

# Upper Huffman Scenic Overlook Group H

John Rego

Scott Browning

Jesse Kephart



# Project Team

**Project Mentor**  
Rys Miranda, P.E., LEED AP  
Chief of Design and Construction  
Alaska State Parks

**Project Manager**  
John Rego

**Project Engineer**  
Jesse Kephart

**Project Engineer**  
Scott Browning

# John Rego

- 12 years materials testing and inspection experience.
- Certified professional geologist since 2014.
- Staff Geologist DOWL 2/05 through 5/08
- Geologist/Special Inspector EMC since 5/08.
- Led numerous soil investigations in the state of Alaska.
- Responsible for Geotechnical and Foundation Design, Engineers Estimate, Design Study Report (DSR)/Special Provisions.



# Scott Browning

- 3 years experience working for State Park Design & Construction.
- 10 years as a civil contractor for a major Alaska landscape company.
- Responsible for geometric elements and site plan.



# Jesse Kephart

- 15+ years building and developing property.
- Specialized in heavy timber construction.
- Work has been featured in Timber Homes Illustrated and on HGTV.
- Responsible for pavilion design structural analysis.



# Problem Statement

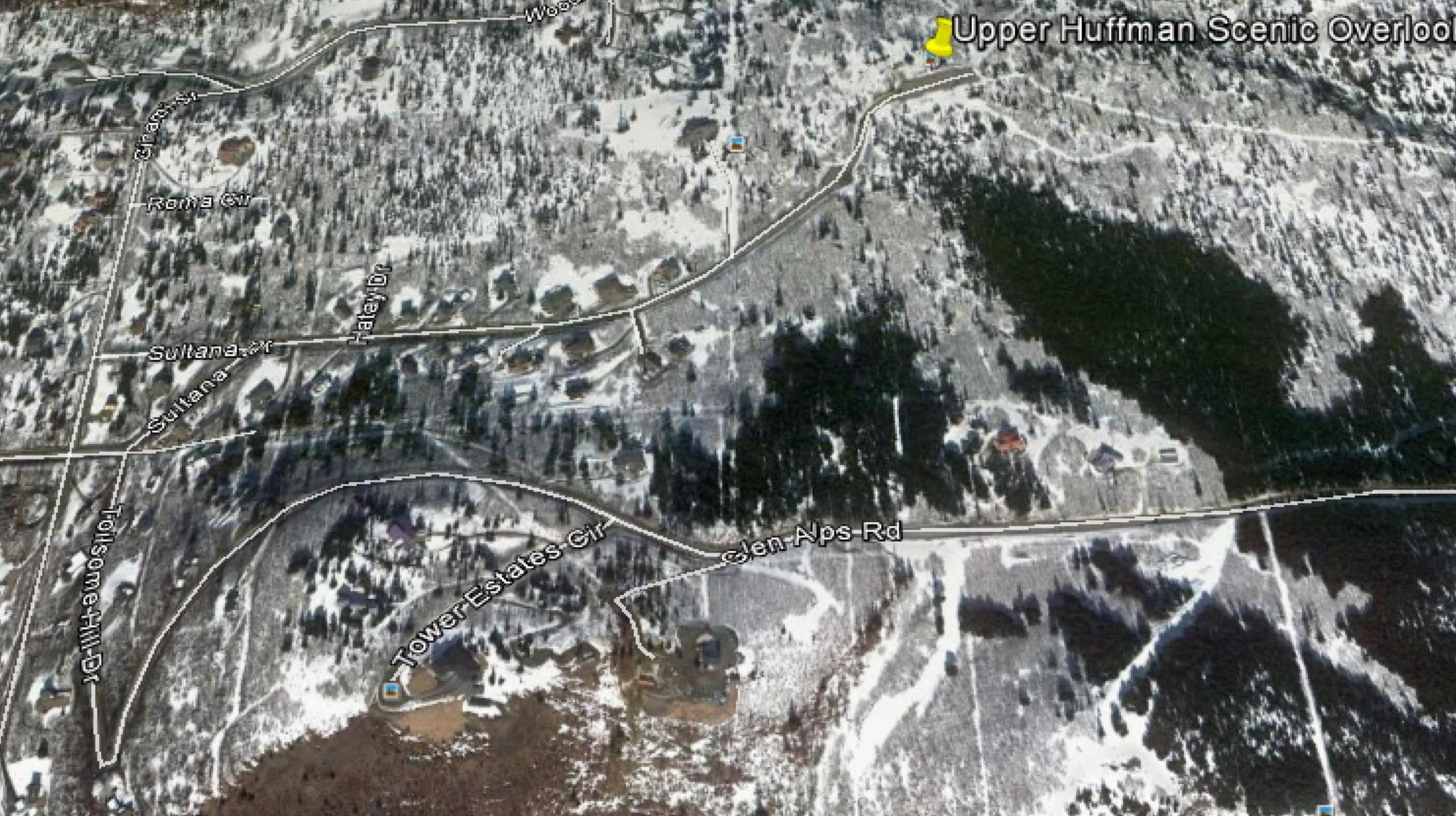
- **Glenn Alps Trailhead and Viewpoint regularly exceeds it's capacity.**
- **The Upper Huffman Scenic Overlook is designed to offer similar recreational activities to alleviate pressure off of Glen Alps.**



# Deliverables

- **65% Site Plans**
- **65% Design of Pavilion**
- **Geotechnical Review and Recommendations**
- **Engineers Estimate**
- **Design Study Report (DSR)/ Special Provisions**
- **Scale Model of the Pavilion**

Upper Huffman Scenic Overlook



Wood

Chatham St

Roma Cir

Sultana Cir

Sultana Cir

Haley Dr

Tollson-Hill Dr

Tower Estates Cir

Glen-Aps Rd

# Due Diligence

- **Site visits**
- **Review of Applicable Codes/Regulations**
  1. **NDS**
  2. **IBC**
  3. **Municipality of Anchorage**
  4. **SSHC**





# Due Diligence (November)



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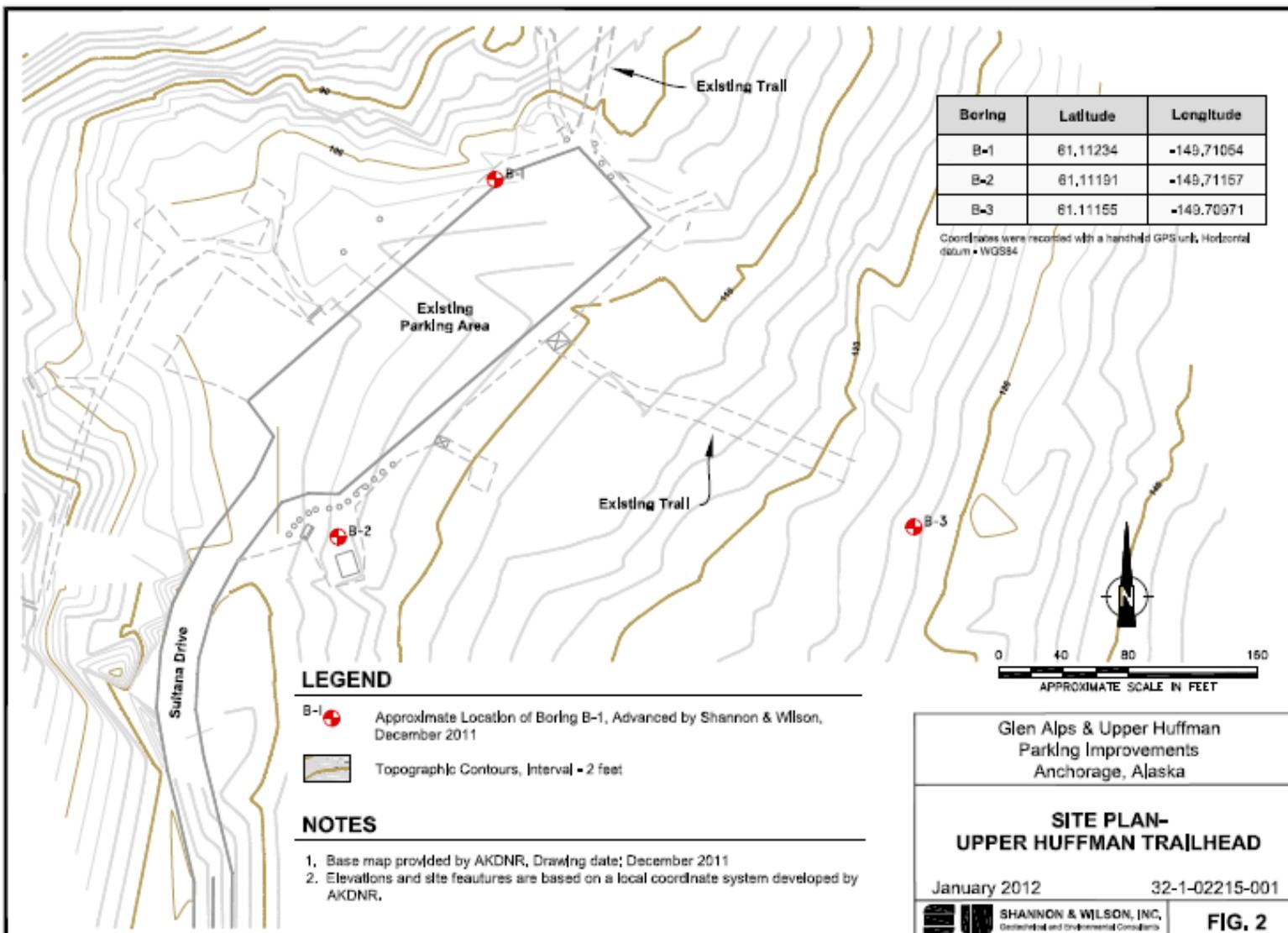
# Due Diligence...



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# Geotechnical Data Report

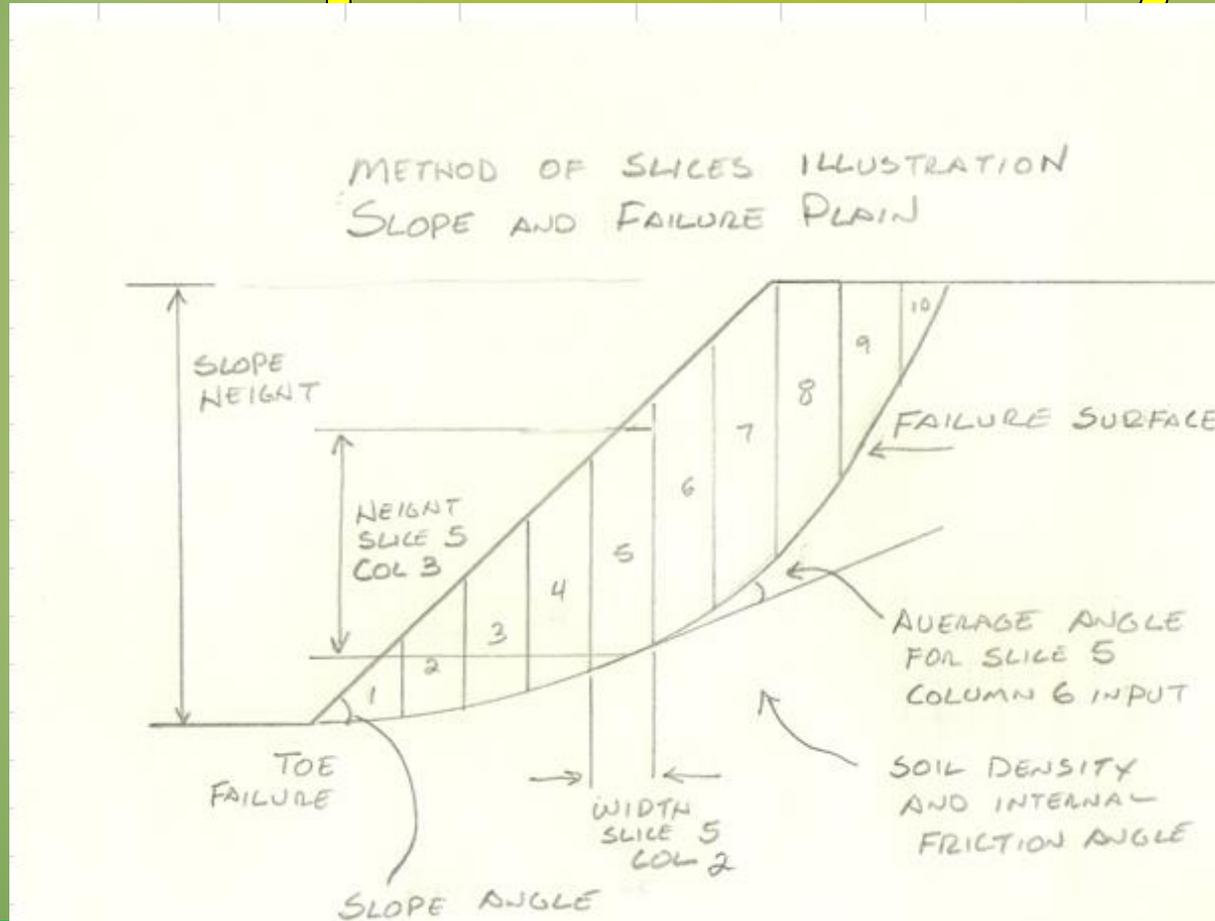
- Provided Geotechnical Data Report . (SW, 1-12)
- Two Test Borings within Project Area.
- Analyzed boring logs and sample test sheets.
- Established Bearing Capacity and Slope Stability.



# Bearing Capacity

Unit Weight, $\gamma =$	130 lbs/ft <sup>3</sup>	Footing Depth, $D_f =$	4 ft
Cohesion, $c =$	0 lbs/ft <sup>2</sup>	Footing Width, $B =$	6.00 ft
Friction Angle, $\phi =$	30 <sup>o</sup>		
$N_c =$	37.16	Factor of Safety, $FS =$	3
$N_q =$	22.46		
$N_\gamma =$	19.13		
<b><u>TERZAGHI BEARING CAPACITY - STRESS LIMITED</u></b>			
Ultimate Bearing Capacity, $q_u =$	19,140 psf		$q_u = cN_c + qN_q + \frac{1}{2}\gamma BN_\gamma$
Allowable Bearing Capacity, $[q] =$	6,380 psf		$[q] = \frac{q_u}{FS}$
	==> <b>6,400 psf (Rounded)</b>		

# Slope Stability



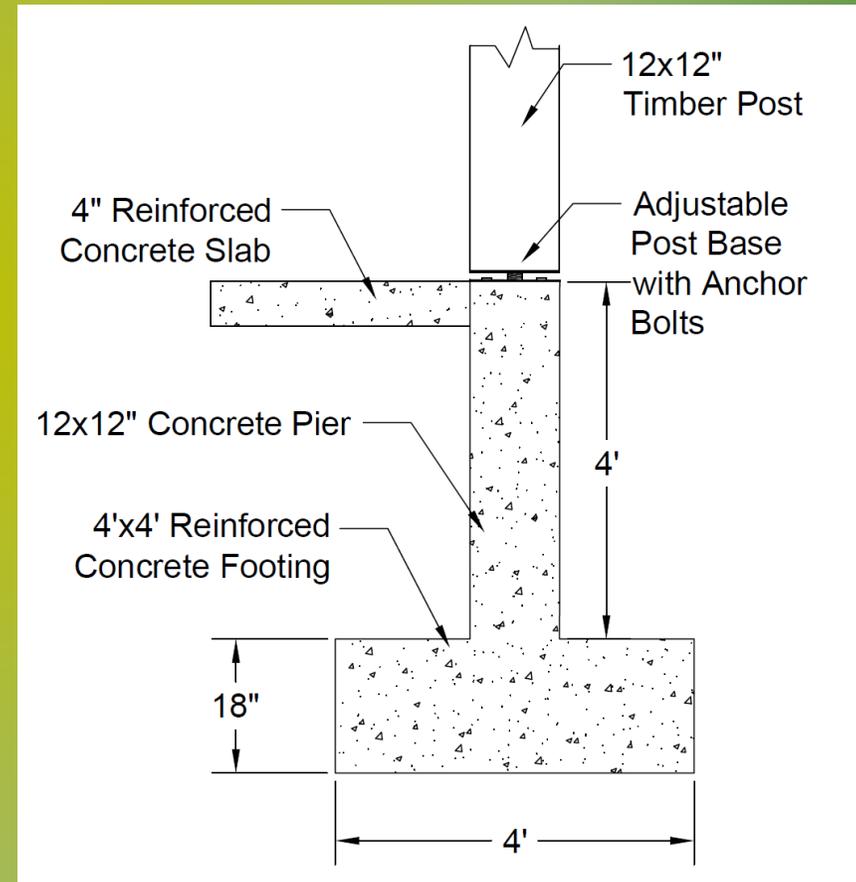
# Bishops Method Slices

USACE Manual Number EM1110-2-1902, 10-3-03

Input the following Values					Cohesion												
<b>Unit Weight of Soil</b>					<b>130</b>	PCF			Times								
<b>Friction Angle of Soil</b>					<b>20</b>	DEG			Base								
<b>Cohesion of Soil</b>					<b>0</b>	PSF			Plus								
<b>Trial Factor of Safety</b>					<b>1.5</b>	DL	Weight	Weight									
<b>Slope Angle</b>					<b>30</b>	DEG	Times	Times	Bishop			Bishop			Bishop		
<b>Slope Height</b>					<b>20</b>	FT	Sin	Tan	Term	Column 8	Term	Column 8	Term	Column 8	Term	Column 8	
						Base	Base	Friction	Trial FS	Divide	New FS	Divide	New FS	Divide			
Slice	Width	Height	Area	Weight	Angle	Angle	Angle	Value	Column 9	Value	Column 11	Value	Column 13				
	(FT)	(FT)	(CF)	(LBS)	DEG	(LBS)	(LBS)	DL	DL	DL	DL	DL	DL	DL	DL		
1	4.9	2.5	12	1599	7	184	582	1.0	570	1.0	561.1	1.0	560				
2	4.9	5.0	25	3197	8	467	1164	1.0	1136	1.0	1113.9	1.0	1111				
3	4.9	7.5	37	4796	11	923	1746	1.0	1698	1.1	1655.6	1.1	1650				
4	4.9	9.0	44	5755	13	1314	2095	1.0	2036	1.1	1975.7	1.1	1967				
5	4.9	11.0	54	7034	19	2244	2560	1.0	2497	1.1	2395.3	1.1	2381				
6	4.9	12.0	59	7674	25	3194	2793	1.0	2765	1.1	2617.0	1.1	2597				
7	4.9	12.0	59	7674	30	3837	2793	1.0	2829	1.1	2645.3	1.1	2620				
8	4.9	8.0	39	5116	35	2898	1862	1.0	1936	1.0	1791.9	1.1	1772				
9	4.9	5.0	25	3197	40	2051	1164	0.9	1261	1.0	1151.5	1.0	1137				
10	4.9	2.0	10	1279	43	875	465	0.9	520	1.0	470.8	1.0	464				
					Sum	17987		Sum	17248		16378.2		16259				
	<b>Input</b>	<b>Input</b>			<b>Input</b>			<b>New FS</b>	<b>1.0</b>	<b>New FS</b>	<b>0.9</b>	<b>New FS</b>	<b>0.9</b>				

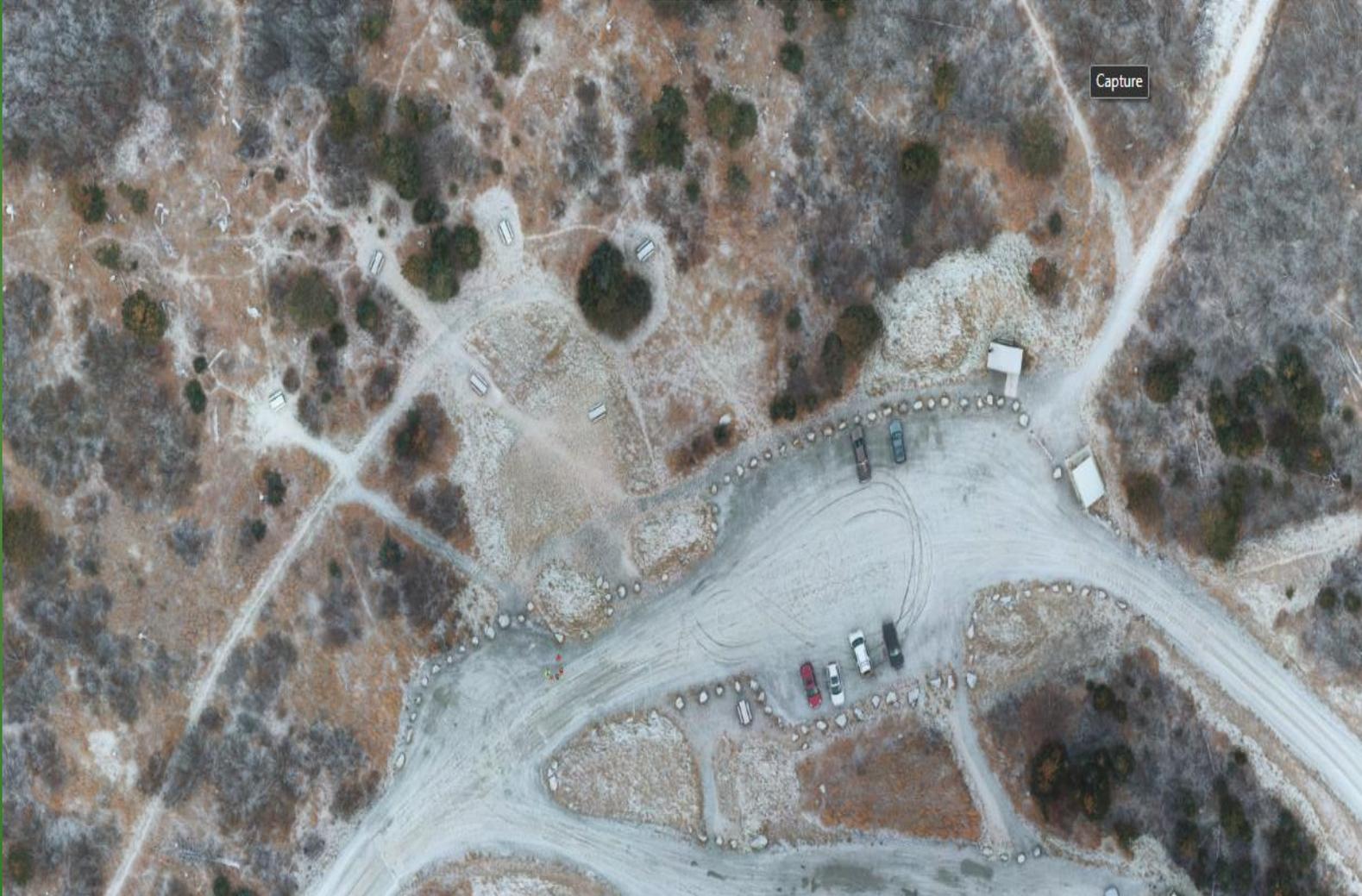
# Foundation Recommendations

- 4 total spread footers.
- Each column 30k with max snow load
- bearing capacity of 4,000 pcf  
dimensions 4x4x1.5 feet



# Construction Recommendations

- Any existing soils that do not meet the requirements for structural fill removed and replaced within building footprint.
- Excavated material may be suitable for reuse depending on the quality of the material excavated or reused as landscaping material.
- Native soils should be proof-rolled prior to placing the backfill.

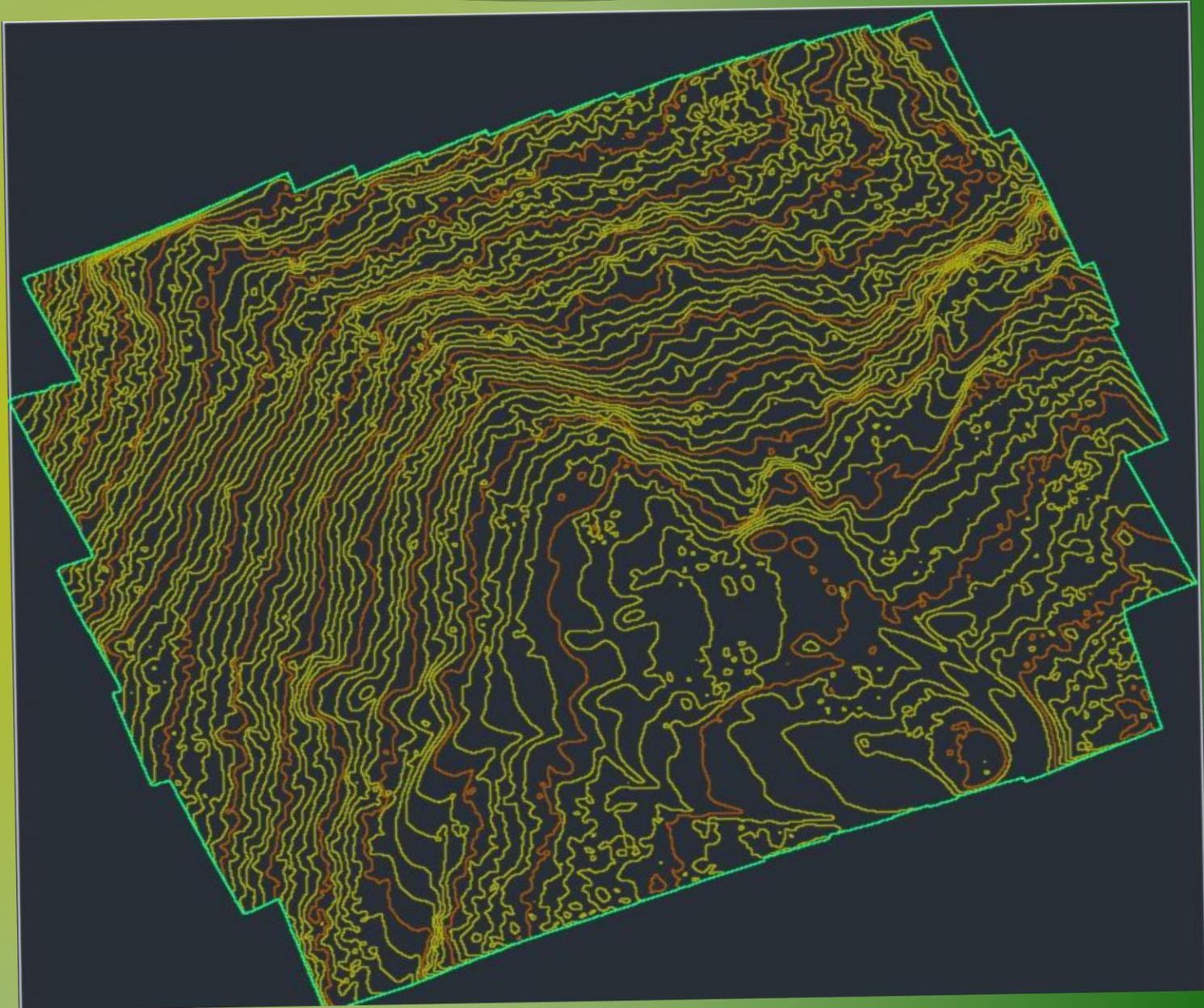


# Site Aerial View

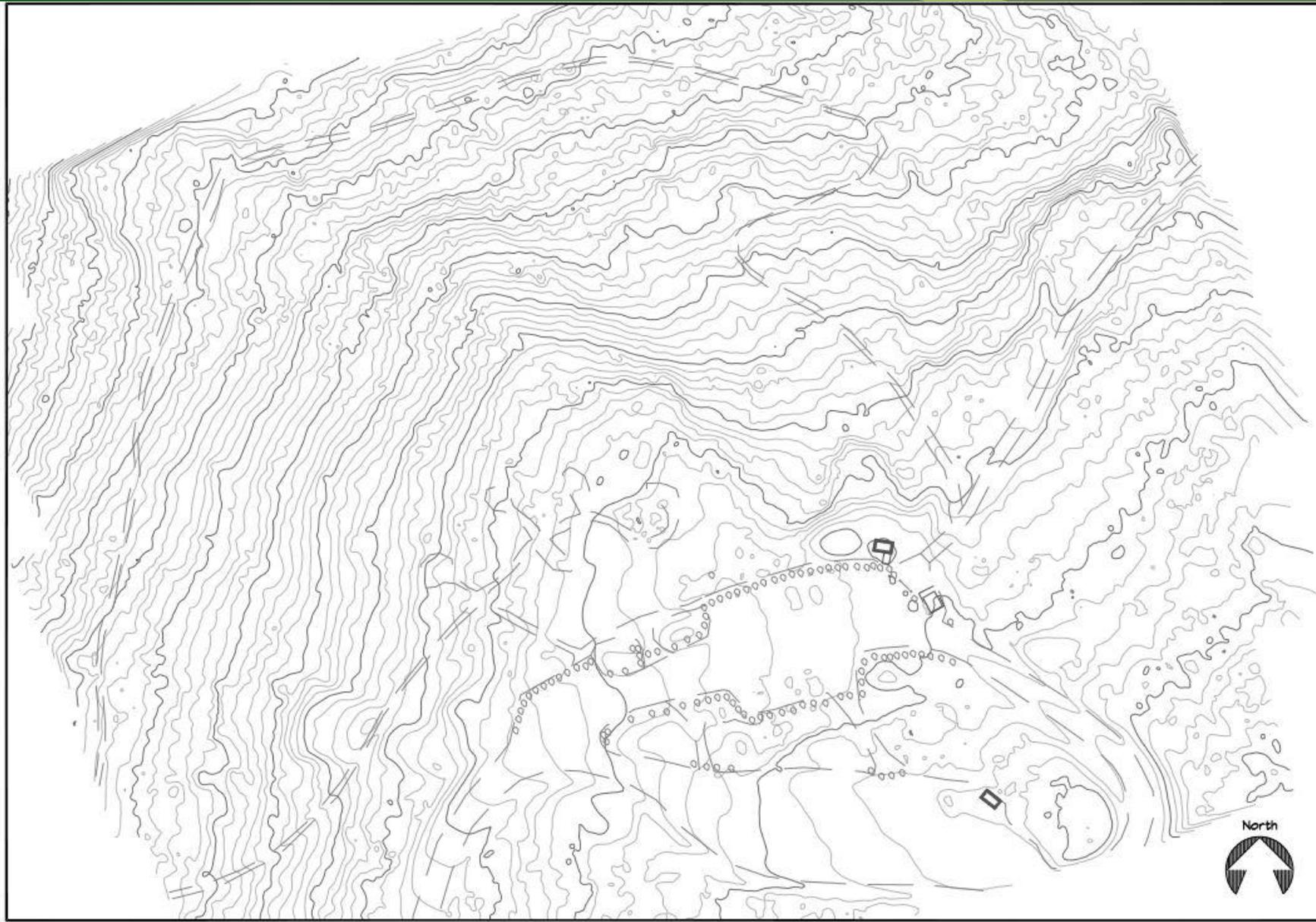


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# CONTOUR OF SITE



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VICINITY MAP

UPPER HUFFMAN  
SCENIC OVERLOOK



PREPARED: SDB  
DRAWN: SDB  
REVIEWED: -  
DATE: 04/07/17  
SHEET  
C2  
OF SHEETS



# Vicinity Map

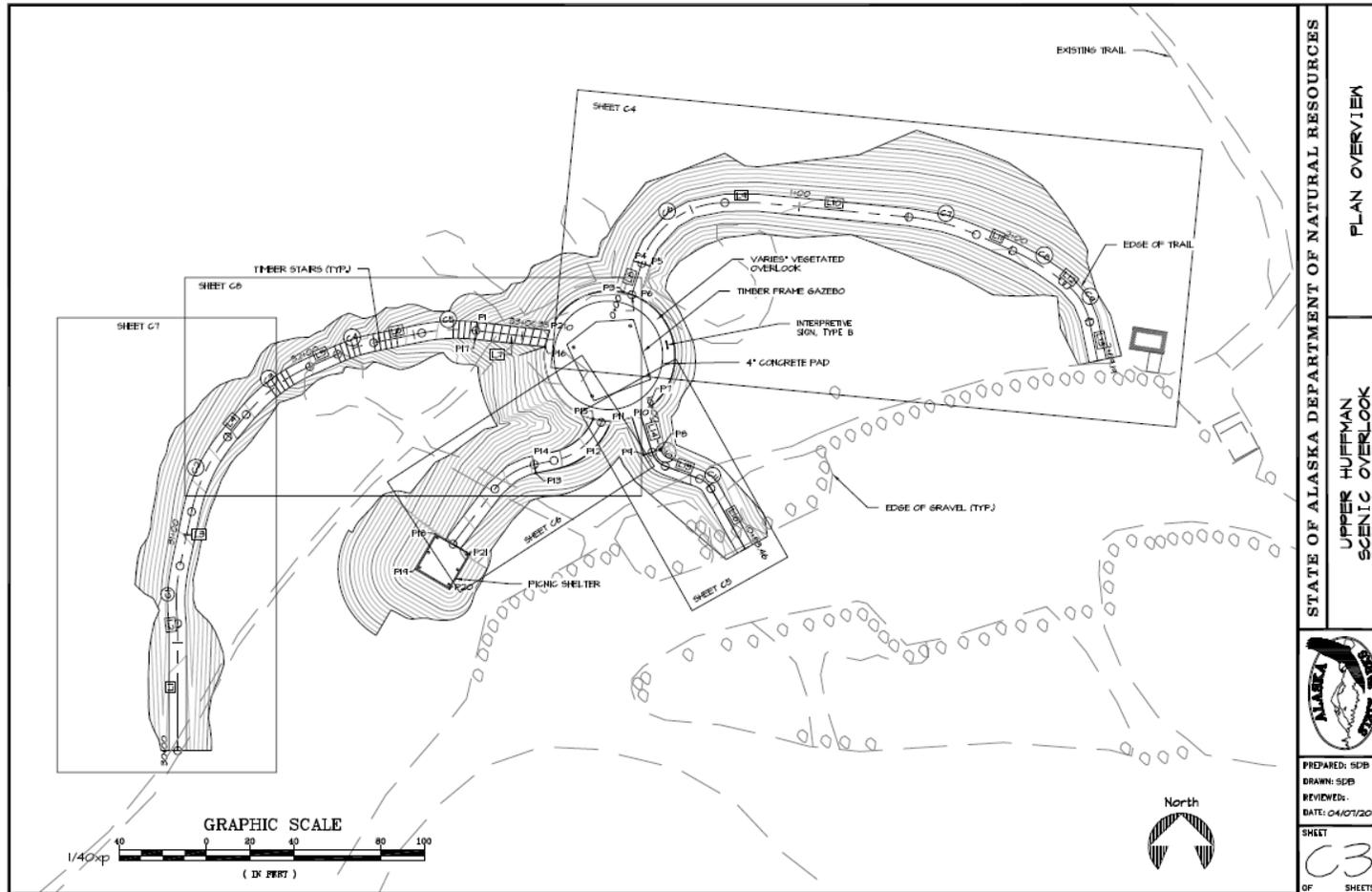


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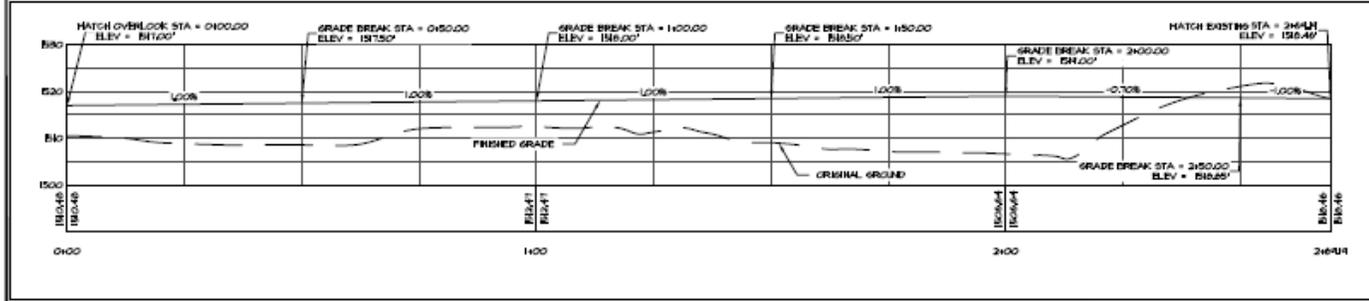
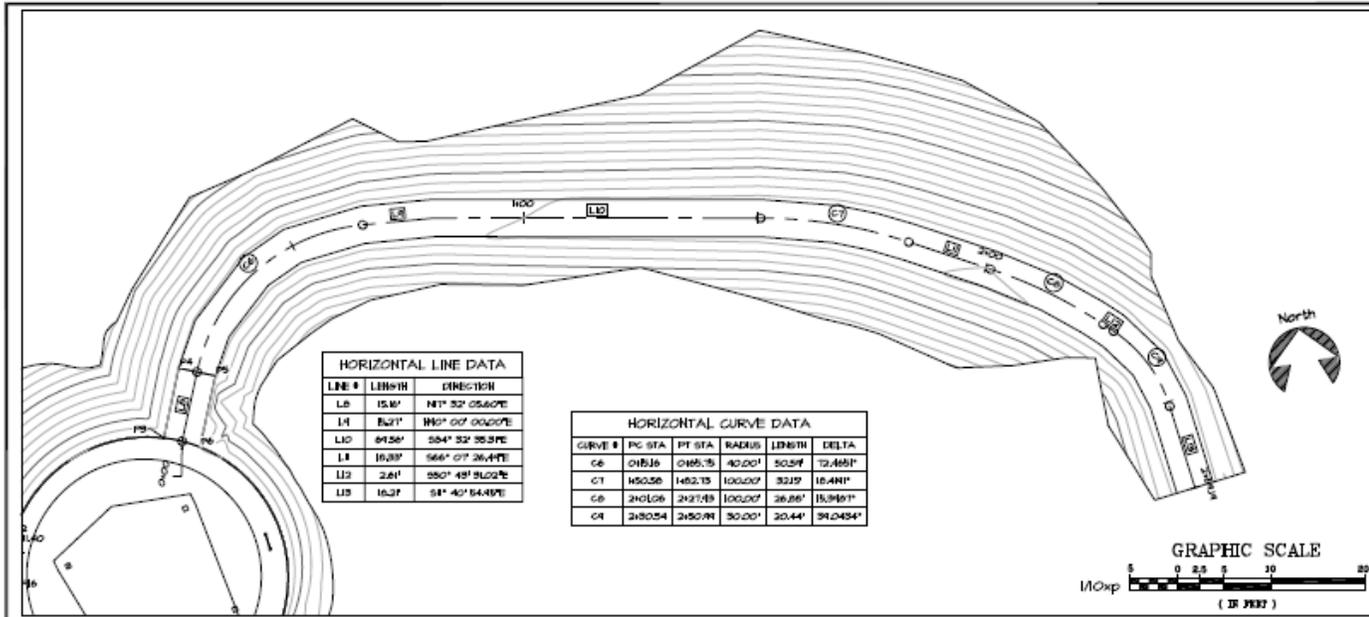
# Site Design

- Modified site design from conceptual drawing due to mass fill quantities.
- Conceptual drawing not practical design or economically viable.
- Approached client discussed alternatives.

# Site Plans



# Site Plans

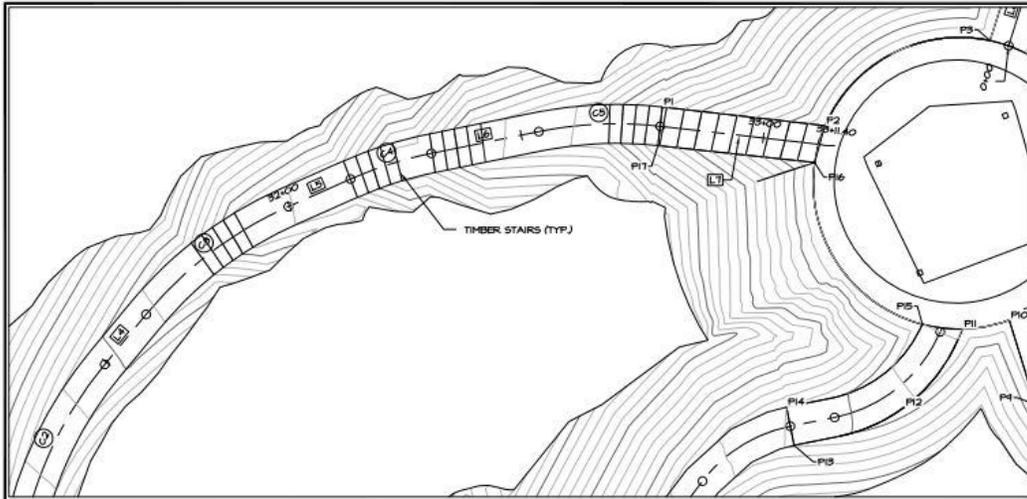


STATE OF ALASKA DEPARTMENT OF NATURAL RESOURCES  
TRAIL PLAN & PROFILE  
STATIONS 0+00 TO 2+64.14  
UPPER HUFFMAN  
SCENIC OVERLOOK

PREPARED BY:  
DRAWN BY:  
REVIEWED:  
DATE: 05/24/11  
SHEET  
**C4**  
OF 1 SHEETS

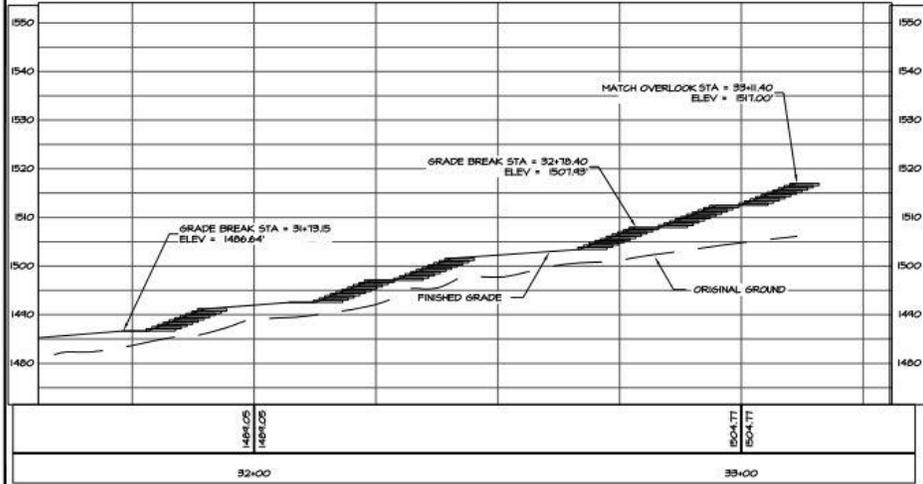
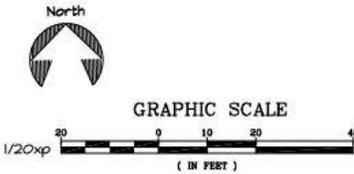


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HORIZONTAL LINE DATA		
LINE #	LENGTH	DIRECTION
L4	13.32'	N34° 35' 08.34"E
L5	13.45'	N66° 02' 54.87"E
L6	22.52'	N18° 32' 13.42"E
L7	32.70'	S83° 32' 11.70"E

HORIZONTAL CURVE DATA					
CURVE #	PC STA	PT STA	RADIUS	LENGTH	DELTA
C2	31+10.82	31+44.44	80.00'	36.62'	27.6561°
C3	31+62.76	31+99.76	80.00'	37.00'	26.4463°
C4	32+13.71	32+91.15	80.00'	77.44'	12.4665°
C5	32+53.67	32+78.70	80.00'	25.03'	17.4241°



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UPPER HUFFMAN  
SCENIC OVERLOOK  
TRAIL PLAN & PROFILE  
STATIONS 31+50 TO 33+11.4



PREPARED: SCB  
DRAWN: SCB  
REVIEWED:  
DATE: 09/24/17

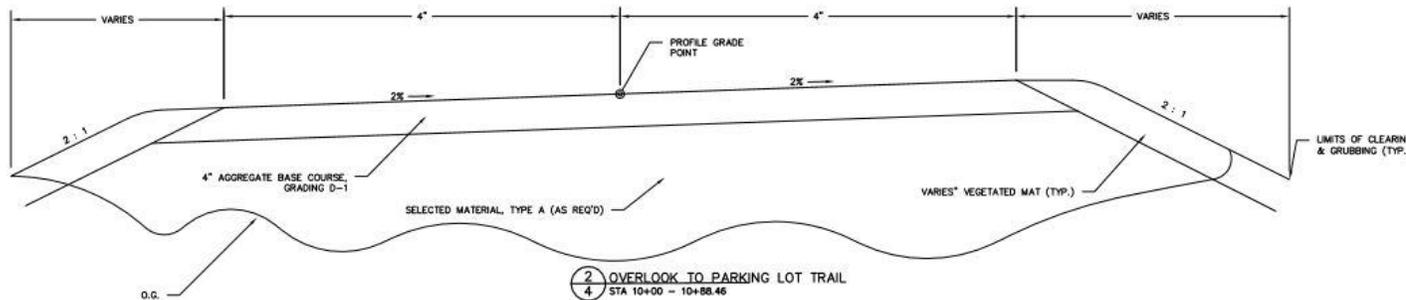
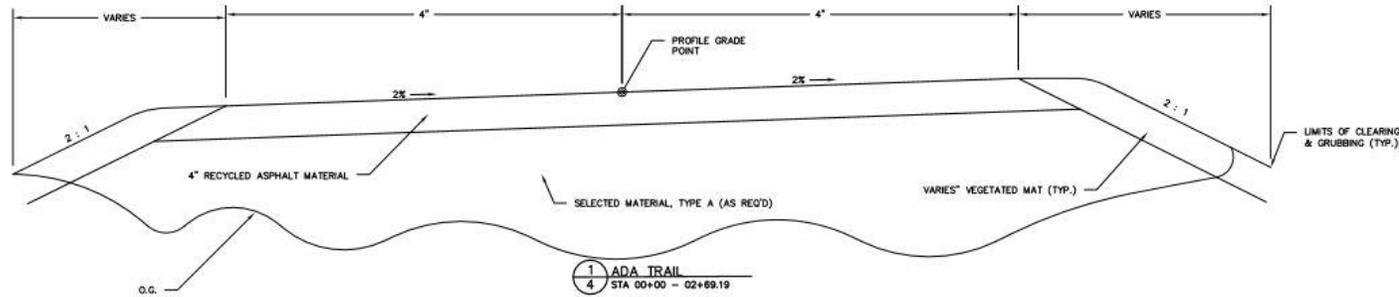
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# Site Plans



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# Site Plans



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TYPICAL SECTIONS

UPPER HUFFMAN  
SCENIC OVERLOOK



PREPARED: SDB  
DRAWN: SDB  
REVIEWED:  
DATE: 04/5/2017

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OF SHEETS



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# Structural Analysis

## Considerations:

- LRFD Method
- 50 psf Ground Snow Load
- Dead Loads
  1. Douglas Fir 30.6 pcf
  2. Spruce/ Pine Decking 3.7 psf
  3. Metal Roof (26 gauge) 0.9 psf



# LRFD

**LRFD- Load Resistance Factor Design**

$$\phi R_n \geq \gamma D$$

**Where:**

$\phi$  = Adjustment Factor

$R_n$  = Nominal Resistance (Strength)

$\gamma$  = Load Factor

$D$  = Demand (Load)



# Timber Calculations

Timber members have several *Modes* of failure including:

- Bending
- Shear
- Bearing
- Deflection
- Compression



# Calculations Depend on:

## Material Properties:

- Species- Douglas Fir
- Grade- Structural Select **FOHC**
- Moisture Content- less than 19%

## Section Properties:

- Area
- $I_{xx}$  (Moment of Inertia)
- $S_{xx}$  (Section Modulus)



# Mathcad

PTC Mathcad Express Prime 3.1 - [C:\Users\Uesse\Documents\00 UAA SPRING 2017\Senior Design\Timber Design\Timbercheck.mcd]

4.5.17 HW Timber checker PTC Mathcad Express

$$I_u = 2.06 \cdot I_d = 98.88 \quad \lambda = 0.8 \quad (\text{Table 4D NDS})$$

$$E_{min} = 5.8 \cdot 10^5 \text{ psi}$$

$$C_f = \left( \frac{12}{d} \right)^{0.9} = 0.926$$

$$R_H = \sqrt{\frac{(L-d)}{b^2}} = 4.871$$

$$F_b = F_b \cdot K_F \cdot \phi \cdot \lambda = (2.764 \cdot 10^3) \text{ psi}$$

$$F_{BE} = \frac{(1.2 \cdot E_{min})}{R_H^2} = (2.933 \cdot 10^4) \text{ psi}$$

$$C_{L1} = \frac{\left( 1 + \left( \frac{F_{BE}}{F_b} \right) \right)}{1.9} - \sqrt{\left( \frac{\left( 1 + \left( \frac{F_{BE}}{F_b} \right) \right)^2}{1.9} - \left( \frac{F_{BE}}{F_b} \right) \right)} = 0.995$$

$$F'_b = F_b \cdot C_m \cdot C_t \cdot C_L \cdot C_F \cdot C_{FU} \cdot C_i \cdot C_r \cdot K_F \cdot \phi \cdot \lambda = (2.546 \cdot 10^3) \text{ psi}$$

Unit conversion tips & t

# MS Excel

Timber Beam Checker - Microsoft Excel

LRFD	Variables	Bending	Shear	Compression	Deflection
1	length 288	Fb 1600	Fv 170	Fc 625	Delta LT 7.1932163 0.59943
2	lxx 10274	Cf 1	Fv 293.76	Cb 1.13	Delta ST 4.7954775 0.39962
3	E 1600000	Fb 2763.52	V 5644	Fc 939.375	Delta TT 1.29878
4	Sx 874	Fbactual 1905.36	fv 114.02	Area 86.25	Pass allowable 2.4
5	Area 223	Pass	Pass	Capacity 81021.1	Delta snow allowable 1.2 Pass
6	Emin 5.80E+05	Mu 1665288	Pass	Reaction 21560	Delta snow actual 0.49311
7	Dead 37.34 psf				
8	Snow 37.8 psf				
9	Linear load 3080 plf				
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

# RISA

RISA-3D Demonstration - [C:\Users\Uesse\Documents\RISADemo\Model Files\Parks timber frame version 2.R3D]

File Edit Settings Units View Insert Modify Spreadsheets Solve Results Tools Window Help

Model View

Shape Selection

General | Hot Rolled | Cold Formed | Wood | Concrete | Aluminum

Material Selection: DF Solid Sawn, Visually Graded Douglas Fir-Larch, No.1

Select a Size: 6X7, 6X8, 6X9, 6X10, 6X11, 6X12, 6X13, 6X14, 6X15, 6X18, 7X7, 7X8

Enter the Size: Rectangular (Thickness, Width), Round (Diameter)

Plies 1 Bolted

OK Cancel Help View Design Properties



# Timber Plans



Upper Huffman Scenic Overlook  
Timber Frame Pavilion



Seawolves Engineering

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UPPER HUFFMAN  
SCENIC OVERLOOK

TIMBER PAVILION PLAN

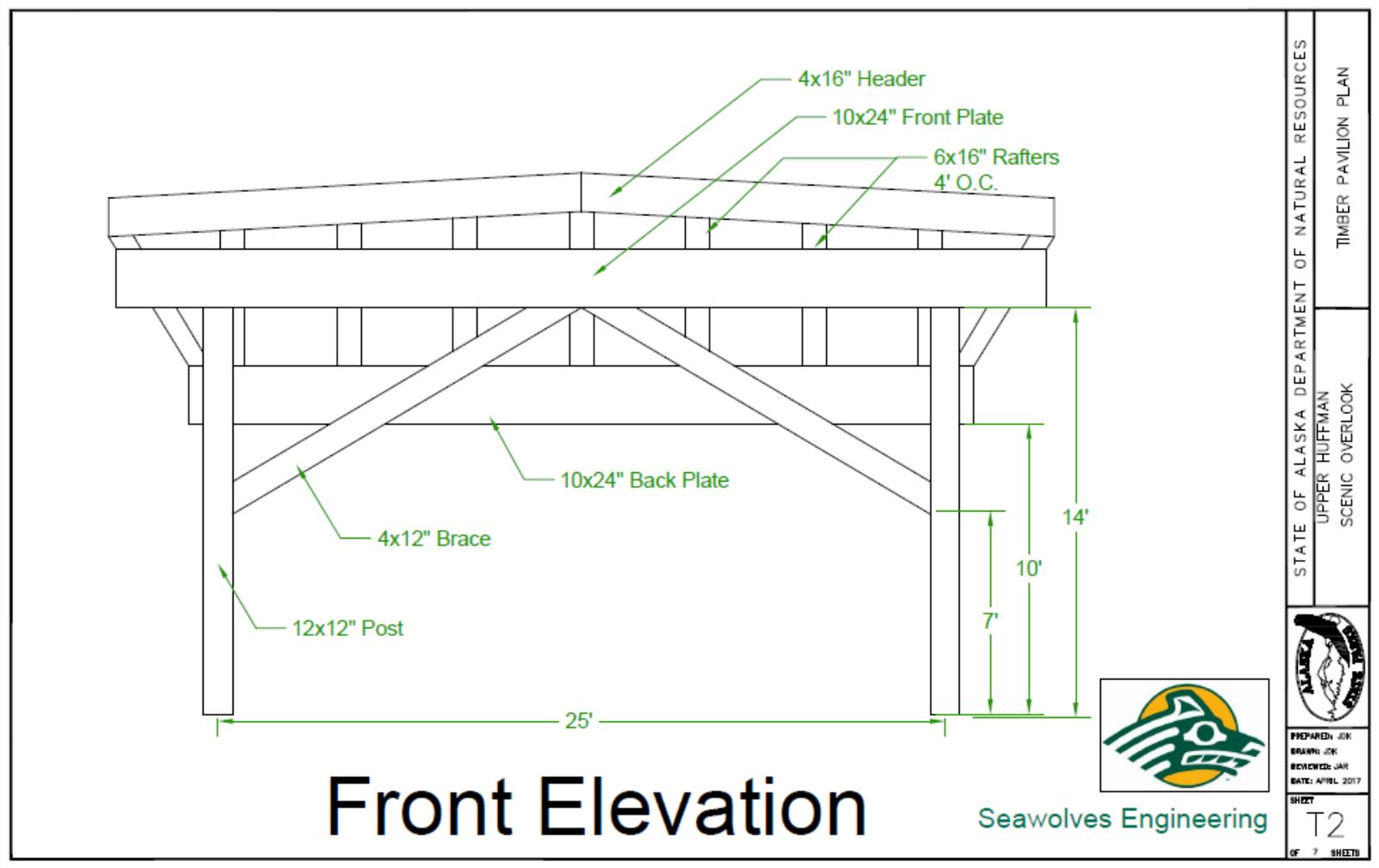


PREPARED: JJK  
DRAWING: JJK  
REVIEWED: JAR  
DATE: APRIL 2017  
SHEET  
T1  
OF 7 SHEETS

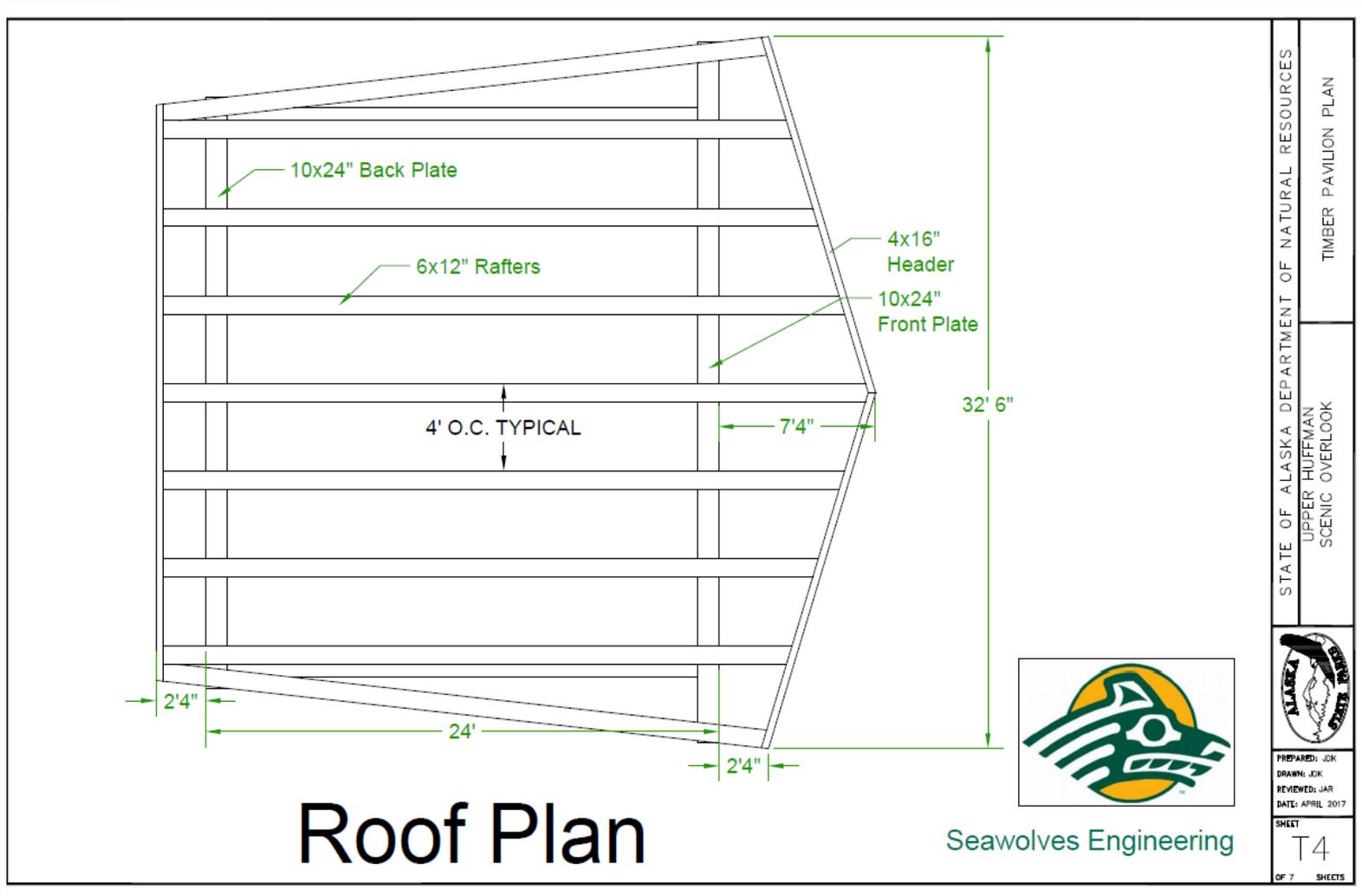


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# Timber Plans...



# Timber Plans...



Roof Plan

Seawolves Engineering



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# Scale Model (1:16)



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# Engineer's Estimate: ~ \$1.2 Million



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DEPARTMENT OF NATURAL RESOURCES



ENGINEER'S ESTIMATE  
Upper Huffman Scenic Overlook

**BASIC BID**

ITEM NO.	ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
201(3B)	Clearing and Grubbing	L.S.	\$15,000.00	All Req'd	\$15,000.00
202(1)	Removal of Structures and Obstructions	L.S.	\$5,000.00	All Req'd	\$5,000.00
203(3A)	Unclassified Excavation	L.S.	\$5,000.00	All Req'd	\$5,000.00
203(6A)	Borrow	Ton	\$25.00	7,500	\$187,500.00
301(1)	Aggregate Base Course, Grading D-1	Ton	\$45.00	75	\$3,375.00
301(2)	RAM, Recycled Asphalt Material	Ton	\$185.00	45	\$8,325.00
501(1)	Structural Concrete	C.Y.	\$150.00	5	\$750.00
506(1)	Timber Frame, Custom Pavilion	L.S.	\$250,000.00	All Req'd	\$250,000.00
608(15)	Concrete Slab, 4-inches thick	S.Y.	\$150.00	270	\$40,500.00
621(5)	Vegetative Mat	S.Y.	\$150.00	1,300	\$195,000.00
625(2)	Handrail	L.F.	\$40.00	75	\$3,000.00
640(1)	Mobilization and Demobilization	L.S.	\$35,000.00	All Req'd	\$35,000.00
641(1)	Erosion, Sediment, and Pollution Control Adminis	L.S.	\$10,000.00	All Req'd	\$10,000.00
641(2)	Temporary Erosion, Sediment, and Pollution Con	C.S.	\$11,000.00	All Req'd	\$11,000.00
641(3)	Withholding	C.S.	\$0.00	All Req'd	\$0.00
642(1)	Construction Surveying	L.S.	\$15,000.00	All Req'd	\$15,000.00
642(3)	Three Person Survey Party	Hour	\$325.00	5	\$1,625.00
643(2)	Traffic Maintenance	L.S.	\$5,000.00	All Req'd	\$5,000.00
650(26)	Picnic Shelter	Each	\$40,000.00	1	\$40,000.00
650(26)	Intrepretive Sign, Type B	Each	\$2,500.00	1	\$2,500.00
<b>BASIC BID (BB) TOTAL</b>					<b>\$833,575.00</b>
<b>PROJECT CONTINGENCY (PC, 10% OF BB)</b>					<b>\$83,400.00</b>
<b>DESIGN SERVICES (DS, 15% OF BB)</b>					<b>\$125,100.00</b>
<b>CONSTRUCTION ADMINISTRATION (CA, 15% OF BB)</b>					<b>\$125,100.00</b>
<b>PROJECT TOTAL (BB + PC + DS + CA + IE)</b>					<b>\$1,167,175.00</b>



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Questions?



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