FINAL
STRUCTURAL FOUNDATION ENGINEERING REPORT
REVISED

Chilkat River
Bridge No. 0742

HAINES HWY MP 3.5 TO 25.3

PROJECT NUMBER: 0956028/ Z686060000

May 2023

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No. CE - 9800
5/8/2023

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Contents

Introduction

This report presents structural foundation engineering recommendations for the proposed replacement Chilkat River Bridge No. 0742, which will cross the Chilkat River on the Haines Highway, about 23 miles north of Haines, Alaska. This bridge is located at about 59.41524°N 135.9322°W. This report is based on information provided by the Southcoast Region Highway Design Section, the Statewide Bridge Design Section, and the Southcoast Region Materials Section subsurface investigation.

This will be a new structure having the following characteristics:

- Four spans
- new bridge along existing road alignment
- overall length of 541 feet
- overall width of 39 feet 4 inches
- no skew
- begin bridge station: 1224+58.00
- end bridge station: 1229+99.00

Limitations

The analysis and recommendations contained in this report are based on the results of field exploration, laboratory testing, and engineering evaluation. The available subsurface soil explorations indicate conditions only at the specific borehole locations, at a specific time, and only to the depths penetrated. The boreholes do not necessarily reflect strata variations that may exist between, and adjacent to, the drilled boreholes.

If variations in the subsurface soils from those described in the Foundation Geology Report are noted during construction, notify the State Foundation Engineer so the recommendations in this report may be re-evaluated.

If any changes in the character, design, or location of the proposed structure are made, the conclusions and recommendations in this report become invalid unless the changes are reviewed, and the conclusions in this report are modified, or verified by the State Foundation Engineer.

Seismic

The General Procedure outlined in Section 3.4 of the AASHTO LRFD Seismic Bridge Design Specifications (2020) was followed to characterize the seismic hazard. The General Procedure uses mapped gridded values of peak ground acceleration, 0.2 second spectral acceleration, and 1.0 second spectral acceleration to develop the 5-percent-damped-design response spectrum chart.

These procedures use a design earthquake with a return period of 975 years, or a 7 percent probability of exceedance (PE) in 75 years. Site class D was selected for the bridge site. Site factors were selected from Table 3.4.2.3-1 through 3.4.2.3-2 in AASHTO (2020) and multiplied by the mapped peak ground accelerations and spectral accelerations in order to determine the modified peak ground acceleration and spectral accelerations. The results of the hazard analysis are presented in Tables 1 and 2.

Table 1: Recommended seismic parameters for Chilkat River Bridge, No. 0742

Parameter	Value
Acceleration Coefficient, (PGA)	0.32 g
Spectral Acceleration Coefficient at Short Period, (S_S)	0.74 g
Spectral Acceleration Coefficient at Period of 1.0 s, (S_1)	0.29 g

Table 2: Recommended seismic parameters for Chilkat River Bridge, No. 0742

Parameter	Abutment 1	Piers 2, 3, 4, Abutment 5
Site Class	E	D
Site Factor at Zero Period, (F_{pga})	1.13	1.18
Site Factor for Short Period, (F_a)	1.21	1.20
Site Factor for Long Period, (F_v)	2.85	1.83
Design Ground Acceleration Coefficient (A_s)	0.36 g	0.38 g
Design 0.2-sec Spectral Acceleration Coefficient, (S_{DS})	0.90 g	0.89 g
Design 1.0-sec Spectral Acceleration Coefficient, (S_{D1})	0.82 g	0.53 g
Seismic Zone	4	4
Seismic Design Category	D	D

Statewide Materials classified Abutment 1 as Site Class E while Piers 2, 3, 4, and Abutment 5 were classified as Site Class D. The site class designation is based on the soil stiffness as determined by the Standard Penetration Test (SPT) blow counts (AASHTO 2020).

Section 3.10.2 of the 2020 AASHTO LRFD Bridge Design Specifications states that a site-specific acceleration spectrum should be developed for sites within 6 miles of an active fault less than 10,000 years old. This bridge site is within an area of defined seismicity, however, the age of the nearest fault, the Chilkat River section of the Denali Fault, is aged at 1.6 million years and therefore does not require a site-specific analysis, and the AASHTO general procedure is recommended.

Liquefaction

The project site is classified as seismic zone 4 based on the calculation of the response acceleration coefficient, S_{D1} (AASHTO Table 3.10.6-1). Section 10.5.4.2 of the 2020 AASHTO LRFD Bridge Design Specifications states that a liquefaction assessment shall be conducted for projects within Seismic Zones 3 and 4 if:

- The groundwater level anticipated at the site is within 50 feet of the existing or Final ground surface, whichever is lower, and
- Sands and low plasticity silts are present in the upper 75 feet that have corrected SPT blow counts, $(N_1)_{60}$, less than or equal to 25 blows per foot.

Groundwater at the site was observed within 15 feet of the existing ground surface at the abutments and over the surface at the piers; and soils with corrected N-values less than 25 blows per foot are present at the site; therefore, a liquefaction assessment was determined to be necessary.

Section 3.10.1 of the 2020 AASHTO LRFD Bridge Design Specifications states that bridges shall be designed based on earthquake ground motions that have a 7 percent probability of exceedance in 75 years. This probability of exceedance corresponds to a return period of about 1000 years.

A liquefaction analysis was conducted using the simplified empirical method as outlined by Youd et al. (2001). The design earthquake was selected based on the deaggregation of the probabilistic seismic hazard which was completed for this site using the internet-based USGS Interactive Deaggregation, Dynamic: Alaska 2007 (v2.1.2) and the historical earthquake record for nearby faults. A design earthquake with a moment magnitude (M_w) of 7.47 was selected. The corresponding site modified Peak Ground Acceleration of soil (A_s) used in the analysis was 0.38 g.

Liquefaction Analysis Results

Liquefaction potential is considered “high” when the capacity to demand ratio is calculated at 1.1 or lower, is considered “medium” when calculated to be between 1.1 and 1.4 and is considered “low” when the capacity to demand ratio is calculated at higher than 1.4. Results from the simplified analysis indicate that the liquefaction potential is high at the bridge site.

Abutment 1:

Using the earthquake magnitude and ground acceleration input parameters defined above, the results of the liquefaction analysis indicate that the design ground motions will generate excess pore water pressure sufficient to trigger full liquefaction. In the test holes (TH10-1A & TH10-1B) directly above the abutment, a fully liquefiable layer is present from about 17-42 feet below existing ground surface (elevation 119 to 94 feet) as well as from about 102-115 feet below existing ground surface (elevation 34 to 21 feet).

Pier 2:

Using the earthquake magnitude and ground acceleration input parameters defined above, the results of the liquefaction analysis indicate that the design ground motions will generate excess pore water pressure sufficient to trigger full liquefaction. In the test hole (TH10-2) which represents Pier 2, a fully liquefiable layer is present from about 0-9 feet below existing ground surface (elevation 112 to 104 feet).

Pier 3:

Using the earthquake magnitude and ground acceleration input parameters defined above, the results of the liquefaction analysis indicate that the design ground motions will generate excess pore water pressure sufficient to trigger full liquefaction. In the test hole (TH10-3) which represents Pier 3, a fully liquefiable layer is present from about 7-22 feet below existing ground surface (elevation 104 to 89 feet) as well as from about 53-62 feet below existing ground surface (elevation 58 to 49 feet).

Pier 4:

Using the earthquake magnitude and ground acceleration input parameters defined above, the results of the liquefaction analysis indicate that the design ground motions will generate excess pore water pressure sufficient to trigger full liquefaction. In the test hole (TH10-4) which represents Pier 4, a fully liquefiable layer is present from about 10-29 feet below existing ground surface (elevation 108 to 89 feet) as well as from about 51-53 feet below existing ground surface (elevation 67 to 65 feet), as well as from about 64-68 feet below existing ground surface (elevation 54 to 50 feet) as well as from about 75-79 feet below existing ground surface (elevation 43 to 39 feet).

Abutment 5:

Using the earthquake magnitude and ground acceleration input parameters defined above, the results of the liquefaction analysis indicate that the design ground motions will generate excess pore water pressure sufficient to trigger full liquefaction. In the test hole (TH10-5) which represents Abutment 5, a fully liquefiable layer is present from about 18-26 feet below existing ground surface (elevation 118 to 110 feet) as well as from about 32-51 feet below existing ground surface (elevation 104 to 85 feet), as well as from about 71-76 feet below existing ground surface (elevation 65 to 60 feet).

Liquefaction Induced Settlement:

Liquefaction induced settlement at the project site was estimated using methods developed by Tokimatsu & Seed (1987) with M correction, and by Ishihara & Yoshimine (1992), and using the seismic parameters of the design earthquake. Actual settlements are expected to be between on half to two times the calculated value.

Table 3: Summary of Liquefaction induced Settlement at each Substructure

Location	Calculated Surface Settlement
Abutment 1	11 inches
Pier 2	3 inches
Pier 3	6 inches
Pier 4	9 inches
Abutment 5	10 inches

Drag Load

Section 3.11.8 of the 2020 AASHTO LRFD Bridge Design Specifications states that drag load on piles or shafts shall be evaluated when:

- sites are underlain by compressible material such as clay, silt, or organic soil,
- fill will be, or has recently been, placed adjacent to piles or shafts,

- groundwater is substantially lowered, or
- liquefaction of loose, sandy soil can occur.

This is expected to have foundations in liquefiable soils, therefore a drag analysis was performed.

As per the neutral plane analysis method, drag loads will develop in pile foundations due to minute settlements of the surrounding soils after pile installation. The nominal drag load is expected to change during and immediately after the design seismic event, as the soil/pile friction is not expected to change because no excess pore pressures are predicted to develop from the earthquake shaking.

The drag loads presented below should be multiplied by an appropriate load factor and then combined with the factored dead load in order to check for structural adequacy of the pile. Note that drag load is zero in the strength limit state, as the drag loads will diminish with downward pile deformation.

Table 4: Summary of Nominal Drag Load at each Substructure

Location	Pile Size	Nominal Drag Load (Seismic)	Nominal Drag Load (Static)	Load Factor (Seismic / Static)
Abutment 1	24” x 0.50” Pipe	215 kips	215 kips	1.00 / 1.40
Pier 2	48” x 1.00” Pipe	410 kips	410 kips	1.00 / 1.40
Pier 3	48” x 1.00” Pipe	385 kips	385 kips	1.00 / 1.40
Pier 4	48” x 1.00” Pipe	380 kips	380 kips	1.00 / 1.40
Abutment 5	24” x 0.50” Pipe	145 kips	160 kips	1.00 / 1.40

Table 5: Summary of Neutral Plane Analysis

Location	Pile Size	Assumed Pile Length	Assumed Nominal Dead Load	Calculated Pile Settlement (seismic condition)
Abutment 1	24” x 0.50” Pipe	146 feet	189 kips	0 inches

Pier 2	48” x 1.00” Pipe	152 feet	396 kips	0 inches
Pier 3	48” x 1.00” Pipe	146 feet	396 kips	0 inches
Pier 4	48” x 1.00” Pipe	147 feet	396 kips	0 inches
Abutment 5	24” x 0.50” Pipe	145 feet	189 kips	0 inches

Note: Pile settlement during the seismic condition can be reduced with increased pile embedment. Increased pile length will also increase the drag forces acting on the pile in both static and seismic conditions.

Scour

Although the abutments will be protected with rip rap, 10 feet of scour has been assumed for each abutment at this bridge. Scour has been accounted for by attributing zero skin friction from the layers or soil within the scour zone. However, this skin friction will be present during pile driving and must be overcome during pile installation. This increased driving resistance must be added to the required driving resistance as shown in the contract and is presented below as overdrive resistance.

The estimated depth of scour should be reviewed after the Hydraulics and Hydrology report is finalized.

Table 6: Estimated Overdrive Resistance Required to Account for Soil Scour

Location	Pile Size	Depth of Scour	Nominal Overdrive
Abutment 1	24”	10 feet	10 kips
Pier 2	48”	17 feet	30 kips
Pier 3	48”	18 feet	40 kips
Pier 4	48”	19 feet	35 kips
Abutment 5	24”	10 feet	10 kips

Lateral Resistance

No pile lateral resistance calculations were performed with these recommendations. The soil parameters tabulated in Appendix C may be used in the lateral analysis. The tables include parameters for use in software programs such as FB-MultiPier, COM624, and LPILE, which will internally generate the p-y curves. These parameters may also be input into the program DFSAP, which uses the strain wedge model to predict the lateral performance. The parameters listed are for lateral analysis only and should not be used in any other fashion.

Do not apply resistance factors to any of the parameters in these tables, as these are displacement-based analyses, even at the strength limit state.

The lateral response of the piles should also be checked during a frozen soil condition.

Group Reduction Factors

For lateral pile loading, reductions in the soil response p-y curves are necessary if the piles are spaced close enough to influence the other piles in the group. The values of P shall be multiplied by P-multiplier values, P_m, to account for group effects. The values of P_m presented below should be used, if applicable.

Longitudinal Direction

For pile loading in the longitudinal direction, it is necessary to reduce the P values in the soil response p-y curves if the center to center spacing of the piles is less than 5 equivalent pile diameters. The p-y multiplier can be determined from the equation below:

$P_m = 0.1(S) + 0.5$

Where:

P_m = p-y multiplier

S = center to center pile spacing, expressed in number of equivalent pile diameters

Transverse Direction

For pile loading in the transverse direction, it is necessary to reduce the P values in the soil response p-y curves if the center to center spacing of the piles is less than 5 equivalent pile diameters. The p-y multiplier for the first pile can be determined from the equation below:

$P_m = 0.1(S) + 0.5$

The second pile will be influenced by the “shadow” of the first pile if the pile spacing is less than 5.7 equivalent pile diameters. The p-y multiplier for the second pile can be determined from the equation below:

$P_m = 0.225(S) - 0.275$

The third and subsequent piles will be influenced by the “shadow” of the piles in front if the pile spacing is less than 6.5 equivalent pile diameters. The p-y multiplier for the third and subsequent piles can be determined from the equation below:

$P_m = 0.2(S) - 0.3$

Roadway Approach Embankment

Backfill material behind the abutment walls should be Selected Material, Type A per Section 205 of Standard Specifications. This material may be modeled with a total unit weight of 138 pcf and an angle of internal friction of 36°.

Global Stability and Lateral Displacements

A stability analysis was performed for Abutment 1 and Abutment 5. The slopes were analyzed for static and seismic (pseudo-static) stability using *Slide 7.0* (Rocscience, Inc. 2016). Residual soil strengths were used to model the effects of liquefaction during and after the seismic event using the procedure proposed by Kramer (2008). The passive resistive force provided by the bridge superstructure and the shear resistance provided by the abutment piles were included in each analysis. The bridge superstructure resistive force was calculated using the guidelines developed by Caltrans (2012). The piles were modeled as 24 inch diameter, 0.5 inch wall steel pipe piles filled with reinforced concrete using *RSPile 1.0* (Rocscience, Inc. 2016). Graphic results from the stability analysis are provided in Appendix D.

The bridge configuration and pile spacing used in this analysis were based on the CAD drawing provided by Bridge Design on April 19, 2016. The modulus of elasticity for the pile and reinforced concrete core was assumed to be 40,600 ksi. If the width of the bridge or the spacing of the piles is modified this analysis should be updated to reflect the new configuration and the slope stability re-evaluated.

Static Stability

Under static conditions a minimum capacity to demand (C/D) ratio of 1.5 is required for the slope to be considered stable. The results of the static analysis indicate that both slopes are acceptable.

- Static C/D ratio for Abutment 1 = 2.32
- Static C/D ratio for Abutment 5 = 2.19

Seismic Stability

Pseudo-static slope stability analyses were performed at both abutments using the estimated full drained strength of the foundation soils and a seismic coefficient of 0.190 g, which is one-half of the surface acceleration (0.5 x PGA x F_{pga} from Tables 1 and 2) and corrected for embankment height. This model mimics conditions during an earthquake before any loss of soil strength occurs. Slope migration is expected to be less than two inches if the C/D ratio is greater than 1.1.

The results of the pseudo-static analysis indicate that both slopes are acceptable.

- Seismic C/D ratio for Abutment 1 = 1.64
- Seismic C/D ratio for Abutment 5 = 1.43

Post-Liquefaction Static Stability

Static slope stability analyses were performed at both abutments using the estimated residual strength of the foundation soils. This model mimics conditions after shaking has ceased and maximum pore pressures occur. A C/D ratio greater than 1.0 is required for the slope to be considered stable. If the C/D ratio is less than 1.0 flow failure is predicted to occur.

The results of the post-liquefaction static stability analysis indicate that both slopes are acceptable.

- Post Liquefaction Static Stability C/D ratio for Abutment 1 = 1.22
- Post Liquefaction Static Stability C/D ratio for Abutment 5 = 1.58

Post-Liquefaction Seismic Stability

Pseudo-static slope stability analyses were performed at both Abutment 1 and Abutment 5 using the estimated residual strength of the foundation soils and a seismic coefficient of 0.190 g, which is one-half of the surface acceleration (0.5 x PGA x F_{pga} from Tables 1 and 2) and corrected for embankment height. This model mimics conditions during an earthquake when the soil strength is reduced due to increased pore pressures. Under these conditions incremental displacement of the slope towards the channel is possible. Total slope displacement is expected to be less than two inches if the C/D ratio is greater than 1.1.

- Post-Liquefaction Seismic Stability C/D ratio for Abutment 1 = 0.86
- Post-Liquefaction Seismic Stability C/D ratio for Abutment 5 = 1.31

The results of the post-liquefaction static stability analysis indicate that Abutment 1 is expected to have more than one or two inches of slope displacement, even with the shear strength provided by the piles included in the analysis.

To quantify the expected lateral spread, a Newmark sliding block analysis was performed (Bray and Travasarou, 2008). The analysis indicates that when using the shear resistance of one row of 24-inch piles with a center to center spacing of 6.5 feet, slope migration is expected to be less than one half of the pile diameter, which is the performance criteria established by the Department's Bridge Design Section. The results of the analysis are presented below:

- Post-Liquefaction Seismic Stability yield acceleration for Abutment 1 = 0.11 g
- Post-Liquefaction Seismic Stability lateral displacement for Abutment 1 = 10 inches

Foundation Recommendations

Driven pipe piles are recommended to support the abutments and piers at this bridge. Figure 1 and Figure 5 present the estimated driving resistances and uplift resistance for 24-inch diameter pipe piles at the abutments. Figures 2 through Figure 4 present the estimated driving resistances and uplift resistance for 48-inch diameter pipe piles at the piers. Actual observed capacities are expected to vary plus or minus 25 percent from the presented calculated values.

The following recommendations apply:

- The combined axial capacity (compression and uplift) of a pile group can be estimated by summing the capacities of the individual piles, so long as the piles are spaced no closer than 2.5 times the widest dimension of the pile.
- Group effects have not been included in the attached capacity estimates. If pile spacing is less than 2.5 times the diameter of the pile, group effects must be considered in the axial capacity calculations.
- Piling should be grade 50 steel.
- The method of support for the foundation piles will be from both side friction and end bearing.
- The actual pile tip elevations will vary across the footprint of the foundation as the bearing layer is not anticipated to be level.
- The foundation piles should be installed vertical (plumb).

Pile Field Acceptance

Statewide Materials recommends monitoring the pile installation using either dynamic testing with signal matching (PDA/CAPWAP) on one pile per substructure or by using the presumptive wave equation without dynamic measurements.

The following resistance factor should be applied to the nominal resistance as observed from the chosen testing method to obtain the required capacity:

Table 7: Recommended Field Acceptance Methods and Appropriate Resistance Factors

Resistance Determination Method	Resistance Factor	Source

Table 7: Recommended Field Acceptance Methods and Appropriate Resistance Factors

Resistance Determination Method	Resistance Factor	Source
Driving criteria established by dynamic testing, quality control by dynamic testing of at least one pile at Abutment 1, and one pile at Abutment 2	0.65	AASHTO Table 10.5.5.2.3-1

Construction Considerations

The soil boring logs indicate cobbles and/or boulders at various depths at most of the foundation locations and difficult driving is anticipated. Statewide materials recommends that a down hole hammer capable of removing cobbles and boulders through the pipe piles is included in the required equipment on the Contractors pile driving plan.

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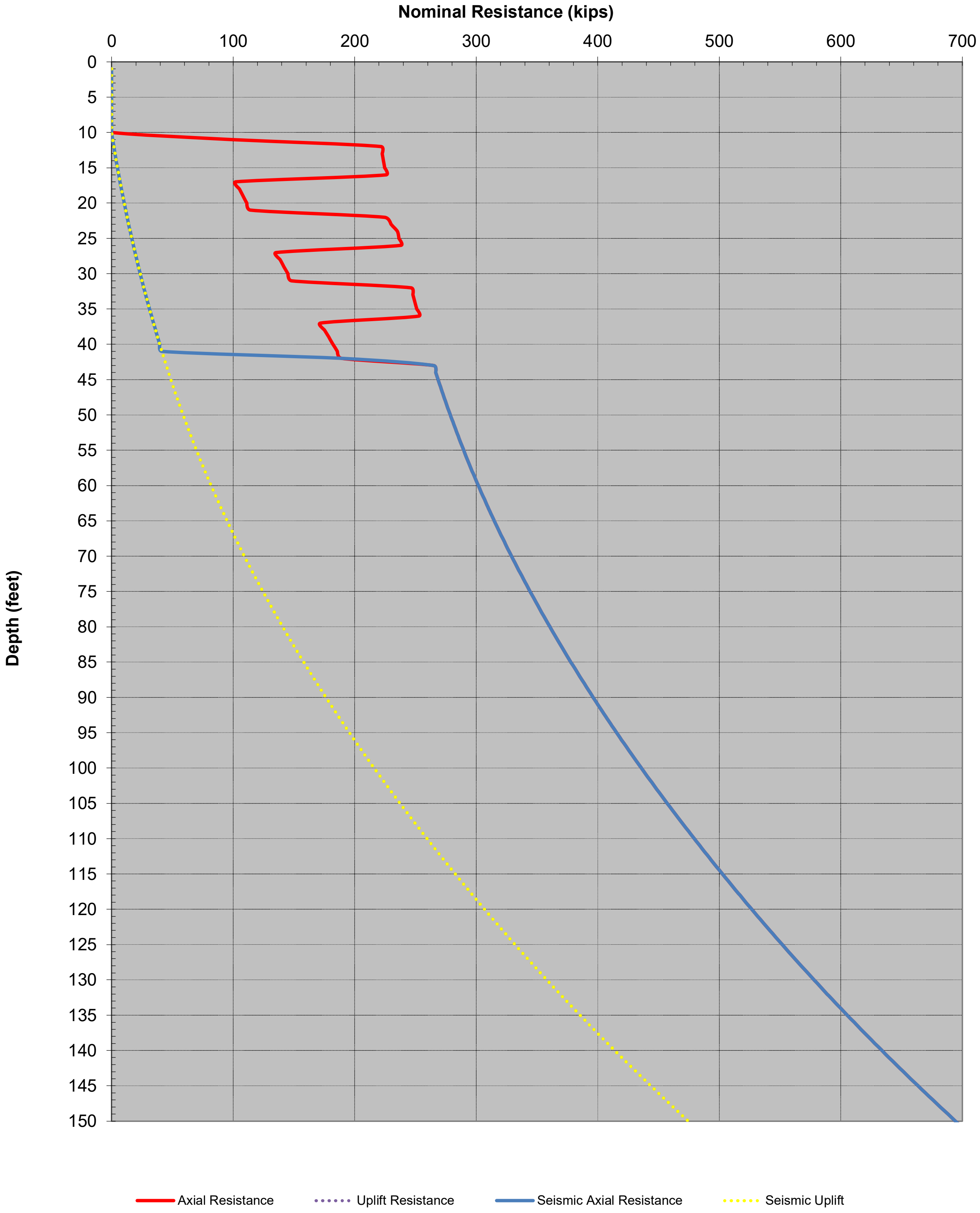
Appendix A Figures

Chilkat River Bridge No 742

Abutment 1

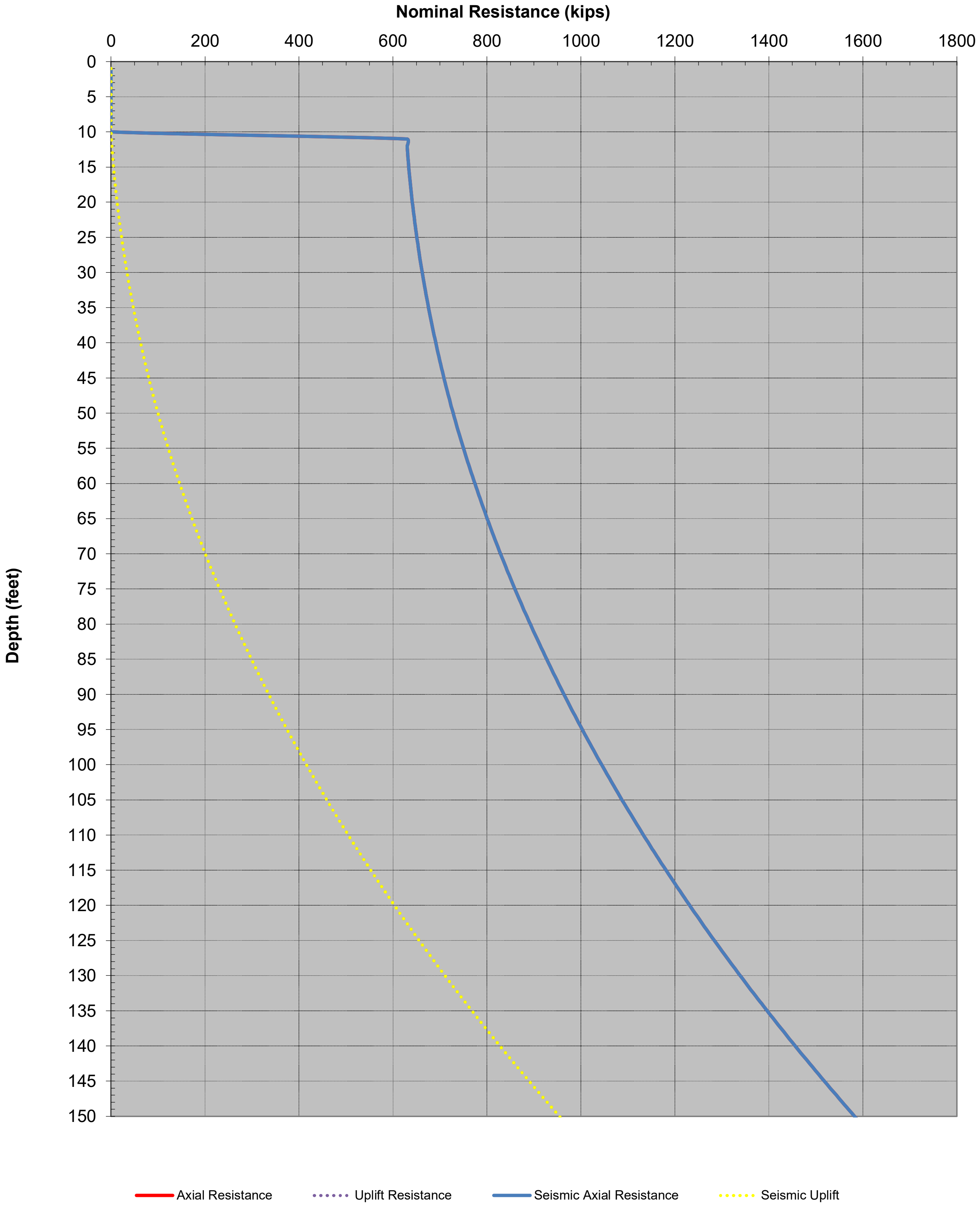
Estimated Nominal Resistance
24 inch x 0.5 inch Open Pipe Piles
Elevation = 136 Feet



Chilkat River Bridge No 742

Pier 2

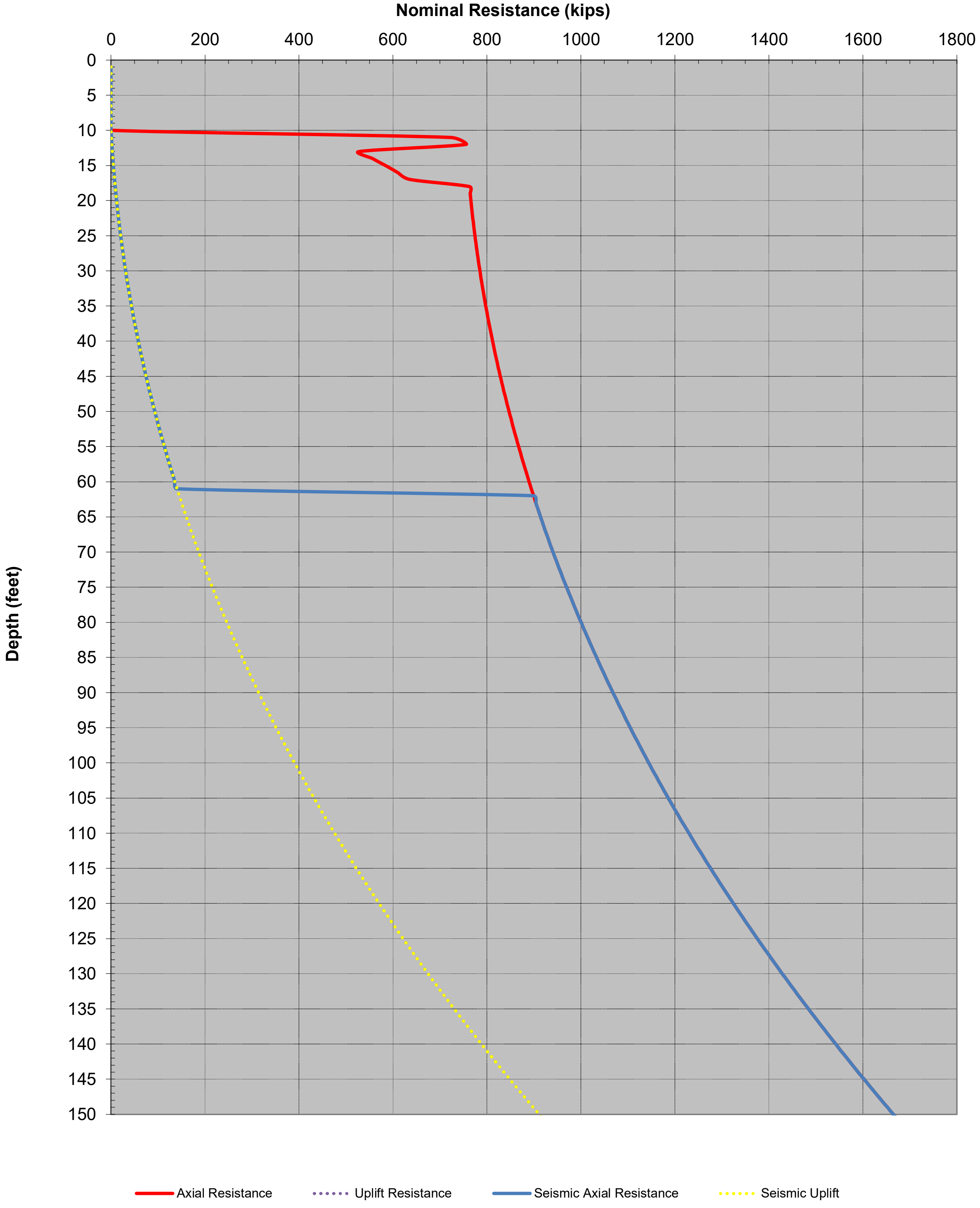
Estimated Nominal Resistance
48 inch x 1 inch Open Pipe Piles
Elevation = 113 Feet



Chilkat River Bridge No 742

Pier 3

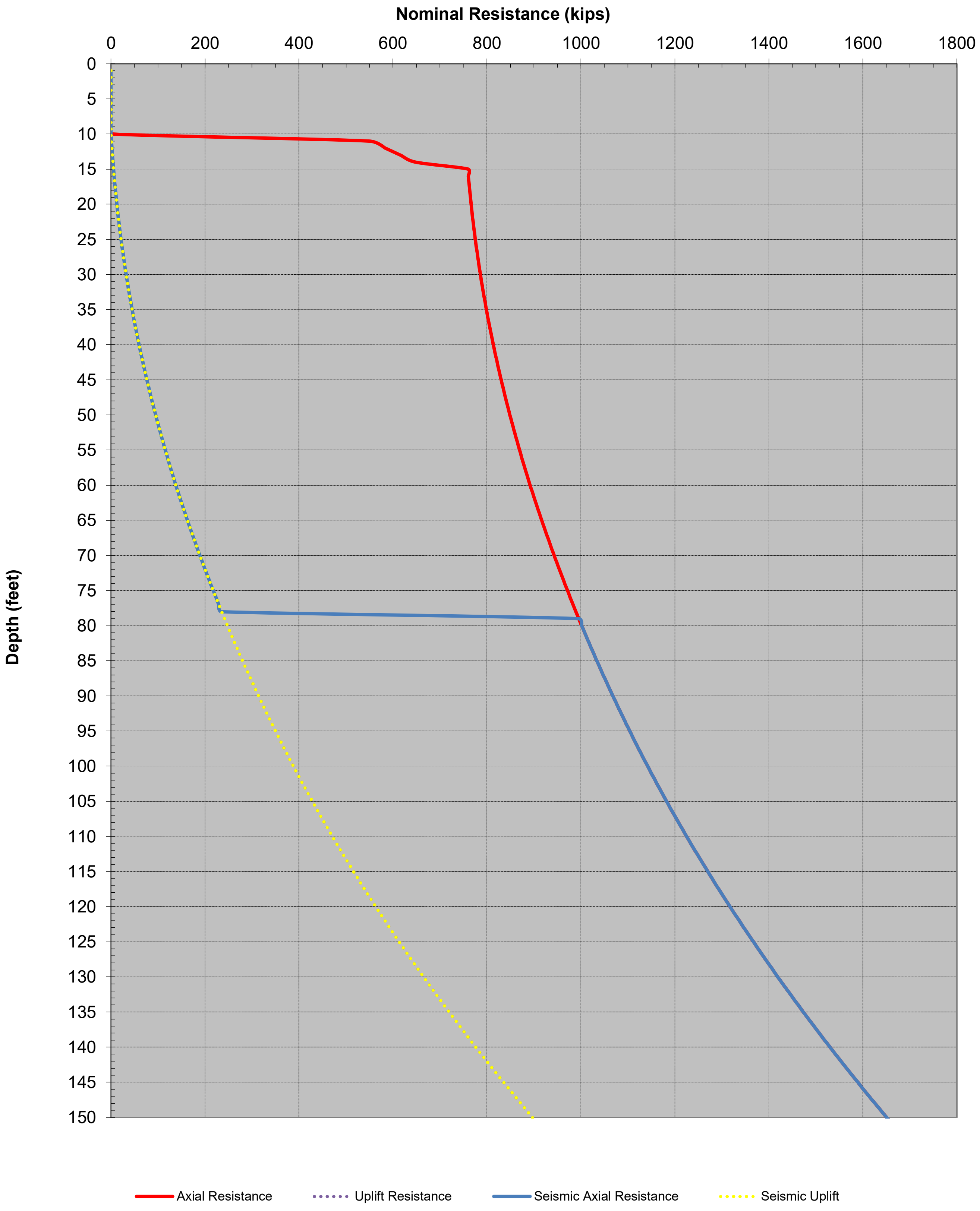
Estimated Nominal Resistance
48 inch x 1 inch Open Pipe Piles
Elevation = 111 Feet



Chilkat River Bridge No 742

Pier 4

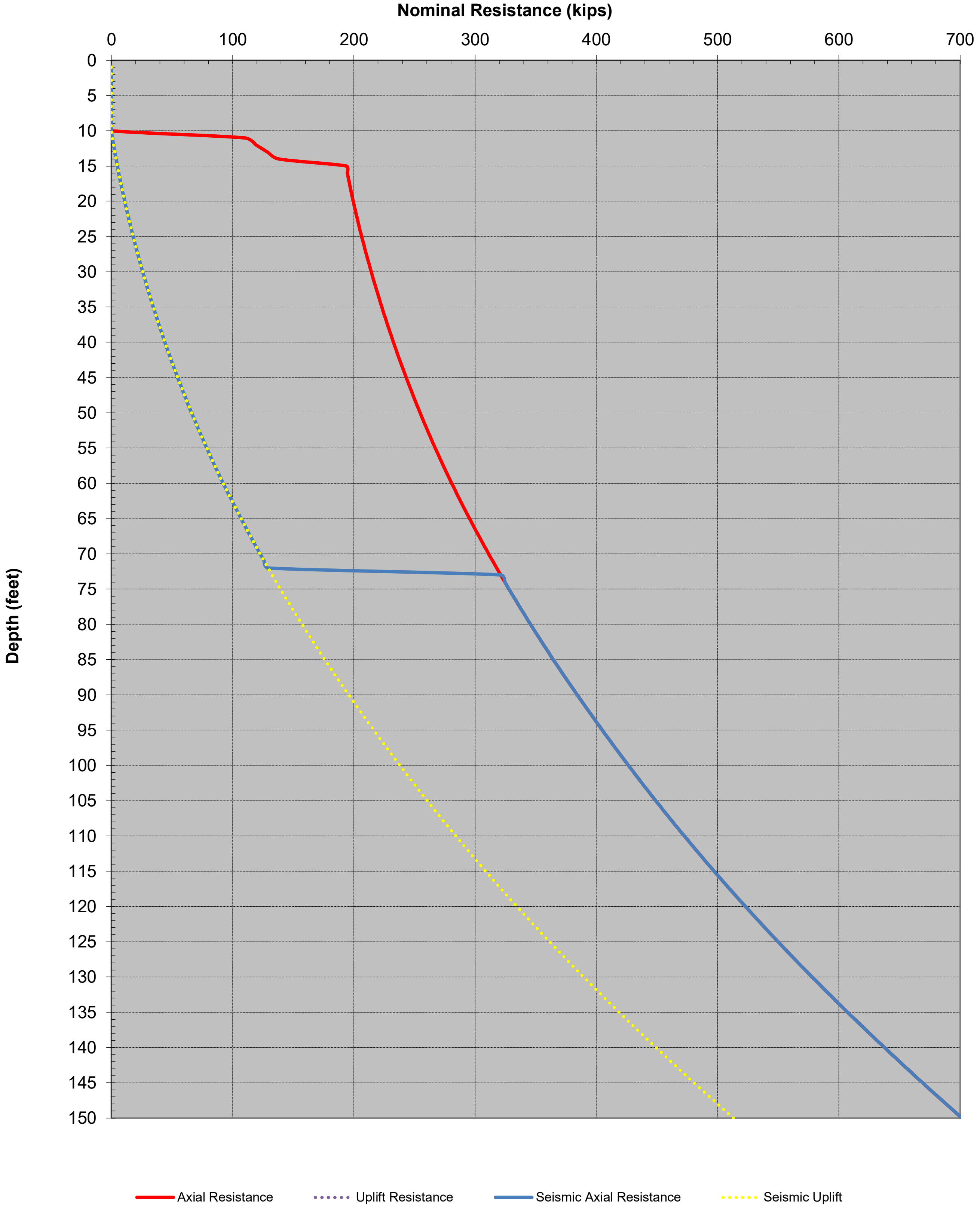
Estimated Nominal Resistance
48 inch x 1 inch Open Pipe Piles
Elevation = 118 Feet



Chilkat River Bridge No 742

Abutment 5

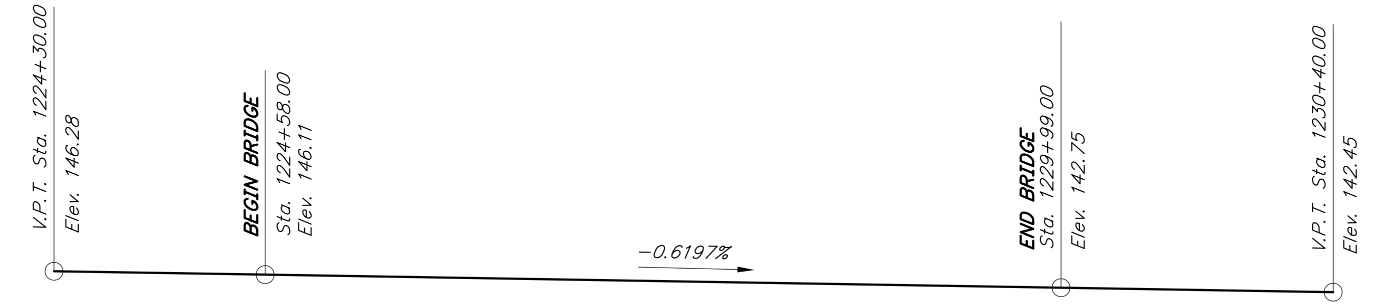
Estimated Nominal Resistance
24 inch x 0.5 inch Open Pipe Piles
Elevation = 133 Feet



Appendix B General Layout and Site Plan

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2022	N1	N25

TBD



PROFILE GRADE DATA
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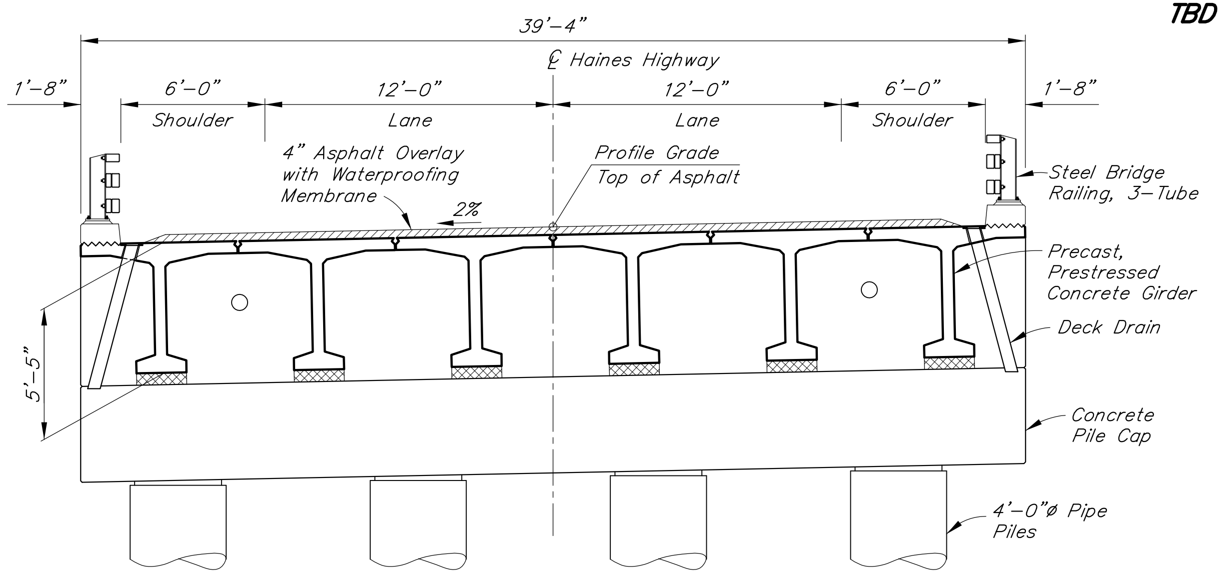
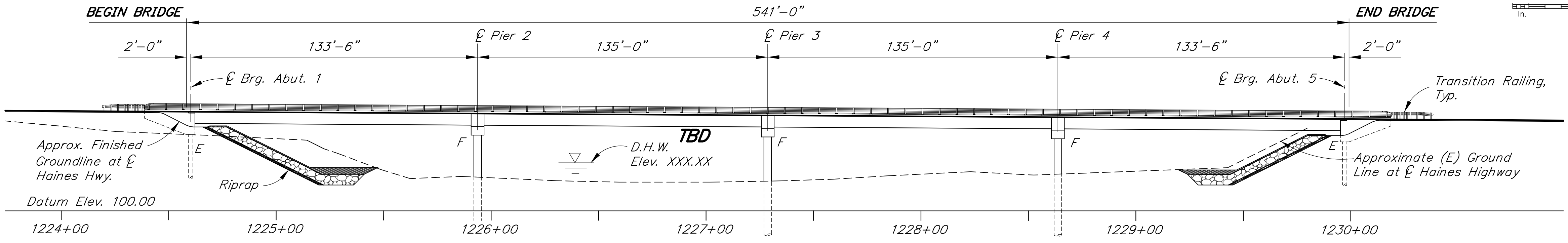


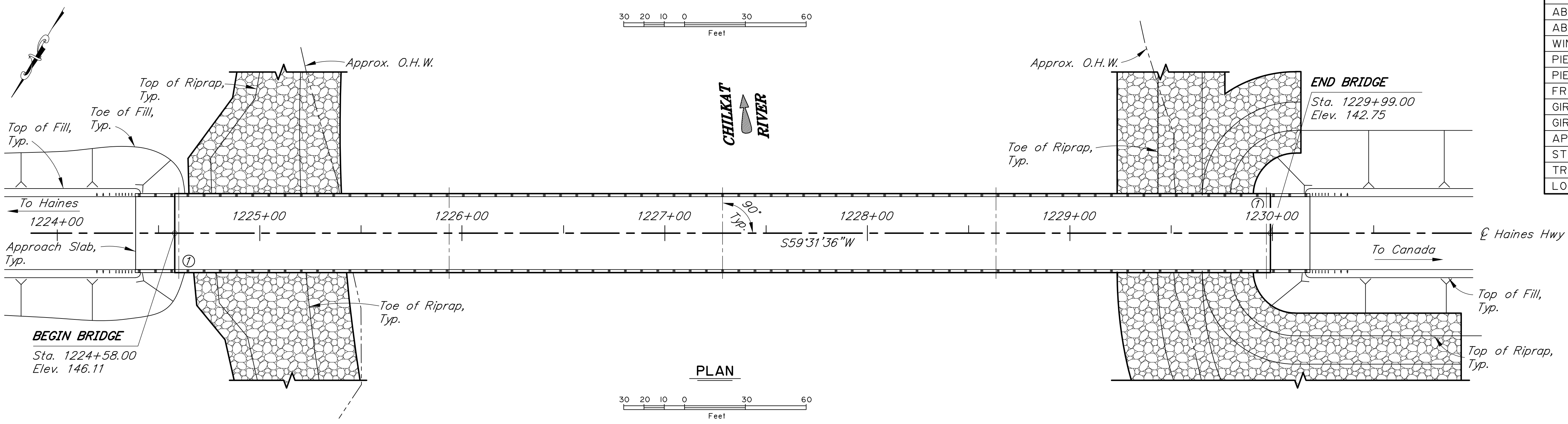
TYPICAL SECTION

12 0 4 8
In. Feet



ELEVATION

30 20 10 0 30 60
Feet



PLAN

30 20 10 0 30 60
Feet

BRIDGE DRAWING INDEX

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PRELIMINARY PLAN

① Approximate location of Bridge Number Plate.

R:\cad\742\742–1 Wed, Apr/19/23 11:19am

DESIGNED BY: Jesse Escamilla III	CHECKED: Douglas Gelineau	LAYOUT BY: Jesse Escamilla III	CHECKED BY: Douglas Gelineau
DRAWN BY: Sam Sollie	CHECKED: Jesse Escamilla III	SPECIFICATIONS BY: Jesse Escamilla III	P S & E COMPARED: Douglas Gelineau
QUANTITIES BY: Jesse Escamilla III	CHECKED: Douglas Gelineau	APPROVAL RECOMMENDED BY: Rich Pratt	

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION
3132 Channel Drive
Juneau, Alaska 99801
907–465–2975

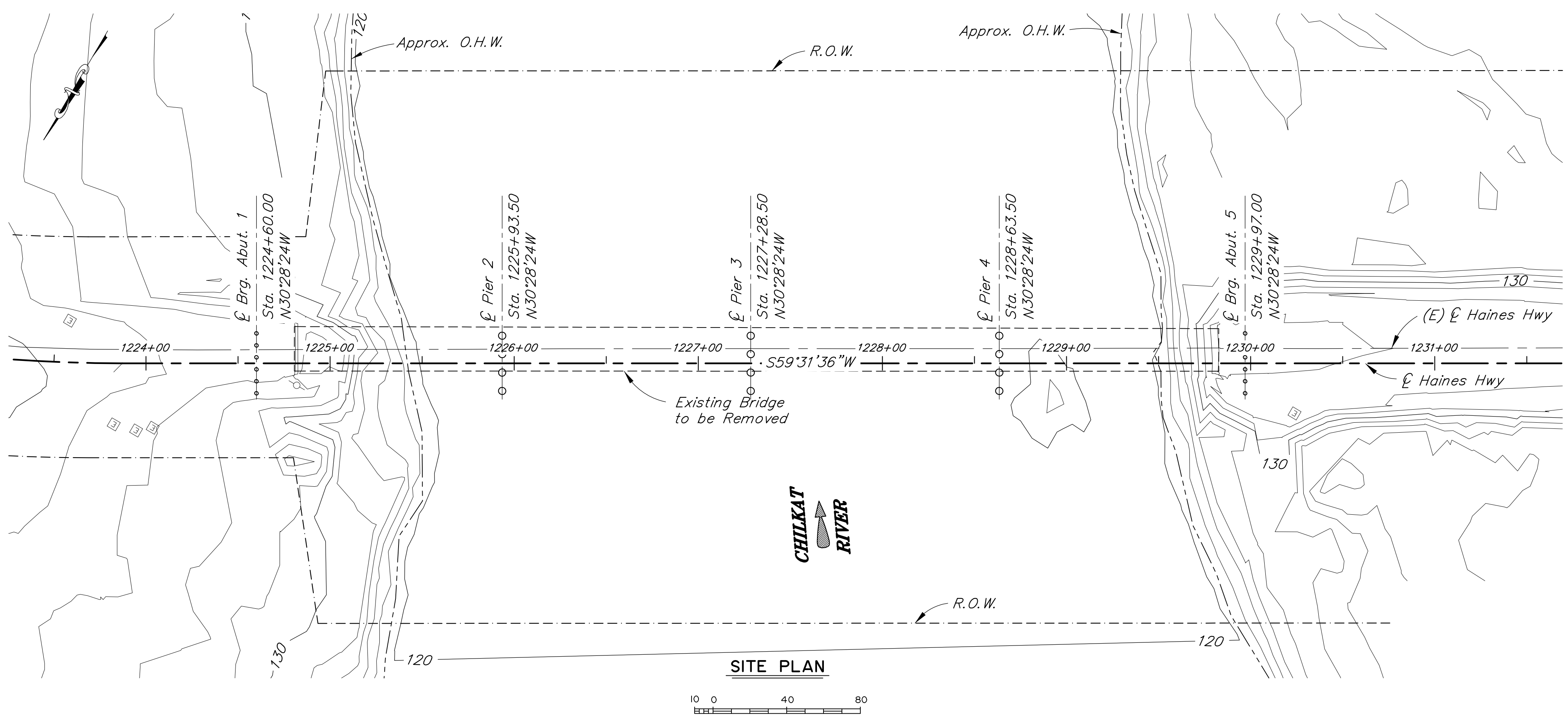
CHILKAT RIVER BRIDGE

HAINES HIGHWAY

GENERAL LAYOUT

BRIDGE NO. 742
DWG. NO. 1

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2022	N2	N25



SITE PLAN

GENERAL NOTES

DESIGN: AASHTO LRFD Bridge Design Specifications, 2020 Edition, with latest interim specifications.

Seismic design per AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2011 with latest interim revisions.

LIVE LOAD: HL–93 or "B–Train" whichever produce maximum demand.

DEAD LOAD: Includes 50 psf for all wearing surfaces.

SEISMIC PARAMETERS:
PGA = 0.32
S_s = 0.74
S_1 = 0.29
Site Class = D
Liquefaction Potential = High
AASHTO 7% probability of exceedance in 75 years.

REINFORCEMENT: ASTM A706, Grade 60, Fy = 60,000 psi
ASTM A970 Headed bars, Class HA.
Space reinforcement evenly unless otherwise noted.

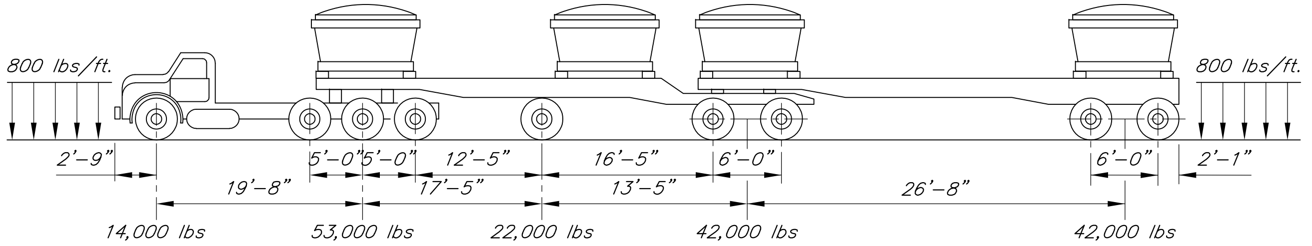
PRESTRESSED CONCRETE: See "GIRDERS" Dwg.

CONCRETE: Class A Concrete unless otherwise noted, f'c = 4,000 psi

STRUCTURAL STEEL: ASTM A709, Grade 36T3, Fy = 36,000 psi
Galvanize structural steel in accordance with AASHTO M111 unless noted otherwise.

STRUCTURAL STEEL PILING: API 5L X52 PSL2, Fy = 52,000 psi. or
ASTM A709, GR50T3, Fy = 50,000 psi.
Pile Tip reinforcing is required.

B-TRAIN



PILE DATA TABLE

LOCATION	PILE TYPE	DRIVING CRITERIA: MINIMUM PENETRATION (ft)	DRIVING CRITERIA: ESTIMATED PILE TIP ELEVATION (ft)	DRIVING CRITERIA: DRIVING RESISTANCE (K)	DESIGN DATA: STRENGTH I FACTORED LOAD (K)	DESIGN DATA: NOMINAL RESISTANCE (K)	DESIGN DATA: RESISTANCE FACTOR, ϕ
Abutment 1	2'–0"øx½" Pipe		35	670	670	435	0.65
Pier 2	4'–0"øx1" Pipe		4	1,610	1,610	1,045	0.65
Pier 3	4'–0"øx1" Pipe		–4	1,610	1,610	1,045	0.65
Pier 4	4'–0"øx1" Pipe		–2	1,610	1,610	1,045	0.65
Abutment 5	2'–0"øx½" Pipe		19	670	670	435	0.65

ESTIMATE OF QUANTITIES

ITEM NO.	ITEM	PAY UNIT	ESTIMATING UNIT	SUBST.	SUPERST.	TOTAL QUANTITY
202.0023.0000	Removal of Bridge No. 742	LS	SF	All Req'd	All Req'd	All Req'd
203.0003.0000	Unclassified Excavation	CY	CY			
205.0006.0000	Structural Fill	CY	CY			
501.0001.0000	Class A Concrete	LS	CY	465.5	221.6	687.1
501.0007.0000	Precast Concrete Member, 133'–6" Decked Bulb–Tee	EA	EA	–––	24	24
503.0001.0000	Reinforcing Steel	LS	LBS			
503.0002.0000	Epoxy–Coated Reinforcing Steel	LS	LBS			
505.0005.0000	Furnish Structural Steel Pipe Piles, 2'–0" Dia. x ½"	LF	LF	1,290	–––	1,290
505.0005.0000	Furnish Structural Steel Pipe Piles, 4'–0" Dia. x 1"	LF	LF	1,616	–––	1,616
505.0006.0000	Drive Structural Steel Pipe Piles, 2'–0" Dia. x ½"	EA	EA	12	–––	12
505.0006.0000	Drive Structural Steel Pipe Piles, 4'–0" Dia. x 1"	EA	EA	12	–––	12
507.0001.0003	Steel Bridge Railing, 3–Tube	LF	LF	–––	1,162	1,162
508.0001.0000	Waterproofing Membrane, Spray–Applied	LS	SF	–––	20,916	20,916
520.0001.0000	Temporary Crossings	LS	SF	–––	All Req'd	All Req'd
606.0016.0000	Transition Rail	EA	EA	–––	4	4
611.0001.0001	Riprap, Class I	CY	CY			
611.0001.0003	Riprap, Class III	CY	CY			
631.0002.0001	Geotextile, Erosion Control, Class 1	SY	SY			

Item numbers are for reference only. Quantities shown are not necessarily the pay quantities nor the total quantity of the particular item.

ABBREVIATIONS:

℄ = centerline
℘ = plate
& = and
@ = at
ø = diameter
± = approximate
Abut. = abutment
Approx. = approximate
b.f. = back/dirt face
bot. = bottom
Br. = bridge
btwn. = between
Brg. = bearings
C.A. = center of gravity
C.I.P. = cast in place
CJP = complete joint penetration
Clr. = clear, clearance
CMP = corrugated metal pipe
CY = cubic yard
Dia. = diameter
D.H.W. = design high water
Dwg. = drawing
E = expansion
(E) = existing
EA = each
Elev. = elevation
e.a. = each face
e.w. = each way
Ext. = exterior
F = fixed
f.f. = front/air face
f'c = specified concrete compressive strength
f'ci = specified concrete compressive strength at release
Ft. = feet
Fy = yield stress
Galv. = galvanize
H.S. = high strength
Hwy. = highway
ID = internal diameter
in = inch
Int. = interior
Jt. = joint
K = kips
ksf = 1000 pounds per square foot
ksi = 1000 pounds per square inch
LBS or lb = pounds
LF = linear foot
LS = lump sum
LT. = left
max. = maximum
min. = minimum
MSE = mechanically stabilized earth
n.f. = near face
No. = number
o.c. = on center
O.H.W. = ordinary high water
pcf = pounds per cubic foot
psf = pounds per square foot
psi = pounds per square inch
R = radius
R.O.W. = right of way
RT. = right
Rd. = road
spcs. = space, spaces
Sta. = station
SF = square feet
SY = square yard
Std. = standard
subst. = substructure
superst. = superstructure
Symm. = symmetric
Typ. = typical
UT = ultrasonic testing
V.P.C. = point of vertical curve
V.P.I. = point of vertical intersection
V.P.T. = point of vertical tangent
w/ = with

DESIGNED BY: Jesse Escamilla III	CHECKED: Douglas Gelineau	FOUNDATIONS REVIEWED BY: Dave Hemstreet
DRAWN BY: Sam Sollie	CHECKED: Jesse Escamilla III	**PRELIMINARY PLAN**
QUANTITIES BY: Jesse Escamilla III	CHECKED: Douglas Gelineau	

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
BRIDGE SECTION
3132 Channel Drive
Juneau, Alaska 99801
907–465–2975

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

SITE PLAN

BRIDGE NO. 742
DWG. NO. 2

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Appendix C Soil Parameters for Lateral Loading Analysis

Table C1: Soil Properties for use in lateral analysis, Bridge 0742, Abutment 1, Elevation 136 feet

Material Type	Depth Interval d (ft)	Effective Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle φ (degrees)	Corrected SPT $(N_1)_{60}$ (bpf)	Strain at 50% Deflection e50 (%)	Constant of Horizontal Subgrade Reaction n_h (pci)	Seismic Condition P-Multiplier
Gravel	0-8	137	0	43	60	N/A	355	1.00
Silty Sand	8-12	106	0	29	5	N/A	12	1.00
Silty Sand	12-17	60	0	37	25	N/A	81	1.00
Silty Sand	17-32	44	0	29	4	N/A	13	0.10
Silty Sand	32-37	55	0	34	12	N/A	42	0.21
Silty Sand	37-43	39	0	27	2	N/A	6	0.08
Silty Sand	43-53	60	0	38	28	N/A	89	1.00
Silty Sand	53-57	60	0	37	23	N/A	75	1.00
Silty Sand	57-63	75	0	43	60	N/A	197	1.00
Silty Sand	63-67	60	0	37	24	N/A	79	1.00
Silty Sand	67-72	75	0	43	60	N/A	197	1.00
Silty Sand	72-82	62	0	39	36	N/A	111	1.00
Sand	82-86	75	0	43	60	N/A	197	1.00
Sand	86-91	61	0	38	30	N/A	95	1.00
Sand	91-102	64	0	39	43	N/A	132	1.00
Silty Sand	102-116	59	0	37	21	N/A	70	1.00
Silty Sand	116-122	61	0	38	32	N/A	99	1.00
Silty Sand	122-127	65	0	40	45	N/A	139	1.00
Silty Sand	127-	75	0	43	60	N/A	197	1.00

Table C2: Soil Properties for use in lateral analysis, Bridge 0742, Pier 2, Elevation 113 feet

Material Type	Depth Interval d (ft)	Effective Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle φ (degrees)	Corrected SPT $(N_1)_{60}$ (bpf)	Strain at 50% Deflection e50 (%)	Constant of Horizontal Subgrade Reaction n_h (pci)	Seismic Condition P-Multiplier
Sand	0-10	61	0	38	31	N/A	98	0.28
Gravel	10-19	75	0	43	60	N/A	197	1.00
Gravel	19-24	62	0	39	36	N/A	111	1.00
Silty Sand	24-29	60	0	38	27	N/A	86	1.00
Silty Sand	29-34	64	0	39	43	N/A	131	1.00
Sand	34-44	61	0	38	30	N/A	96	1.00
Silty Sand	44-59	75	0	43	60	N/A	197	1.00
Gravel	59-64	64	0	39	44	N/A	135	1.00
Gravel	64-69	60	0	38	29	N/A	91	0.92
Gravel	69-80	75	0	43	60	N/A	197	1.00
Silty Sand	80-95	59	0	37	21	N/A	70	1.00
Sand	95-99	75	0	43	60	N/A	197	1.00
Sand	99-104	64	0	39	43	N/A	131	1.00
Sand	104-	75	0	43	60	N/A	197	1.00

Table C3: Soil Properties for use in lateral analysis, Bridge 0742, Pier 3, Elevation 111 feet

Material Type	Depth Interval d (ft)	Effective Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle φ (degrees)	Corrected SPT $(N_1)_{60}$ (bpf)	Strain at 50% Deflection e50 (%)	Constant of Horizontal Subgrade Reaction n_h (pci)	Seismic Condition P-Multiplier
Gravel	0-7	62	0	39	37	N/A	113	0.75
Gravel	7-13	59	0	37	21	N/A	70	0.44
Sand	13-23	57	0	35	16	N/A	54	0.20
Sand	23-37	61	0	38	30	N/A	94	1.00
Gravel	37-53	65	0	40	46	N/A	142	1.00
Gravel	53-63	59	0	37	22	N/A	74	0.26
Gravel	63-77	75	0	43	60	N/A	197	1.00
Silt	77-98	62	0	39	36	N/A	110	1.00
Sand	98-	75	0	43	60	N/A	197	1.00

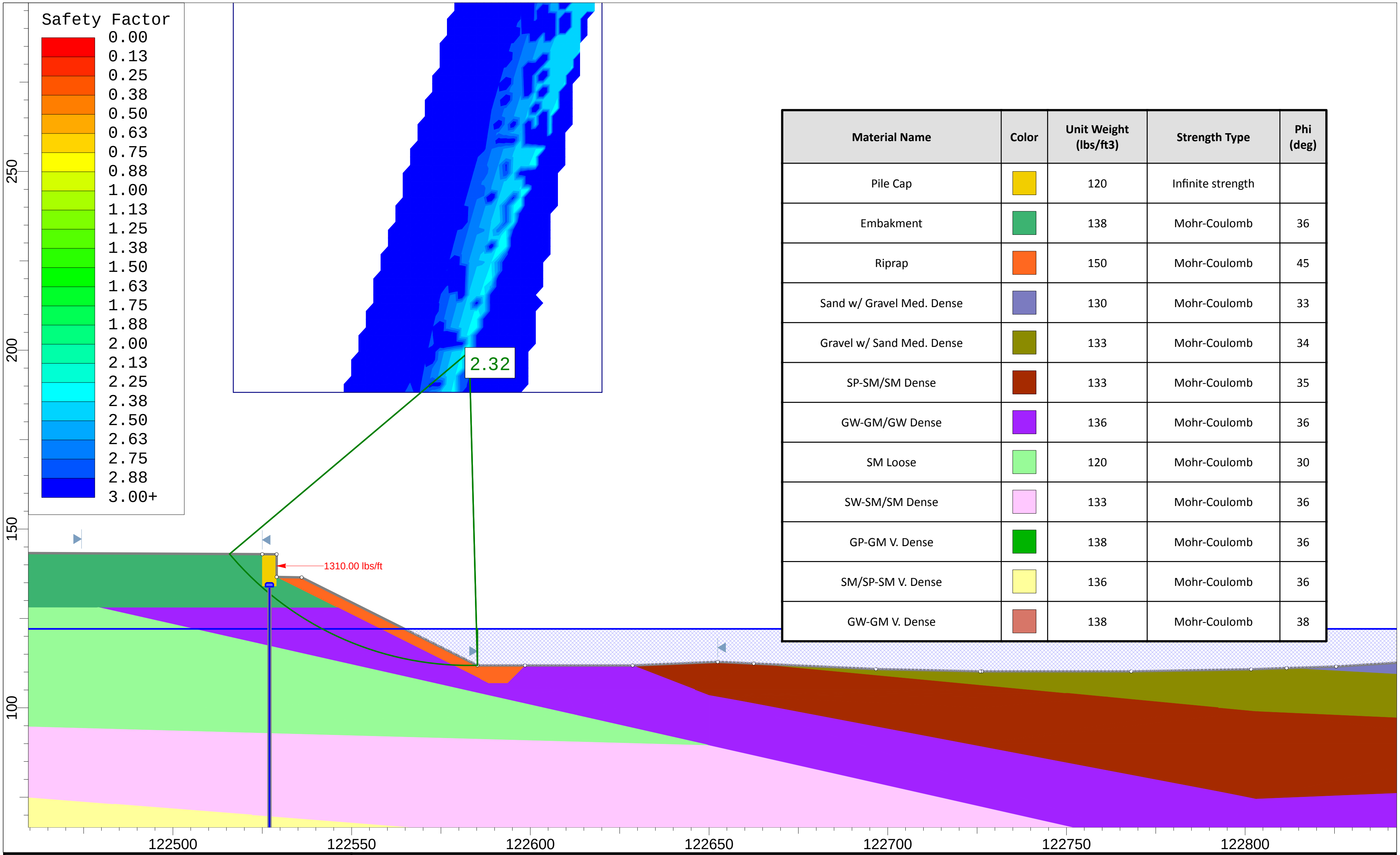
Table C4: Soil Properties for use in lateral analysis, Bridge 0742, Pier 4, Elevation 118 feet

Material Type	Depth Interval d (ft)	Effective Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle φ (degrees)	Corrected SPT $(N_1)_{60}$ (bpf)	Strain at 50% Deflection e50 (%)	Constant of Horizontal Subgrade Reaction n_h (pci)	Seismic Condition P-Multiplier
Gravel	0-4	67	0	40	49	N/A	153	1.00
Sand	4-10	62	0	39	38	N/A	116	0.74
Sand	10-30	57	0	35	16	N/A	55	0.21
Sand	30-39	62	0	39	36	N/A	112	1.00
Gravel	39-44	63	0	39	39	N/A	121	1.00
Gravel	44-51	60	0	38	29	N/A	92	0.83
Sand	51-54	61	0	38	32	N/A	101	0.74
Silty Sand	54-59	64	0	39	43	N/A	132	1.00
Silty Sand	59-64	62	0	39	38	N/A	117	0.65
Gravel	64-69	60	0	38	28	N/A	89	0.57
Gravel	69-75	60	0	38	28	N/A	91	0.71
Gravel	75-80	60	0	38	26	N/A	86	0.51
Gravel	80-84	61	0	38	33	N/A	103	1.00
Silty Sand	84-98	60	0	38	29	N/A	91	1.00
Gravel	98-0	75	0	43	60	N/A	197	1.00

Table C5: Soil Properties for use in lateral analysis, Bridge 0742, Abutment 5, Elevation 130 feet

Material Type	Depth Interval d (ft)	Effective Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle φ (degrees)	Corrected SPT $(N_1)_{60}$ (bpf)	Strain at 50% Deflection e50 (%)	Constant of Horizontal Subgrade Reaction n_h (pci)	Seismic Condition P-Multiplier
Gravel	0-8	95	0	25	0	N/A	0	0.00
Silt	8-15	108	0	30	6	N/A	17	1.00
Sand	15-24	57	0	35	16	N/A	55	0.16
Sand	24-29	61	0	38	32	N/A	100	1.00
Sand	29-49	57	0	35	16	N/A	53	0.15
Gravel	49-68	69	0	40	51	N/A	162	1.00
Silty Sand	68-74	59	0	37	21	N/A	71	0.63
Gravel	74-86	64	0	39	44	N/A	134	1.00
Gravel	86-100	59	0	37	22	N/A	73	1.00
Silty Sand	100-105	60	0	38	26	N/A	85	1.00
Silt	105-111	58	0	36	17	N/A	57	1.00
Silt	111-139	75	0	43	60	N/A	197	1.00
Sand	139-145	60	0	37	22	N/A	75	1.00
Sand	145-	75	0	43	60	N/A	197	1.00

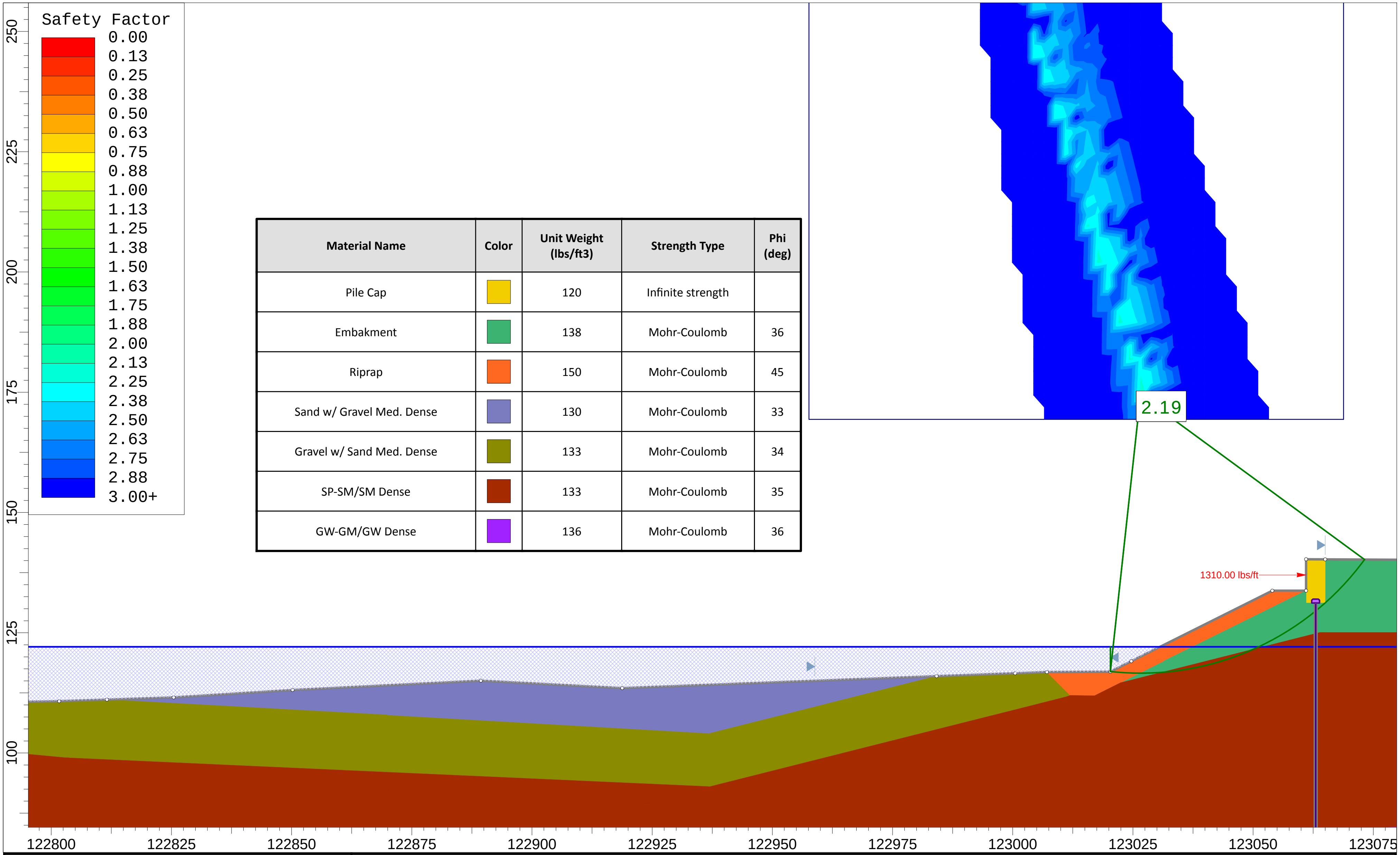
Appendix D Global Stability Analysis Results



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Pile Cap	🟨	120	Infinite strength	
Embakment	🟩	138	Mohr-Coulomb	36
Riprap	🟧	150	Mohr-Coulomb	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	36
SM Loose	🟩	120	Mohr-Coulomb	30
SW-SM/SM Dense	🟪	133	Mohr-Coulomb	36
GP-GM V. Dense	🟩	138	Mohr-Coulomb	36
SM/SP-SM V. Dense	🟨	136	Mohr-Coulomb	36
GW-GM V. Dense	🟥	138	Mohr-Coulomb	38

Project	Chilkat River No. 0742		
Analysis Description	Abutment 1- Static Stability		
Drawn By	T. Eckhoff	*Scale*	1:446
Company	ADOT&PF		
Date	7/13/2016, 11:32:36 AM	*File Name*	0742 Fence TWE.slmd

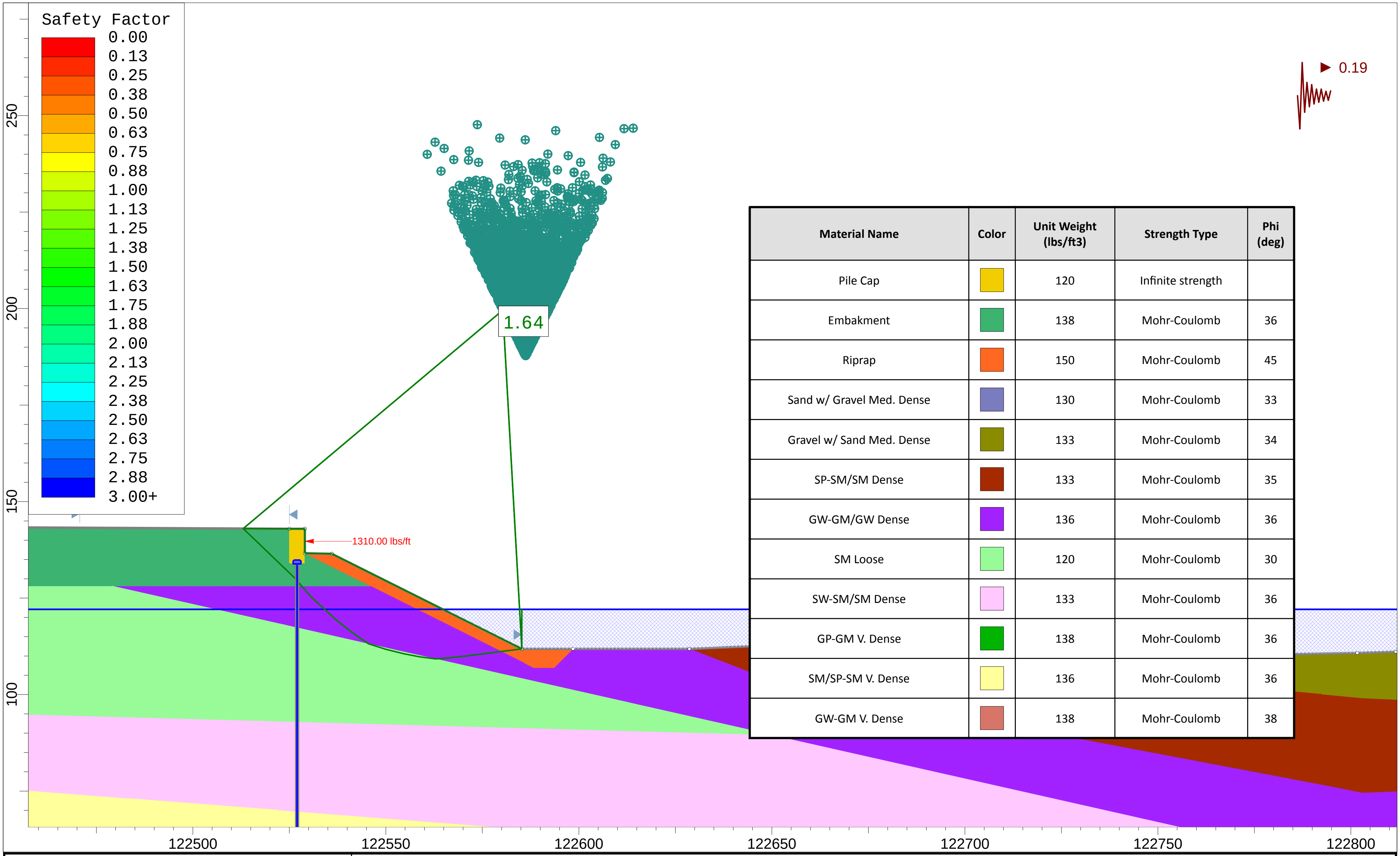
SLIDEINTERPRET 7.014



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Pile Cap	🟨	120	Infinite strength	
Embakment	🟩	138	Mohr-Coulomb	36
Riprap	🟧	150	Mohr-Coulomb	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	36

SLIDEINTERPRET 7.014

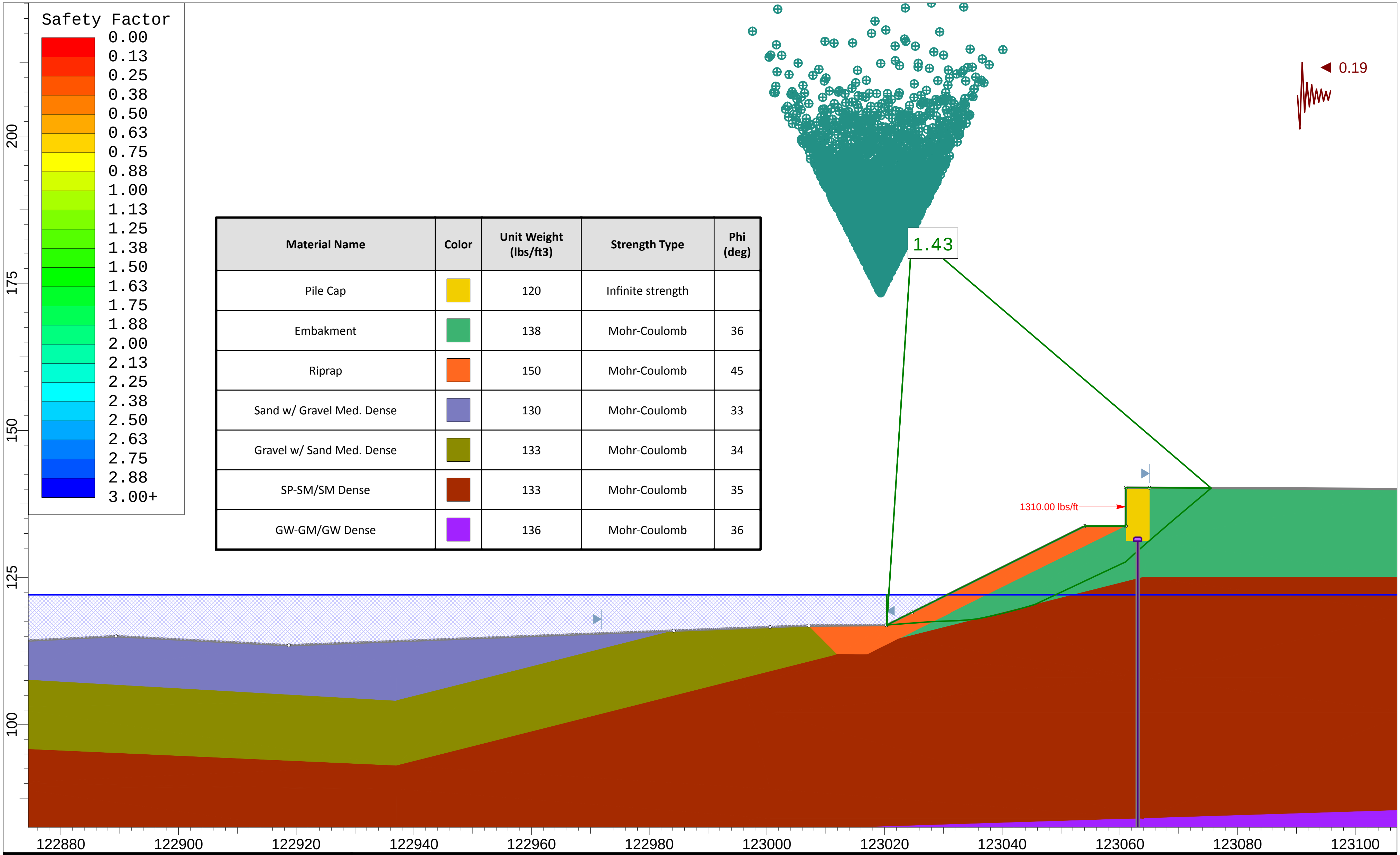
Project	Chilkat River No. 0742
Analysis Description	Abutment 5- Static Stability
Drawn By	T. Eckhoff
Scale	1:331
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
File Name	0742 Fence TWE.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Pile Cap	🟨	120	Infinite strength	
Embakment	🟩	138	Mohr-Coulomb	36
Riprap	🟧	150	Mohr-Coulomb	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	34
SP-SM/SM Dense	🟫	133	Mohr-Coulomb	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	36
SM Loose	🟩	120	Mohr-Coulomb	30
SW-SM/SM Dense	🟪	133	Mohr-Coulomb	36
GP-GM V. Dense	🟩	138	Mohr-Coulomb	36
SM/SP-SM V. Dense	🟨	136	Mohr-Coulomb	36
GW-GM V. Dense	🟥	138	Mohr-Coulomb	38

SLIDEINTERPRET 7.014

Project	Chilkat River No. 0742
Analysis Description	Abutment 1- Pseudo-Static Stability
Drawn By	T. Eckhoff
Scale	1:413
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
File Name	0742 Fence TWE.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Pile Cap	🟨	120	Infinite strength	
Embakment	🟩	138	Mohr-Coulomb	36
Riprap	🟧	150	Mohr-Coulomb	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	36

rocscience

SLIDEINTERPRET 7.014

Project Chilkat River No. 0742

Analysis Description Abutment 5- Pseudo-Static Stability

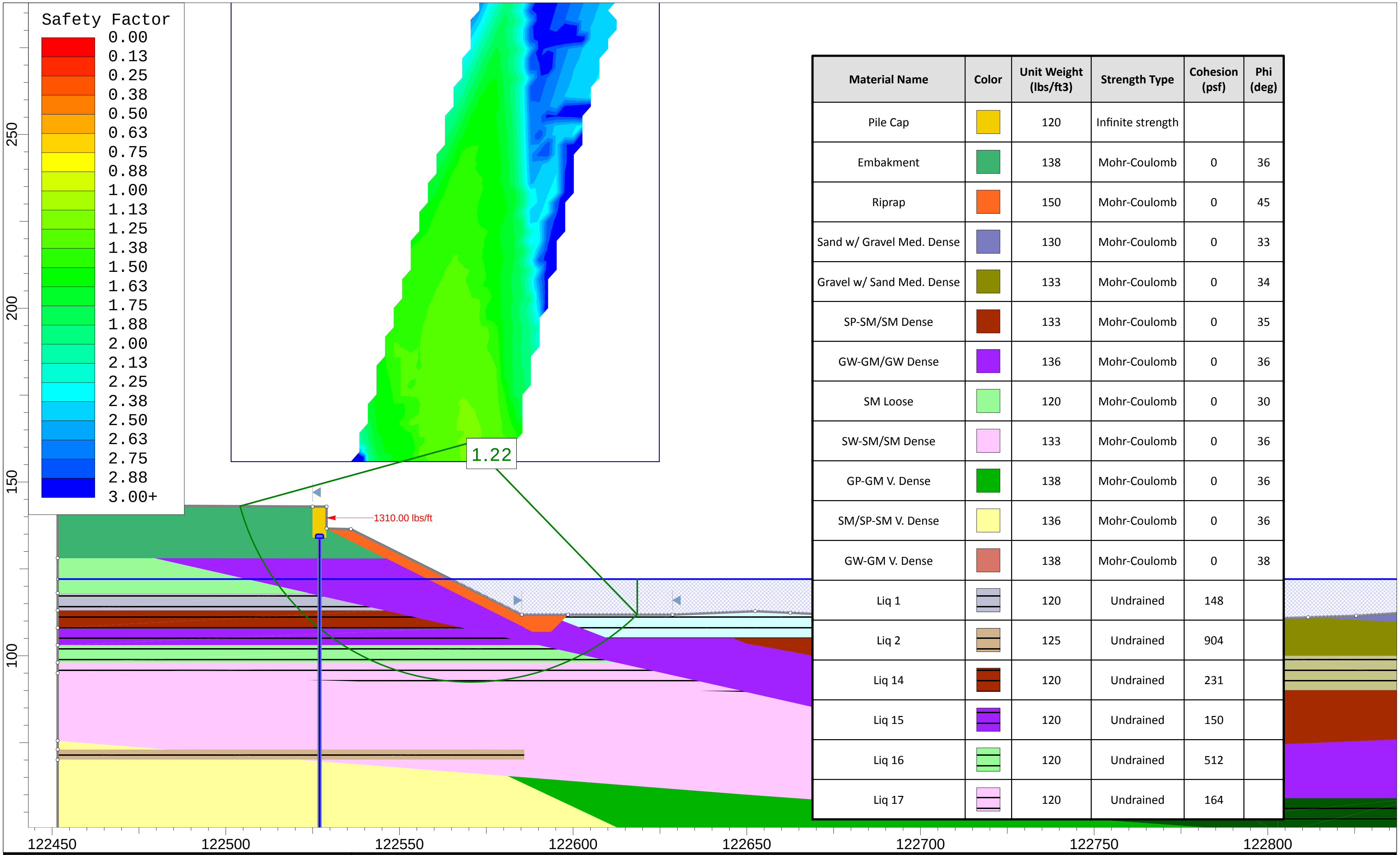
Drawn By T. Eckhoff

Scale 1:271

Company ADOT&PF

Date 7/13/2016, 11:32:36 AM

File Name 0742 Fence TWE.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pile Cap	🟨	120	Infinite strength		
Embakment	🟩	138	Mohr-Coulomb	0	36
Riprap	🟧	150	Mohr-Coulomb	0	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	0	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	0	34
SP-SM/SM Dense	🟫	133	Mohr-Coulomb	0	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	0	36
SM Loose	🟩	120	Mohr-Coulomb	0	30
SW-SM/SM Dense	🟪	133	Mohr-Coulomb	0	36
GP-GM V. Dense	🟩	138	Mohr-Coulomb	0	36
SM/SP-SM V. Dense	🟨	136	Mohr-Coulomb	0	36
GW-GM V. Dense	🟥	138	Mohr-Coulomb	0	38
Liq 1	▤	120	Undrained	148	
Liq 2	▤	125	Undrained	904	
Liq 14	▤	120	Undrained	231	
Liq 15	▤	120	Undrained	150	
Liq 16	▤	120	Undrained	512	
Liq 17	▤	120	Undrained	164	

SLIDEINTERPRET 7.014

Project	Chilkat River No. 0742
Analysis Description	Abutment 1- Post-Liquefaction Static Stability
Drawn By	T. Eckhoff
Scale	1:459
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
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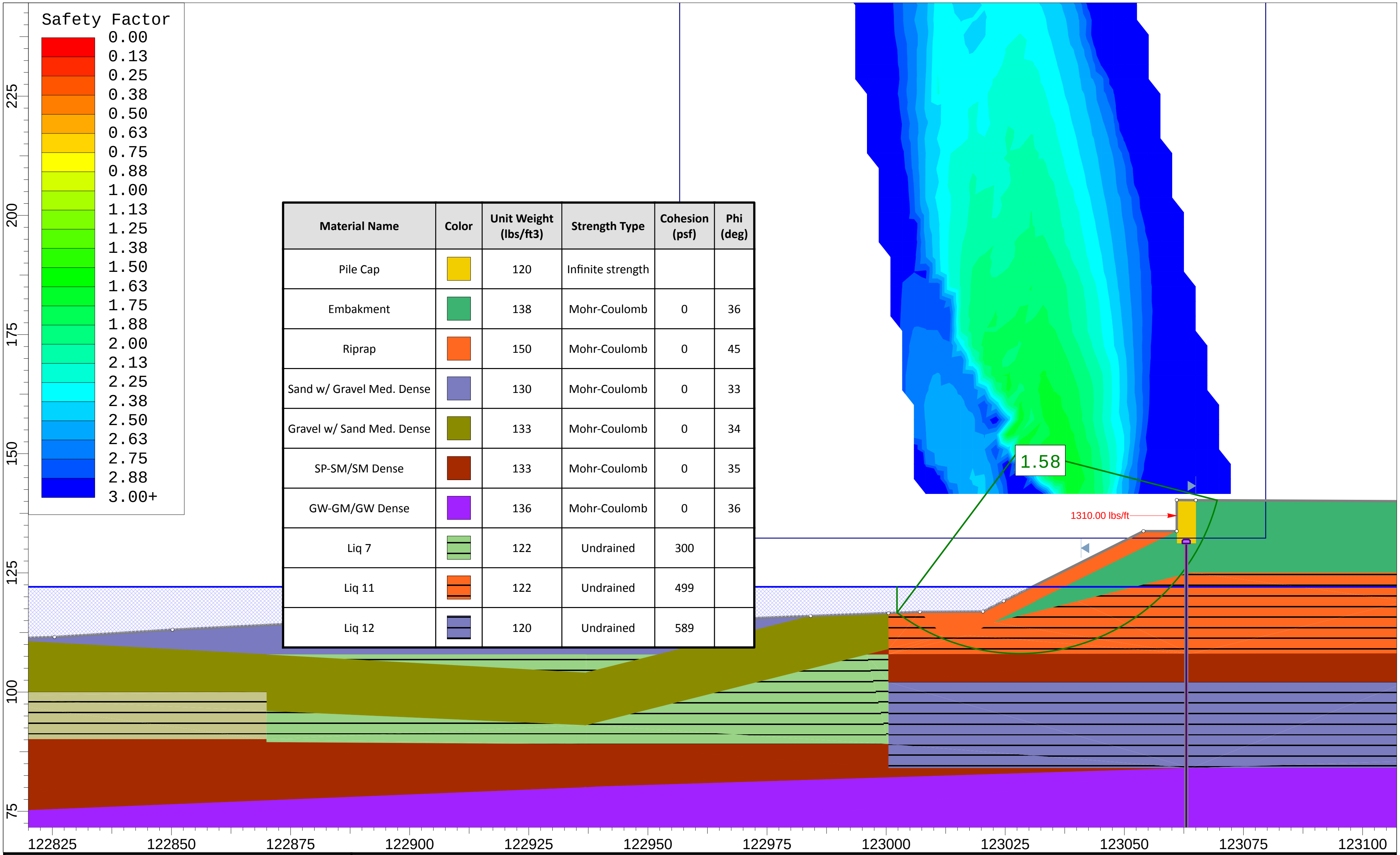

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pile Cap	🟨	120	Infinite strength		
Embakment	🟩	138	Mohr-Coulomb	0	36
Riprap	🟧	150	Mohr-Coulomb	0	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	0	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	0	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	0	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	0	36
Liq 7	▤	122	Undrained	300	
Liq 11	▤	122	Undrained	499	
Liq 12	▤	120	Undrained	589	

Project	Chilkat River No. 0742
Analysis Description	Abutment 5- Post-Liquefaction Static Stability
Drawn By	T. Eckhoff
Scale	1:334
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
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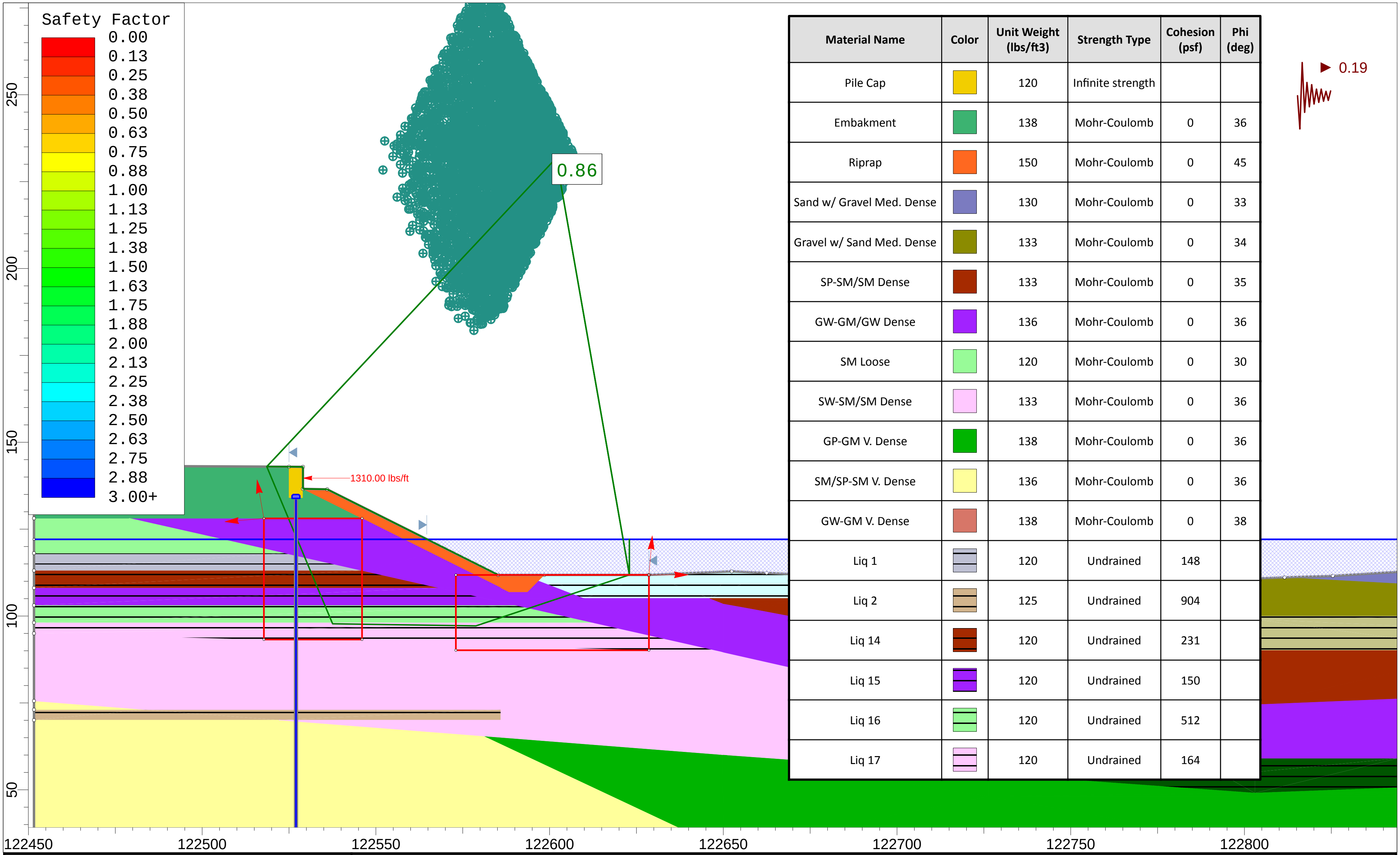
SLIDEINTERPRET 7.014



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pile Cap	🟨	120	Infinite strength		
Embakment	🟩	138	Mohr-Coulomb	0	36
Riprap	🟧	150	Mohr-Coulomb	0	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	0	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	0	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	0	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	0	36
SM Loose	🟩	120	Mohr-Coulomb	0	30
SW-SM/SM Dense	🟪	133	Mohr-Coulomb	0	36
GP-GM V. Dense	🟩	138	Mohr-Coulomb	0	36
SM/SP-SM V. Dense	🟨	136	Mohr-Coulomb	0	36
GW-GM V. Dense	🟥	138	Mohr-Coulomb	0	38
Liq 1	▤	120	Undrained	148	
Liq 2	▤	125	Undrained	904	
Liq 14	▤	120	Undrained	231	
Liq 15	▤	120	Undrained	150	
Liq 16	▤	120	Undrained	512	
Liq 17	▤	120	Undrained	164	

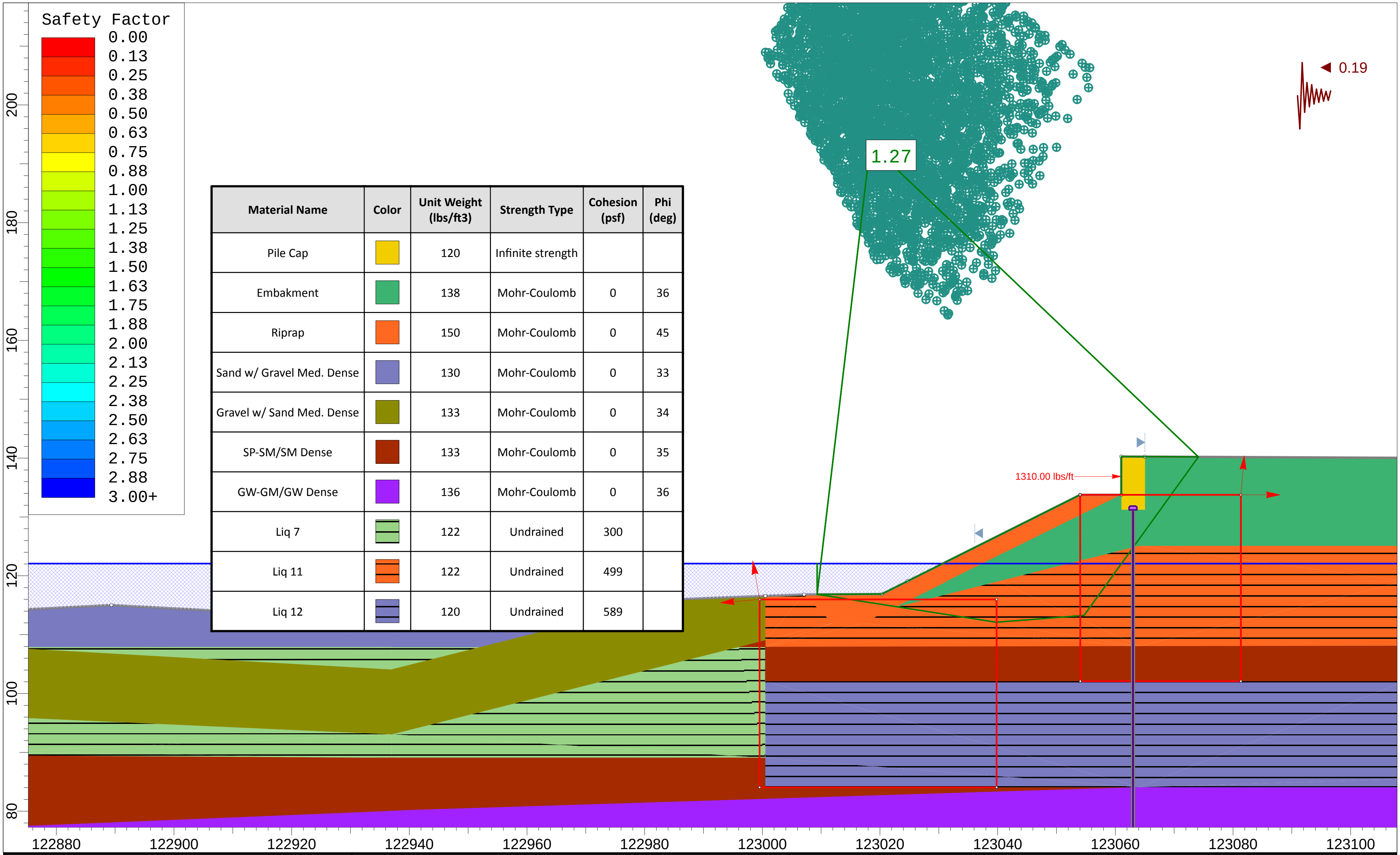
SLIDEINTERPRET 7.014

Project
Chilkat River No. 0742

Analysis Description
Abutment 1- Post-Liquefaction Seismic Stability

Drawn By T. Eckhoff
Scale 1:459
Company ADOT&PF

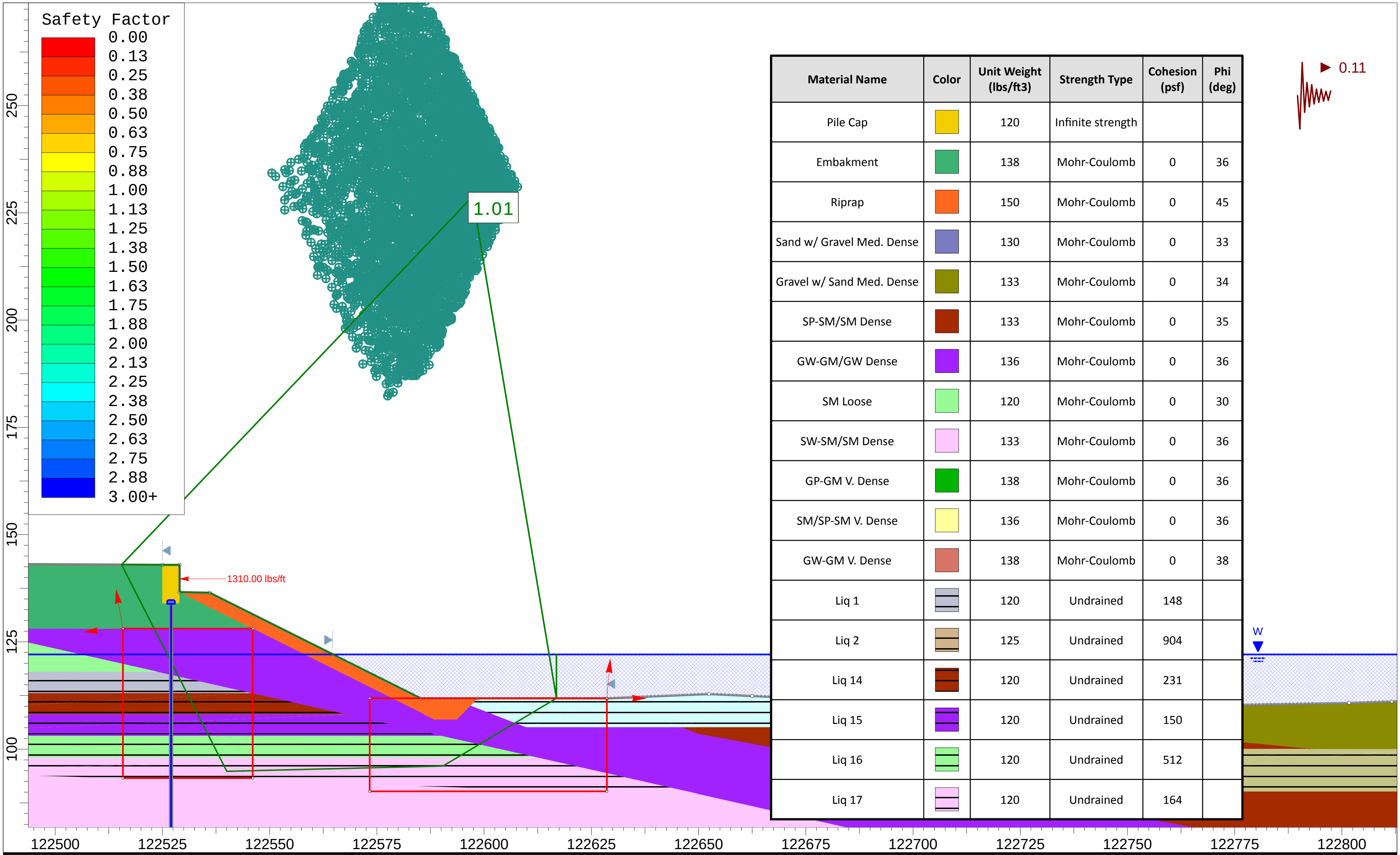
Date 7/13/2016, 11:32:36 AM
File Name 0742 Fence TWE.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pile Cap	🟨	120	Infinite strength		
Embakment	🟩	138	Mohr-Coulomb	0	36
Riprap	🟧	150	Mohr-Coulomb	0	45
Sand w/ Gravel Med. Dense	🟦	130	Mohr-Coulomb	0	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	0	34
SP-SM/SM Dense	🟥	133	Mohr-Coulomb	0	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	0	36
Liq 7	▤	122	Undrained	300	
Liq 11	▤	122	Undrained	499	
Liq 12	▤	120	Undrained	589	

SLIDEINTERPRET 7.014

Project	Chilkat River No. 0742
Analysis Description	Abutment 5- Post Liquefaction Seismic Stability
Drawn By	T. Eckhoff
Scale	1:271
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
File Name	0742 Fence TWE.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pile Cap	🟨	120	Infinite strength		
Embakment	🟩	138	Mohr-Coulomb	0	36
Riprap	🟧	150	Mohr-Coulomb	0	45
Sand w/ Gravel Med. Dense	🟪	130	Mohr-Coulomb	0	33
Gravel w/ Sand Med. Dense	🟫	133	Mohr-Coulomb	0	34
SP-SM/SM Dense	🟫	133	Mohr-Coulomb	0	35
GW-GM/GW Dense	🟪	136	Mohr-Coulomb	0	36
SM Loose	🟩	120	Mohr-Coulomb	0	30
SW-SM/SM Dense	🟪	133	Mohr-Coulomb	0	36
GP-GM V. Dense	🟩	138	Mohr-Coulomb	0	36
SM/SP-SM V. Dense	🟨	136	Mohr-Coulomb	0	36
GW-GM V. Dense	🟥	138	Mohr-Coulomb	0	38
Liq 1	▤	120	Undrained	148	
Liq 2	▤	125	Undrained	904	
Liq 14	▤	120	Undrained	231	
Liq 15	▤	120	Undrained	150	
Liq 16	▤	120	Undrained	512	
Liq 17	▤	120	Undrained	164	

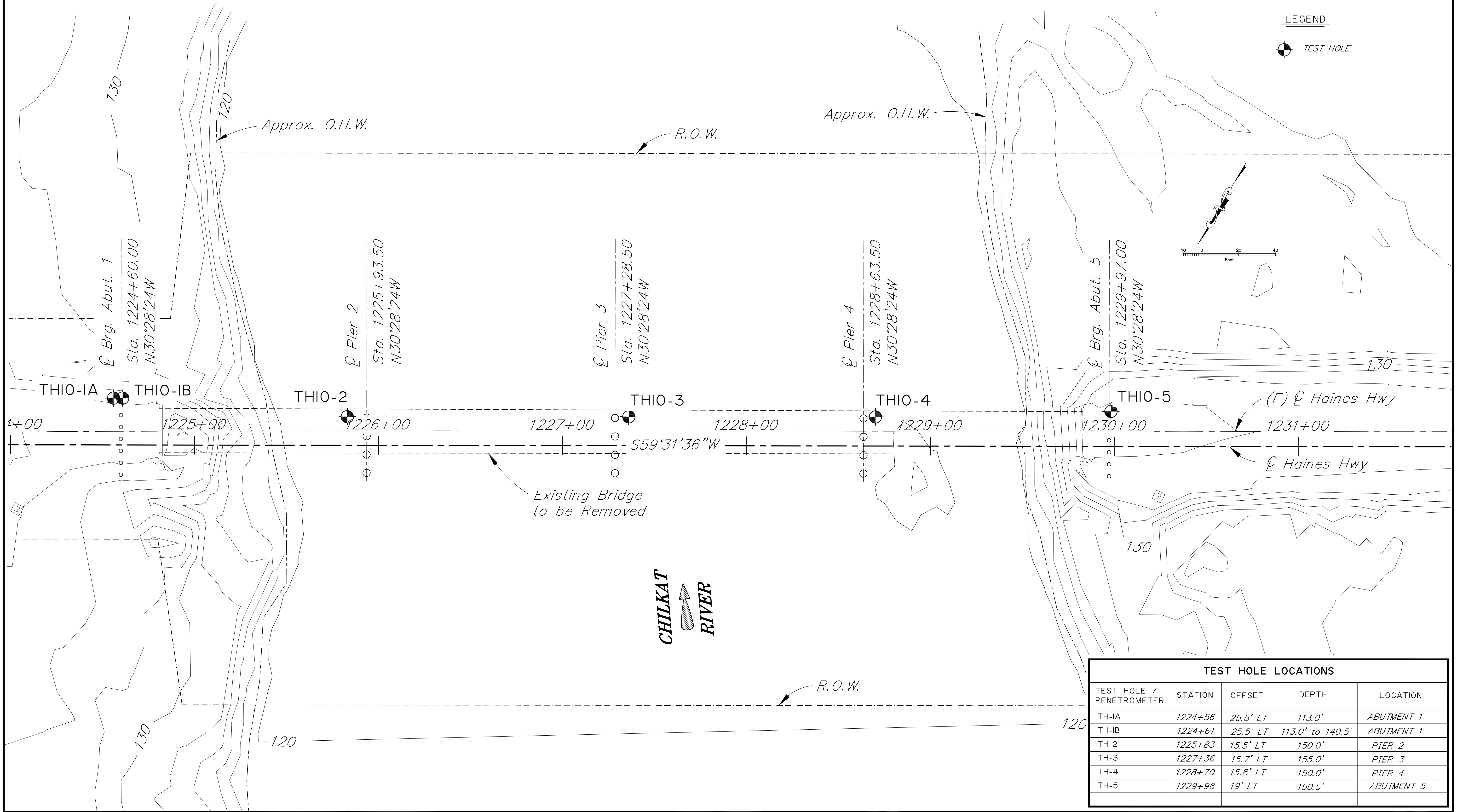
rocscience

SLIDEINTERPRET 7.014

Project	Chilkat River No. 0742
Analysis Description	Abutment 1- Post Liquefaction Seismic Stability Yield Acceleration
Drawn By	T. Eckhoff
Scale	1:371
Company	ADOT&PF
Date	7/13/2016, 11:32:36 AM
File Name	0742 Fence TWE.slmd

Appendix E Test Hole Boring Logs

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N18	N25



TEST HOLE LOCATIONS

TEST HOLE / PENETROMETER	STATION	OFFSET	DEPTH	LOCATION
TH-IA	1224+56	25.5' LT	113.0'	ABUTMENT 1
TH-IB	1224+61	25.5' LT	113.0' to 140.5'	ABUTMENT 1
TH-2	1225+83	15.5' LT	150.0'	PIER 2
TH-3	1227+36	15.7' LT	155.0'	PIER 3
TH-4	1228+70	15.8' LT	150.0'	PIER 4
TH-5	1229+98	19' LT	150.5'	ABUTMENT 5

DESIGNED BY:	D.Hemstreet	CHECKED:	Engineer
DRAWN BY:	K. Chang/RA	CHECKED:	Engineer
QUANTITIES BY:	Engineer	CHECKED:	Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOCATIONS

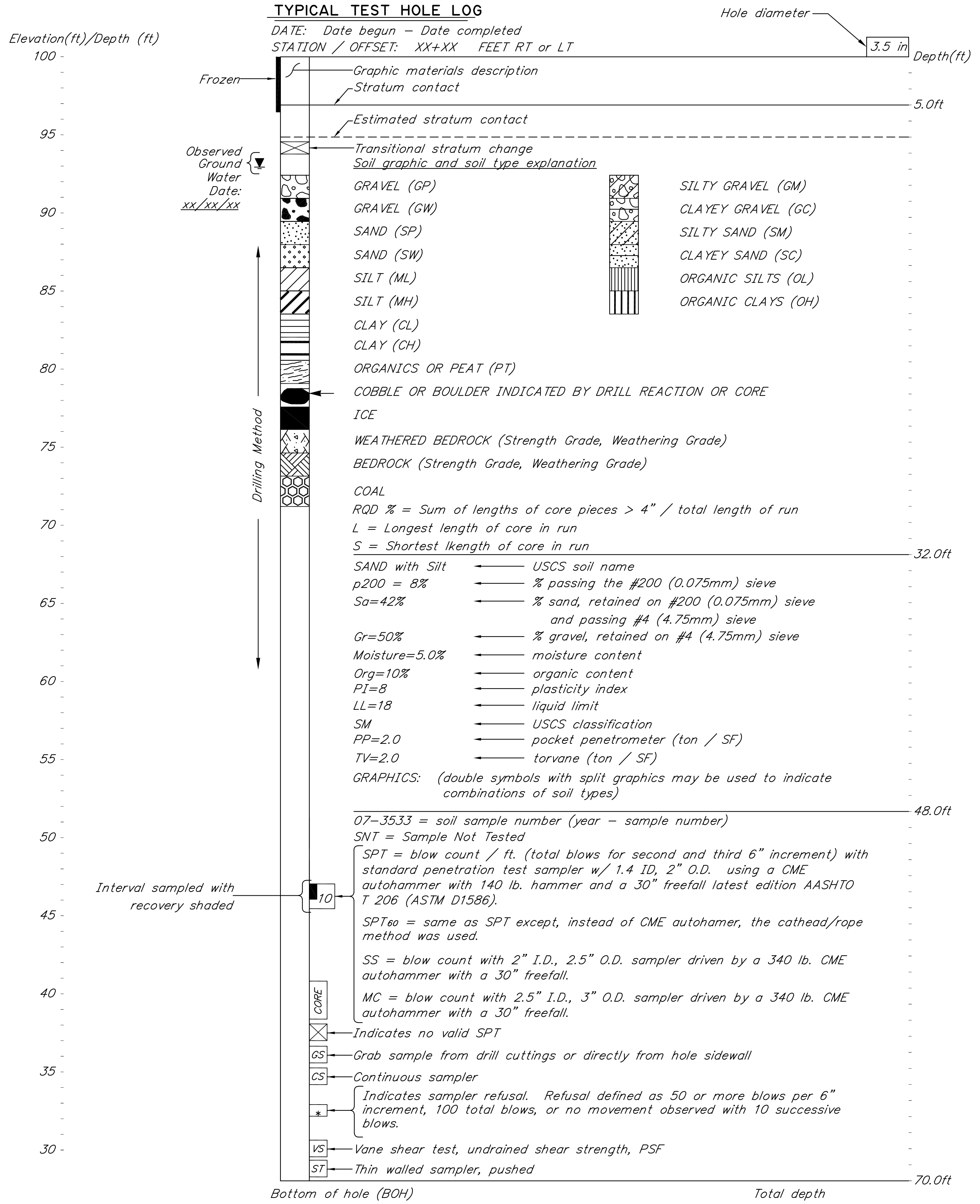
BRIDGE NO. 742
DWG. NO. 18

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-1 LOC Apr 19, 2023 - 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N19	N25

TYPICAL TEST HOLE LOG

DATE: Date begun – Date completed
STATION / OFFSET: XX+XX FEET RT or LT



Graphic materials description
Stratum contact
Estimated stratum contact
Transitional stratum change

Soil graphic and soil type explanation

GRAVEL (GP)
GRAVEL (GW)
SAND (SP)
SAND (SW)
SILT (ML)
SILT (MH)
CLAY (CL)
CLAY (CH)
ORGANICS OR PEAT (PT)
COBBLE OR BOULDER INDICATED BY DRILL REACTION OR CORE
ICE
WEATHERED BEDROCK (Strength Grade, Weathering Grade)
BEDROCK (Strength Grade, Weathering Grade)
COAL

SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
SILTY SAND (SM)
CLAYEY SAND (SC)
ORGANIC SILTS (OL)
ORGANIC CLAYS (OH)

RQD % = Sum of lengths of core pieces > 4" / total length of run
L = Longest length of core in run
S = Shortest lkength of core in run

SAND with Silt	USCS soil name
p200 = 8%	% passing the #200 (0.075mm) sieve
Sa=42%	% sand, retained on #200 (0.075mm) sieve and passing #4 (4.75mm) sieve
Gr=50%	% gravel, retained on #4 (4.75mm) sieve
Moisture=5.0%	moisture content
Org=10%	organic content
PI=8	plasticity index
LL=18	liquid limit
SM	USCS classification
PP=2.0	pocket penetrometer (ton / SF)
TV=2.0	torvane (ton / SF)

GRAPHICS: (double symbols with split graphics may be used to indicate combinations of soil types)

07–3533 = soil sample number (year – sample number)
SNT = Sample Not Tested

SPT = blow count / ft. (total blows for second and third 6" increment) with standard penetration test sampler w/ 1.4 ID, 2" O.D. using a CME autohammer with 140 lb. hammer and a 30" freefall latest edition AASHTO T 206 (ASTM D1586).

SPT_{60} = same as SPT except, instead of CME autohamer, the cathead/rope method was used.

SS = blow count with 2" I.D., 2.5" O.D. sampler driven by a 340 lb. CME autohammer with a 30" freefall.

MC = blow count with 2.5" I.D., 3" O.D. sampler driven by a 340 lb. CME autohammer with a 30" freefall.

Indicates no valid SPT
Grab sample from drill cuttings or directly from hole sidewall
Continuous sampler

Indicates sampler refusal. Refusal defined as 50 or more blows per 6" increment, 100 total blows, or no movement observed with 10 successive blows.

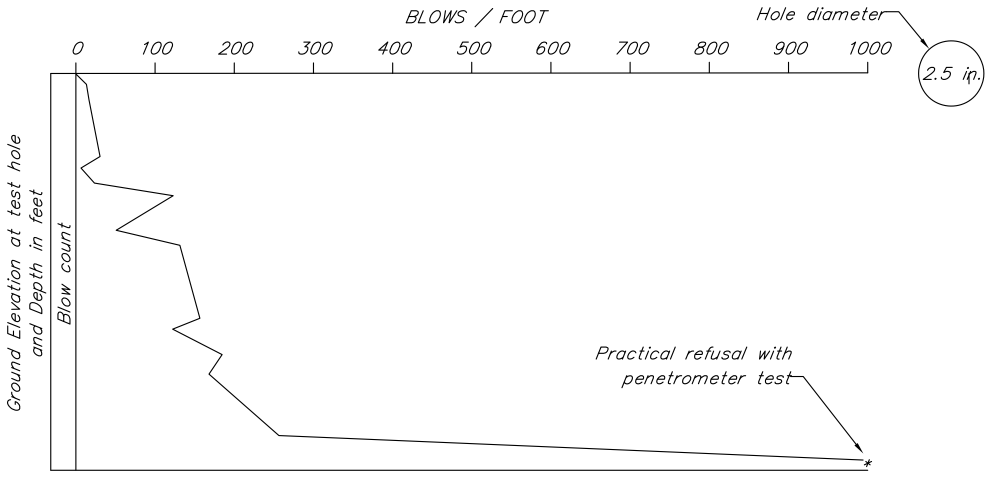
Vane shear test, undrained shear strength, PSF
Thin walled sampler, pushed

NOTES:

1) The test hole logs depicted graphically in these drawings are distillations of the original field logs, based on post–field investigation review and analysis. These drafted logs include changes made to field descriptions based upon laboratory test data, review and analysis. Detailed field observations of rock and soil sampled during the drilling program are not reproduced in the drafted logs.
2) Description of soils follows Alaska Geotechnical Procedures manual. Classification of soils follows Unified Soil Classification System (ASTM D2487).
3) The test hole logs from these sheets are an integral part of the Foundation Geology Report. See Construction Contract Bid Documents – invitation to bid/notice to bidders. Important information about the test hole logs and the foundation investigation is contained in the report. The test hole logs are not severable from and cannot be completely and correctly interpreted without reference to the Foundation Geology Report.

TYPICAL PENETROMETER TEST LOG

DATE: Date begun – Date completed
STATION / OFFSET: XX+XX / RT or LT (feet)



Bottom of hole (BOH)

NOTES:
Penetrometer W/2.5" O.D., with a CME AUTOMATIC Hammer using a 340 lb. weight and a 30" freefall

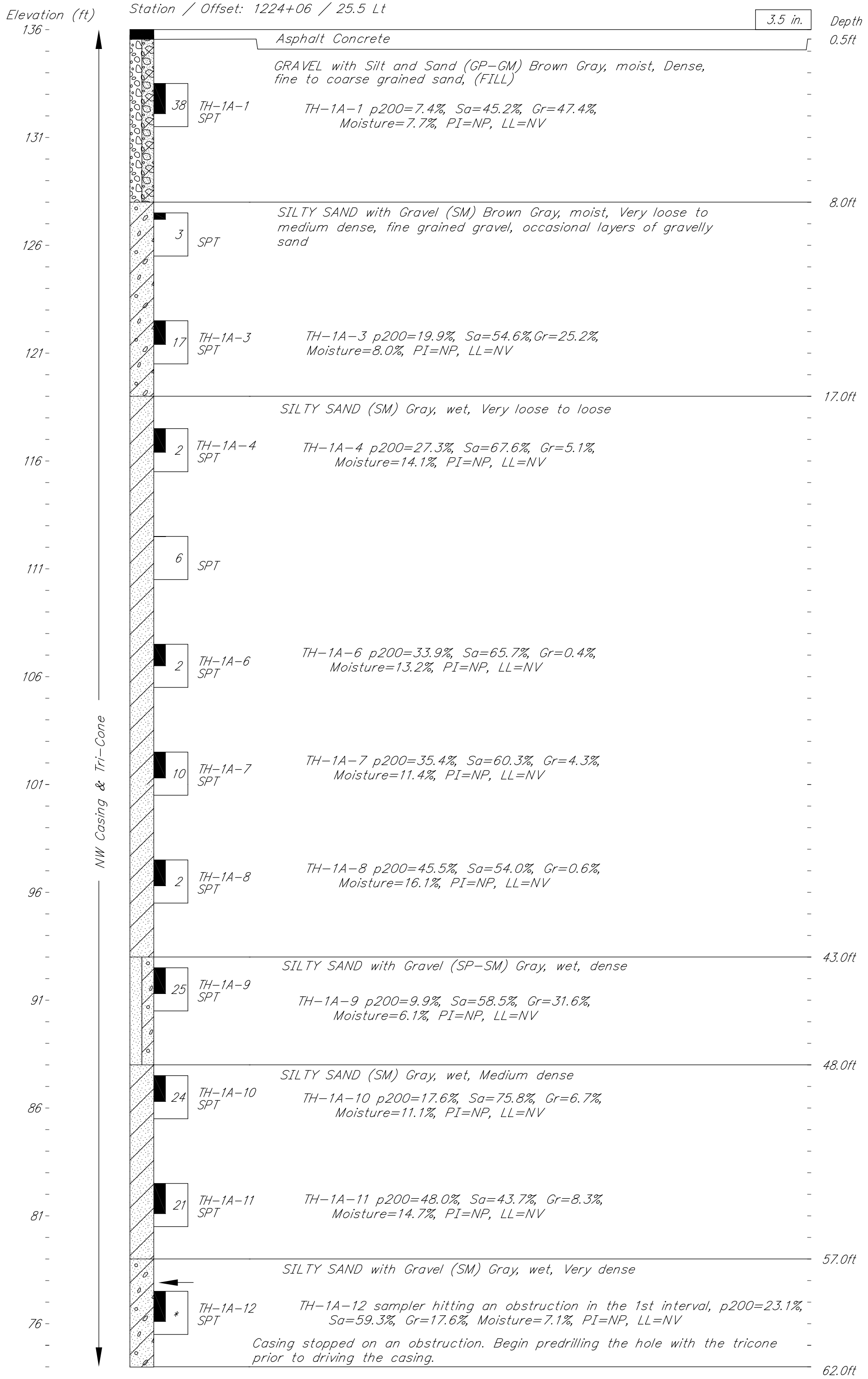
DESIGNED BY: D.Hemstreet	CHECKED: Engineer	STATE OF ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES STATEWIDE MATERIALS	David A. Hemstreet No. CE 9800 5/8/23	CHILKAT RIVER BRIDGE HAINES HIGHWAY TEST HOLE & PENETROMETER LEGEND
DRAWN BY: K. Chang	CHECKED: Engineer			BRIDGE NO. 742
QUANTITIES BY: Engineer	CHECKED: Engineer			DWG. NO. 19

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-2 TYP Apr 19, 2023 - 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N20	N25

THIO-IA

Date: 7/24/10 – 7/25/10
Station / Offset: 1224+06 / 25.5 Lt



Asphalt Concrete — 0.5ft

GRAVEL with Silt and Sand (GP–GM) Brown Gray, moist, Dense, fine to coarse grained sand, (FILL)

TH–1A–1 p200=7.4%, Sa=45.2%, Gr=47.4%, Moisture=7.7%, PI=NP, LL=NV

8.0ft

SILTY SAND with Gravel (SM) Brown Gray, moist, Very loose to medium dense, fine grained gravel, occasional layers of gravelly sand

TH–1A–3 p200=19.9%, Sa=54.6%,Gr=25.2%, Moisture=8.0%, PI=NP, LL=NV

17.0ft

SILTY SAND (SM) Gray, wet, Very loose to loose

TH–1A–4 p200=27.3%, Sa=67.6%, Gr=5.1%, Moisture=14.1%, PI=NP, LL=NV

TH–1A–6 p200=33.9%, Sa=65.7%, Gr=0.4%, Moisture=13.2%, PI=NP, LL=NV

TH–1A–7 p200=35.4%, Sa=60.3%, Gr=4.3%, Moisture=11.4%, PI=NP, LL=NV

TH–1A–8 p200=45.5%, Sa=54.0%, Gr=0.6%, Moisture=16.1%, PI=NP, LL=NV

43.0ft

SILTY SAND with Gravel (SP–SM) Gray, wet, dense

TH–1A–9 p200=9.9%, Sa=58.5%, Gr=31.6%, Moisture=6.1%, PI=NP, LL=NV

48.0ft

SILTY SAND (SM) Gray, wet, Medium dense

TH–1A–10 p200=17.6%, Sa=75.8%, Gr=6.7%, Moisture=11.1%, PI=NP, LL=NV

TH–1A–11 p200=48.0%, Sa=43.7%, Gr=8.3%, Moisture=14.7%, PI=NP, LL=NV

57.0ft

SILTY SAND with Gravel (SM) Gray, wet, Very dense

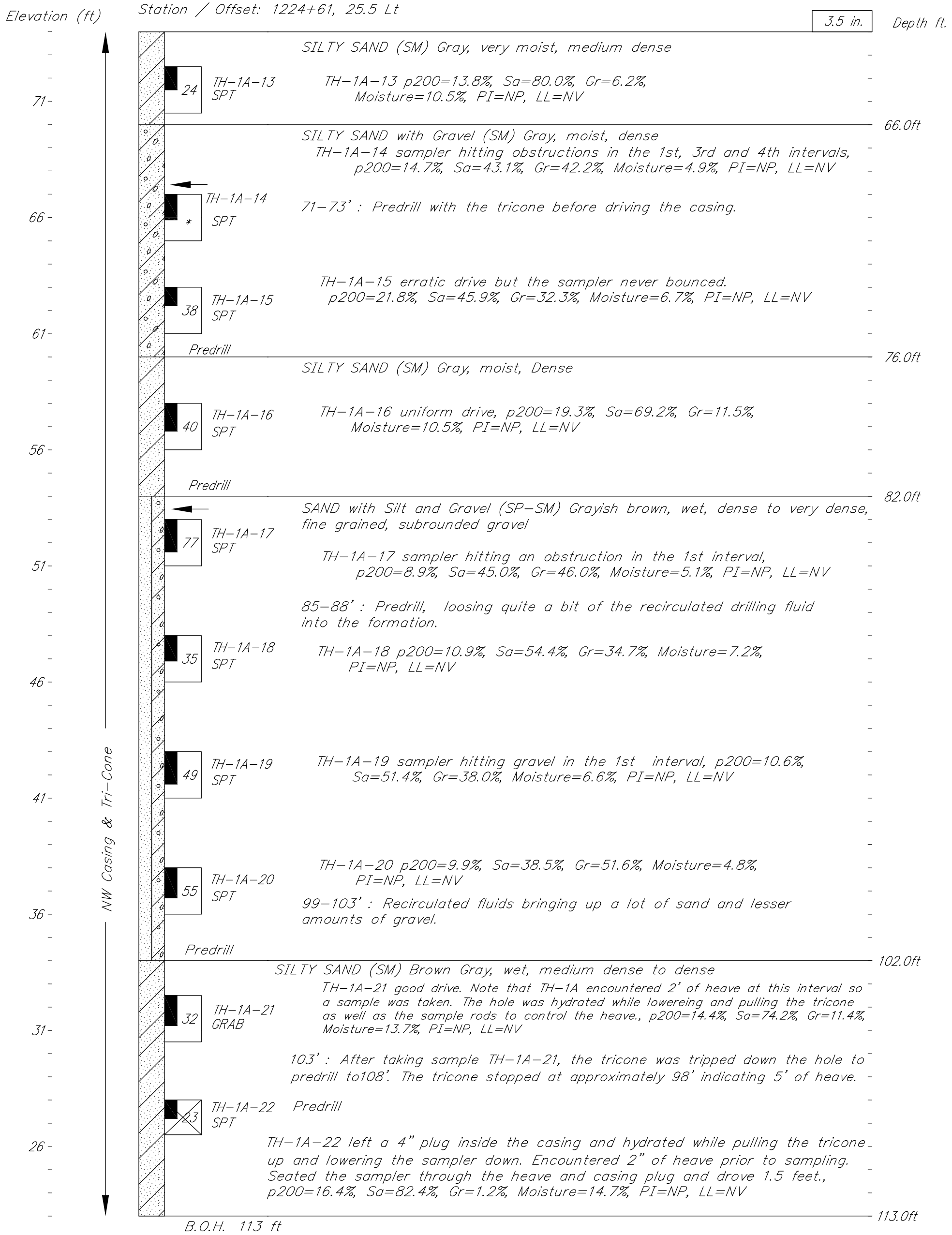
TH–1A–12 sampler hitting an obstruction in the 1st interval, p200=23.1%, Sa=59.3%, Gr=17.6%, Moisture=7.1%, PI=NP, LL=NV

Casing stopped on an obstruction. Begin predrilling the hole with the tricone prior to driving the casing.

62.0ft

THIO-IA (Cont.)

Date: 7/24/10 – 7/25/10
Station / Offset: 1224+61, 25.5 Lt



SILTY SAND (SM) Gray, very moist, medium dense

TH–1A–13 p200=13.8%, Sa=80.0%, Gr=6.2%, Moisture=10.5%, PI=NP, LL=NV

66.0ft

SILTY SAND with Gravel (SM) Gray, moist, dense

TH–1A–14 sampler hitting obstructions in the 1st, 3rd and 4th intervals, p200=14.7%, Sa=43.1%, Gr=42.2%, Moisture=4.9%, PI=NP, LL=NV

71–73' : Predrill with the tricone before driving the casing.

TH–1A–15 erratic drive but the sampler never bounced. p200=21.8%, Sa=45.9%, Gr=32.3%, Moisture=6.7%, PI=NP, LL=NV

76.0ft

SILTY SAND (SM) Gray, moist, Dense

TH–1A–16 uniform drive, p200=19.3%, Sa=69.2%, Gr=11.5%, Moisture=10.5%, PI=NP, LL=NV

82.0ft

SAND with Silt and Gravel (SP–SM) Grayish brown, wet, dense to very dense, fine grained, subrounded gravel

TH–1A–17 sampler hitting an obstruction in the 1st interval, p200=8.9%, Sa=45.0%, Gr=46.0%, Moisture=5.1%, PI=NP, LL=NV

85–88' : Predrill, loosing quite a bit of the recirculated drilling fluid into the formation.

TH–1A–18 p200=10.9%, Sa=54.4%, Gr=34.7%, Moisture=7.2%, PI=NP, LL=NV

TH–1A–19 sampler hitting gravel in the 1st interval, p200=10.6%, Sa=51.4%, Gr=38.0%, Moisture=6.6%, PI=NP, LL=NV

TH–1A–20 p200=9.9%, Sa=38.5%, Gr=51.6%, Moisture=4.8%, PI=NP, LL=NV

99–103' : Recirculated fluids bringing up a lot of sand and lesser amounts of gravel.

102.0ft

SILTY SAND (SM) Brown Gray, wet, medium dense to dense

TH–1A–21 good drive. Note that TH–1A encountered 2' of heave at this interval so a sample was taken. The hole was hydrated while lowereing and pulling the tricone as well as the sample rods to control the heave., p200=14.4%, Sa=74.2%, Gr=11.4%, Moisture=13.7%, PI=NP, LL=NV

103' : After taking sample TH–1A–21, the tricone was tripped down the hole to predrill to108'. The tricone stopped at approximately 98' indicating 5' of heave.

Predrill

TH–1A–22 left a 4" plug inside the casing and hydrated while pulling the tricone up and lowering the sampler down. Encountered 2" of heave prior to sampling. Seated the sampler through the heave and casing plug and drove 1.5 feet., p200=16.4%, Sa=82.4%, Gr=1.2%, Moisture=14.7%, PI=NP, LL=NV

113.0ft

B.O.H. 113 ft
See TH–1B for contination of this this test hole
140 lb. hammer, CME Auto Hammer, For Sampler

DESIGNED BY:	D.Hemstreet	CHECKED:	Engineer
DRAWN BY:	K. Chang/RA	CHECKED:	Engineer
QUANTITIES BY:	Engineer	CHECKED:	Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

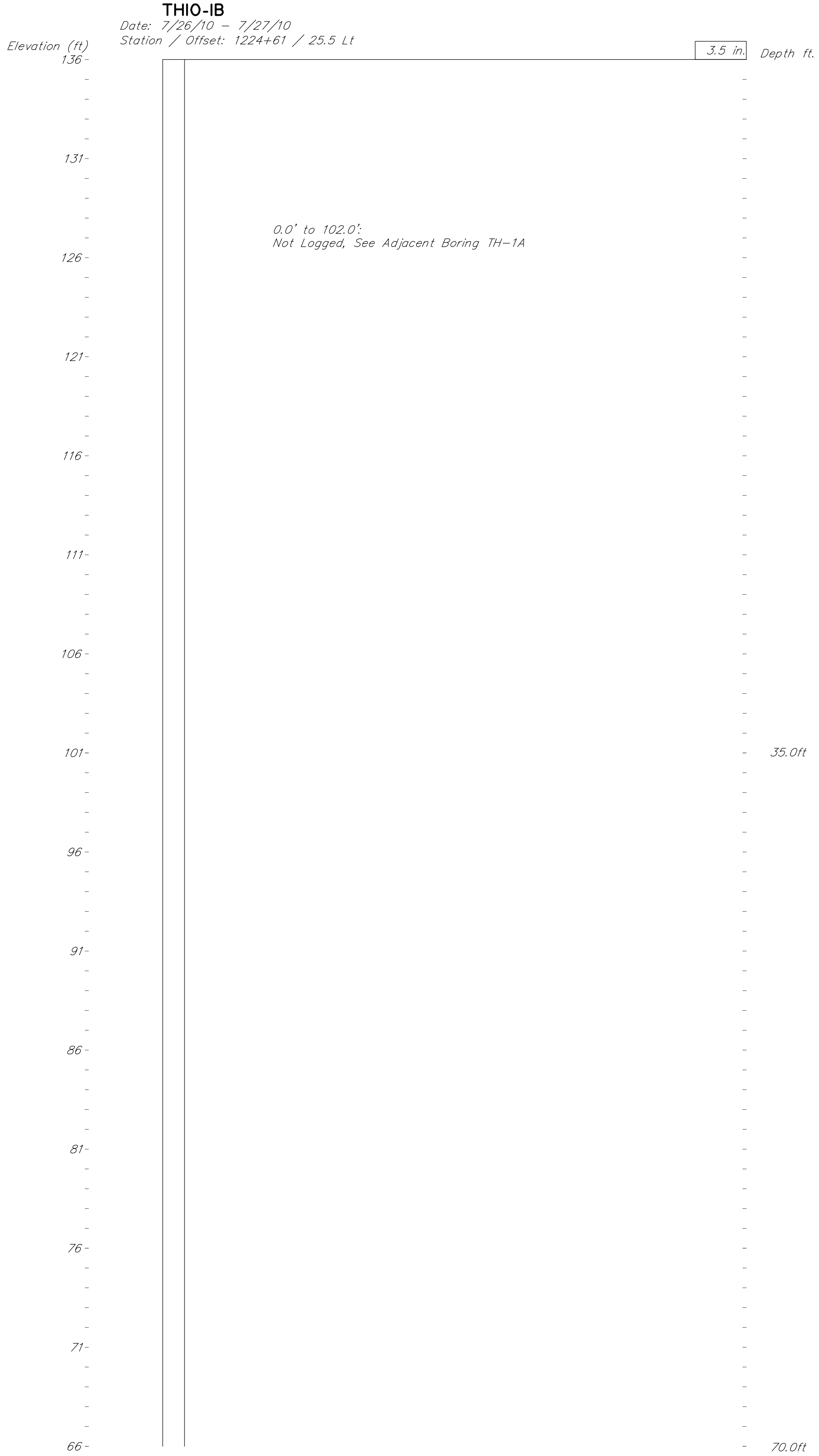
TEST HOLE & PENETROMETER LOGS

BRIDGE NO. 742
DWG. NO. 20

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N21	N25

THIO-IB

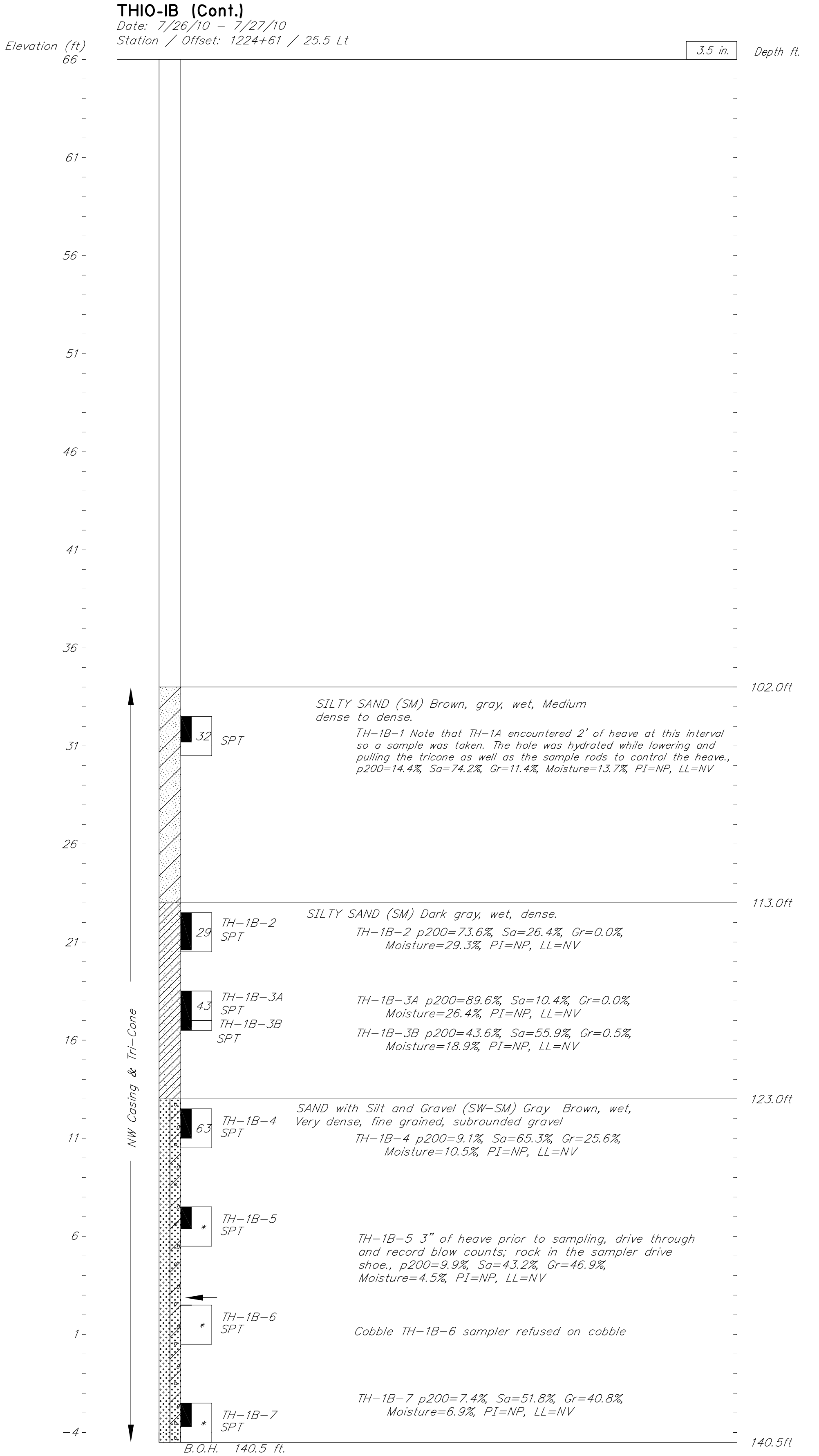
Date: 7/26/10 – 7/27/10
Station / Offset: 1224+61 / 25.5 Lt



0.0' to 102.0':
Not Logged, See Adjacent Boring TH–1A

THIO-IB (Cont.)

Date: 7/26/10 – 7/27/10
Station / Offset: 1224+61 / 25.5 Lt



SILTY SAND (SM) Brown, gray, wet, Medium dense to dense.

TH–1B–1 Note that TH–1A encountered 2' of heave at this interval so a sample was taken. The hole was hydrated while lowering and pulling the tricone as well as the sample rods to control the heave., p200=14.4%, Sa=74.2%, Gr=11.4%, Moisture=13.7%, PI=NP, LL=NV

SILTY SAND (SM) Dark gray, wet, dense.

TH–1B–2 p200=73.6%, Sa=26.4%, Gr=0.0%, Moisture=29.3%, PI=NP, LL=NV

TH–1B–3A p200=89.6%, Sa=10.4%, Gr=0.0%, Moisture=26.4%, PI=NP, LL=NV

TH–1B–3B p200=43.6%, Sa=55.9%, Gr=0.5%, Moisture=18.9%, PI=NP, LL=NV

SAND with Silt and Gravel (SW–SM) Gray Brown, wet, Very dense, fine grained, subrounded gravel

TH–1B–4 p200=9.1%, Sa=65.3%, Gr=25.6%, Moisture=10.5%, PI=NP, LL=NV

TH–1B–5 3" of heave prior to sampling, drive through and record blow counts; rock in the sampler drive shoe., p200=9.9%, Sa=43.2%, Gr=46.9%, Moisture=4.5%, PI=NP, LL=NV

Cobble TH–1B–6 sampler refused on cobble

TH–1B–7 p200=7.4%, Sa=51.8%, Gr=40.8%, Moisture=6.9%, PI=NP, LL=NV

B.O.H. 140.5 ft.
See TH–1A for the first 108' of this test hole log. 140 lb hammer, CME Auto Hammer, For Sampler

DESIGNED BY:	D.Hemstreet	CHECKED:	Engineer
DRAWN BY:	K. Chang/RA	CHECKED:	Engineer
QUANTITIES BY:	Engineer	CHECKED:	Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOGS

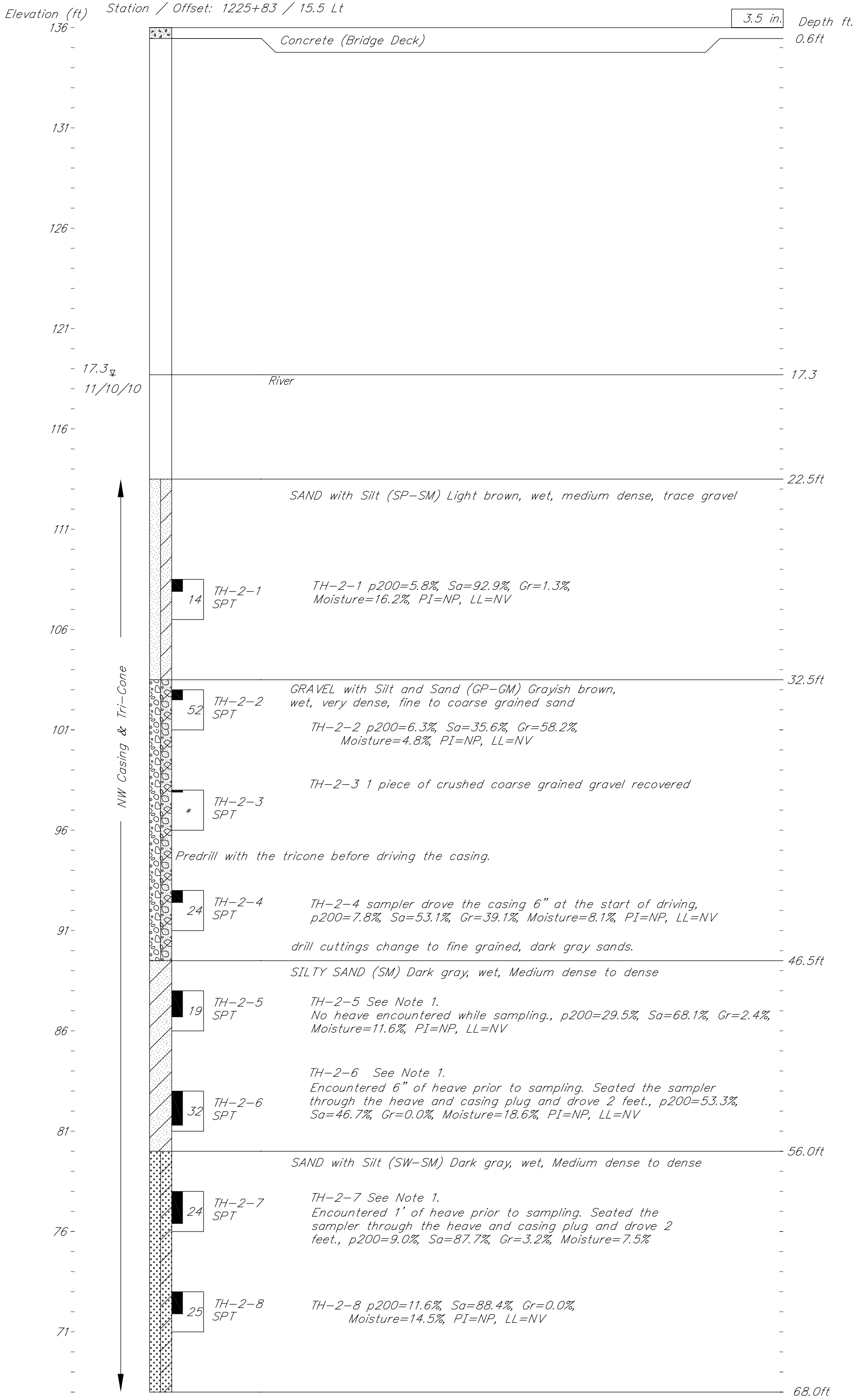
BRIDGE NO. 742
DWG. NO. 21

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-4 TH10-1B Apr 19, 2023 – 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N22	N25

THIO-2

Date: 11/10/10 – 11/13/10
Station / Offset: 1225+83 / 15.5 Lt



Concrete (Bridge Deck)

River

SAND with Silt (SP–SM) Light brown, wet, medium dense, trace gravel

TH–2–1 p200=5.8%, Sa=92.9%, Gr=1.3%,
Moisture=16.2%, PI=NP, LL=NV

GRAVEL with Silt and Sand (GP–GM) Grayish brown, wet, very dense, fine to coarse grained sand

TH–2–2 p200=6.3%, Sa=35.6%, Gr=58.2%,
Moisture=4.8%, PI=NP, LL=NV

TH–2–3 1 piece of crushed coarse grained gravel recovered

Predrill with the tricone before driving the casing.

TH–2–4 sampler drove the casing 6" at the start of driving,
p200=7.8%, Sa=53.1%, Gr=39.1%, Moisture=8.1%, PI=NP, LL=NV

drill cuttings change to fine grained, dark gray sands.

SILTY SAND (SM) Dark gray, wet, Medium dense to dense

TH–2–5 See Note 1.
No heave encountered while sampling., p200=29.5%, Sa=68.1%, Gr=2.4%,
Moisture=11.6%, PI=NP, LL=NV

TH–2–6 See Note 1.
Encountered 6" of heave prior to sampling. Seated the sampler through the heave and casing plug and drove 2 feet., p200=53.3%, Sa=46.7%, Gr=0.0%, Moisture=18.6%, PI=NP, LL=NV

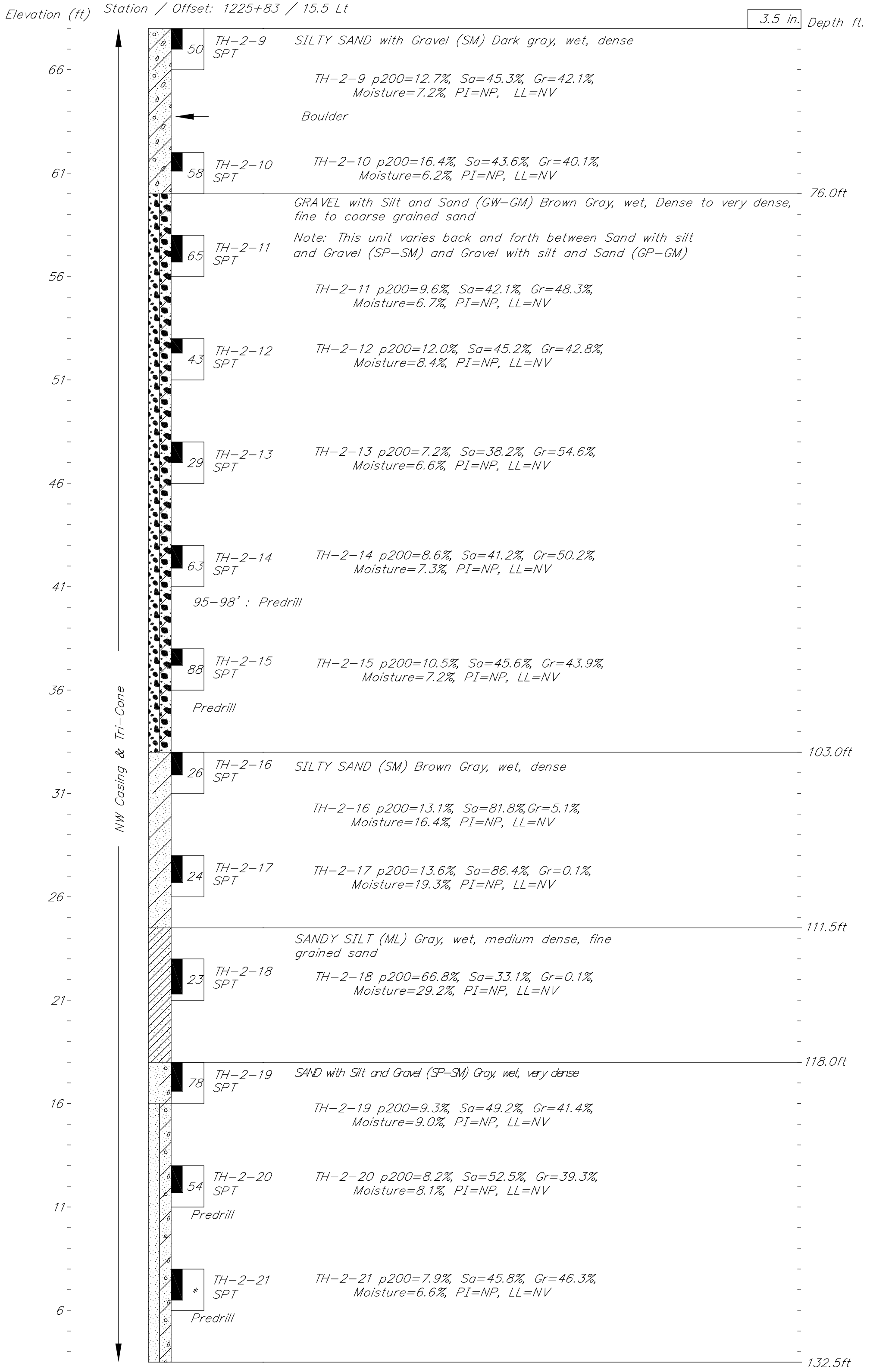
SAND with Silt (SW–SM) Dark gray, wet, Medium dense to dense

TH–2–7 See Note 1.
Encountered 1' of heave prior to sampling. Seated the sampler through the heave and casing plug and drove 2 feet., p200=9.0%, Sa=87.7%, Gr=3.2%, Moisture=7.5%

TH–2–8 p200=11.6%, Sa=88.4%, Gr=0.0%,
Moisture=14.5%, PI=NP, LL=NV

THIO-2 (Cont.)

Date: 11/10/10 – 11/13/10
Station / Offset: 1225+83 / 15.5 Lt



SILTY SAND with Gravel (SM) Dark gray, wet, dense

TH–2–9 p200=12.7%, Sa=45.3%, Gr=42.1%,
Moisture=7.2%, PI=NP, LL=NV

Boulder

TH–2–10 p200=16.4%, Sa=43.6%, Gr=40.1%,
Moisture=6.2%, PI=NP, LL=NV

GRAVEL with Silt and Sand (GW–GM) Brown Gray, wet, Dense to very dense, fine to coarse grained sand

Note: This unit varies back and forth between Sand with silt and Gravel (SP–SM) and Gravel with silt and Sand (GP–GM)

TH–2–11 p200=9.6%, Sa=42.1%, Gr=48.3%,
Moisture=6.7%, PI=NP, LL=NV

TH–2–12 p200=12.0%, Sa=45.2%, Gr=42.8%,
Moisture=8.4%, PI=NP, LL=NV

TH–2–13 p200=7.2%, Sa=38.2%, Gr=54.6%,
Moisture=6.6%, PI=NP, LL=NV

TH–2–14 p200=8.6%, Sa=41.2%, Gr=50.2%,
Moisture=7.3%, PI=NP, LL=NV

95–98' : Predrill

TH–2–15 p200=10.5%, Sa=45.6%, Gr=43.9%,
Moisture=7.2%, PI=NP, LL=NV

Predrill

SILTY SAND (SM) Brown Gray, wet, dense

TH–2–16 p200=13.1%, Sa=81.8%,Gr=5.1%,
Moisture=16.4%, PI=NP, LL=NV

TH–2–17 p200=13.6%, Sa=86.4%, Gr=0.1%,
Moisture=19.3%, PI=NP, LL=NV

SANDY SILT (ML) Gray, wet, medium dense, fine grained sand

TH–2–18 p200=66.8%, Sa=33.1%, Gr=0.1%,
Moisture=29.2%, PI=NP, LL=NV

SAND with Silt and Gravel (SP–SM) Gray, wet, very dense

TH–2–19 p200=9.3%, Sa=49.2%, Gr=41.4%,
Moisture=9.0%, PI=NP, LL=NV

TH–2–20 p200=8.2%, Sa=52.5%, Gr=39.3%,
Moisture=8.1%, PI=NP, LL=NV

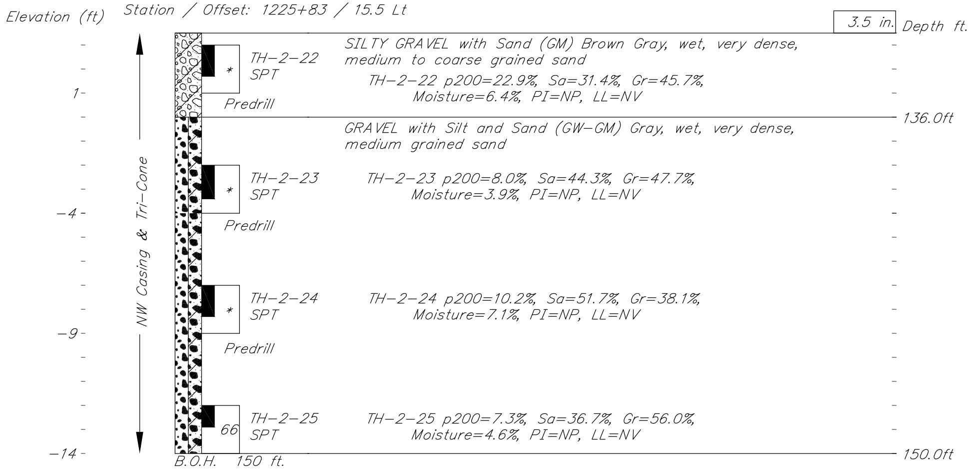
Predrill

TH–2–21 p200=7.9%, Sa=45.8%, Gr=46.3%,
Moisture=6.6%, PI=NP, LL=NV

Predrill

THIO-2 (Cont.)

Date: 11/10/10 – 11/13/10
Station / Offset: 1225+83 / 15.5 Lt



SILTY GRAVEL with Sand (GM) Brown Gray, wet, very dense, medium to coarse grained sand

TH–2–22 p200=22.9%, Sa=31.4%, Gr=45.7%,
Moisture=6.4%, PI=NP, LL=NV

Predrill

GRAVEL with Silt and Sand (GW–GM) Gray, wet, very dense, medium grained sand

TH–2–23 p200=8.0%, Sa=44.3%, Gr=47.7%,
Moisture=3.9%, PI=NP, LL=NV

Predrill

TH–2–24 p200=10.2%, Sa=51.7%, Gr=38.1%,
Moisture=7.1%, PI=NP, LL=NV

Predrill

TH–2–25 p200=7.3%, Sa=36.7%, Gr=56.0%,
Moisture=4.6%, PI=NP, LL=NV

B.O.H. 150 ft.
Mudline 22.5 feet below the bridge deck at elevation 114 feet.
140 lb hammer, CME Auto Hammer, For Sampler

Note 1.
Left a 1" plug inside the casing and hydrated while pulling Tricone up and lowering the sampler down to eliminate potential heave.

DESIGNED BY: D.Hemstreet	CHECKED: Engineer
DRAWN BY: K. Chang/RA	CHECKED: Engineer
QUANTITIES BY: Engineer	CHECKED: Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
David A. Hemstreet
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOGS

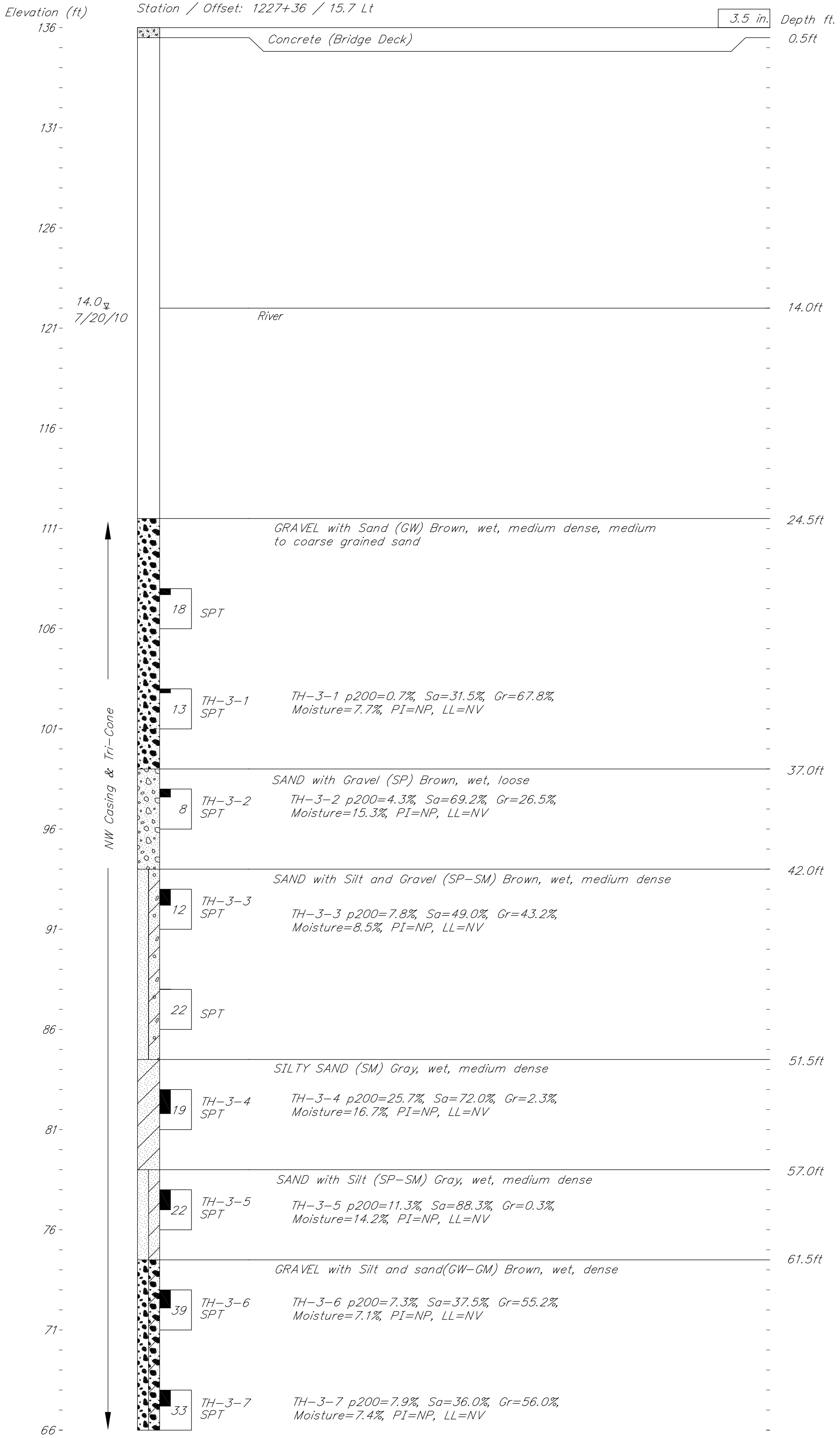
BRIDGE NO. 742
DWG. NO. 22

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-5 TH10-2 Apr 19, 2023 - 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N23	N25

THIO-3

Date: 7/20/10 – 7/22/10
Station / Offset: 1227+36 / 15.7 Lt



0.5ft — Concrete (Bridge Deck)

14.0ft — River

24.5ft — GRAVEL with Sand (GW) Brown, wet, medium dense, medium to coarse grained sand

18 SPT

13 TH-3-1 SPT — TH-3-1 p200=0.7%, Sa=31.5%, Gr=67.8%, Moisture=7.7%, PI=NP, LL=NV

37.0ft — SAND with Gravel (SP) Brown, wet, loose

8 TH-3-2 SPT — TH-3-2 p200=4.3%, Sa=69.2%, Gr=26.5%, Moisture=15.3%, PI=NP, LL=NV

42.0ft — SAND with Silt and Gravel (SP-SM) Brown, wet, medium dense

12 TH-3-3 SPT — TH-3-3 p200=7.8%, Sa=49.0%, Gr=43.2%, Moisture=8.5%, PI=NP, LL=NV

22 SPT

51.5ft — SILTY SAND (SM) Gray, wet, medium dense

19 TH-3-4 SPT — TH-3-4 p200=25.7%, Sa=72.0%, Gr=2.3%, Moisture=16.7%, PI=NP, LL=NV

57.0ft — SAND with Silt (SP-SM) Gray, wet, medium dense

22 TH-3-5 SPT — TH-3-5 p200=11.3%, Sa=88.3%, Gr=0.3%, Moisture=14.2%, PI=NP, LL=NV

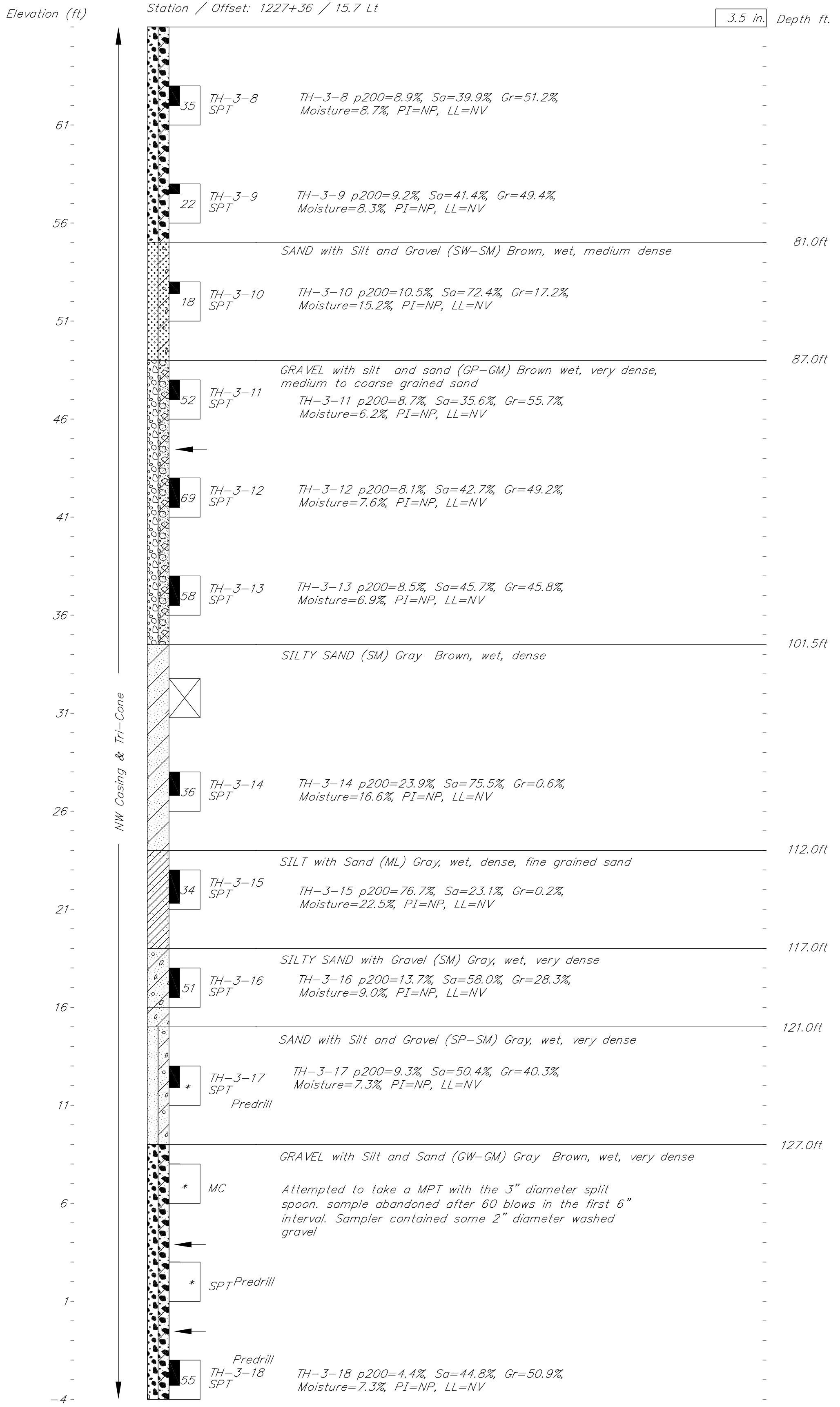
61.5ft — GRAVEL with Silt and sand(GW-GM) Brown, wet, dense

39 TH-3-6 SPT — TH-3-6 p200=7.3%, Sa=37.5%, Gr=55.2%, Moisture=7.1%, PI=NP, LL=NV

33 TH-3-7 SPT — TH-3-7 p200=7.9%, Sa=36.0%, Gr=56.0%, Moisture=7.4%, PI=NP, LL=NV

THIO-3 (Cont.)

Date: 7/20/10 – 7/22/10
Station / Offset: 1227+36 / 15.7 Lt



35 TH-3-8 SPT — TH-3-8 p200=8.9%, Sa=39.9%, Gr=51.2%, Moisture=8.7%, PI=NP, LL=NV

22 TH-3-9 SPT — TH-3-9 p200=9.2%, Sa=41.4%, Gr=49.4%, Moisture=8.3%, PI=NP, LL=NV

81.0ft — SAND with Silt and Gravel (SW-SM) Brown, wet, medium dense

18 TH-3-10 SPT — TH-3-10 p200=10.5%, Sa=72.4%, Gr=17.2%, Moisture=15.2%, PI=NP, LL=NV

87.0ft — GRAVEL with silt and sand (GP-GM) Brown wet, very dense, medium to coarse grained sand

52 TH-3-11 SPT — TH-3-11 p200=8.7%, Sa=35.6%, Gr=55.7%, Moisture=6.2%, PI=NP, LL=NV

69 TH-3-12 SPT — TH-3-12 p200=8.1%, Sa=42.7%, Gr=49.2%, Moisture=7.6%, PI=NP, LL=NV

58 TH-3-13 SPT — TH-3-13 p200=8.5%, Sa=45.7%, Gr=45.8%, Moisture=6.9%, PI=NP, LL=NV

101.5ft — SILTY SAND (SM) Gray Brown, wet, dense

36 TH-3-14 SPT — TH-3-14 p200=23.9%, Sa=75.5%, Gr=0.6%, Moisture=16.6%, PI=NP, LL=NV

112.0ft — SILT with Sand (ML) Gray, wet, dense, fine grained sand

34 TH-3-15 SPT — TH-3-15 p200=76.7%, Sa=23.1%, Gr=0.2%, Moisture=22.5%, PI=NP, LL=NV

117.0ft — SILTY SAND with Gravel (SM) Gray, wet, very dense

51 TH-3-16 SPT — TH-3-16 p200=13.7%, Sa=58.0%, Gr=28.3%, Moisture=9.0%, PI=NP, LL=NV

121.0ft — SAND with Silt and Gravel (SP-SM) Gray, wet, very dense

* TH-3-17 SPT Predrill — TH-3-17 p200=9.3%, Sa=50.4%, Gr=40.3%, Moisture=7.3%, PI=NP, LL=NV

127.0ft — GRAVEL with Silt and Sand (GW-GM) Gray Brown, wet, very dense

* MC — Attempted to take a MPT with the 3" diameter split spoon. sample abandoned after 60 blows in the first 6" interval. Sampler contained some 2" diameter washed gravel

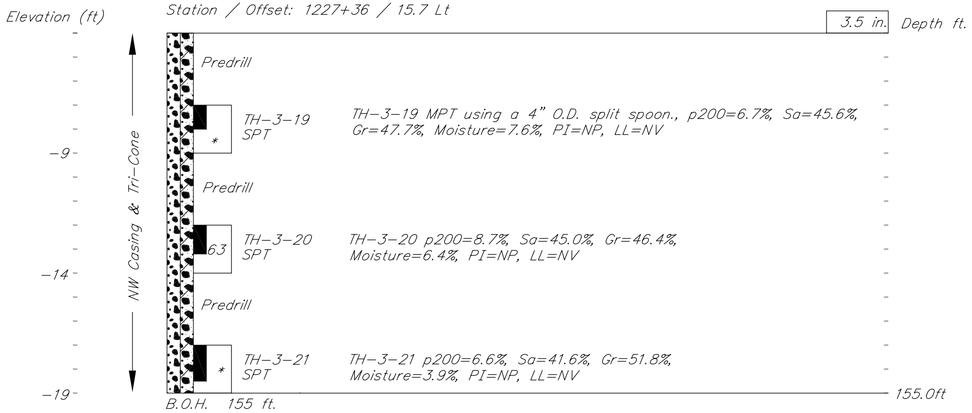
* SPT Predrill

Predrill

55 TH-3-18 SPT — TH-3-18 p200=4.4%, Sa=44.8%, Gr=50.9%, Moisture=7.3%, PI=NP, LL=NV

THIO-3 (Cont.)

Date: 7/20/10 – 7/22/10
Station / Offset: 1227+36 / 15.7 Lt



Predrill

* TH-3-19 SPT — TH-3-19 MPT using a 4" O.D. split spoon., p200=6.7%, Sa=45.6%, Gr=47.7%, Moisture=7.6%, PI=NP, LL=NV

Predrill

63 TH-3-20 SPT — TH-3-20 p200=8.7%, Sa=45.0%, Gr=46.4%, Moisture=6.4%, PI=NP, LL=NV

Predrill

* TH-3-21 SPT — TH-3-21 p200=6.6%, Sa=41.6%, Gr=51.8%, Moisture=3.9%, PI=NP, LL=NV

155.0ft

B.O.H. 155 ft.
Mudline 24.5 feet below the bridge deck at approximate elevation 112 feet.
140 lb hammer, CME Auto Hammer, For Sampler

DESIGNED BY:	D.Hemstreet	**CHECKED:**	Engineer
DRAWN BY:	K. Chang/RA	**CHECKED:**	Engineer
QUANTITIES BY:	Engineer	**CHECKED:**	Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOGS

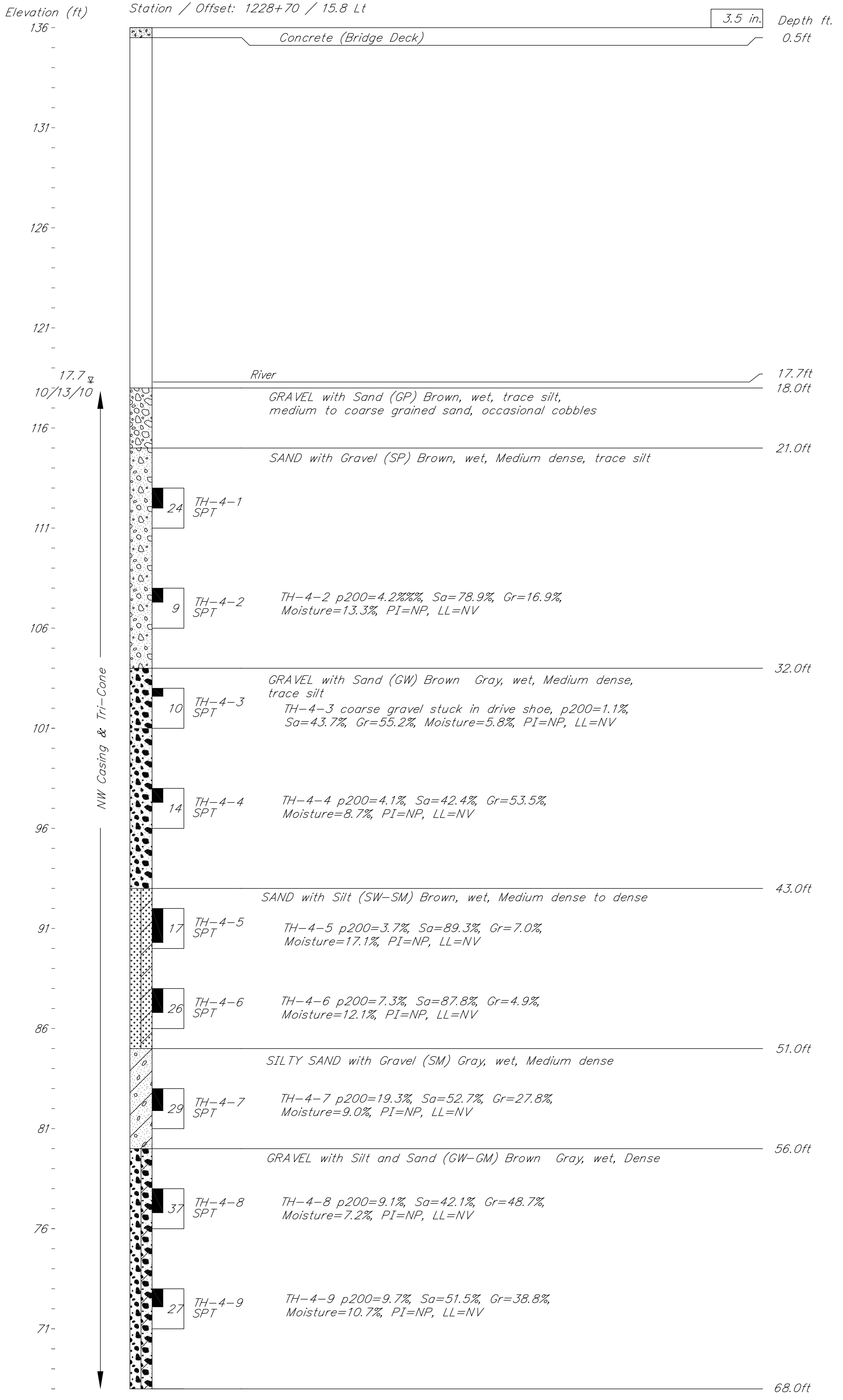
BRIDGE NO. 742
DWG. NO. 23

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-6 TH10-3 Apr 19, 2023 - 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N24	N25

THIO-4

Date: 10/13/10 – 10/15/10
Station / Offset: 1228+70 / 15.8 Lt



Concrete (Bridge Deck) — 0.5ft

River — 17.7ft

18.0ft

GRAVEL with Sand (GP) Brown, wet, trace silt, medium to coarse grained sand, occasional cobbles

21.0ft

SAND with Gravel (SP) Brown, wet, Medium dense, trace silt

TH–4–1 SPT

TH–4–2 SPT — TH–4–2 p200=4.2%%%, Sa=78.9%, Gr=16.9%, Moisture=13.3%, PI=NP, LL=NV

32.0ft

GRAVEL with Sand (GW) Brown Gray, wet, Medium dense, trace silt

TH–4–3 SPT — TH–4–3 coarse gravel stuck in drive shoe, p200=1.1%, Sa=43.7%, Gr=55.2%, Moisture=5.8%, PI=NP, LL=NV

TH–4–4 SPT — TH–4–4 p200=4.1%, Sa=42.4%, Gr=53.5%, Moisture=8.7%, PI=NP, LL=NV

43.0ft

SAND with Silt (SW–SM) Brown, wet, Medium dense to dense

TH–4–5 SPT — TH–4–5 p200=3.7%, Sa=89.3%, Gr=7.0%, Moisture=17.1%, PI=NP, LL=NV

TH–4–6 SPT — TH–4–6 p200=7.3%, Sa=87.8%, Gr=4.9%, Moisture=12.1%, PI=NP, LL=NV

51.0ft

SILTY SAND with Gravel (SM) Gray, wet, Medium dense

TH–4–7 SPT — TH–4–7 p200=19.3%, Sa=52.7%, Gr=27.8%, Moisture=9.0%, PI=NP, LL=NV

56.0ft

GRAVEL with Silt and Sand (GW–GM) Brown Gray, wet, Dense

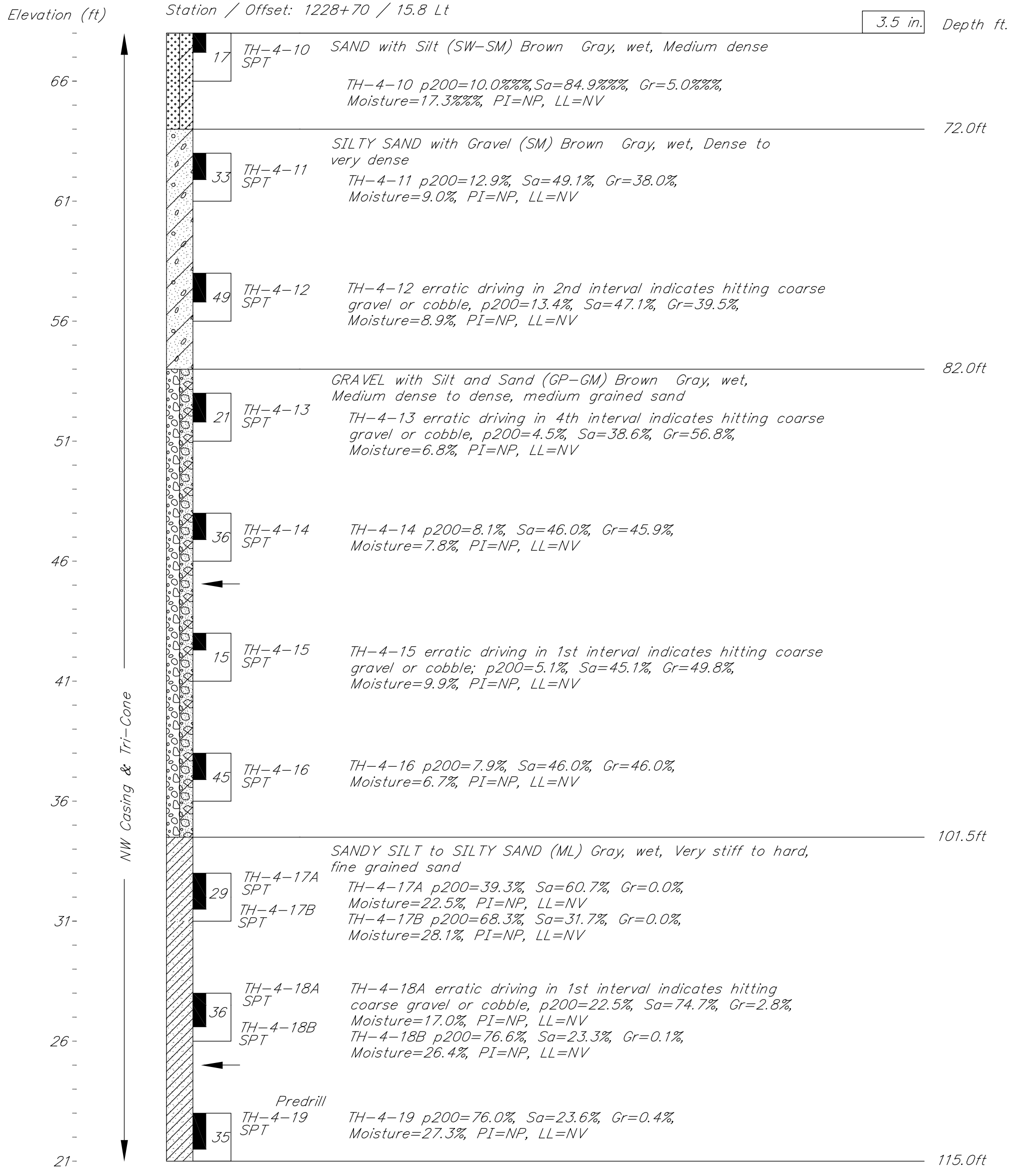
TH–4–8 SPT — TH–4–8 p200=9.1%, Sa=42.1%, Gr=48.7%, Moisture=7.2%, PI=NP, LL=NV

TH–4–9 SPT — TH–4–9 p200=9.7%, Sa=51.5%, Gr=38.8%, Moisture=10.7%, PI=NP, LL=NV

68.0ft

THIO-4 (Cont.)

Date: 10/13/10 – 10/15/10
Station / Offset: 1228+70 / 15.8 Lt



TH–4–10 SPT — SAND with Silt (SW–SM) Brown Gray, wet, Medium dense

TH–4–10 p200=10.0%%%,Sa=84.9%%%, Gr=5.0%%%, Moisture=17.3%%%, PI=NP, LL=NV

72.0ft

SILTY SAND with Gravel (SM) Brown Gray, wet, Dense to very dense

TH–4–11 SPT — TH–4–11 p200=12.9%, Sa=49.1%, Gr=38.0%, Moisture=9.0%, PI=NP, LL=NV

TH–4–12 SPT — TH–4–12 erratic driving in 2nd interval indicates hitting coarse gravel or cobble, p200=13.4%, Sa=47.1%, Gr=39.5%, Moisture=8.9%, PI=NP, LL=NV

82.0ft

GRAVEL with Silt and Sand (GP–GM) Brown Gray, wet, Medium dense to dense, medium grained sand

TH–4–13 SPT — TH–4–13 erratic driving in 4th interval indicates hitting coarse gravel or cobble, p200=4.5%, Sa=38.6%, Gr=56.8%, Moisture=6.8%, PI=NP, LL=NV

TH–4–14 SPT — TH–4–14 p200=8.1%, Sa=46.0%, Gr=45.9%, Moisture=7.8%, PI=NP, LL=NV

TH–4–15 SPT — TH–4–15 erratic driving in 1st interval indicates hitting coarse gravel or cobble; p200=5.1%, Sa=45.1%, Gr=49.8%, Moisture=9.9%, PI=NP, LL=NV

TH–4–16 SPT — TH–4–16 p200=7.9%, Sa=46.0%, Gr=46.0%, Moisture=6.7%, PI=NP, LL=NV

101.5ft

SANDY SILT to SILTY SAND (ML) Gray, wet, Very stiff to hard, fine grained sand

TH–4–17A SPT
TH–4–17B SPT

TH–4–17A p200=39.3%, Sa=60.7%, Gr=0.0%, Moisture=22.5%, PI=NP, LL=NV
TH–4–17B p200=68.3%, Sa=31.7%, Gr=0.0%, Moisture=28.1%, PI=NP, LL=NV

TH–4–18A SPT
TH–4–18B SPT

TH–4–18A erratic driving in 1st interval indicates hitting coarse gravel or cobble, p200=22.5%, Sa=74.7%, Gr=2.8%, Moisture=17.0%, PI=NP, LL=NV
TH–4–18B p200=76.6%, Sa=23.3%, Gr=0.1%, Moisture=26.4%, PI=NP, LL=NV

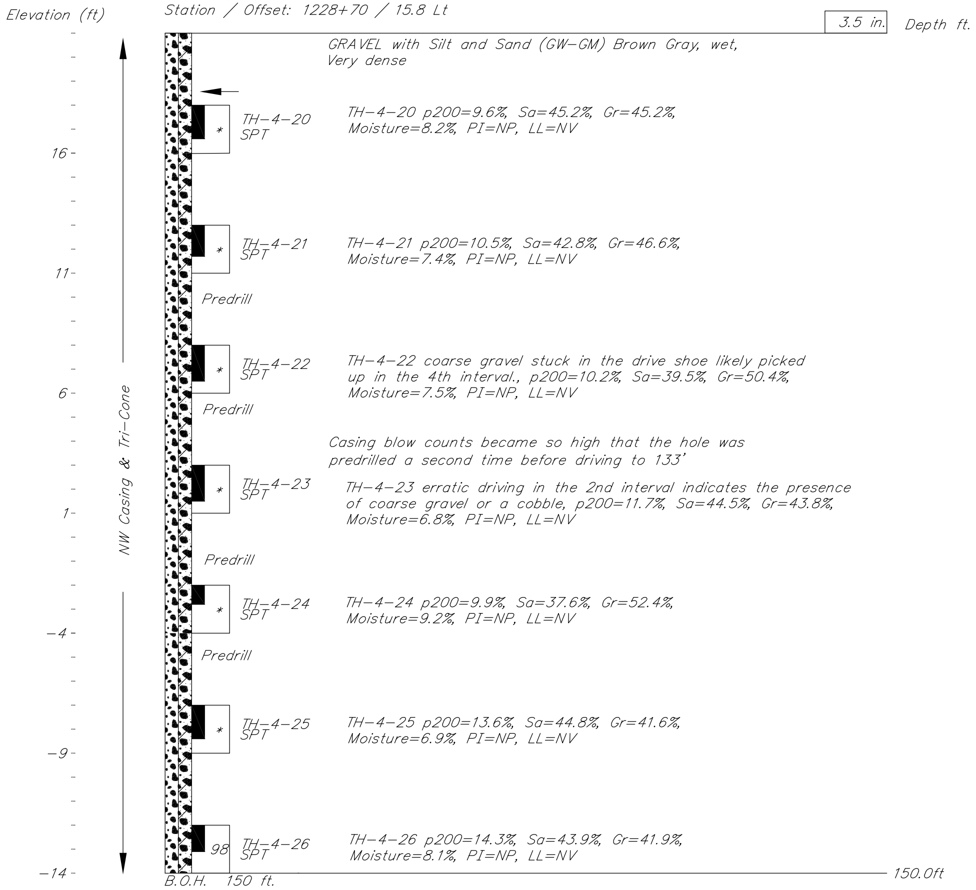
Predrill

TH–4–19 SPT — TH–4–19 p200=76.0%, Sa=23.6%, Gr=0.4%, Moisture=27.3%, PI=NP, LL=NV

115.0ft

THIO-4 (Cont.)

Date: 10/13/10 – 10/15/10
Station / Offset: 1228+70 / 15.8 Lt



GRAVEL with Silt and Sand (GW–GM) Brown Gray, wet, Very dense

TH–4–20 SPT — TH–4–20 p200=9.6%, Sa=45.2%, Gr=45.2%, Moisture=8.2%, PI=NP, LL=NV

TH–4–21 SPT — TH–4–21 p200=10.5%, Sa=42.8%, Gr=46.6%, Moisture=7.4%, PI=NP, LL=NV

Predrill

TH–4–22 SPT — TH–4–22 coarse gravel stuck in the drive shoe likely picked up in the 4th interval., p200=10.2%, Sa=39.5%, Gr=50.4%, Moisture=7.5%, PI=NP, LL=NV

Predrill

Casing blow counts became so high that the hole was predrilled a second time before driving to 133'

TH–4–23 SPT — TH–4–23 erratic driving in the 2nd interval indicates the presence of coarse gravel or a cobble, p200=11.7%, Sa=44.5%, Gr=43.8%, Moisture=6.8%, PI=NP, LL=NV

Predrill

TH–4–24 SPT — TH–4–24 p200=9.9%, Sa=37.6%, Gr=52.4%, Moisture=9.2%, PI=NP, LL=NV

Predrill

TH–4–25 SPT — TH–4–25 p200=13.6%, Sa=44.8%, Gr=41.6%, Moisture=6.9%, PI=NP, LL=NV

TH–4–26 SPT — TH–4–26 p200=14.3%, Sa=43.9%, Gr=41.9%, Moisture=8.1%, PI=NP, LL=NV

150.0ft

B.O.H. 150 ft.
Mudline 17.8 feet below the bridge deck at elevation 118.7 feet. 140 lb hammer, CME Auto Hammer, For Sampler

DESIGNED BY: D.Hemstreet	CHECKED: Engineer
DRAWN BY: K. Chang/RA	CHECKED: Engineer
QUANTITIES BY: Engineer	CHECKED: Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOGS

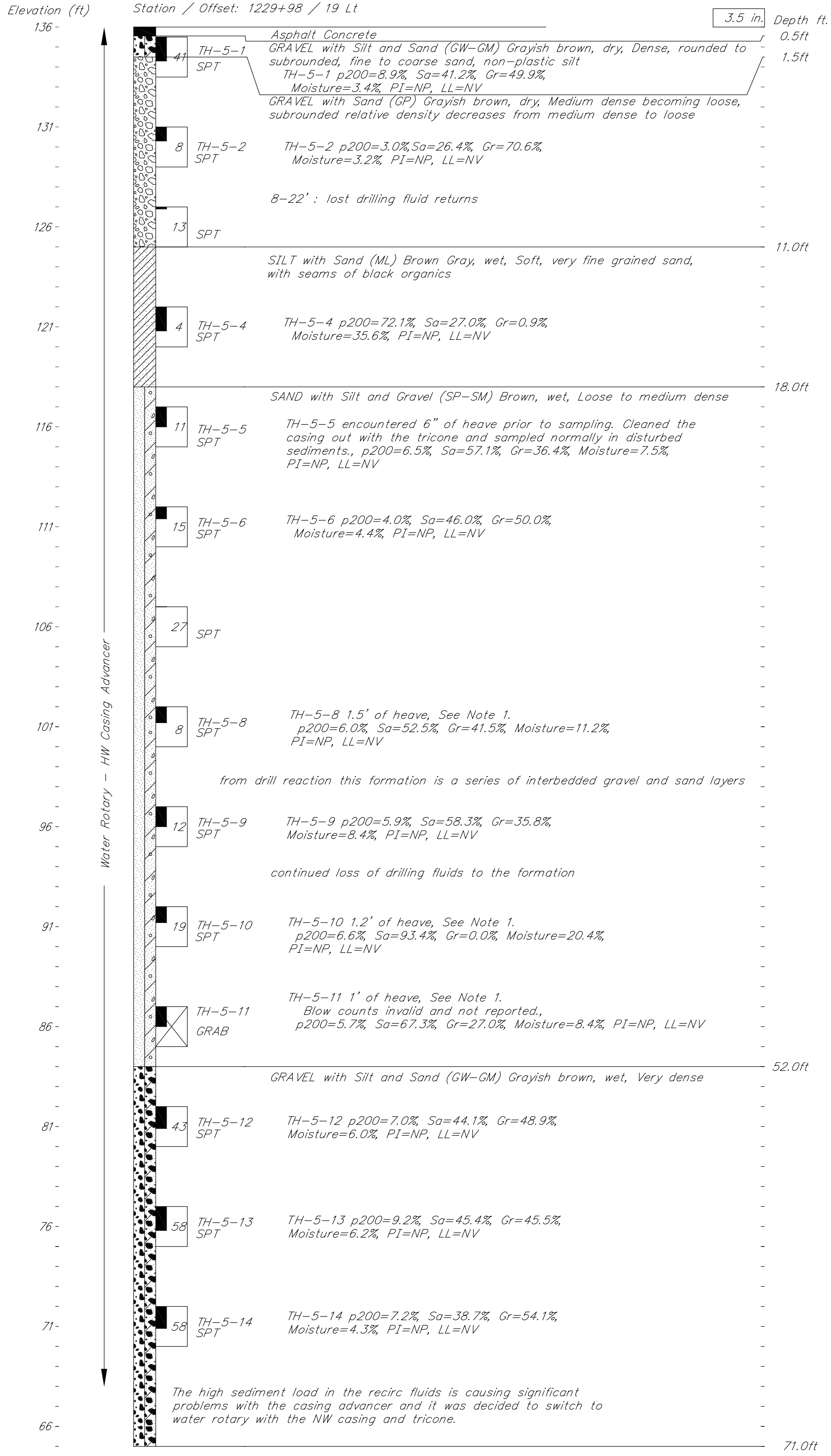
BRIDGE NO. 742
DWG. NO. N24

R:\cad\742\DWGS\23-4-19\742_GEO_23-4-19,-7 TH10-4 Apr 19, 2023 - 3:56pm

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0956028/Z686060000	2021	N25	N25

THIO-5

Date: 7/15/10 – 7/19/10
Station / Offset: 1229+98 / 19 Lt



Asphalt Concrete

GRAVEL with Silt and Sand (GW-GM) Grayish brown, dry, Dense, rounded to subrounded, fine to coarse sand, non-plastic silt
TH-5-1 p200=8.9%, Sa=41.2%, Gr=49.9%,
Moisture=3.4%, PI=NP, LL=NV

GRAVEL with Sand (GP) Grayish brown, dry, Medium dense becoming loose, subrounded relative density decreases from medium dense to loose

TH-5-2 p200=3.0%,Sa=26.4%, Gr=70.6%,
Moisture=3.2%, PI=NP, LL=NV

8–22' : lost drilling fluid returns

SILT with Sand (ML) Brown Gray, wet, Soft, very fine grained sand, with seams of black organics

TH-5-4 p200=72.1%, Sa=27.0%, Gr=0.9%,
Moisture=35.6%, PI=NP, LL=NV

SAND with Silt and Gravel (SP-SM) Brown, wet, Loose to medium dense

TH-5-5 encountered 6" of heave prior to sampling. Cleaned the casing out with the tricone and sampled normally in disturbed sediments., p200=6.5%, Sa=57.1%, Gr=36.4%, Moisture=7.5%, PI=NP, LL=NV

TH-5-6 p200=4.0%, Sa=46.0%, Gr=50.0%,
Moisture=4.4%, PI=NP, LL=NV

TH-5-8 1.5' of heave, See Note 1.
p200=6.0%, Sa=52.5%, Gr=41.5%, Moisture=11.2%,
PI=NP, LL=NV

from drill reaction this formation is a series of interbedded gravel and sand layers

TH-5-9 p200=5.9%, Sa=58.3%, Gr=35.8%,
Moisture=8.4%, PI=NP, LL=NV

continued loss of drilling fluids to the formation

TH-5-10 1.2' of heave, See Note 1.
p200=6.6%, Sa=93.4%, Gr=0.0%, Moisture=20.4%,
PI=NP, LL=NV

TH-5-11 1' of heave, See Note 1.
Blow counts invalid and not reported.,
p200=5.7%, Sa=67.3%, Gr=27.0%, Moisture=8.4%, PI=NP, LL=NV

GRAVEL with Silt and Sand (GW-GM) Grayish brown, wet, Very dense

TH-5-12 p200=7.0%, Sa=44.1%, Gr=48.9%,
Moisture=6.0%, PI=NP, LL=NV

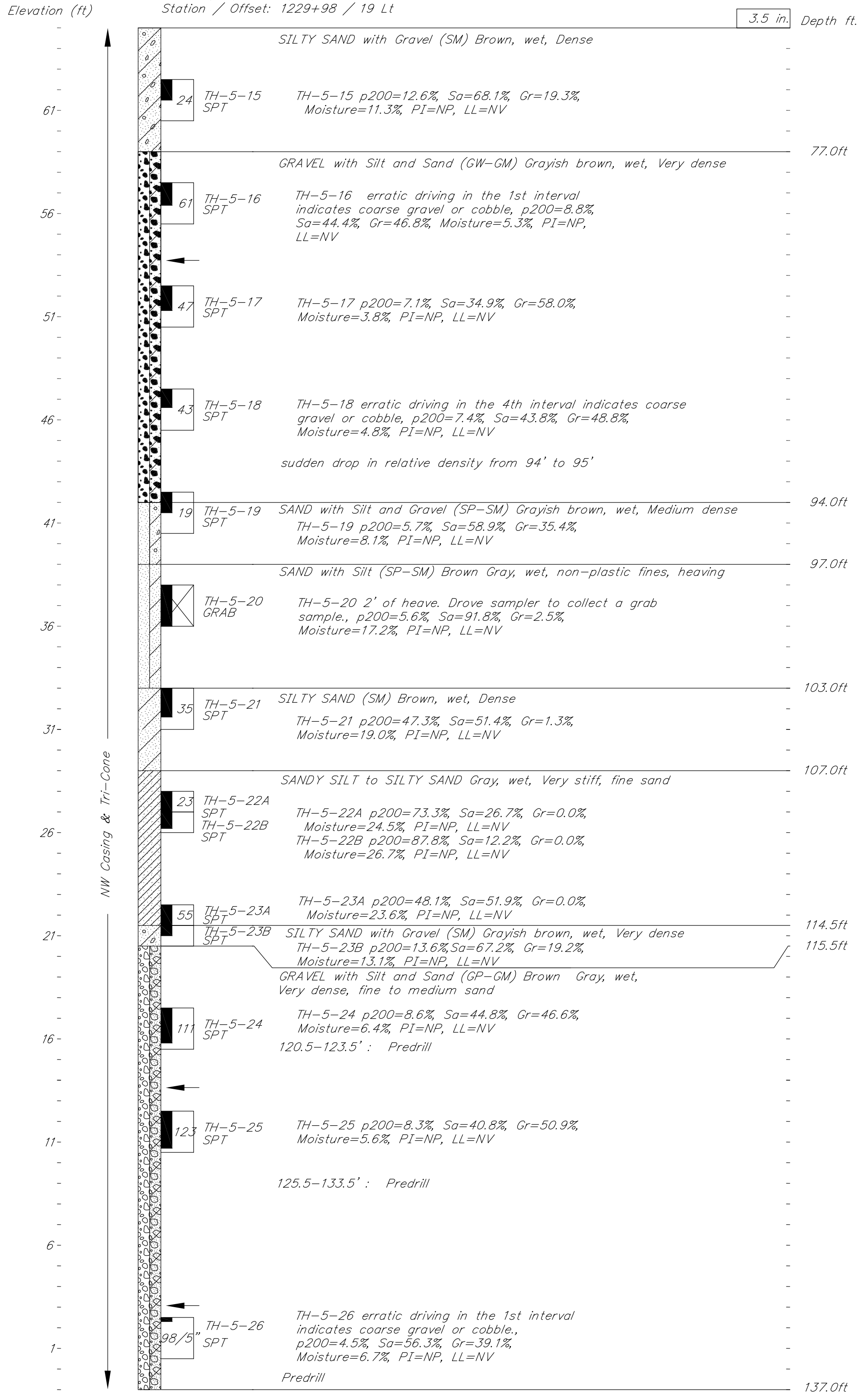
TH-5-13 p200=9.2%, Sa=45.4%, Gr=45.5%,
Moisture=6.2%, PI=NP, LL=NV

TH-5-14 p200=7.2%, Sa=38.7%, Gr=54.1%,
Moisture=4.3%, PI=NP, LL=NV

The high sediment load in the recirc fluids is causing significant problems with the casing advancer and it was decided to switch to water rotary with the NW casing and tricone.

THIO-5 (Cont.)

Date: 7/15/10 – 7/19/10
Station / Offset: 1229+98 / 19 Lt



SILTY SAND with Gravel (SM) Brown, wet, Dense

TH-5-15 p200=12.6%, Sa=68.1%, Gr=19.3%,
Moisture=11.3%, PI=NP, LL=NV

GRAVEL with Silt and Sand (GW-GM) Grayish brown, wet, Very dense

TH-5-16 erratic driving in the 1st interval indicates coarse gravel or cobble, p200=8.8%, Sa=44.4%, Gr=46.8%, Moisture=5.3%, PI=NP, LL=NV

TH-5-17 p200=7.1%, Sa=34.9%, Gr=58.0%,
Moisture=3.8%, PI=NP, LL=NV

TH-5-18 erratic driving in the 4th interval indicates coarse gravel or cobble, p200=7.4%, Sa=43.8%, Gr=48.8%,
Moisture=4.8%, PI=NP, LL=NV

sudden drop in relative density from 94' to 95'

SAND with Silt and Gravel (SP-SM) Grayish brown, wet, Medium dense
TH-5-19 p200=5.7%, Sa=58.9%, Gr=35.4%,
Moisture=8.1%, PI=NP, LL=NV

SAND with Silt (SP-SM) Brown Gray, wet, non-plastic fines, heaving

TH-5-20 2' of heave. Drove sampler to collect a grab sample., p200=5.6%, Sa=91.8%, Gr=2.5%,
Moisture=17.2%, PI=NP, LL=NV

SILTY SAND (SM) Brown, wet, Dense
TH-5-21 p200=47.3%, Sa=51.4%, Gr=1.3%,
Moisture=19.0%, PI=NP, LL=NV

SANDY SILT to SILTY SAND Gray, wet, Very stiff, fine sand

TH-5-22A p200=73.3%, Sa=26.7%, Gr=0.0%,
Moisture=24.5%, PI=NP, LL=NV
TH-5-22B p200=87.8%, Sa=12.2%, Gr=0.0%,
Moisture=26.7%, PI=NP, LL=NV

TH-5-23A p200=48.1%, Sa=51.9%, Gr=0.0%,
Moisture=23.6%, PI=NP, LL=NV

SILTY SAND with Gravel (SM) Grayish brown, wet, Very dense
TH-5-23B p200=13.6%,Sa=67.2%, Gr=19.2%,
Moisture=13.1%, PI=NP, LL=NV

GRAVEL with Silt and Sand (GP-GM) Brown Gray, wet, Very dense, fine to medium sand

TH-5-24 p200=8.6%, Sa=44.8%, Gr=46.6%,
Moisture=6.4%, PI=NP, LL=NV
120.5–123.5' : Predrill

TH-5-25 p200=8.3%, Sa=40.8%, Gr=50.9%,
Moisture=5.6%, PI=NP, LL=NV

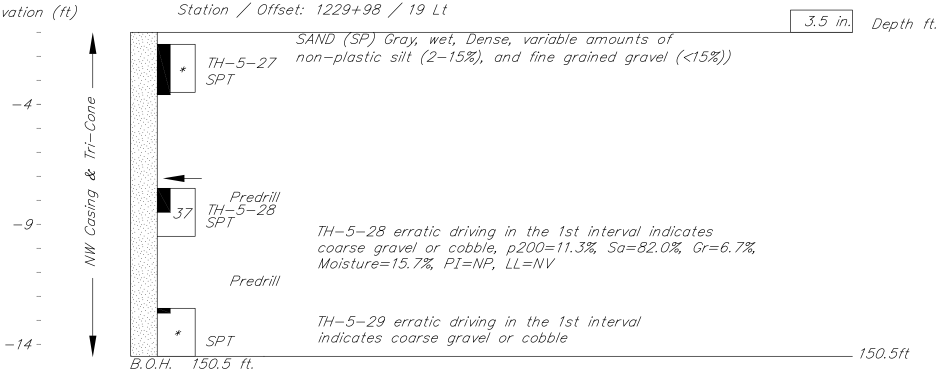
125.5–133.5' : Predrill

TH-5-26 erratic driving in the 1st interval indicates coarse gravel or cobble., p200=4.5%, Sa=56.3%, Gr=39.1%,
Moisture=6.7%, PI=NP, LL=NV

Predrill

THIO-5 (Cont.)

Date: 7/15/10 – 7/19/10
Station / Offset: 1229+98 / 19 Lt



SAND (SP) Gray, wet, Dense, variable amounts of non-plastic silt (2–15%), and fine grained gravel (<15%))

TH-5-28 erratic driving in the 1st interval indicates coarse gravel or cobble, p200=11.3%, Sa=82.0%, Gr=6.7%,
Moisture=15.7%, PI=NP, LL=NV

TH-5-29 erratic driving in the 1st interval indicates coarse gravel or cobble

B.O.H. 150.5 ft.
140 lb hammer, CME Auto Hammer, For Sampler

Note 1.
Left a 1" plug inside the casing and hydrated while pulling Tricone up and lowering the sampler down to eliminate potential heave.

DESIGNED BY:	D.Hemstreet	CHECKED:	Engineer
DRAWN BY:	K. Chang/RA	CHECKED:	Engineer
QUANTITIES BY:	Engineer	CHECKED:	Engineer

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
STATEWIDE MATERIALS

David A. Hemstreet
No. CE 9800
5/8/23

CHILKAT RIVER BRIDGE

HAINES HIGHWAY

TEST HOLE & PENETROMETER LOGS

BRIDGE NO. 742
DWG. NO. 25