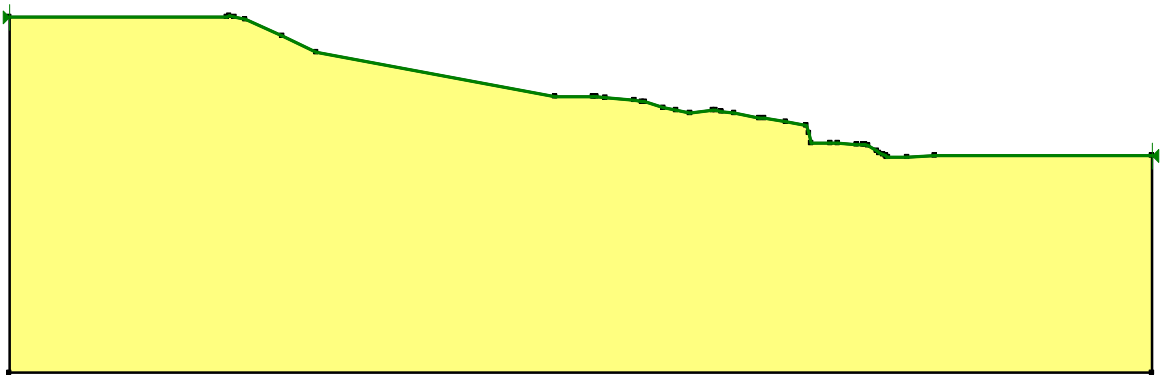

**Figure 4- STATION 0+41.24- Equilibrium Model**

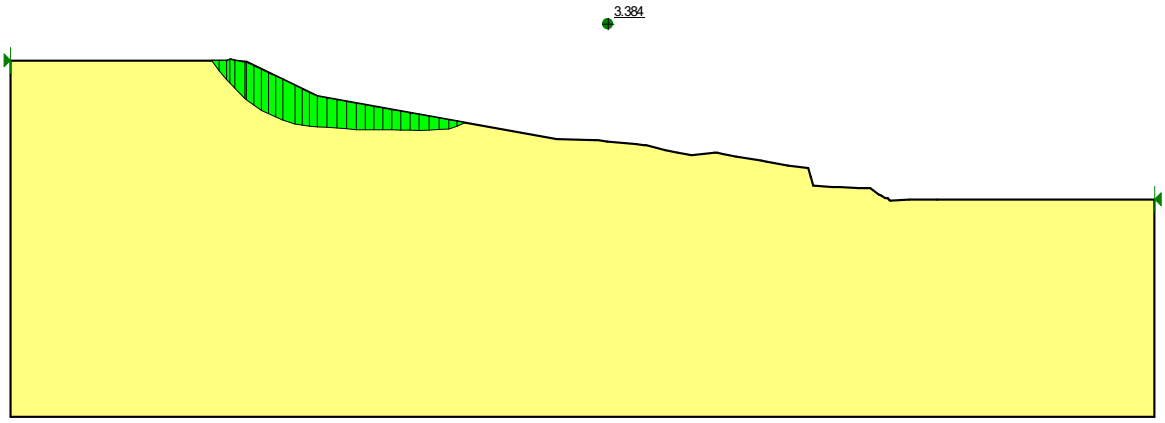


**Figure 5- STATION 0+41.24- Failure Surface**

**FS=3.38**

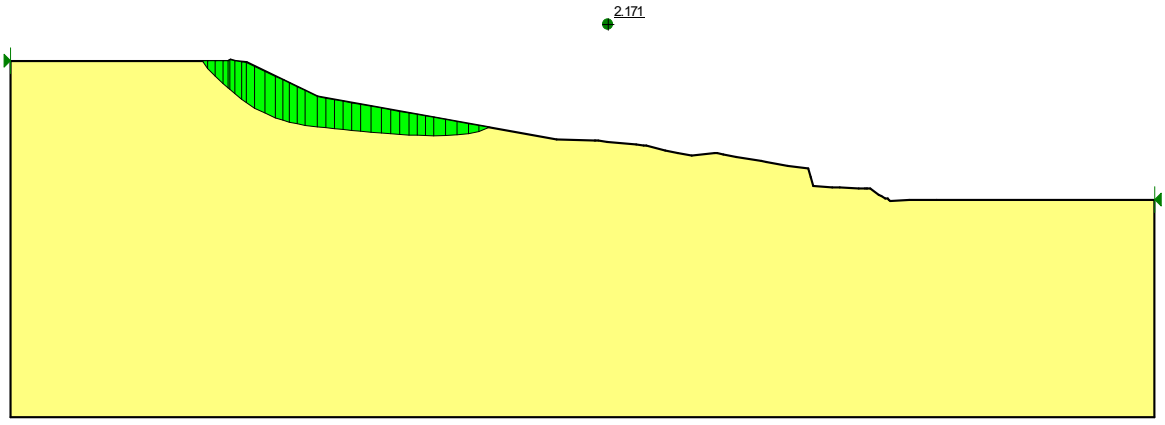


**Figure 6- STATION 0+41.24- Failure surface in earthquake condition**

**FS=2.17**

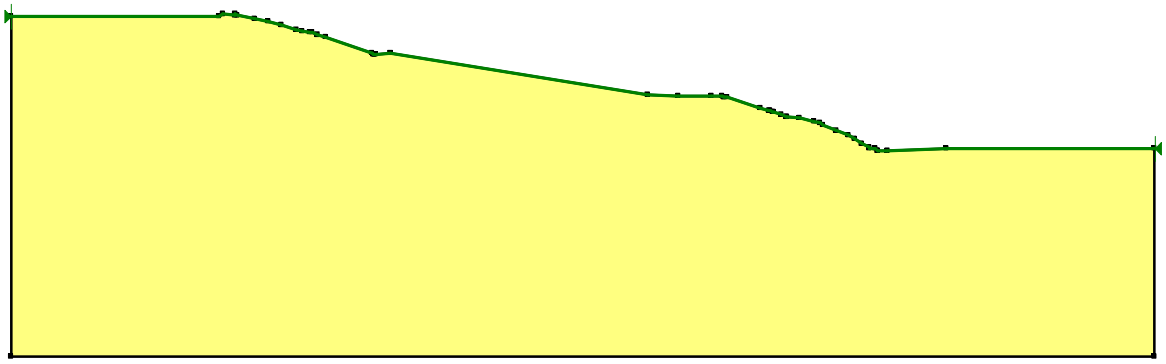

**Figure 7- STATION 0+94.45- Equilibrium Model**

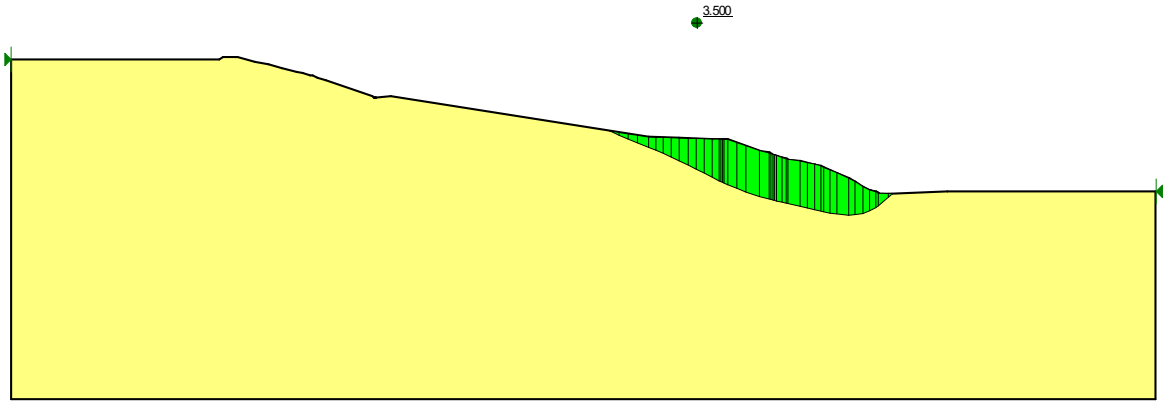


**Figure 8- STATION 0+94.45- Failure Surface**

**FS=3.50**

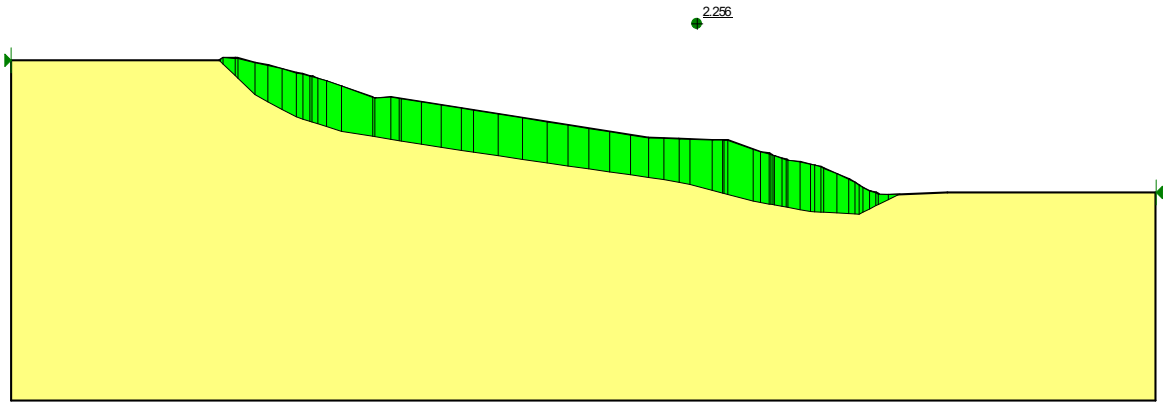


**Figure 9- STATION 0+94.45- Failure surface in earthquake condition**

**FS=2.25**

**Summary:**

**Table. 2, Safety factor of Limit equilibrium**

| STATION | Static | Pseudo static |
|---|---|---|
| STATION 0+16.90 | 3.49 | 2.19 |
| STATION 0+41.24 | 3.38 | 2.17 |
| STATION 0+94.45 | 3.50 | 2.25 |